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Vol. 203 No. 4355

3 – 16 July 2009

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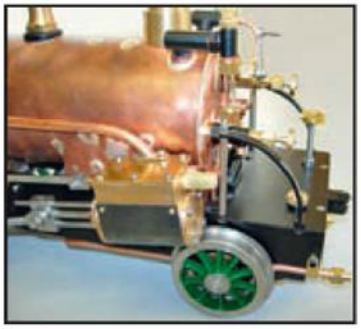

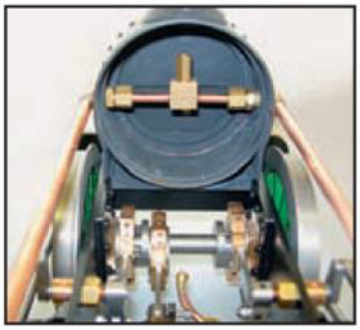

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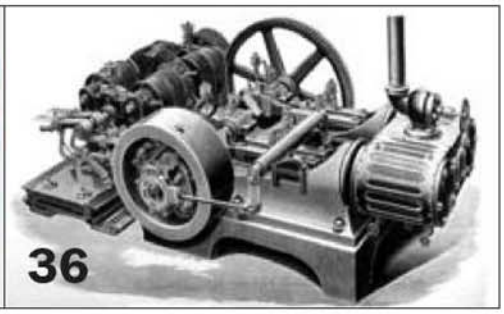

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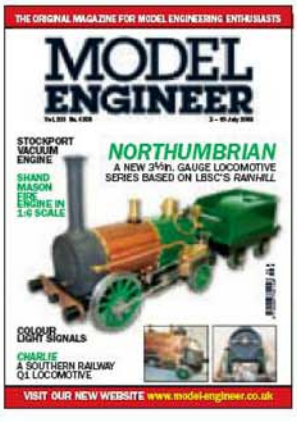

ON THE COVER...

Northumbrian *is a new engine being described by Tony Weale. See page 28 for details.*
(Photograph by Paul Dewstowe)

PLEASE SEE PAGE 10 TO TAKE ADVANTAGE OF OUR LATEST SUBSCRIPTION OFFER

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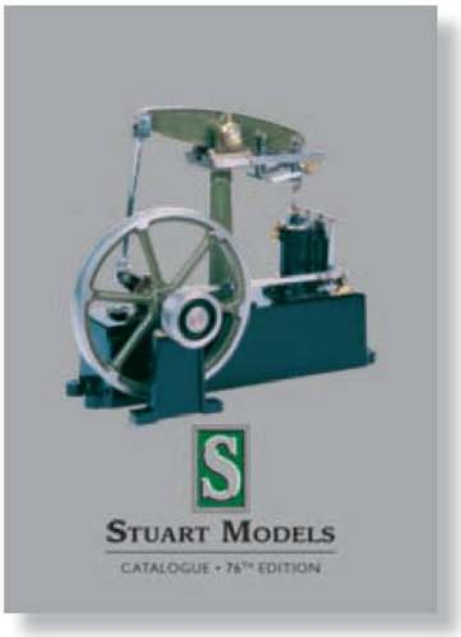

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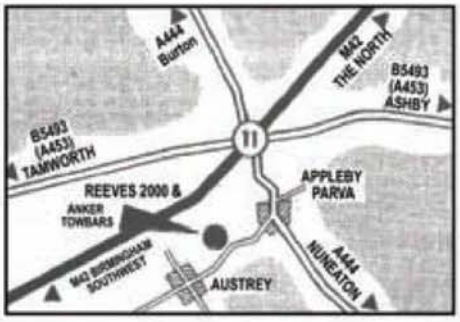

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DAVID CLARK
Editor

Northumbrian

This issue sees the start of a new beginner's locomotive in 3½in. gauge. It only uses a few castings so it should be relatively cheap and quick to build. A couple of prototype locomotives built from the drawings are already running.

It is based on LBSC's *Rainhill* design but almost everything has been modified from the original. Tony Weale, the designer was responsible for the recent *Ayesha* series that proved very popular. Tony has passed the design for *Ayesha* to the **National 2½in. Gauge Association** who are able to supply castings for *Ayesha* as well as many other locomotives.

Sir Stirling Moss supports Italian slot car rally

An ambitious slot car version of one of the world's most famous prestige car races, the Mille Miglia, has gained support from Sir Stirling Moss. It takes place in Italy this July in support of the Alzheimer's Research Trust.

The Mini Mille Miglia runs on 4/5 July in Umbria and is modelled on the 1,000 mile Mille Miglia road race which took place between 1927 and 1957 and boasted Sir Stirling as one of its winners. In recent times, the race has been reintroduced as a tour entered by 400 classic cars, many of which feature world-famous racing drivers and celebrities behind the wheel.

The slot car re-enactment is as strict on entry as the life-sized tour, and eligible models must hark back to the legendary Maseratis, Ferraris, Porsches and other classic marques that made up the original field. The replica track, stretching over 30 metres, has been painstakingly modelled on the Italian countryside and features cyprus-lined hairpins, castles, bridges, a village, valleys and forests. Over 80 cars have entered into the re-enactment, sent by enthusiasts from around the world.

Event team leader, Graham Lane, said:

"Watching the full-size version of the current Mille Miglia in 2008, when those beautiful historic cars drove through the ancient streets of Assisi, captured my imagination and spawned the idea. We have cars coming from as far away as Australia and the States.

"I'm proud to support the Alzheimer's Research Trust, as the disease took my Mother, Hazel Lane, to whom the Mini Mille Miglia is dedicated."

Rebecca Wood, Chief Executive of the Alzheimer's Research Trust, said:

"The amount of work that has gone into this event is phenomenal and it doesn't surprise me that slot car drivers from across the world want to be part of it.

Sir Stirling Moss, who won the Mille Miglia in 1955 in a record time, said:

"Alzheimer's has, very sadly, touched all our families. The idea is so different and so much fun, I have to say, I am delighted to be a patron of the Mini Mille Miglia."

More information on the Mini Mille Miglia is available from the website at **http://mini-mille-miglia.webs.com/**

Kent's Garden Railway Show

This show is presented by the G Scale Society Kent Group supported by Swale Borough Council (as part of the Swale Festival) on Saturday 25 July 2009, 10am - 4pm at the Alexander Centre, Preston Street, Faversham, Kent ME13 8NZ.

Admission: Adults £3, Children £1, Family £7. Children must be accompanied by an adult.

There is an exhibition of many of the scales and gauges which are run in gardens. Layouts, traders, railway books, heritage railways, raffle and much more will be in attendance.

W. **www.gscalekent.co.uk**

I/C Topics

I am still looking for a contributor with I/C engine experience to author *I/C Topics* for us. If you have relevant knowledge and experience designing and building I/C engines, I would like to hear from you at the usual editorial email or address. We do pay quite well for articles.

Lionsmeet

The **Old Locomotive Committee** has pleasure in announcing that Lionsmeet will be hosted this year by the **York City & District Society of Model Engineers** at the society's track at Dringhouses, York on Saturday 1 August 2009. Lionsmeet is an informal annual gathering of all those with an interest in the Liverpool and Manchester Railway locomotive *Lion* in all its manifestations and gauges. All such persons are invited to bring their locomotives, in any gauge, finished or not, and any *Lion* memorabilia they may have to the event for display or demonstration. There will be a competition, limited to 3½in. 5in. and 7¼in. gauge engines, to establish the hardest working *Lion* based on the measurement of work done by the engine during a 10 minute run.

The track will be open to those wishing to practise from 10.00 am and the competition will start at 1.00pm. Period dress is optional. Prior application is unnecessary, but further information and directions are available by emailed request to: **alnbby@yahoo.co.uk**, or T. 01254 812049. The clubhouse phone number is 07749 408215, and the nearby road, The Pastures, has the postcode YO24 2JE, for SatNavs.

Editor on a jolly

I am going on another jolly in early August. Paul Lewin, the General manager of the Ffestiniog and Welsh Highland Railways has invited me to Ffestiniog to drive one of the big South African Garratts. Although these may not be my favourite Ffestiniog/Welsh Highland Railway locomotives Paul says he will try to convert me.

I do like the older style Ffestiniog locomotives (although several of them came from elsewhere) particularly *Prince* and the new build *Taliesin*. I have travelled behind *Taliesin* on a vintage train a few years back and thoroughly enjoyed it. If you ever get a chance to visit the Ffestiniog Railway, you will not regret it. Take a ride up the line and enjoy yourself.

Paul has also promised to show me Lyd, the new Lynton and Barnstaple locomotive nearing completion. The Manning Wardles are really nice looking locomotives and perhaps, one day, I shall see one running on the Lynton and Barnstaple Railway.

Boston Lodge, the Ffestiniog locomotive and carriage works have produced some superb items of rolling stock in the past. Although only seen (by me) as photographs, the Welshpool & Llanfair coaches look superb. I think we will see a lot more items of narrow gauge rolling stock emerge from Boston Lodge in the future. I am looking forward to it.

POSTBAG

FIRST CLASS POST

Judging standards at ME Exhibition

SIRS, - Re. the letter from Brian Turnbull (*M.E.* 4353, 5 June 2009). I have been a judge at the Model Engineer Exhibition for over 30 years, only missing two exhibitions in that time and therefore feel I know something about the subject. To suggest that the purchase of laser or water cut frames, lost wax castings, and ready-made boilers do not confer an advantage is absolute nonsense. If somebody wishes to use these aids in order to build a model more quickly, then that is their right and it is up to them. However, they cannot expect to be judged on a par with the person who makes everything for themselves. He says that sand castings are used and most locomotive builders certainly do so, but these castings only represent full-sized practice. As far as boiler fittings are concerned I have never yet seen a top award given to a locomotive with commercially made boiler fittings. One always hopes that if the boiler is not made by the exhibitor it will be declared and adjustment will be made to the marks accordingly. Incidentally, making a boiler does not need sequential silver-soldering, but that is another matter.

Most exhibitors who gain a top award supply a photographic record of the construction which helps the judges establish the quality of their work. Judges are given marking sheets and there are a number of boxes in which to enter marks, relating to the various disciplines. The boxes carrying the highest marks relate to quality of craftsmanship and amount of work. While obviously there is one for finish this has a much lower mark. A judge cannot give a high mark for parts that the exhibitor has not made with the result that marks for the completed model will be considerable lower. This is something that is very obvious when it comes to stationary engines. Many are made from kits of parts sold as sets. As far as I can recall the only Gold Medal winners in this class have been models made entirely from scratch and probably the builder has also measured the original and made the drawings as well. Particularly fine examples of this are the models of Cherry Hill, she does everything including the research.

The exhibitor will be judged on his or her efforts and not just on what the model looks like. I have judged at other venues where the attitude has been for judges to look at the exhibits and give prizes on appearance alone, this is wrong and if followed to its ultimate conclusion could result in someone employing a skilled craftsman to make a model for them, have it painted professionally and then enter in a competition. That may be good enough if one is looking for the best model, but the Model Engineer competition is looking for the best craftsmanship and one hopes that things will stay that way.

Having said that there may well be a case for another class of competition within the exhibition. Model boats are divided into scratchbuilt and kit built models and have been for as long as I can recall. Whether such an idea is practical in other disciplines is a matter for speculation. It is doubtful if these days there are sufficient entries to justify such a move and it would have to apply to all classes not just locomotives. The matter will

Q1 class locomotives

SIRS, - I am delighted as an ex-Ashford Works apprentice locomotive fitter and turner who worked on the Q1 class in the 1950s to see Nick Feast's construction series on *Charlie*, and in 3½in. gauge as well. As we all get older it gets much more difficult to handle large locomotives as even the components begin to be heavy, and of course those of us who have been pensioners for many years have seen our incomes seriously eroded to the point that to take on a 5in. or larger size project the cost will often mean that the project will be shelved before construction starts.

Nick mentions that the Q1s were constructed at Brighton Works, but in fact C1 to C16 were Brighton products, while C17 to C36 were constructed at Ashford Works. The remaining four back at Brighton (as noted in *A Pictorial Record of Southern Locomotives* by J. H. Russell). I am quite sure that component manufacture would have been shared between Ashford and Brighton, possibly Eastleigh as well which was common practice on the Southern, particularly in the BR Southern Region days.

At Ashford Works we did not build locomotives; we 'constructed' them as the works plates always noted!

One of the more unpleasant features of working, particularly underneath the *Charlies* was that the boiler insulation was a fibreglass type product held in place by what can only be described as chicken wire, and one would come out twitching as though one had St. Vitus' dance where the fibreglass had got down ones neck! The *Charlies* also had a reputation for the regulator to stick open, particularly after an overhaul, and while on the Boiler Mounting gang I remember a fitter having remedy for such a problem out in what was known as the 'Old Shed' after trial steaming.

Clive Young, Kent.

Write to us

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not rest with me but personally I think that things should remain as they are. If someone enters a model where parts have been used 'as a means to an end' as Mr. Turnbull puts it, then if it is good enough it is still eligible for an award but surely the person entering cannot expect to get a top one if they have only made a proportion of it.
Stan Bray, Lincolnshire.

ME competition - a reader's view

SIRS, - I also find the subject of bought-in parts disturbing where competitions are concerned. To my mind Mr. Turnbull has been rather selective in his comments and refers to using laser cut frames, lost wax castings and kit parts as merely time savers. I would say that marking out, cutting, drilling, bending accurately and finishing platework is a skilled part of the process and to allow others to do this is not just merely saving time. Yes, model engineers have always used sand castings but there is still work to be done and plenty of room for error. Anyone who has turned, bored, filed and polished a GWR safety valve bonnet from a casting, as I have, will testify what a time consuming difficult job it is. The alternative of buying a lost wax casting and merely polishing it is very attractive and will probably result in a better product but cannot by any stretch of the imagination be called just time saving. The same applies to couplings; during the recent Model Engineer competition, where my 56XX received a Bronze Medal, I noted that several of the other engines had bought-in couplings. They looked good and were probably better than mine, but at least I can claim mine as my own work not someone else's. I could go on about backhead fitting as well but I am sure that you get my drift.

The question of equipment is something else completely. In our hobby it is unlikely in my opinion that full CNC will take over due to the variety and low quantities of parts. Having digital readout on machines makes life easier and makes for greater accuracy but the job still has to be setup and the process controlled by the modeller.

In conclusion, I accept that bought-in parts will become more available and people will use them. The dilemma is during competition. If the model is only to be judged for fidelity to prototype and finishing processes then at the extreme end of this debate the entire model could be bought-in and just polished and painted. This could signal the end of scratchbuilt models in competition. I realise that this is an extreme and unlikely situation but a new line has to be drawn. The current application form does call for a list of bought in finished parts and I believe that the quantity and level of completion of these parts should be taken into account.
David Murray, Surrey.

Unimat motor

SIRS, - Many thanks for forwarding the four replies to my plea for help regarding a new motor for the above (*M.E.* 4352, 22 May 2009). I contacted the reader who asked me to phone him and also the one who offered a new motor. I was delighted to receive from the latter this afternoon a replacement, which is an original Unimat motor, very clean and hardly used and at an incredibly low price. Many thanks for your help with this problem.
John Weight, by email.

Pleasing improvements

SIRS, - I would like to congratulate you on the recent improvements to the *Model Engineer* magazine. The difference has been quite noticeable. I am particularly pleased to see the reintroduction of some fairly straightforward constructional series, in this case the Shand Mason steam fire engine, a subject in which I have always had a keen interest, and the 3½in. Q1 locomotive by Nick Feast. I had the pleasure of riding behind this model a few weeks ago at the Southampton Track open weekend. This is a most fascinating engine, which steams extremely well for its size. This is of course, in addition to the excellent models described by Anthony Mount.

My only, very small, reservation is the use of metric measurements. Having been involved with model engineering for over 40 years, my workshop facilities are completely geared to imperial measurements, and it is a little late for me to re - equip to go metric.

Having said that, I realise that we must move on as, hopefully, there will be some youngsters who will be equally encouraged by the inclusion of these models and will set up their facilities in metric from the beginning.

Your contra deal with *Steam Railway* magazine also looks an interesting development, and could bring benefits to readers of both magazines.
Richard Upton, Hampshire.

Northumbrian, *which starts in this issue, is in imperial. I don't intend to phase out imperial in favour of metric. Ed.*

Problems with cylinder castings

SIRS, - Regarding the letter from John Dadswell who has had problems with cylinder castings (*M.E.* 4353, 5 June 2009). Re. the need to fill and remachine misplaced port holes in a cylinder casting, the following may be of some assistance. Many years ago (about 50 or so) I was making a shaping machine and using a shaper to machine the table, which was of cast iron. I made the mistake of walking away and leaving; while I was away the tool worked loose and dug into the work, the result was a very large section of the table was a right mess and had a large area that was ⅛in. lower than it should be. The resulting mess was filled with sif-bronze and remachined and is perfectly true and accurate to this day.

I also had a problem with a cylinder casting at one time with large blow holes appearing when the ports were machined. On that occasion I bored the ports out, making three round recesses, machined some cast iron bar to fit the recesses and screwed the plugs in place. The port face was remachined and the engine is in perfect working order. The plugs need to be a good fit and can be held in place with 6 or 8BA screws. It is advisable to make ones own screws as it is then possible to make a head that will recess in the plug, leaving sufficient material to allow the slot to be machined away afterwards.
Stan Bray, Lincolnshire.

Calliper oddity revealed

SIRS, - The device in the picture (*M.E.* 4353, 5 June 2009) is in fact a trouser clip used when riding a pushbike to keep your trousers off the chain.

More modern ones are a sprung circular band which you put on after folding your trouser leg over. With the 'calliper' style, you still folded your trousers over, and then hooked one end of the 'callipers' into the leg part, and the other end into the folded over part.

I have never used them, but remember my grandfather using them, and my grandmother grumbling at him because the hooks were damaging the trouser cloth!
Eric Lander, by email.

Thanks to all who emailed and phoned in with answers to this query. Ed.

Stockport Vacuum Engine

ANTHONY MOUNT

Anthony Mount describes the main body of the column plus its bosses and top part.

PART 3

Continued from page 741 (M.E. 4354, 19 June 2009)

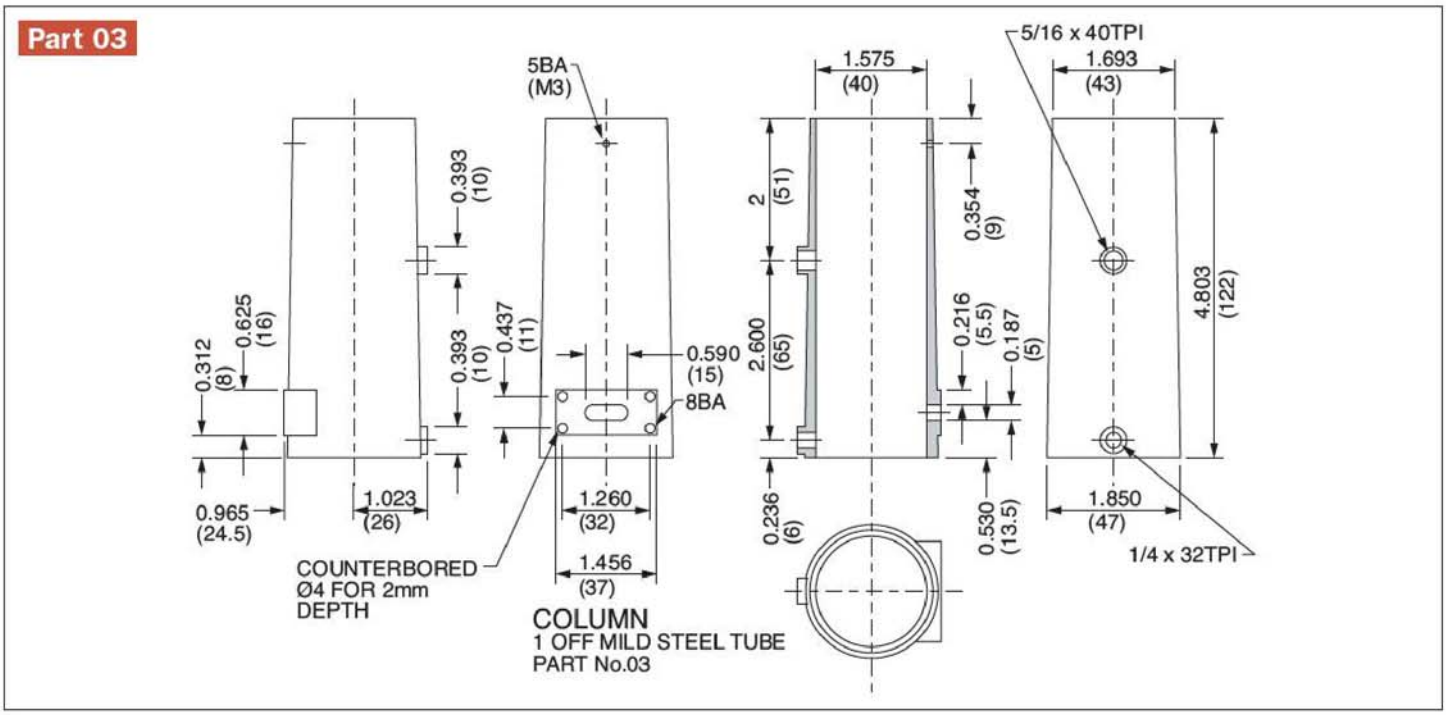
Skimming the column.

Drilling the bolt holes.

The main body of the column (Part 3) is made from a length of steel tube. I used a piece of hydraulic tubing 50mm O/D x 40mm I/D; the bore was already to size and of a very good finish. This material is not free cutting like EN1A as often supplied to model engineers so be prepared for the swarf to come off in coils rather than chips.

One end of the tube was gripped in the self-centring chuck by the inside with a thin spacing washer to allow the tool to cut full length without fouling the chuck jaws. The other end was supported by a running centre in the tailstock, as shown in **photo 10**. If you do not have a centre of such large diameter, turn up a stepped plug to a tight fit in the tube with an ordinary centre hole in the middle as seen in the photo. The taper can be put on with the top slide which only needs to be set over by about 0.6 degrees.

As you can see from the drawing there is a flat area near the bottom for the slide



valve and this is fixed to the column with four stepped studs. Because of the round section of the column a stratagem a little out of the ordinary will need to be followed so that it fits snugly.

A length of 50.8mm (2in.) square mild steel is hopefully to be provided in the kit for the column top. It is supplied over length so cut off a short length and machine down to 16mm (0.625in.) thick. Drill through and open out until you can get a boring tool in, then set over the top slide and bore out to a tight fit on the tapered column when it is 7mm (0.275in.) from the bottom.

Set up the block in the mill and use an edge finder and co-ordinates for centring the four bolt holes, then part drill tapping size for 8BA, do not go right through, then counterbore 4mm (5/32in.) diameter x 4mm (5/32in.) deep. At the same setup locate and drill a hole at each end of the slot.

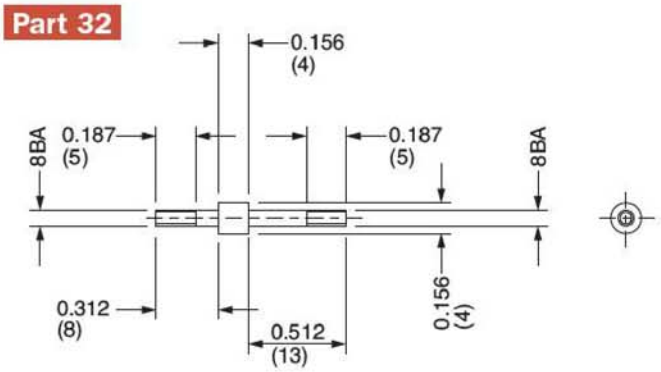
Fit the block to the column and put a tight fitting plug in the inside of the column, then you can drill the bolt holes right through the column wall (**photo 11**). The drilled holes can then be tapped 8BA. Doing the job this way the drill and tap cannot 'see' the curve of the column and will cut a straight hole and thread.

Remove the plug and replace it with the cast base. Check it is the right way round with regard to the machined slot and clamp once more in the machine vice. Place equal height packing underneath the base lugs so that it is square to the table and place a clamp over the length of the column so that the cast base is held firmly against the end of the column (**photo 12**).

Locate the predrilled holes for the slot and with a 5mm (3/16in.) end mill proceed to machine the slot right through the column into the cast base.

Milling the slot.

Part 32



SHOULDERED STUDS
4 OFF STAINLESS STEEL
PART No.32

Remove the block and cut out the piece you need and machine to size, which can then be bolted back onto the column with the special shouldered studs (Part 32). Actually screwing in the studs is not as easy as it sounds; you do not want to use pliers on the threads as this invariably chews up the thread.

First screw an 8BA nut onto the short thread of the stud, then make up something like a box spanner but with an 8BA tapped end instead of a hexagon socket; the material can be hexagon as well and cross drill the other end for a small tommy bar.

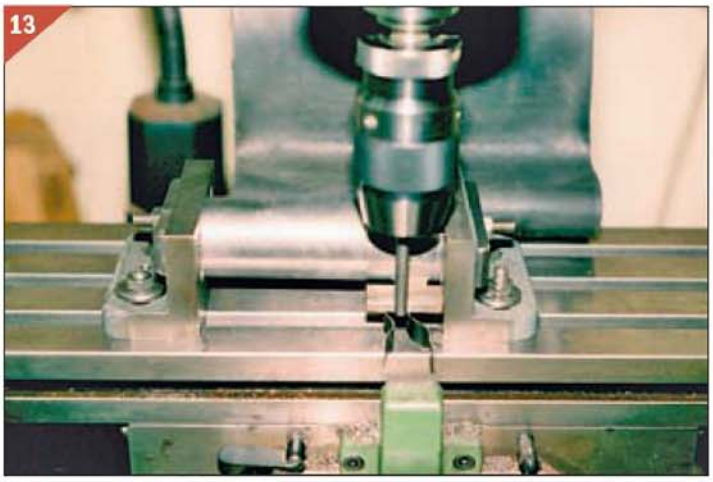
Screw the driver onto the short thread and lock it into place with the ordinary nut. The stud can now be screwed in firmly and the driver removed by releasing the lock nut.

If you build the same model with a friend only one of you need make the bottom block as two pieces can be made from the one block.

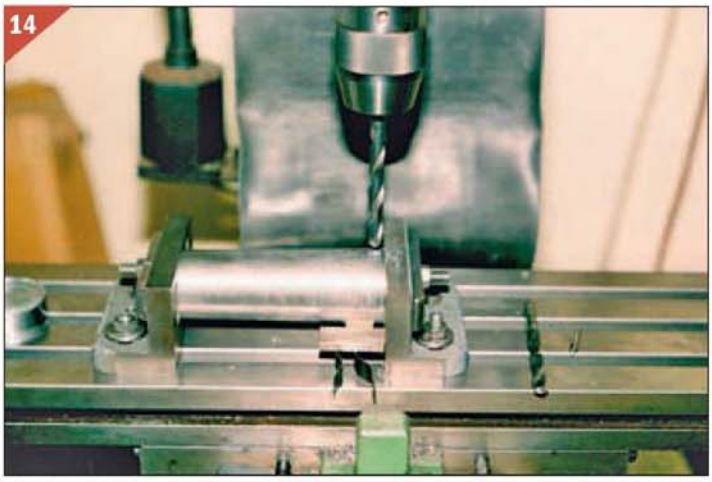
I smeared the joint with Gun Gum, a paste used to seal holes in motorbike exhausts as a gasket material suitable for high temperatures. When it was time to fix the base to the column, I used the same paste on the joint. To align the column with the base I drilled a couple of 2.5mm (3/32in.) holes through the column and into the base spigot and tapped in a couple of tight fitting pins; they were filed flush and disappeared from view.

I did wonder whether a rust joint would be suitable in these two instances; has anybody had any experience with rust joints that they could pass on?

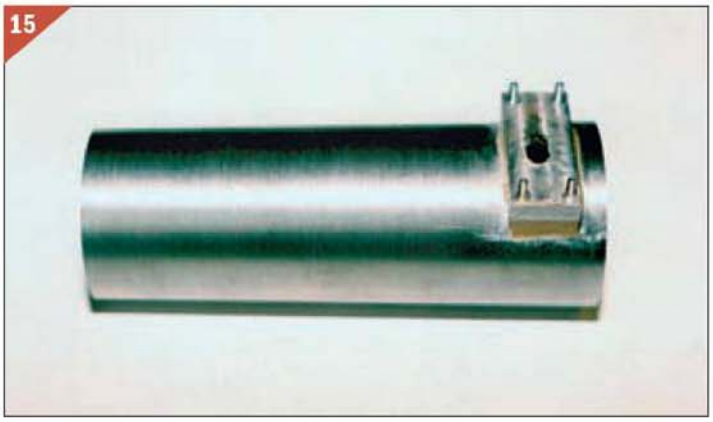
The two bosses for the cooling system can be made from steel, stainless steel or brass. Drill through and tap ¼in. x 32tpi for the bottom boss and 5/16in. x 40tpi for the top one. With regard to the >>



Finding the position of the bosses.



Drilling the bosses.

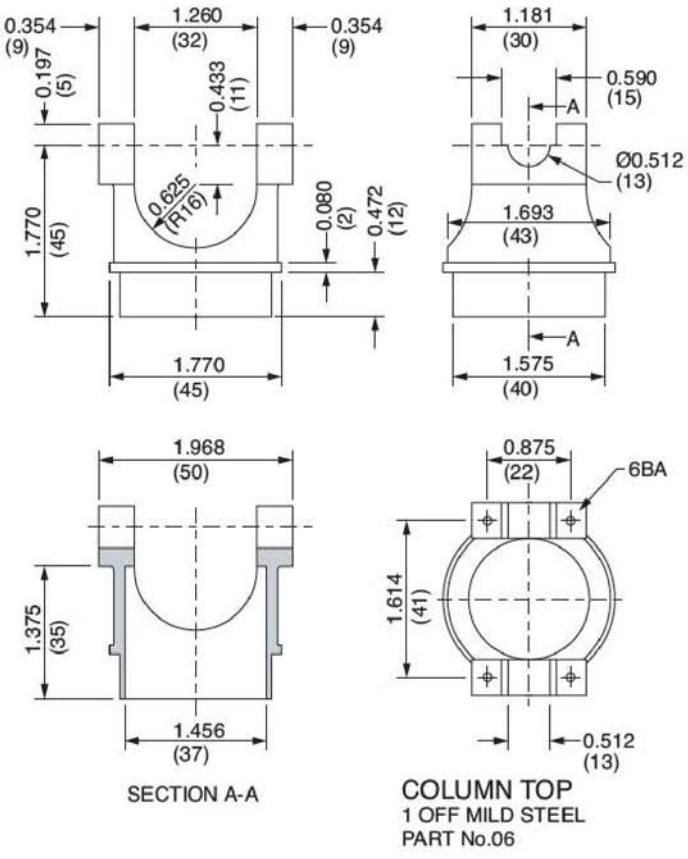


The completed column.

thread in the bottom boss, if you intend to fit a commercially supplied drain valve check the thread as they are not standard amongst the suppliers. Polly Model Engineering can supply a suitable valve.

For drilling the boss holes I clamped the column between two angle plates (**photo 13**) and used a length of 6mm (¼in.) diameter rod as an edge finder. This was brought up against a parallel touching the end of the rectangular valve face. Co-ordinates were then used to locate the centres for the bosses. **Photograph 14** shows one being drilled, and **photo 15** shows the completed column.

For fixing the bosses to the column I tapped the holes in the column M10 x 1 and threaded the ends of the boss to screw into the column, again using Gun Gum filler as a sealant. It also formed a fillet all round the bottom of the boss, which once painted, helped the column to look like a casting.



Part 06

Column top (Part 6)

For the column top a piece of 50.8mm (2in.) square mild steel is used. I did consider using a casting here, but it would be difficult to hold and machine. Starting with a square block it is easy to hold with nice datum's on all faces.

I expect the block will be supplied with the kit but a good source of large section steel, aluminium and cast iron and some more exotic materials is M Machines, T. 01325 381 300 (usual disclaimer).

Hold the block in the 4-jaw chuck to clean up the sawn ends and finish about 2mm oversize in length. This is to avoid the cross hole breaking out of the end. Centre and drill through, opening out with successive drills to 25mm (1in.) diameter. Change to a boring tool and open out to 32mm (1.260in.) diameter. Do not go right through or you will run into the chuck face so stop about 5mm from the end. Reverse the block in the chuck and open out the bore to 37mm (1.456in.) diameter to a depth of 35mm (1.375in.).

The next requirement is to bore a 32mm (1.260in.) diameter hole that will form the connection between the two bearing blocks. Mark out the centre position on the side of the block and set up in the four jaw independent chuck. A packing piece will be needed top and bottom to support the jaws over the already bored hole and they can be of different thicknesses to help balance the block, this can be seen in **photo 16**.

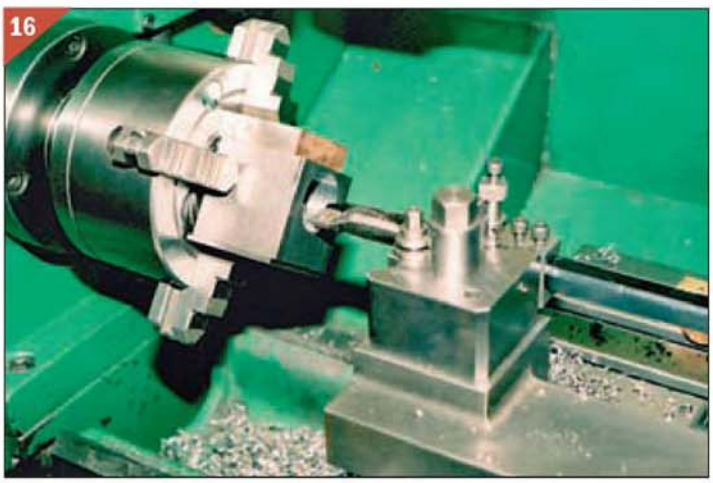
Keep the block about 3mm (⅛in.) from the face of the chuck to leave clearance for the boring bar to run through. Centre and drill to about 6mm (¼in.) diameter; only go halfway then turn the block around as there is a step inside the block because of the previously formed holes and the drill will not stay on course.

Centre again on the other side of the block and drill through to meet the existing hole. Open out to about 14mm (9/16in.) with a drill. You may need to turn the block around again if the drill runs out. Change to a boring tool and open out to finished diameter. The intermittent cut does not affect a boring tool as badly as it does a drill.

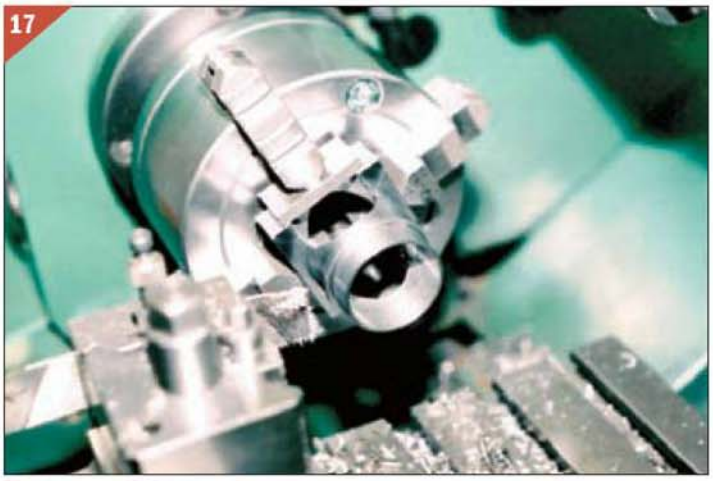
Reposition the block in the 4-jaw chuck, again with packing on two faces to give support over the just machined hole. Set the hole to run true and turn the outside down to a 45mm (1.750in.) diameter for a depth of 35mm (1.375in.), this operation is seen in **photo 17**.

It will make the job easier on the lathe if the corners of the block are sawn off first to reduce the amount of vibration from the intermittent cut as the square block is reduced to a round one. Next turn down for 12mm (0.472in.) to 40mm (1.574in.) diameter, a close fit into the column.

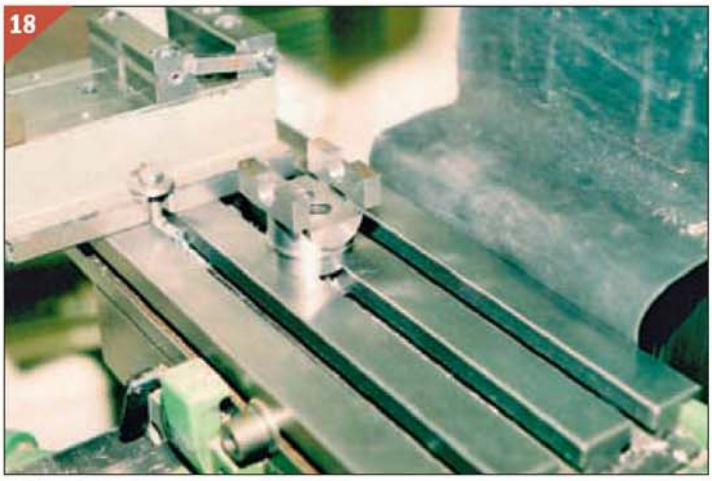
Change to a parting tool and turn down the section above the bead to 43mm (1.690in.) diameter; use only shallow cuts



Boring the column top block.



Turn to a good fit in the column.



Milling the bearing cap seats.

The machined column top.

working from side to side as there is now intermittent cutting as the diameter is reduced enough to have run into the other hole.

A change is now made from the lathe to the milling machine. With the block clamped in the machine vice by the ends for drilling the bearing holes, use an edge finder and co-ordinates to locate the position of the bearing hole. This is opened out in stages to 12mm diameter.

I have shown plain bearings but you might like to consider ball races: there are some available at 7mm I/D x 11mm O/D x 3mm wide Code No. SMR117ZZ from Arc Euro Trade, T. 0116 2695693, usual disclaimer. I would suggest two ball races to each bearing, pressed into dummy bearing shells as detailed for the plain bearings but bored out each end to take the ball races.

As there is but little power from this type of hot air engine the reduced friction means ball races are worth considering.

Now clamp the block to the milling machine table so that the slots for the bearing caps can be machined with a slot drill. I made up a special clamp for this job; it consisted of a 50mm (2in.) length of 32mm (1¼in.) diameter mild steel rod sawn in half to form a D section. Two 8mm holes were drilled right through at 15mm (0.590in.) centres equally spaced around the centre and counterbored at 13mm (½in.) diameter to house the heads of two M8 Allen screws.

The clamp plate rested in the hollow below the bearing blocks and the screws passed into tee nuts in the table tee slots. The block was set square by using a small angle plate against the square top of the block and a square off the table edge against the lower leg of the angle plate.

As can be seen from **photo 18** this method of clamping gives full access to all sides of the block. Do not be tempted to use only one screw in the centre as the cutting forces could contrive to turn the block around the screw.

Machine the 15mm wide slot for the bearing cap first; you can use a vernier to measure either side of the slot so that it is centred in the block. Now change to the other axis and machine away the waste to form the channel between the bearing blocks.

The column top can be removed from the mill and the waste material either side of the bearing blocks can be sawn off. If you have a small cut off bandsaw this will do the job with ease, but be careful that you do not allow the saw to drop onto the nice machined surfaces.

The column top can be clamped back on the milling machine to use the side of the end mill to clean up the sawn surfaces. All that remains to be done is to drill and tap for the bearing cap stud holes and these can be done using co-ordinates or by using the bearing caps clamped to the column top as a drill guide.

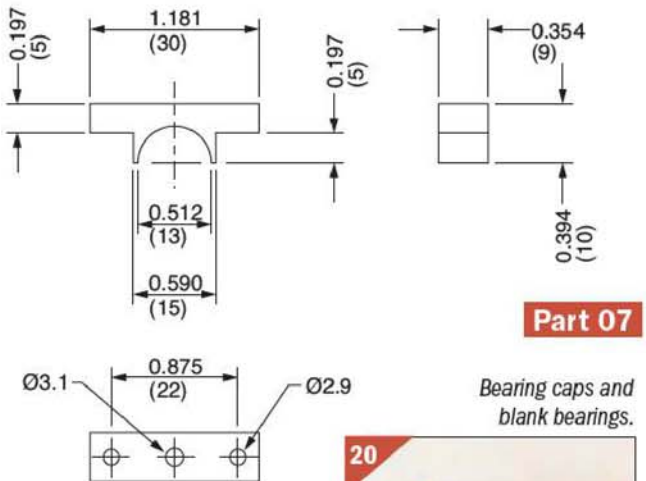
Finish off by filing small radii to all edges. The column top is painted and paint cannot stick to a sharp edge and chamfers are no good either as they are in effect two sharp edges. The almost completed top is shown in **photo 19**.

Bearing caps (Part 7)

Two bearing caps are required and they are made from a short length of 10mm square mild steel bar. They can be squared off to length in the lathe in the 4-jaw self-centring chuck if you have one.

Change to the independent 4-jaw chuck and set up the two blocks together so that the bearing hole can be drilled through. While set up a facing cut can be taken to clean up the face. Reverse in the chuck and face off the other side bringing to finished thickness. Now change over to the milling machine and drill first the stud holes then mill the rebates either side to form the tongue that fits into the column top. Aim for a nice fit into the housing (**photo 20**).

●*To be continued.*



Bearing caps and blank bearings.

Shand Mason Steam Fire Engine in 1:6 scale

GÜNTER KALLIES

Günter Kallies continues with the description of the chassis for his horse-drawn fire engine of 1890.

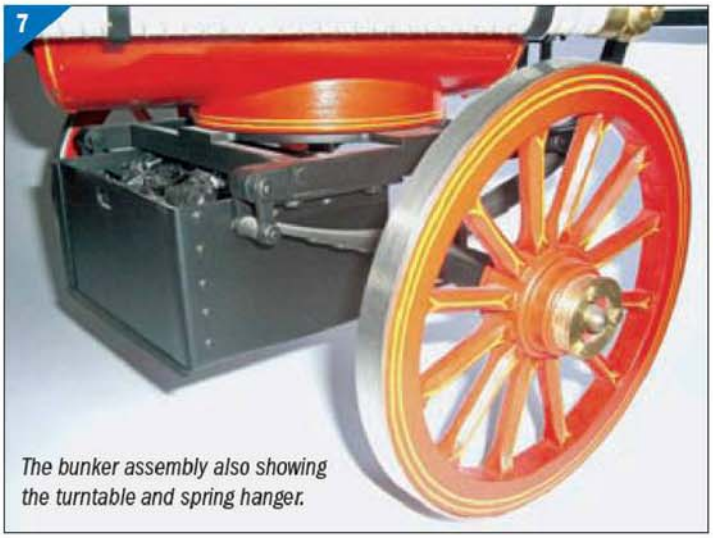
PART 3

Continued from page 681 (M.E. 4353, 5 June 2009)

The forecarriage consist of two side members (112), which are connected together by two crossmembers (114). The side members can be made from any available material. Drawn steel or brass profiles are less suitable because they are harder to bend. Strips sawn out from sheet metal and carefully annealed are much more appropriate for bending and forming. The strips can be formed by hammering around a piece of round steel in the vice and the final contour can be finished off with a file. Both side members clamped together will insure a similar final shape as well as having the same hole positions. The crossmembers (114) require short plugs in their ends. These can easily be produced by clamping in a 4-jaw chuck in the lathe and turning down to the appropriate diameter and length. It is important that the middle portions are the same length to ensure a parallel distance between the side members after assembly. The plugs are riveted into the side members (112). The end of the front beam (113) is fastened to the heads of the side members using countersunk screws. The eyebolts and hooks are located in this crossbeam to attach the harnesses to.

6

One side of the brake assembly.



7

The bunker assembly also showing the turntable and spring hanger.

Turntable (117)

This is made from 3mm sheet metal. The corner points are drilled and then sawn out with a small bow saw or fretsaw. A socket made from brass is riveted to the turntable and becomes the rotation point for the forecarriage. The turntable is fastened to the frame with eight countersunk screws. When drilling these screw holes the frame must be square and precisely aligned, later correction is not possible. The fittings (110) or (115) for the leaf spring connections are sawn out and riveted onto the frame. The outside edges of these fittings should be chamfered or rounded as shown in the drawing.

Shaft shoe (116)

This is located under the front crossbeam and is made from two parts. The U-shaped portion with 12mm width inside and the upper portion bolted to the crossbeam. Both elements are bent from 1.5mm thick and 6mm wide brass strips and the

joint brazed together in line with silver solder. Other fittings at the front beam are also made from brass.

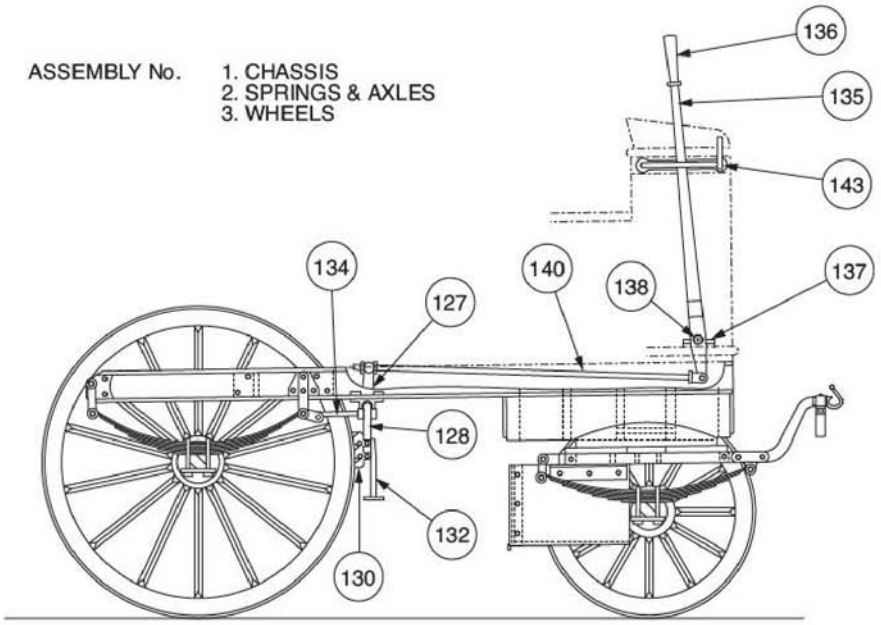
Eyebolt (119)

For this part start with a 6mm dia. piece of material, turning down and threading the plug first. Then the threaded plug is clamped in the lathe chuck and the ball head can be turned, e.g. with a form tool or by hand using a graver and finishing with a file and emery on the running lathe; be very careful with such a manual operation. If you are not familiar with such operations please grind a form tool to turn the ball end. Finally, machine the side faces and cross drill.

Hook (118)

A piece of 6 x 12mm flat steel or brass is the ideal material for this. First turn down the threaded plug. To do this the material must be clamped in the 4-jaw chuck running about 3mm out of centre. Next the head portion should be machined to the thickness of 2.5mm or 1.6 millimetres. After cross drilling, the final contour can be worked with a set of needle files. Lastly, all edges should be rounded smoothly.

Note: not every manufacturing step will be explained in these articles or every individual part mentioned. Components that are very simple, e.g. the slope irons (120) or (121), do not require any explanation. However, such parts used in pairs should be clamped together for shaping and drilling to ensure equal shape and relative position of holes.



WHEELS FROM THE RHS NOT SHOWN

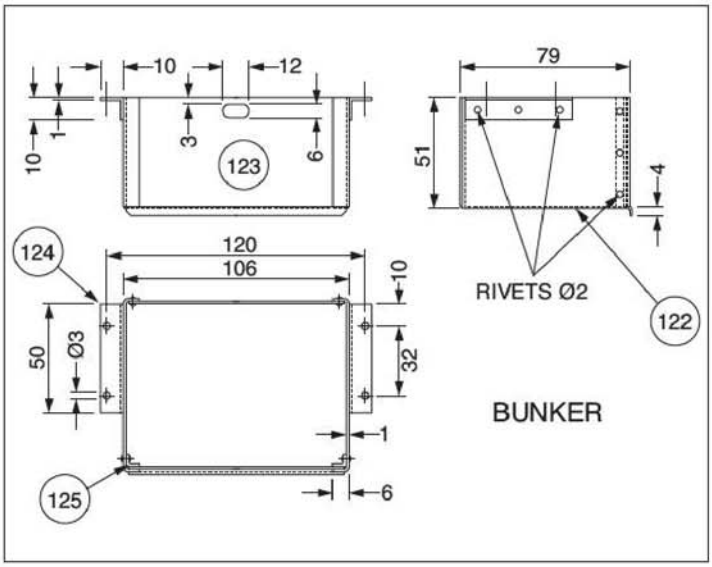
Bunker (122)

This is fastened to the bogie in-between the front wheels. Make this box from 0.7mm brass sheet metal by cutting and bending according to the drawing. Bending can be done over a wooden form block using a mallet or soft-faced hammer. The form block corners should have smooth radii on all edges to avoid the metal cracking. It is important before starting work that the metal is well annealed prior to bending, so that the spring back effect is limited. After bending the box, the corner profiles (124 and (125) are riveted in place. With the assembly of the front vertical corner profiles (125) a sufficient slit for the sliding plate has to be left. The sliding plate (123) is cut out of 1.6mm brass sheet and should be in place when the corner profiles (125) are drilled and riveted. For the hand hole in the sliding plate two 6mm holes should be drilled and the material in-between worked out with a small file to an elongated hole. The bunker is fastened to the side members of the front bogie using four M3 screws.

Brake parts

The brake system works on the rear wheels only. The shaft brackets (126) are made from brass and fastened from below to the girders of the chassis using two M2.5 screws each. The crank arm (128) is produced from 6mm dia. round steel. First the 5mm plug is turned down, then the lever can be bent and filed to shape in the vice according to the >>

Flycutting the radius on the turntable mounting.



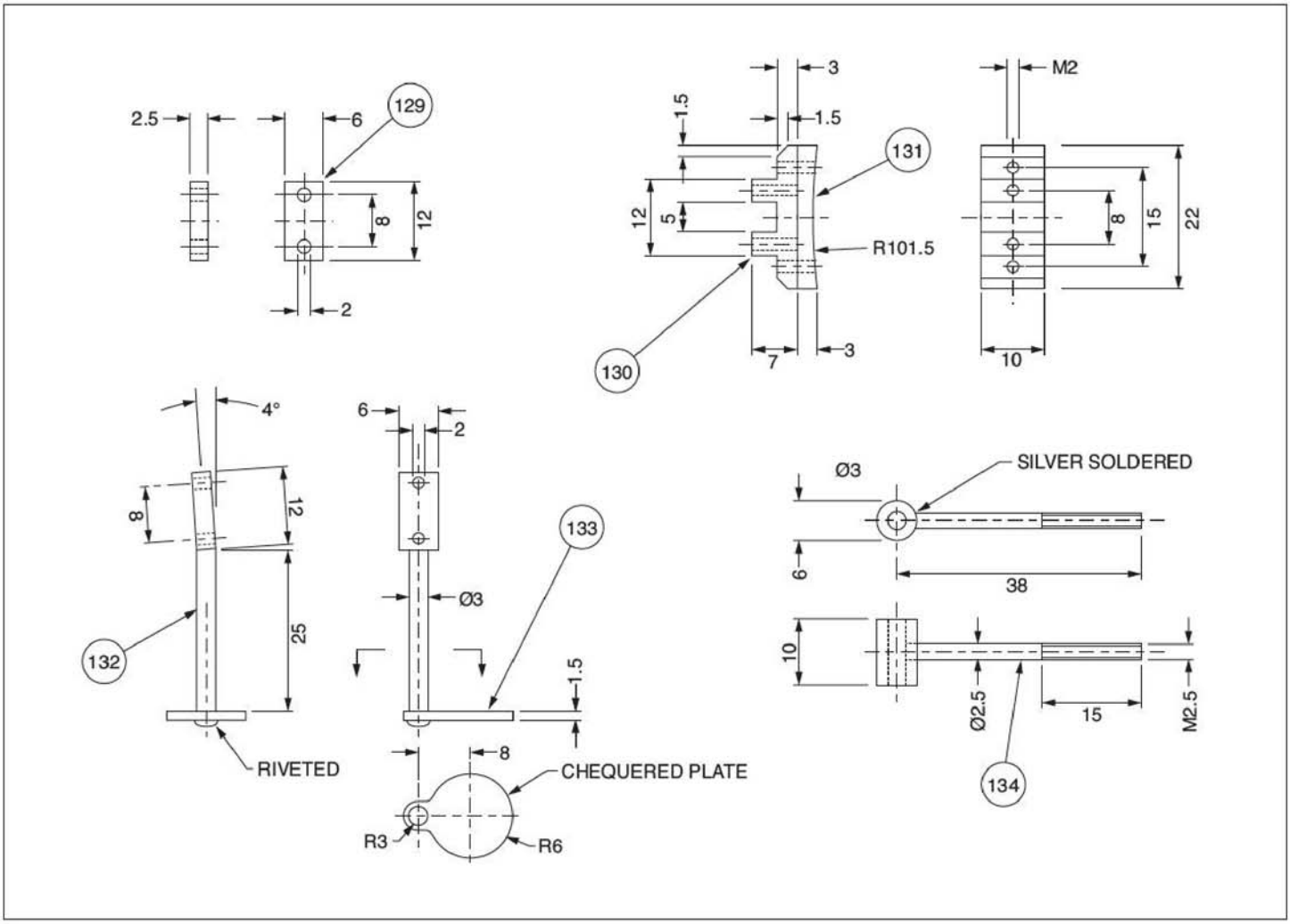
The forecarriage showing the turntable.

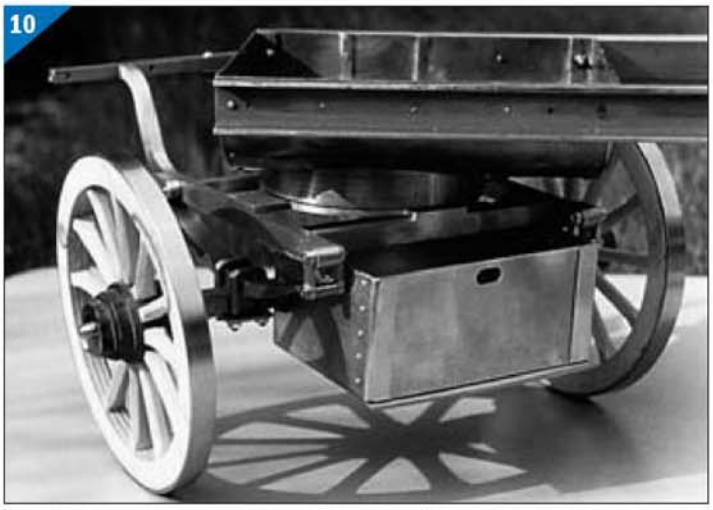
drawing. If steel was selected to make this component, hot bending is recommended. A cross-drilled pivot is riveted to the lower end of the torque arm (127). Make sure that these pivots are only loose riveted and that they can slightly rotate.

The keep plate (129) is easily produced and no instruction is needed. The brake shoe is made of two parts: the shoe (130) made from brass and the brake pad (131) of Tufnol, fibre or hardwood. Both parts are held together with two small M2 countersunk screws. On the left side of the vehicle a footstep (132), (133) is attached to the brake shoe in place of the plain keep plate. The footstep assembly consists of the shank (132) and the step plate (133). The chequered plate can easily be produced on the centre lathe or in the milling machine using a 60deg. 'D' Bit or 'Fly-cutter'. Line by line can be cut to the distance of approximately 1mm, first at 45deg. and afterwards at 135 degrees. The eyebolt (134) for the shaft bracket (126) is made from two individual parts brazed together. The 3mm dia. hole should be drilled after brazing.

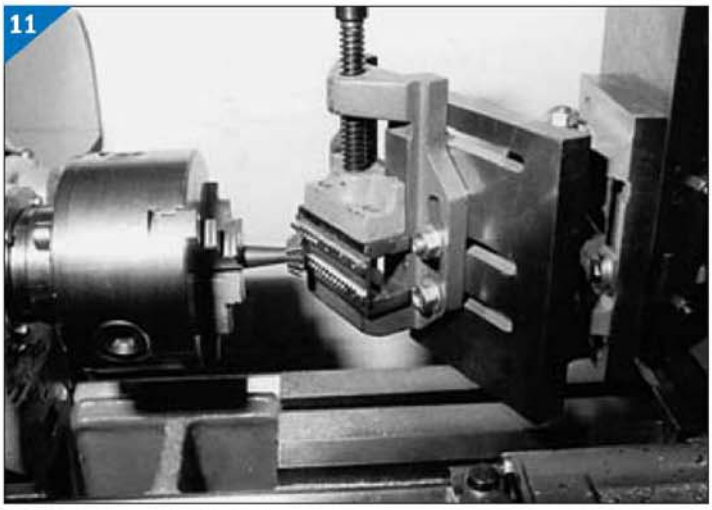
The brake levers (135) are sawn from a piece of 2.5mm steel sheet metal and may be held in the 4-jaw chuck for turning down and threading the spigoted ends. The handles (136) are turned from a piece of round brass or stainless steel and tapped in the centre for screwing to the levers.

Both brackets (137) can be produced in one operation. Make the profile from a brass bar, including drilling, and separate it afterwards into two pieces of the required length. The common axis of both brake levers is more complex. Two rotary parts (138), (139) fitted together, form the complete axle. This allows separate operation of the left-hand or right-hand brake lever. The tension rod (140) and the fork head (141) and the bolt (142) make the linkage between the brake lever and the rear brake gear assembly. The components are so simple that detailed description is not needed. All dimensions necessary to make them are given in the drawing. Merely the fork head (141), which is made from 6 x 6 square brass stock, requires some explanation. First it is turned down to





The complete forecarriage and turntable assembly.



Machining the rack in the lathe.

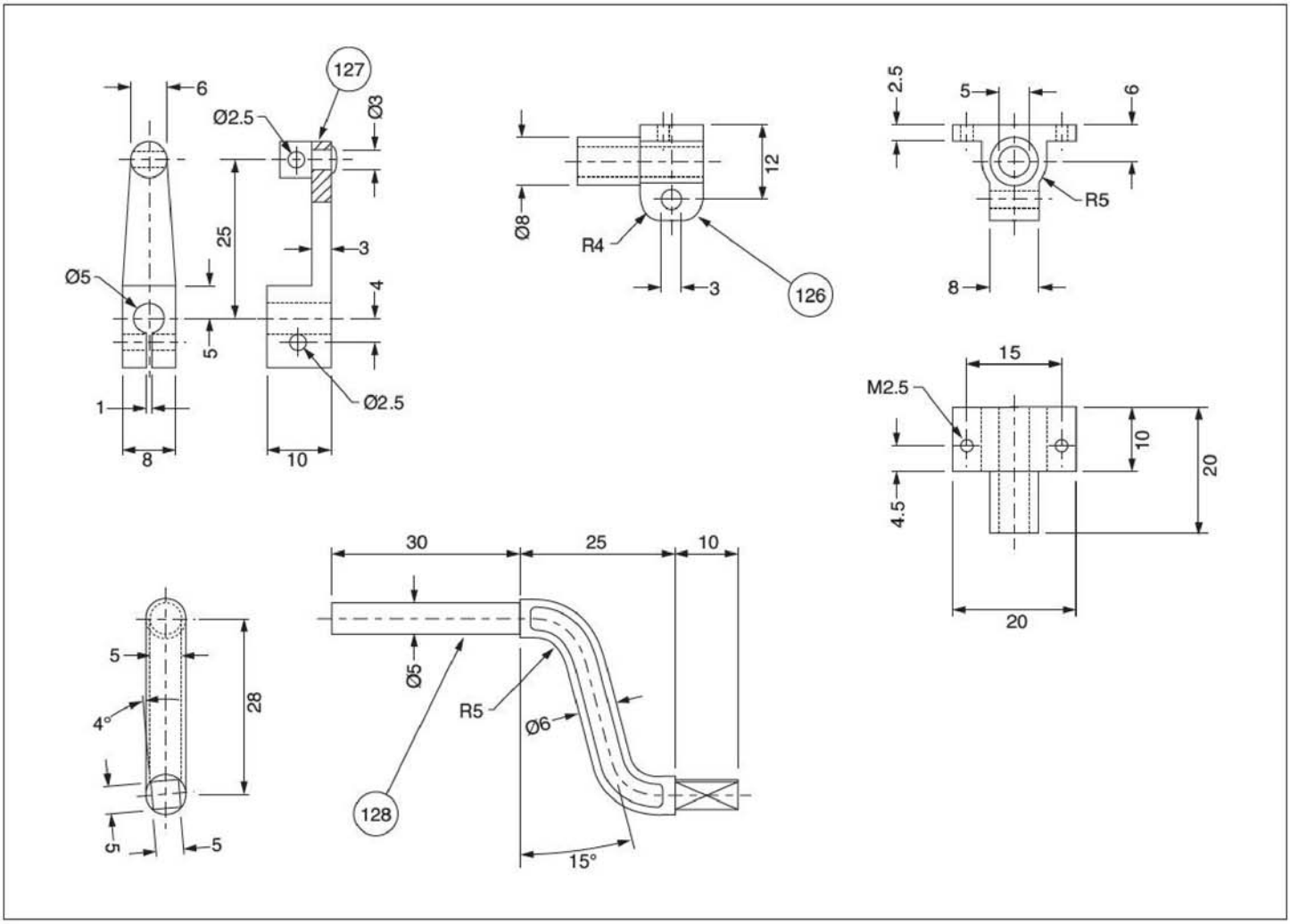
5mm dia. and the thread is machined. Next step is to cut the part to length, cross drill and slit. Finally it can be trimmed to the round shape.

The last component of this assembly is the rack frame including the lamp bearer. Three separate and individual parts are needed. The rack (143), the lamp bracket (144) and the lever guard (145). The rack is made from a 10 x 5mm piece of brass. The ratchet teeth can be cut in the lathe with a fly-cutter or any other 60deg. profile cutter. The lever guards are made by turning and threading 3mm brass rods, finally bending to the right shape. The lamp bracket is made from a piece of 3mm brass sheet metal, held in the 4-jaw chuck to turn it down and screwed to form the stud. Finally, cut and file to shape. The vertical part of this piece is tapered at the top end, to serve as a lamp bracket.

The bolts and nuts necessary must be selected during the assembly. Typically hexagonal head bolts with model size heads are proposed. The position of the individual component is given in the assembly drawing. The necessary holes must be drilled accordingly.

The drawings for some components mentioned appeared in the last instalment and some drawings will appear next time.

To be continued.



EDWARDIAN ELEGANCE
The Midland & Great Northern Joint Railway

RON ISTED

Ron Isted continues his description of the M&GN Joint Railway which focuses in particular on William Marriott's 4-4-2 Tank Engines.

PART 2

Continued from page 684 (M.E. 4353, 5 June 2009)

As well as a physical resemblance, the Norfolk engines also shared with their Essex cousins a purely aesthetic feature pretty well guaranteed to cause any would-be builder of a miniature version to reach instantly for a double measure of the hard stuff - an action that without doubt would again cause anguish to William Marriott, even though he was almost certainly the cause of the problem in the first place. I refer to the curved lettering splayed across the side tanks of the 4-4-2Ts. Now, we have already met this unusual form of graphic design in my article on the London Tilbury & Southend 0-6-2Ts (*M.E.* 4269, 17 March 2006), but at least the names on the Tilbury engines (with one exception) involved a maximum of two words, while that company's heraldic device was comparatively uncomplicated. Mr. Marriott's 10-wheel tankies on the other hand flaunted MIDLAND & GREAT NORTHERN in full across their side tanks, shaded black to the right and below (**fig 4**). The Midland style gilt serif letters were 6in. high, with the centre line of the lettering set at a radius of 13ft. 9in., the whole scheme being unique to the three 4-4-2Ts.

As if this were not enough, approximately 1ft. 8in. below the lettering, measured from the centre-line of lettering at its highest point to the centre of the shield, reposed the railway's highly complex armorial device (**fig 5**).

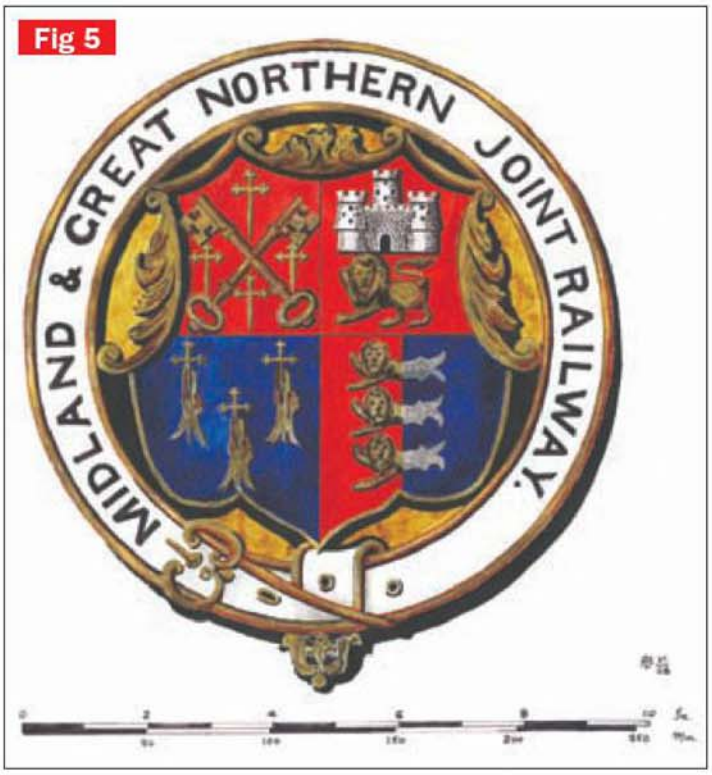
In order to create this elegant but unauthorised (and therefore in heraldic terms totally bogus) emblem, the anonymous designer had hijacked no fewer than four legitimate Coats of Arms from local towns - those of the See of Peterborough, Norwich, Kings Lynn and Great Yarmouth. As we have seen, one of them, Kings Lynn, wasn't even directly served by the M&GN. All four individual Coats of Arms were complicated designs, while the whole ensemble was set off with copious amounts of florid acanthus leaf decoration in gold, plus a garter surround and finally enclosed in a sort of diamond shaped lozenge of black and yellow lining with intertwined corners (**fig 6**). In passing, please note that my illustration, fig 5, of the Midland & Great Northern's heraldic device shows the version carried by 4-4-2T No. 9 when she emerged from Melton Constable works as a new engine in March 1910, probably the last engine to carry the emblem in this form. Some time during that year, the colour of the garter was changed from white to Oxford Blue, while the rather funereal black lettering was replaced by gilt, everything else remaining as in my drawing.

I have drawn figs 5 and 6 as separate items and rather larger than usual, in the hope that anyone wishing to build a model of a Midland & Great Northern engine would perhaps be able to make use of my illustration(s) through some form of reduction process, though that naturally depends on the size of reproduction in the magazine. I must say I would certainly think long and hard about trying to hand-paint either the emblem or the lozenge on a gauge '0' model - or even on a 7¼in. gauge one for that matter! On the Marriott 0-6-0Ts described above, the emblem (without the lozenge) appeared in the centre of the side tanks, except that it was positioned above the number, producing a slightly odd effect. On the little 4-4-0Ts, it was placed between the 'M &' and the 'G N', as it was on the tenders of the Beyer Peacock 'A' class 4-4-0 tender engines mentioned earlier. However, on the Derby built 4-4-0 tender engines, the device appeared on the driving wheel splashers, sometimes with and sometimes without a diamond lozenge surround, but beware! - the lozenge on the Derby 4-4-0s was not the same design as that illustrated in my fig 6, which I believe was unique to the 4-4-2Ts.

While on the subject, a few further details of the M&GN

Fig 4

Fig 5



colour scheme as applied to the Marriott 4-4-2Ts in their early years, and indeed up to the late 1920s, may be useful. I have attempted to portray this in figs 1 and 2, but I fear that trying to produce a full-size quarter inch line at a scale of 1:32, in other words just under 8 thou. wide, is a little beyond my capabilities in watercolour, even with the finest Kolinsky sable brush. The basic locomotive colour at that time was a light brown, which has been described in all sorts of exotic phrases, perhaps the most way out being 'Golden Gorse' - a very evocative piece of alliteration, but totally meaningless in practical terms. Of more use to those wishing to reproduce it are the colour patches that can be found in **refs 3** and **10** listed at the end of this article. I may say that ref 3 by Nigel Digby is one of the most carefully researched and informative books I have ever come across on any subject and is an absolute essential for anyone wishing to build a model of any M&GN locomotive, whatever the scale - or anything else belonging to the company for that matter, as the book gives very full details of colour schemes at various dates, not just of rolling stock, including coaches and wagons of course, but signalling equipment, stations and other buildings, road vehicles -even wagon tarpaulins!

To return to our 4-4-2Ts, the light brown was applied to boiler, including dome, tanks, cab sides and tender sides, while according to Mr. Digby, everything below the footplate, including wheels and cylinders was either burnt sienna (a much darker red-brown) or black. However, it is only fair to say that I have in my own collection an F. Moore colour postcard (approximate date 1910) of one of the M&GN Derby built 4-4-0 tender engines with wheels the same light brown colour as the upper works. In view of the obvious care taken in compiling his book, I am inclined to accept Nigel Digby's specific statement that the wheels were in fact burnt sienna with black tyres, with a lemon chrome line between the black and brown, and this is the scheme I have worked to in producing fig 1. The wheel centres and axle ends were circled in black with a lemon chrome line on the inside only, while one slightly unusual detail is that the lining round the centres of the driving and coupled wheels did not follow the outline of the crank - it was just a plain circle.

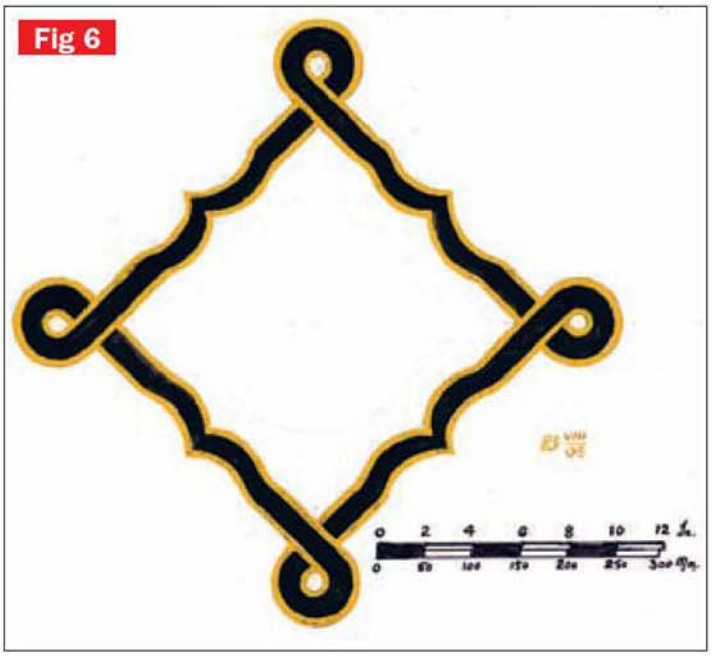
The panel lining on the boiler bands, tanks, (but not the diamond lozenge framing the emblem mentioned above), cab and bunker comprised a 1½in. wide black line, flanked each side by ¼in. of lemon chrome, that is to say a total width of 2in. The diamond lozenge was similar, except that the black line (scaled off various photographs) was only 1in. wide, a fact I found out after having completed my initial attempt at fig 6, using the standard 1½in. black line - I have to admit that this belated discovery did give rise to a certain amount of what LBSC used to call Railroad Esperanto. Tank, cab and tender sides were edged ¾in. black with a ¼in. lemon chrome line between the black and the main light brown panel, while the spacing between what I will call the edge lining and the main panel lining was 3 inches. A curious feature is that the lining on the whole of the bunker consisted of a single panel - in other words it was continuous across the rear of the engine and round both sides. The outer surface of the main frames was burnt sienna, lined out round the edge in black and chrome above the footplate only and the cylinders were also burnt sienna, lined as shown in my fig 1. Now, in his excellent book, Nigel Digby specifically states that the footsteps were unlined burnt sienna, but it all depends on what he means by 'unlined'. A couple of very fine photographs of No. 9, taken at Cromer Beach when the engine was brand new, (the primary source for my illustrations), show definite evidence of lining round the edge of the footsteps, so perhaps the details of the colour scheme varied from engine to engine - or does he mean there was no panel lining? But there would scarcely be room for the standard 2in. wide lining as used elsewhere in any case. The footplate valance was also burnt sienna, lined along the edges in ¾in. black and ¼in. lemon chrome. The buffer beams were vermilion edged in black, but without the lemon chrome line, and the buffer stocks were also edged in black as shown in my fig 1.

By the way, it's worth noting that the outer edges of the buffer beams were curved rather than the more usual vertical straight line. Not visible on my drawing are the inside faces of the main frames, which were also vermilion, as were the safety valve levers. The chimney, smokebox and casing round the outside steam pipe and the top surface of the footplate were black. The first of the 4-4-2Ts, No. 41, built in 1904, carried an oval brass numberplate, but the other two, Nos. 20 (1909) and 9 (1910) were fitted with 9in. high individual brass numerals as shown in my drawing. Apart from their size, they were identical to the 6½in. numerals standard on the Midland Railway.

The first of the trio

Locomotive No. 41, as originally built, also differed from her later sisters by being equipped with a typical Midland Railway short smokebox of the type employed by S. W. Johnson during the earlier period of his reign at Derby, including the characteristic flush fitting door and single piece plate hinge. The other two locomotives, Nos. 20 and 9, emerged from Melton Constable as shown in my figs 1 and 2, with an extended smokebox, twin hinges and a Derby style locking ring as used on the later Johnson Midland engines, and No. 41 was soon altered to conform with them. Even though the chimney was no longer centred longitudinally on the smokebox, I have to say that I prefer the later version, and it would certainly make sense in a live steam model, unless you are happy to recess the front tubeplate well into the barrel. In later years, at least two locomotives, Nos. 20 and 41, and probably No. 9 as well, were fitted with smokebox doors of Deeley design equipped with dog clips, a modification that did nothing for the engines' appearance. Another noticeable visual alteration towards the end of their careers was the >>

Fig 6



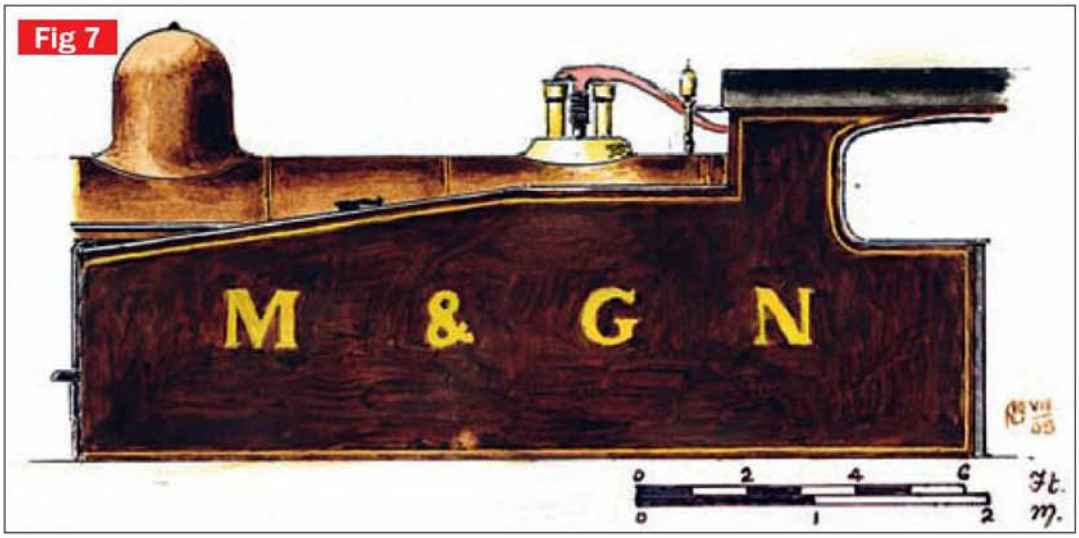
amputation of a wedge-shaped chunk from the top of the front end of the side tanks, producing a downward slope (**fig 7**). Now, if you thought the result of the surgery has a vaguely 'Swindonian' air about it, you would be quite right as by that time engineering activities at Melton Constable Works were controlled by Alfred Nash, an ex-Great Western man, who became Locomotive Engineer for the last few years of the M&GN's existence until the LNER took over complete responsibility for the system in October 1936. The official reason given for the modification was to improve the driver's view forward, although as No. 41 was by then the best part of 30 years-old, it would seem to be a bit late in the day. Official side effects of the excision were that the water capacity of the tanks was reduced by 50 gallons to 1,600 gallons, while half a ton was deducted from the engine weight - both suspiciously round figures. By the time these alterations were made in the early 1930s, the basic colour had been changed to the much darker shade of brown illustrated in fig 7, and the lining simplified to a simple lemon chrome line, which on the sides of the 4-4-2Ts was now extended round to the front of the tank and at the rear up to the cab roof. The shape of the lining across both sides and the rear of the bunker in a single panel remained as before, but had also been reduced to a simple chrome yellow line. The elegant but complicated curved lettering together with all the intricacies of the heraldic emblem, lozenge etc. had been suppressed altogether and replaced by a simple 'M & G N' in 12in. high lemon chrome serif letters, in Midland style, but without shading, as shown in fig 7.

The main frames of these locomotives were in three pieces, with the front and rear portions inside the central section to aid clearances for bogie and trailing wheels, the overlapped joints being between the rear bogie wheels and the drivers, and between the rear coupled wheels and trailing wheels. I think the frames were 1in thick, but that figure has been scaled off my G/A diagram, which is almost totally devoid of dimensions. In any case the matter is academic unless you wish to build a glass case job. The valve gear was Stephenson link motion with locomotive type links operating slide valves, the steam chests being inside the frames, that inaccessible position so beloved of Victorian and Edwardian locomotive designers in this country. I am unable to provide a drawing of the valve gear, as my 1914 M&GN General Arrangement diagram is not very forthcoming on the subject and no other drawing seems to have survived, but the eccentric rods scale off at approximately 4ft. 2½ inches. I'm sorry to say I have also failed to discover port sizes or any details of lap, lead or valve travel. Cylinders were 17¼ x 24in., relatively small for an engine of this size in both diameter and stroke, which in a miniature version should ease to some extent the perennial problem of the fight for space at the front end between the cylinder block and the bogie wheels. The latter were 3ft. diameter, again on the small side, on a 6ft. 6in. wheelbase, both dimensions also favourable to a builder of a small sister. Driving and coupled wheels were 6ft. diameter and the trailing wheels are generally quoted as 3ft. 7in., although according to Ronald Clarke (see references) they were half an inch smaller.

Double slidebars

One difference between the M&GN and the LT&SR 4-4-2Ts lay in the employment of double slidebars on the Melton Constable engines, a feature they shared with the earlier Beyer Peacock 4-4-0s, whereas the Tilbury Tanks were equipped with the standard Adams design of single slidebars. Another difference lay in the method of providing sideplay to the trailing wheels. On the LT&SR engines this was achieved by means of a Webb type radial axlebox, but on William Marriott's M&GN trio the rear wheels were housed in what Ahrons (see references) describes as a Bottomley Radial Truck, a device that seems to me to have more in common with a normal pony truck than with a radial axlebox assembly. Unlike those on the Tilbury tanks, no curved axlebox guides were required in this design, the whole rear wheel unit being attached to a triangular frame pivoted about 5ft. 1in. ahead of the axle centre line in the case of the M&GN engines, this dimension again scaled off my G/A diagram. The sideways movement was controlled by a powerful spring fitted behind the wheels, as in a genuine radial axlebox assembly. The design was very similar to that employed on Henry Ivatt's Great Northern Railway 4-4-2Ts (later LNER C12) and according to the RCTS Locomotives of the LNER, (see references), a complete

Fig 7



set of drawings of the trailing axle assembly of these engines was sent from Doncaster to Melton Constable. My initial reaction was to wonder just how the Derby authorities, nominally responsible for M&GN locomotives, would have reacted to this intrusion into their territory, but then I remembered that the Midland didn't often go in for rear carrying wheels, (apart from the beautiful Johnson Spinners, of course) so they were probably quite grateful. The Bottomley Radial Truck has a lot to recommend it to the builder of small locomotives, since it is a much simpler device to make than the Webb type radial box. Apart from problems of manufacture, the initial design of a true radial axlebox assembly in miniature poses questions regarding the calculation of the optimum radius of the sides of the axlebox due to the relatively sharp curves on the average small track.

Midland & Great Northern Joint 4-4-2Ts: Main Dimensions

Note: these are specifically intended for use in building a miniature version, so internal dimensions such as grate area and I/D of boiler have been omitted. Dimensions prefixed by = have been scaled off drawings and/or photographs and are therefore approximate. Figures for 3½in. gauge have been calculated at ¾in. to the foot, and 5in. gauge at 11/16in. to the foot, both rounded to the nearest 1/64in. For Gauge One, halve the 3½in. gauge figures, for 2½in. gauge, halve the 5in. gauge figures and for 7¼in. gauge, double the 3½in. gauge figures.

Description		Full size	3½in. gauge	5in. gauge
Length over buffers		38ft. 8in.	29in.	41 5/64in.
Height to top of chimney	=	12ft. 11¾in.	9 47/64in.	13 51/64in.
Height to top of dome	=	12ft. 2¼in.	9 9/64in.	12 61/64in
Height to top of cab roof	=	11ft. 5in.	8 9/16in.	12⅛in.
Length of cab roof	=	8ft. 1in.	6 1/16in.	8 19/32in.
Height to footplate	=	4ft. 2 9/16in.	3 5/32in.	4 31/64in.
Width over footplate (max. width)		8ft. 6in.	6 3/8in.	9 1/32in.
Width of side tanks, cab and bunker		8ft. 0in.	6in.	8½in.
Height of tanks & bunker above rails	=	9ft. 1¾in.	6 55/64in.	10 3/16in.
Pitch of boiler above rail level		7ft. 6in.	5 5/8in.	7 31/32in.
External diameter of boiler over cladding	=	4ft. 8in.	3½in.	4 61/64in.
External diameter of smokebox	=	4ft. 11in.	3 11/16in.	5 7/32in.
Diameter of smokebox door	=	4ft. 3in.	3 3/16in.	4 33/64in.
Visible length of smokebox (extended)	=	4ft. 3in.	3 3/16in.	4 33/64in.
Height of chimney above smokebox	=	3ft. 4¼in.	2 33/64in.	3 9/16in.
Total wheelbase		29ft. 6in.	22 1/8in.	31 11/32in.
divided: bogie wheelbase		6ft. 6in.	4 7/8in.	6 29/32in.
rear bogie wheel to driving wheel		7ft. 0in.	5¼in.	7 7/16in.
driving to coupled wheel		8ft. 6in.	6 3/8in.	9 1/32in.
coupled wheel to trailing wheel		7ft. 6in.	5 5/8in.	7 31/32in.
Diameter of bogie wheels (10 spokes)		3ft. 0in.	2¼in.	3 3/16in.
Diameter of driving and coupled wheels (20 spokes)		6ft. 0in.	4½in.	6 3/8in.
Diameter of trailing wheels (12 spokes)		3ft. 7in.	2 11/16in.	3 13/16in.
Pitch of cylinders above rail level	=	3ft. 0in.	2¼in.	3 3/16in.
Cylinder bore		1ft. 5¼in.	1 5/64in.	1 17/32in.
Piston stroke		2ft. 0in.	1½in.	2⅛in.
Length of connecting rod	=	6ft. 3½in.	4 23/32in.	6 11/16in
Length of eccentric rod	=	4ft. 2½in.	3 5/32in.	4 15/32in.

References

1. General Arrangement Diagram of M&GN Joint Committee 4-wheels coupled Tank Engine. Dated 1914. Side Elevation and Plan, few dimensions. Available from the National Railway Museum under ref. no. 4/GW/7114/E.

2. *Locomotives Illustrated No. 85: M&GN Locomotives*. Pub. Ian Allan 1992. Contains good photograph of No. 9 when new, small reproduction of the F. Moore colour postcard mentioned above and excellent photos of other M&GN locomotives.

3. *Liveries of the Midland & Great Northern Railways Joint Committee and its Constituents* by Nigel J. L. Digby, pub. 2002 by M&GN Circle. Priced at just £7.95 this must surely be the best value railway book on the market. In addition to carefully researched and very complete information on colour schemes, it includes numerous side elevation drawings of locomotives, other rolling stock, road vehicles, lettering and lining details and a set of colour patches. Absolutely essential reading for anybody modelling any aspect of the M&GN.

4. *Scenes from the Midland & Great Northern Joint Railway* by R. H. Clark, pub. 1978 by Moorland Publishing. Contains side and end elevations and plan of the 4-4-2Ts, obviously based on ref 1 above, plus list of dimensions, some of which are at variance with other sources. Also two photographs (not very well reproduced) of the 4-4-2Ts under construction and one of No. 41 as originally built with short smokebox.

5. *Locomotives of the LNER Part 7*. Pub. RCTS 1964. Brief history of the M&GN 4-4-2Ts plus list of dimensions as at 1937. Also contains three photos taken in late 1930s with modified side tanks.

6. *The Somerset & Dorset Railway* by Robin Atthill, pub. 1967 by David & Charles. Contains full explanation of working of Whitaker tablet exchange apparatus and photo of the lineside equipment, but not that on the locomotive. The whole of the written section is reproduced on the SDJR Trust website, together with photos of the equipment fitted on the locomotive.

7. The Laurie Marshall Photo Collection. Five photographs of M&GN 4-4-2Ts which were extremely useful in preparing the illustrations to this article.

8. G/A Diagrams of 'Whitaker's Patent Tablet Exchanging Apparatus' Dated 13/09/1906. Side Elevation and plan of locomotive apparatus, as fitted to tender, and detail drawings of catcher. MR drawing Nos. 06-6875 & 06-6876, available from National Railway Museum, ref. nos. 3/GW/11697/E & 3/GW/11698/E.

9. *The British Steam Railway Locomotive 1825-1925* by E. L. Ahrons, pub. by Locomotive Publishing Co. Contains drawing and description of Bottomley Radial Axlebox.

10. *Railway Heraldry* by George Dow, pub. 1973 by David & Charles. A unique and fascinating book, very well researched with many colour reproductions of company emblems, although unfortunately printing standards 35 years ago were not quite as good as they are today.

11. *British Railway Liveries* by Ernest Carter, pub. Burke 1952. Contains a set of very useful colour patches, but beware - the text is confusing and not always accurate.

To be continued.

New lamps and old for the Nottingham SMEE

JOHN LOPEZ

John Lopez focuses on signals.

Safety warning: The LEDs used are extremely bright and the manufacturers advise not to look directly at them at a close distance (It is always worth looking at manufacturer's data!). For focussing my method is to project the image on to a wall or use a mirror across a room so that the distance is extended. I expect you could use 'sunglasses' but have not tried this. The focal distance is approx twice the radius, 34mm in this case, depending on the material and construction. It is also important not to look at the sun through the lens. It might not be as good as a properly designed optic but the result will be the same!

For the LED's sake do not let the sun shine directly on the assembly, a cowl or hood is essential. Remember the LED is at the focus of the lens and will FRY. The LEDs are Static Sensitive so some care in handling them is also necessary. They are DC devices and are polarity sensitive so Diodes will be required if you use AC and controlling resistors for all circuits.

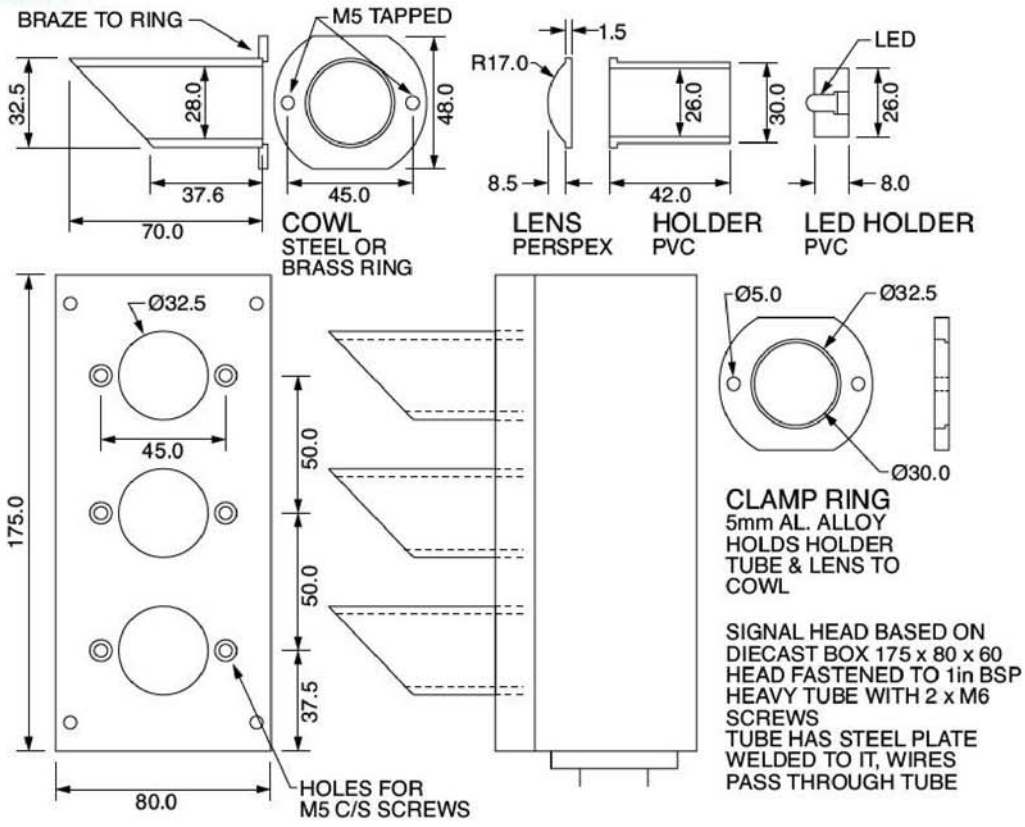
I set the maximum current to 30ma for the ones I use as this gives much better temperature tolerance. To maximise contrast, the front of the signal should be painted black, but this will increase the temperature in the sun. If you suffer temperature problems I suggest that the back and sides of the box are painted aluminium or light grey and perhaps allow some airflow in the box.

If you need a larger size the dimensions can be scaled linearly but don't go silly, you need a reasonable difference in the contrast to see the light effectively.

The 7¼in. colour light signals made some 10 years ago used commercial reflector assemblies. Although they work well close up they could not be seen well at a distance. It was discovered that they were intended for 'Car Parks' and as such had a cover that dispersed the light over a wide angle. These covers were replaced with a simple 'Fresnel lens' and are still in this condition. For the 5in. gauge signals I tried some LEDs but these were not successful due to the beam angle and size, so we resorted to filament bulbs and reflectors. These appeared to be successful, they could be seen quite well, they used reflectors from cheap torches, and had simple flat coloured glasses. However, after a few hot days in the summer we began to suffer failure. This was not the filament as Kevin had set the voltage to 10 volts for 12 volt bulbs, but the plastic bulb holder. This at first distorted and lost contact but later on very hot days the Green Aspect melted wrecking the reflector and lamp bulb in one go. It was just the combination of the heat from the filament (2 watts) and the sun and the fact that the green bulb was at the top and on for long periods at a time. The plan was to replace the reflector with a stainless steel one and use a high temperature plastic for the holder: this was to have been done in January 2007. I made a press tool but got no further; I did, however, make an experimental green matrix with LEDs mounted in a Perspex rod, this was reasonably successful but quite expensive and difficult to wire up (4.1 V LEDs).

Whilst we were commissioning our R/C points Steve Leyland showed me a photo of one of his full size point installations with a LED route indicator using a chip LEDs in a matrix. He sent me four over Christmas and I had a play with them. The problem with LEDs is not the brightness but the beam angle and size. The human eye has a logarithmic response and judges brightness by contrast and size, the LED is just too small. The solution is therefore to use a lot of LEDs or to fool the eye, I chose the latter. A light source that is 10 times brighter does not appear much brighter, but one that is 10 times the area appears 10 times brighter, all you need is an optical system to increase the apparent size of the LED! (This is all to do with subtended angles of the image in the eye just like telescopes and microscopes). From my 'school physics' this can be achieved by placing a biconvex or Plano-convex lens in front of the LED at

Fig 1



the correct distance, I chose a Plano-convex lens as it is much easier to make. There is still one problem, the beam angle. The intensity of the light varies as the (cosine (Beam angle))^4. At first sight this would imply that you need the narrowest beam angle that can be obtained but this is not the case and was the mistake that I made when I first tried them.

Narrow beam angles give the most light but need a long focal length lens and therefore a long distance between the lens and LED and this distance is normally constrained by fitting it into a 'Scale Box'. Because of this constraint we have approximately 50mm between the Lens and back of the box. I first made a 25mm radius Plano-convex lens and placed it 50mm in front of the LED. This worked well but the beam angle was too small so it did not fill the 25mm diameter of the lens. I think the beam angle was 8 degrees. What was needed was a beam angle of 30 degrees. I looked up the RS catalogue and purchased five green LEDs. (All LEDs have a lens built in, this controls the beam angle. You can see the effect of the COS4 by looking at the light intensity in the manufacturer's data). The result was spectacular; although we had lost 60% of the light in absolute terms we had gained 10 times the area so it looked about seven times as bright, close up it was blindingly bright so I reduced the current from 50ma to 30ma (from the manufacturer data this put up the max operating temperature from 80deg. C to 120deg. C). Back to the constraints of the box, although 50mm just fitted in it left the leads to the LED very close to the back of the box so in the interest of reliability I changed the radius of curvature of the lens to 17 millimetres. At 30deg. the beam does not quite fill the lens but is satisfactory. I have the LED codes but as these change frequently I will put a spec.

Green 505nm 30deg. 16000mcd

Amber 590nm 30deg. 6000mcd

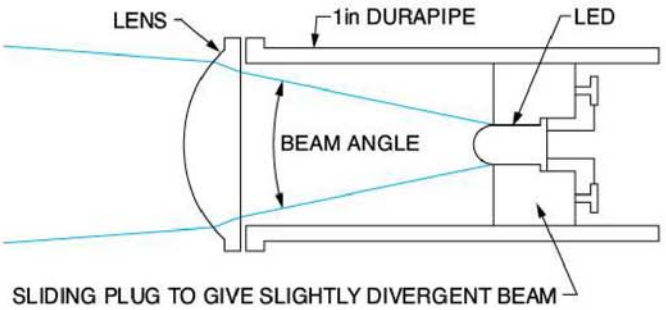
Red 640nm 30 deg 5000mcd

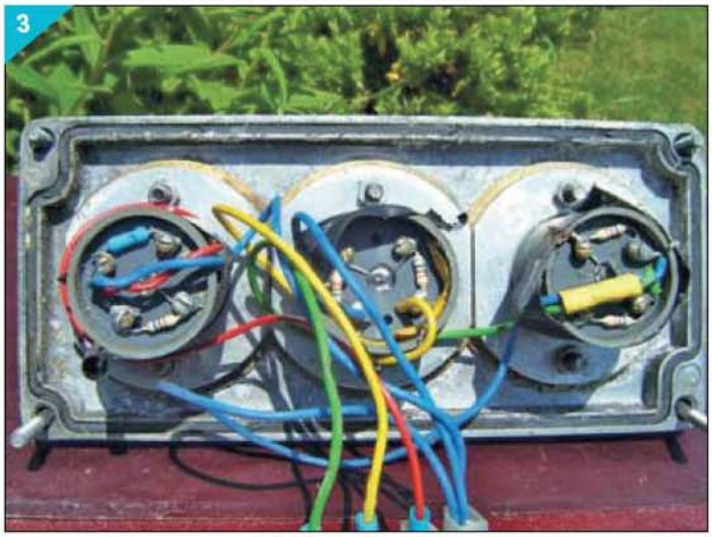
The Lens

I cut about 30 off 32mm squares from 10mm Perspex offcuts and turned these to 32mm round by holding between discs pressed by a revolving centre, I then held these discs in a soft jaw chuck and turned the radius using my template holder with stops set. The lens took about 1.5 minutes to machine and 2 minutes to polish with 4000SiC paper and glass cleaner. The LED was mounted in a PVC disc 12mm thick with the controlling resistors mounted on the back the connection made by soldering to small brass screws in the disc. This disc was a tight sliding fit in some 1in. Durapipe. In operation the beam is focused then slightly defocused to give a slightly divergent beam.

To be continued.

Fig 2





1

The finished Northumbrian. *(Photo: Paul Dewstowe)*

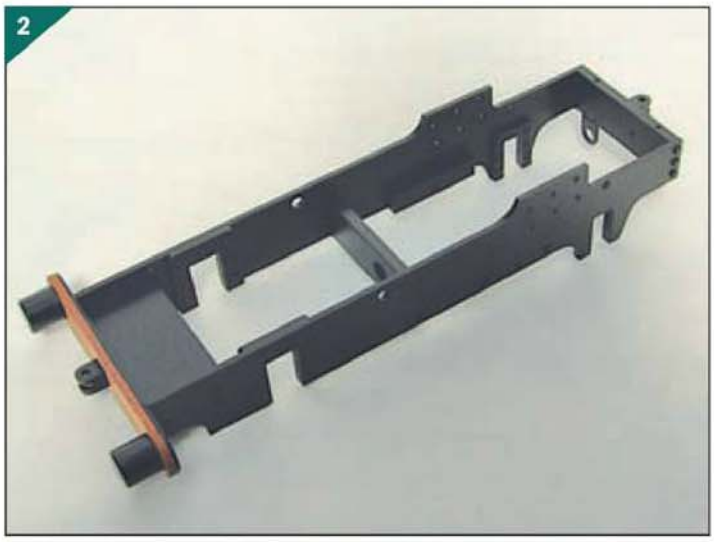
Photographed and built by Paul Dewstowe

Northumbrian
A second look at *Rainhill*

Tony Weale introduces his new locomotive design based on LBSC's *Rainhill*.

Here is a locomotive which should appeal to anyone who felt that *Ayesha* was the wrong gauge, or too complicated for a first attempt. Models of the earliest engines have many advantages for the beginner, which is partly because their builders were beginners themselves and their designs were simple and functional.

2



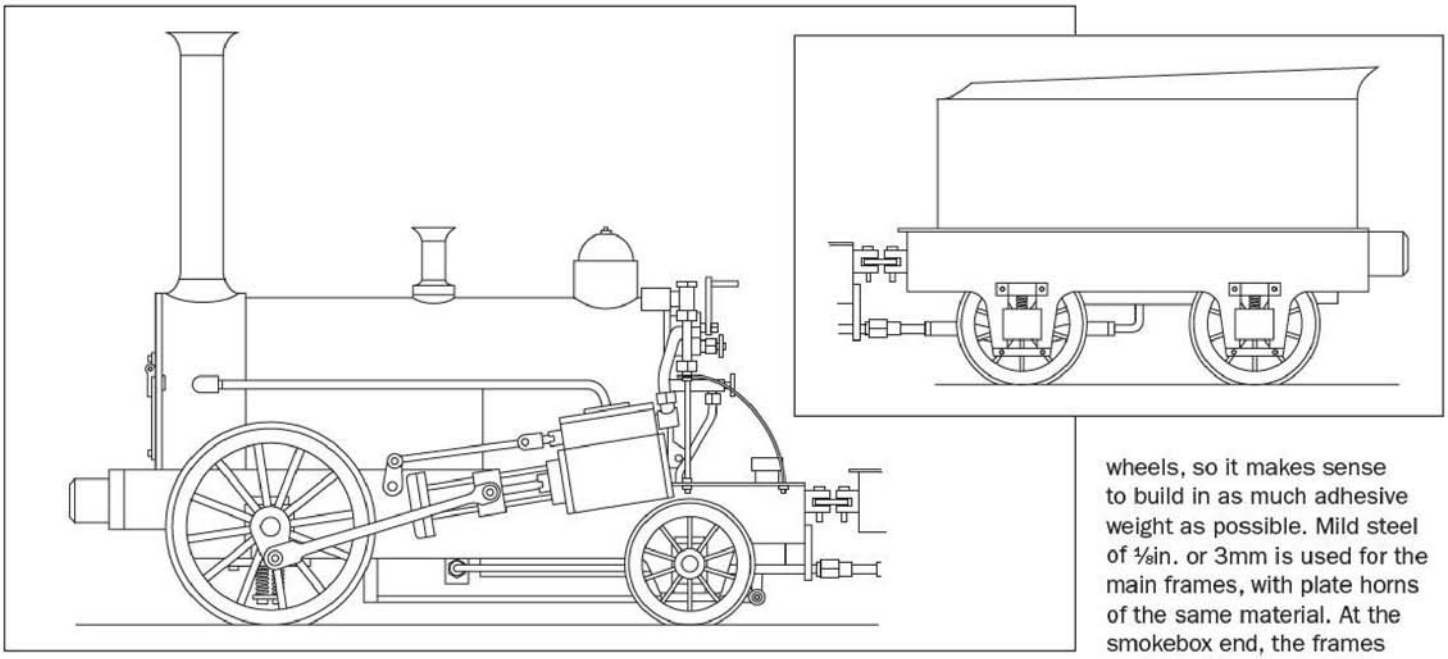
A view of the frames. (Photo: Paul Dewstowe)

The engines were also relatively small machines, so they can be reproduced in our gauges with a minimum of material and equipment. What they lack in size they make up for in character, and with all the working parts exposed they are fascinating to watch in action.

The classic example is, of course, Stephenson's *Rocket*, which was developed into the *Northumbrian* type for the opening of the Liverpool and Manchester Railway. In full-size, this class of locomotives was soon superseded, but a century later it was interpreted in miniature by LBSC as *Rainhill*. One of the problems with finding a 'new' live-steam design, especially one with the beginner in mind, is that LBSC usually got there first, so when considering a simple 3½in. gauge project as a sequel to *Ayesha*, a revised version of *Rainhill* seemed an obvious choice.

Rainhill has been a popular and successful design, but LBSC's construction series comprised only a few pages. It was written in difficult times in 1941, and was typically inspirational stuff, but both the text and the drawings left quite a lot to the builder's imagination. Therefore they are of limited help to anyone making a start today. I have always liked the *Rainhill* concept, but felt that with its high-pitched boiler it did not look very much like the full-sized engine which inspired it. I thought it would be interesting to use the *Rainhill* components in a more prototypical way, and started off by sketching a *Rainhill* with a lowered boiler. This was promising, but led to redesigning almost everything else, and the outcome was *Northumbrian*.

Two of my colleagues from the 2½in. gauge Association's *Ayesha* team, Des Adeley and Paul Dewstowe, made the mistake of asking me what I was going to produce next, so quickly found themselves with a set of drawings to check. They were, of course, quite unable to resist cutting metal,



so at the time of writing we have a selection of prototypes under way. As anyone who has tried it will know, it is almost impossible to check your own drawings, so my thanks are due to both Des and Paul for their valuable feedback and many useful ideas.

Practically every illustration of the actual *Northumbrian* type is different, and most are merely artists' impressions, so it is quite difficult to say what these engines were really like. If built exactly to ¾in. scale, the result would be a small and intricate model, not really suitable for hard work. So this version is certainly not a scale model, just a basic locomotive with character which will pull its driver. With limited adhesion, and potentially as much power as *Ayesha*, it will need careful handling on the track- but that is all part of the fun.

Keeping it simple

I have tried to keep everything as simple as possible, so that the engine can be built easily and reasonably quickly with basic workshop equipment, using a small lathe, plus vertical slide, and a drilling machine. Overall, it is a simpler proposition than *Ayesha*, since there are fewer wheels and less plate work. For once, the slip-eccentric valve gear is true to prototype. The slight complication of rocker arms to the outside valves is not difficult to make, and renders the valves very accessible for accurate setting. On the other hand, everything is exposed to view, so neat workmanship is essential throughout. Non-essential detail has been kept to a minimum, but there is plenty of scope for cosmetic work should the builder feel so inclined.

The boiler is small and straightforward, and should be economical to build, ideal for a first attempt. There will be a non-superheated version, which was suggested by LBSC as a possibility for *Rainhill*. For those who feel that the extra complexity is worthwhile, there will be the option of a radiant superheater, similar to that used in *Ayesha*. Hopefully, both 'wet' and 'dry' examples will be built, and we can discover whether superheating has any effect in a locomotive of this size.

Rainhill wheel castings are used. The cylinders can be made from *Rainhill* castings, but those for *Canterbury Lamb*, otherwise *Invicta*, are preferable since they have greater machining allowances. The smokebox is circular, since this is the easiest form to make, but is disguised by a wrapper sheet and front plate in the appropriate style. The front plate is removable to aid assembly and tube cleaning. The tender is basic, but includes a well tank to increase water capacity, and to make it rather more interesting to build.

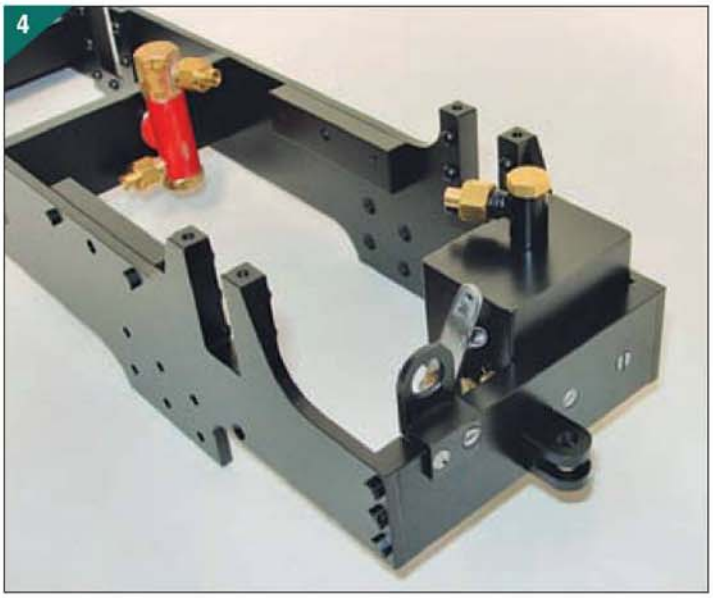
Whilst the design is closely related to *Rainhill*, beware of mixing and matching the two, since there are many dimensional differences. On the subject of dimensions, someone is sure to look at the drawings and point out gleefully that the buffers and couplings are not of the standard height. He might like to go and apply a measuring stick to the original *Rocket*, and while he is doing that, the rest of us can get on with the job.

Main frames

This locomotive will be of similar power to *Ayesha*, but has only one pair of driving wheels, so it makes sense to build in as much adhesive weight as possible. Mild steel of ⅛in. or 3mm is used for the main frames, with plate horns of the same material. At the smokebox end, the frames are joined by a rectangular block, machined to the exact frame spacing, with tapped holes for the fixing screws. This makes for quick and accurate assembly and provides some useful ballast. The pump stay and rear beam are less massive, but use the same method of fixing. It is possible that pre-cut frames and hornplates will become available for this locomotive, in which case the job becomes even simpler, but there should be no real difficulty in making the frames from scratch using a hacksaw and a file.

For the locomotive frames, two pieces of mild steel sheet, 12 x 2½in. are required. In industrial terms these are not much more than offcuts and you may find >>

Another view of the frames. (Photo: Paul Dewstowe)



Underside view of the frames. (Photo: Paul Dewstowe)

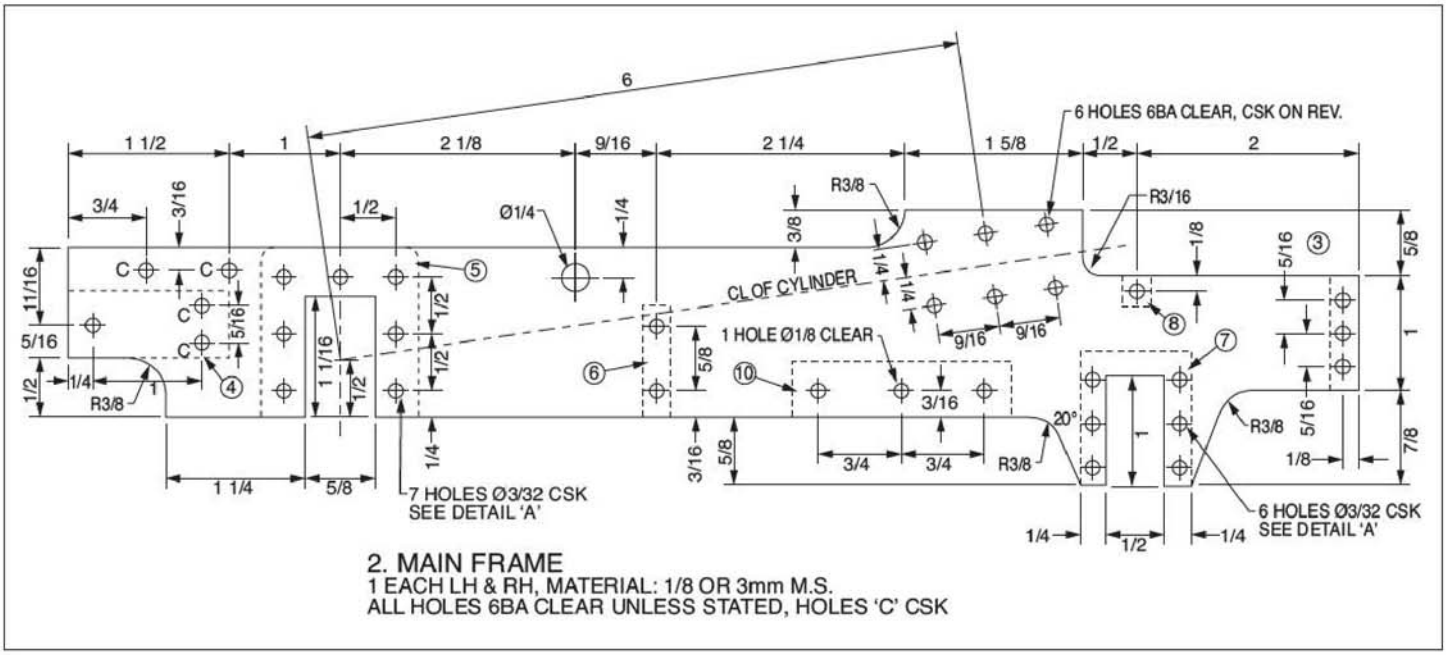
that a local light engineering company (they do still exist) or sheet-metal stockist will supply these cheaply. If possible, get them sheared to exact width. This will save a lot of cutting, and give straight edges to start from. If the shearing is done properly there will not be much distortion at the edges, most of which will have to be trimmed off anyway. Hot-rolled 'black' steel is preferable to bright mild steel, since it is easier to work and less likely to distort when cut. It will probably look quite bright by the time you have finished with it! Either ⅛in. or the slightly thinner 3mm material will do, the width of the frame stretchers being adjusted to suit.

Mark out one of the blank frame plates according to the drawing, scribe the cylinder centre line deeply, and centre-pop all the holes. It is probably most convenient to use the bottom edge of the plate as the datum. Cut the profile by sawing and filing, finishing just outside the marked outline to allow for final finishing. Now lay the first plate over the second blank, align, clamp together and drill through both plates at three of the marked holes - one at each end and one near the middle - and rivet the plates together temporarily. Screws and nuts can be used if preferred, but they have a habit of working loose, so rivets are better for this job. Either steel or copper ones will serve, and they do not need to be countersunk. Next, cut the profile of the second plate, using the first as a guide, and file the pair to the finished size. Take care that the horn slots are vertical, and have parallel sides. Finish the slots slightly undersize to start with, then finalise using a rectangular piece of flat steel bar, of the same width as the finished slot, as a gauge.

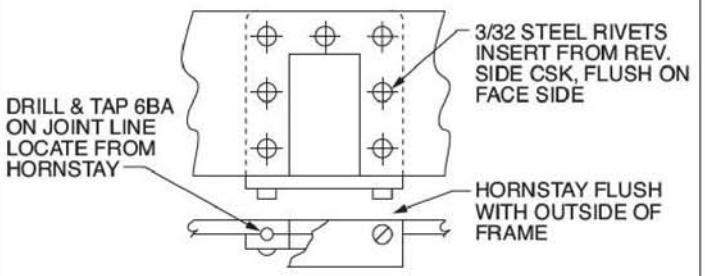
Move to the drilling machine, and set to work on the holes. Starting from the left-hand end of the frame as drawn, we have a group of three holes to attach the leading frame stretcher, and two above this to attach the smokebox. Next are seven holes around the driving axle slot, for the hornplate rivets. On the right of this is a single ¼in. diameter hole to accept the bush for the valve gear rocker shaft, followed by two holes for the pump stay screws. To the right of this there is a group of six holes to secure the cylinder, and below this is a row of three at the bottom edge of the frame. The two outer ones here are to attach the firebox support, while the centre one is a clearance hole for the ashpan pin. Following this we have six holes for the trailing horn stay rivets, with a single hole above them at the footplate support position. Finally, there are three holes to attach the drag beam to the frame. Some additional holes are required at a later stage to attach the guide bar brackets, but these are best located from the brackets themselves, so they are not shown on the frame drawing.

Note that the holes for the cylinder fixing screws are countersunk on the inside of the frame, which is a task for a later stage, whilst the holes for the hornplate rivets, and several others, are countersunk on the outside of the frame plate. Remember that you need one left-hand and one right-hand frame. Four of the holes at the leading end fall behind the driving wheel rim, and must be countersunk to maintain clearance, as should the single screw hole for the footplate support at the rear of the frame. The holes for the pump stay screws should also be countersunk, since the guide bar bracket will partially cover them. The remaining screw holes in the frame can be left plain to accept raised-head screws - hexagon heads will look best - or may also be countersunk if a smooth finish is preferred.

Before separating the frames, it will be useful to transfer the sloping cylinder centre line onto the outside of the second frame. This should be a simple matter of measurement from the bottom edge of the frame. Then separate the frames by filing off the heads of the



2. MAIN FRAME
1 EACH LH & RH, MATERIAL: 1/8 OR 3mm M.S.
ALL HOLES 6BA CLEAR UNLESS STATED, HOLES 'C' CSK



A. HORN & STAY ASSEMBLY

temporary rivets. Complete the countersinking of the cylinder securing holes, and clean up and deburr as necessary.

Some builders may feel that 6BA hexagon heads look rather too large in exposed positions on the chassis. If so, 7BA can be safely substituted, and the holes reduced in size to suit, but remember that smaller taps are easier to break! You can buy 6BA screws with 7BA size heads from Items Mail Order. I have not stated exact drill sizes for screw holes, since ideas on tapping and clearance sizes vary, as does the accuracy of individual drills and taps. Also, some builders may prefer to use small Metric sized fasteners rather than BA sizes.

Hornplates and stays

The next task is to make and fit the hornplates and horn stays. The hornplates fit inside the frames and are made from the same material. Finish the outer profile of the hornplates to size, but do not cut the axlebox slots, or drill any fixing holes. Clamp each hornplate in position on the frame, ensuring that its underside is flush with the bottom edge of the frame. Spot through the rivet holes with a 3/32in. drill, then lightly countersink the holes on the inside of the hornplate.

Secure the hornplate with countersunk steel rivets. Insert one rivet at a time from the outside of the frame, and trim the end of the rivet with a pair of sidecutters so that it projects through the hornplate by just over 3/32 inch. Then support the countersunk head on an anvil, or other flat block of metal, and work the other end of the rivet down with a series of light taps from a small hammer. This will enlarge the end of the rivet, and expand it in the hole. Finish the job with a rivet snap, and a couple of heavier blows from the hammer.

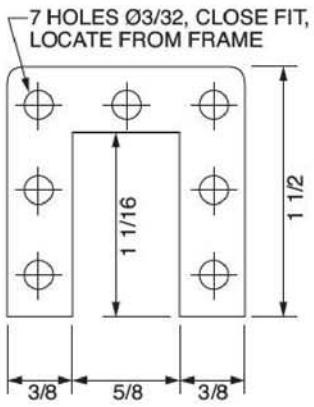
The rivet snap is just a punch with a recessed end. This can be bought, but it is quite easily made by countersinking the squared-off end of a piece of steel rod, say 1/4in. diameter and 6in. long. Strictly speaking, the recess should be semicircular. To form this, anneal the countersunk end by heating to dull red and allowing to cool, then knock a steel ball of suitable diameter into the countersink, repeating the process if necessary. For a 3/32in. snap, a 1/8in. or 5/32in. ball will be about right, but note that it will not be much use for anything else afterwards! Ideally the business end of the tool should be case-hardened, but for the sort of use we are envisaging it can be left soft, and will work-harden quite effectively.

Once the hornplates are attached, cut out the axle slots and finish them by filing to match the finished size of the frame slots, using the flat bar as a gauge, as before. Ensure that the countersunk heads of the rivets are flush with, or slightly below, the outer surface of the frame, since the axlebox flange will bear on this area. Smooth off with a file if necessary.

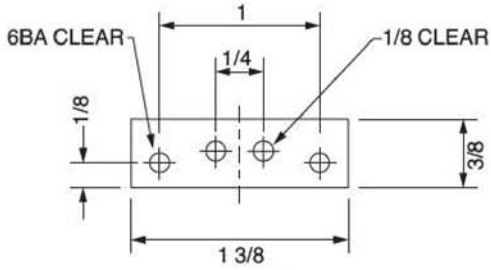
The driving and trailing hornstays are simply cut, filed and drilled from 1/8in. or similar mild steel, and are most quickly made from strip of the required width. With the frame plate held inverted in the vice, centre each stay over its horn slot and spot through the fixing holes into the frame. The spot should be exactly on the joint line between the frame and the hornplate. Drill and tap 6BA at each spot, about 1/4in. deep. It does not matter if the hole runs into the lowest rivet, and if you do have the misfortune to break a tap, all you have to do is drill out the rivets and separate the parts to clear up the mess. This method of fixing hornstays was used by LBSC in a number of designs. It works better than might be expected, and makes a neat job.

For anyone not happy with this arrangement, there are two alternatives. One is to make the hornplates 1/4in. thick, and move the fixing holes in the hornstays inboard so that the screws locate in solid metal. The other is to adopt the method used on *Ayesha II*, with hornstays made from angle and screwed to the main frames. There would be no difficulty with this on the leading axle of *Northumbrian*, but at the trailing end the frame profile would require modification to provide space for the fixing screws.

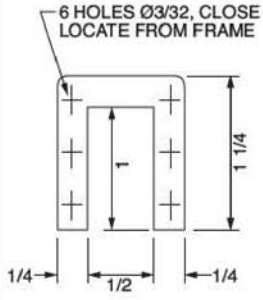
To be continued.



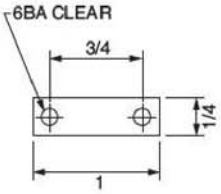
5. DRIVING HORN PLATE
2 OFF, MATERIAL: 1/8 (3mm) M.S.



9. DRIVING HORN STAY
2 OFF, MATERIAL: 1/8 (3mm) M.S.



7. TRAILING HORN PLATE
2 OFF, MATERIAL: 1/8 (3mm) M.S.



11. TRAILING HORN STAY
2 OFF, MATERIAL: 1/8 (3mm) M.S.

NICK FEAST

CHARLIE

A Southern Railway Q1 for 3½in. gauge

Nick Feast looks at the axles and axleboxes.

PART 3

Continued from page 759 (M.E. 4354, 19 June 2009)

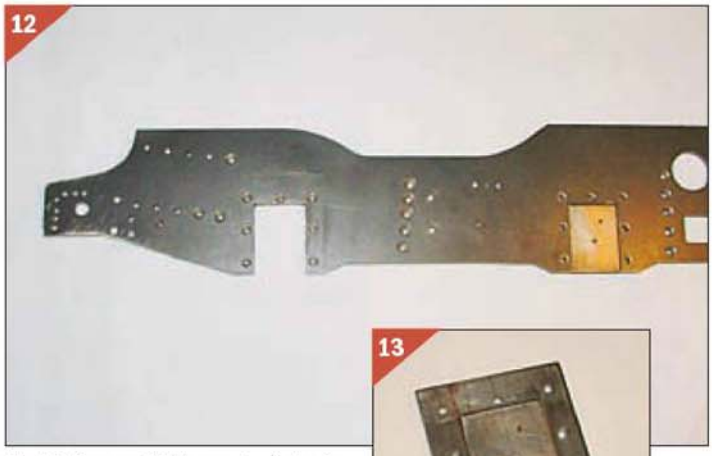
Before starting on the axles I will add a few notes and photos relating to the frame construction described last time. **Photograph 12** shows the centre finder and drilling jig placed in the centre horn slot to allow the position of the centre of the driving axle to be used to mark out the fixings for the cylinder block and the motion plate. The 3mm plate visible is attached to a larger plate behind, which can be any thickness, and has the riveting hole positions drilled in it.

Photograph 13 is of the centre finder and drilling jig used to drill the rivet holes in the frames. **Photograph 14** shows the completed motion plate with the anchor trunnions for the lower links of the Joy valve gear fitted. It is better to complete this item before permanently fixing to the frames. The drawing for the trunnions is included in this article.

Photograph 15 shows a way of locating the holes for the trunnion fixing screws by holding the item in position with Mole Grips and lightly drilling through with a hand drill the same size as the clearance hole. This will neatly centre the tapping drill, which is set up in the pillar drill. This saves a lot of swapping from clearance to tapping drills in the pillar drill with the obvious risk of getting them mixed up. This is easily done in the BA sizes.

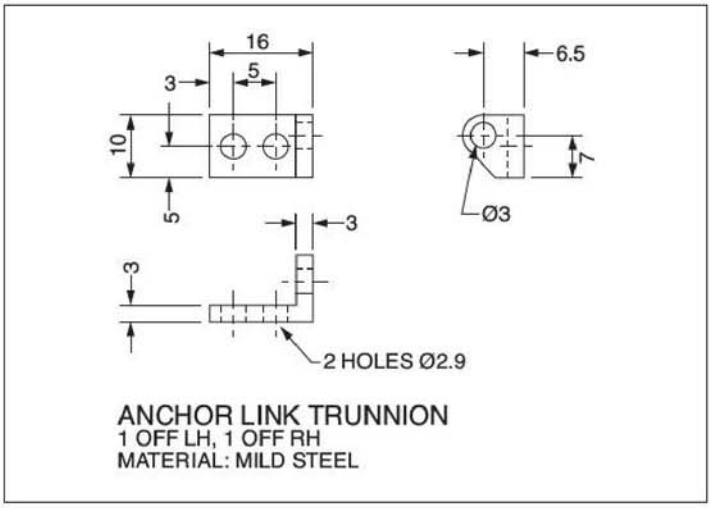
Note that the plate is stamped with 'front' to ensure it goes in the right way round as the holes in the trunnions are offset. There are witness marks on the face where it was held in the 4-jaw chuck and the tool dug in. I reasoned that blunting a lathe tool on the hard face of the laser cut blank was better than blunting a milling cutter! If you do it this way then feed *very* slowly to avoid this mishap.

Since writing the last article Polly Model Engineering have kindly supplied some cast iron horns from my pattern, which should overcome the premature wear experienced with the proprietary hot pressed brass items. The problem is worst on the rear axle, which passes through an arch under the ashpan so is working in a very hostile environment. I have shown the simple jig used

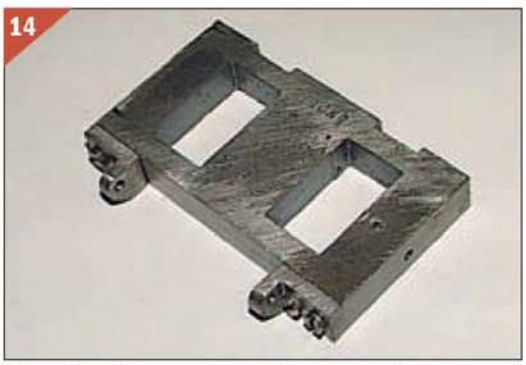


The left frame with the centre finder in position. I have marked out the centre line of the cylinders and from this the fixing holes can be positioned.

This is the centre finder and drilling jig. Remember not to drill the top row of holes for the rear axleboxes. See photo 18.

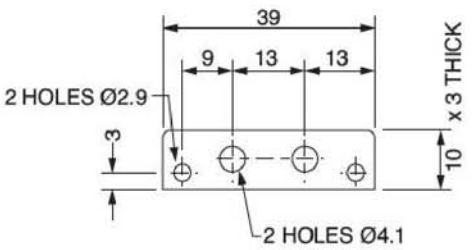


ANCHOR LINK TRUNNION
1 OFF LH, 1 OFF RH
MATERIAL: MILD STEEL

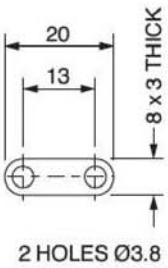


The motion plate uses laser cut 10mm steel plate rather than an expensive bronze casting. It is important to get the trunnions the right way round, they are slightly offset. Mark the front of the plate clearly. The drilling and tapping for the slidebars is done after assembly.

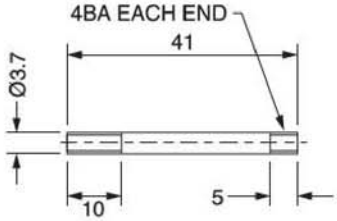
Drill and tap one set of holes in the motion plate and then bolt and clamp the trunnion brackets in position. Use a hand brace or battery drill to spot drill the position of the second holes using a clearance drill. This will stop the tapping drill wandering on the hard surface of the laser cut plate.



HORNSTAY
6 OFF
MATERIAL: MILD STEEL



SPRING PLATE
6 OFF
MATERIAL: MILD STEEL



SPRING PIN
12 OFF
MATERIAL: MILD STEEL

to hold the horn while milling to the required thickness and to slot into the frame cutouts (**photos 16** and **17**). Leave the final tidying up until the horns have been riveted into the frames. The material protruding outside the frames can be filed or milled off before the frames are bolted together to file or mill out the horn faces to suit the axlebox dimension. **Photograph 18** shows a rear horn fitted into place together with the axlebox.

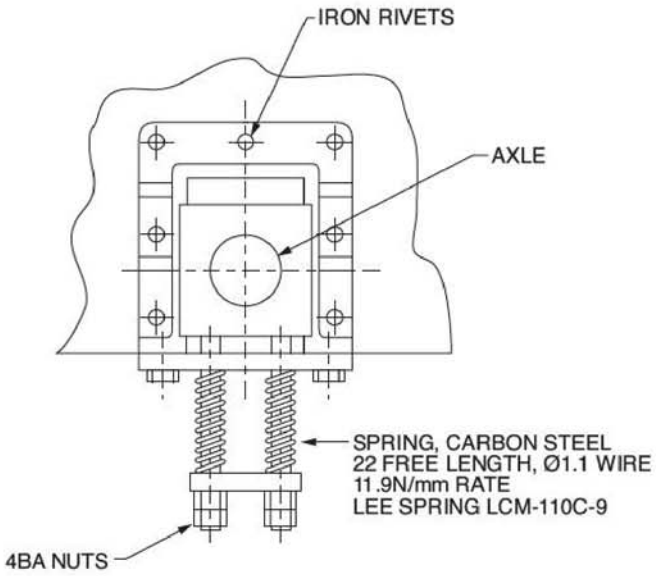
The axles

Continuing with the chassis parts, the next items to make are the axles and these are made from imperial ½in. material on my locomotive as it was readily available. A quick check on the internet reveals that drawn bright mild steel round bar is still available at the moment, but higher grade EN8 is more likely to be metric, which would be slightly smaller at 12 millimetres. Clearly the trend will be metric sizes but this simply means scaling to suit. The perfectionist would opt for ground bar, which is a better bet if buying unseen. I have been fortunate in acquiring some drawn machinery studs about 8in. long, which are not only very close to perfectly round but also machine nicely, even parting off without much fuss. A strip of fine emery soon takes off the slight ridge caused by the drawing process.

First cut three lengths of bar slightly oversize, face the ends to exact length and centre drill. Set up in the lathe as shown in **photo 19** and machine to 11.25mm diameter for the wheels. Note the position of the vernier on the cross slide and try to get all the axles exactly the same diameter. Probably better to discard an axle that comes out undersize at this stage, as >>

16 *A cast iron horn is set up in the jig on the milling table, ensuring that it is lined up with the axis of the machine. File down the back of the horn to remove any roughness from the casting.*

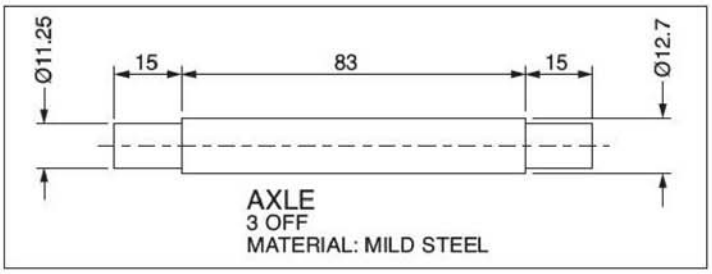
17 *The jig is easily made from 6mm steel plate. The top plate used to clamp the horn in place is made the same width as the frame slot and can be used as a visual guide for the cutter.*

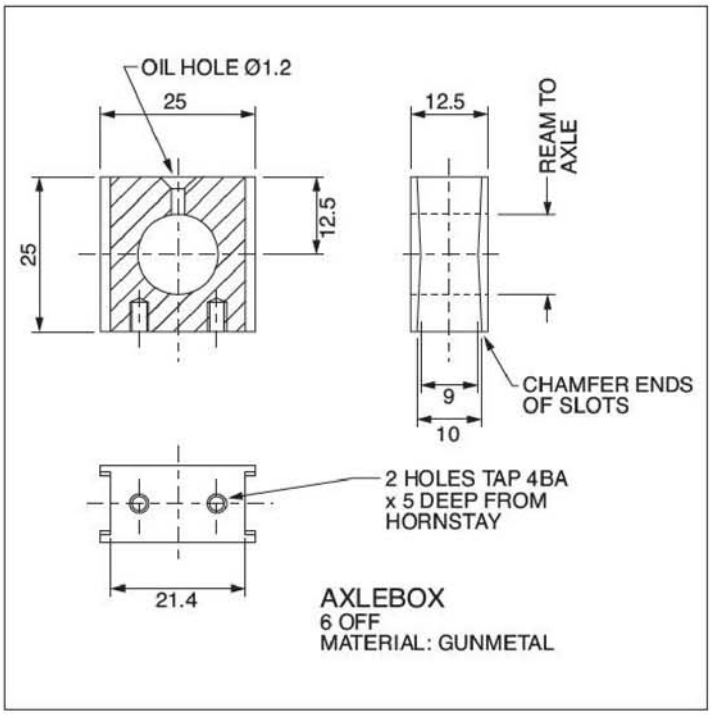


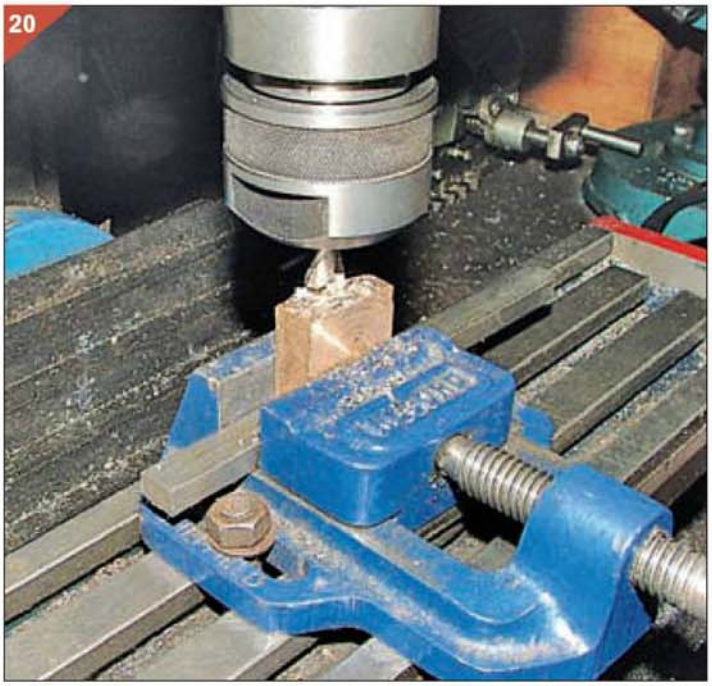
SPRINGING ARRANGEMENT

18 *The rear horns need a considerable amount removed to clear the base of the firebox. Note the row of holes drilled by mistake. Another rivet was added later to the reduced top section of flange.*

19 *An axle is set up in the 3-jaw and machined at the tailstock end. A dead centre is used or live centre if you have one.*







The sawn pieces of bronze for the axleboxes are milled to size in a machine vice bolted to the mill table.

the material is not too costly. There is only a couple of hours work in this at most but care in getting the best possible finish on the axles will pay off later. The centre (driving) axle will be completed in a later article so for the moment put the axles into your growing box of parts.

The axleboxes

We now need to make axle boxes and so suitable chunks of bronze are required. A stick of material suitable for several pieces makes the machining quicker as four of the faces can all be machined close to finished size before cutting to length. Make the boxes slightly oversize, approx. 1-2 millimetres. A vertical mill is the ideal tool here but a milling cutter in the lathe with a vertical slide set up will do the job. However, I would seriously recommend the purchase of a milling machine to those wanting to make locos long term. It is so much quicker to set up for these operations, leaving the lathe free for other things. Saw the material into pieces, again slightly oversize, the degree depending on your ability to hacksaw a straight line. Mill to size as before (**photo 20**). Find the centre by marking diagonals. Centre punch and set up in the 4-jaw chuck so that the punch mark is dead centre (**photos 21** and **22**). Centre drill deeply and try to use a drill with a Morse taper shank to fit your lathe tailstock to take the axle hole out to close to finished size. I had a 29⁄64in. drill available, which I followed up with a 31⁄64in. drill (**photo 23**). This left just a small amount of material to take out with the ½in. reamer. If you need to buy a reamer it makes sense to go fully metric, but of course like most model engineers I have built up a collection of tools over many years. As many were second-hand in the first place they are

The axlebox material is set up in the 4-jaw with the punch mark central.

With the lathe running the punch mark must be static.

After centre drilling the hole position a large drill can be used in the tailstock. A very small amount of run out is permissible, as the milling jig should correct small errors here, assuming we have made the axlebox slightly oversize.

inevitably imperial sizes.

Since the reamer has a slight taper, go in from alternate sides of the axlebox until a good fit on the axle is achieved. It should rotate freely without binding or any measurable play (**photo 24**). If I had been using metric stock bar for the axles then the 29/64in. drill might have allowed a 12mm reamer to be used. **Photograph 25** shows a finished blank axlebox.

Axleboxes

Another jig will be required for the next operation and once made it will probably be adaptable for other small locomotives in future (**photo 26**). This comprises a piece of steel angle which can be bolted to the mill table fitted with a stub to take the axlebox, and a retaining bolt to hold it in place while milling the horn grooves (**photo 27**). I made the hole slotted to avoid the need for packing under the axleboxes, but of course once set the stub must remain fixed for all the axleboxes. This ensures that the hole is central to the rubbing faces of the axlebox, most important if we want a free funning locomotive.

Best to use a milling cutter that is a few millimetres undersize to the slot width, mill down the centre and make a couple more passes to get the width right, since there is always a chance that the tool will 'grab' the material and ruin the slot (**photo 28**). Realistically few of us will be experienced millers with a top quality machine so caution is the key to success, and not taking too much on each cut. Cast bronze bar is tricky to work and not cheap so turn the radio off, make sure you are feeling not too tired and use a decent end-cutting tool. Work out how much metal needs to be removed to end up with an axle box 21.4mm wide on the horn groove, assuming you have successfully achieved a dimension of 21.5mm between the horns. Remember to take half the difference from each side! Make a note of the dial reading and cut each axle box by the same amount each side. This will give us six symmetrical axleboxes.

The axlebox jig is a simple assembly used to hold the items at a fixed height on the milling table.

The axlebox has now been reamed to a close fit on the axle.

A finished reamed axlebox blank.

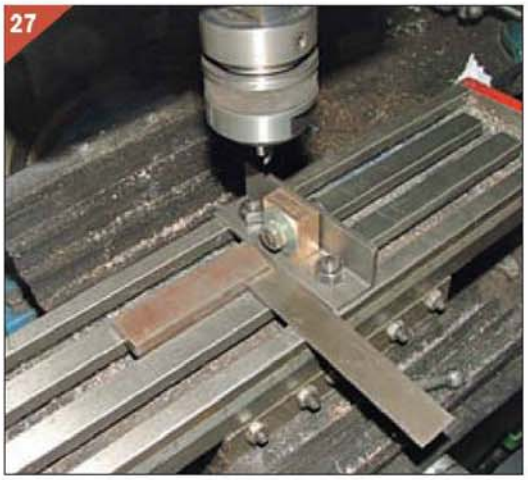
At least we only have six to make so once they are done check for fit in the horns and set about matching them up and any final finishing to size, including radiusing the flanges to allow the wheels to articulate independently. Stamp them so that they can be fitted to their matching horn unless you are so expert that they are completely interchangeable.

I was curious about the clearances used on full-size locomotives and one day asked the senior engineer at a local preserved railway while he was busy setting up a BR 9F in the locomotive yard. The figure he gave me was not much more than the amount I have suggested for our model, which I still find hard to credit. Perhaps wear and tear loosened everything up a bit.

Axleboxes and horns on the 9F are lined up to be central to the frames rather than offset, an idea originated by Bulleid on the Pacifics I believe and in fact the Q1 was also built like this in the full-size. In our model we need all the space we can get between the frames so we have to follow traditional model practice with the frames and horns flush on the outside.

The remaining parts required for the assembly of the axleboxes to the frames are quite straightforward. We will need 12 pins 3.7mm diameter threaded 4BA each end and the material is mild steel. Drill each axlebox and tap 4BA, screw the pins in with a dab of locking compound, it will be a long time before you will need to remove these again.

To be continued.



The milling jig is set up on the mill table to ensure it is square.

Milling the slot in the axlebox.

Lesser-known examples of Engineering 1884 to 1891

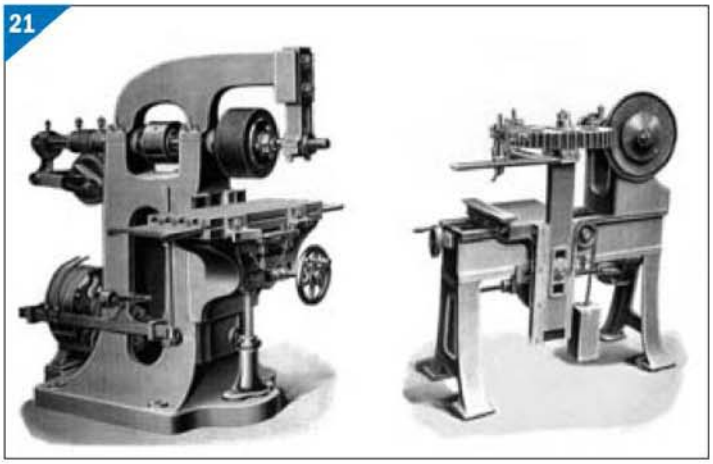
DAVID PIDDINGTON

David Piddington continues his visit to the distant past in search of unusual artefacts.

PART 3

Continued from page 699 (M.E. 4353, 5 June 2009)

21

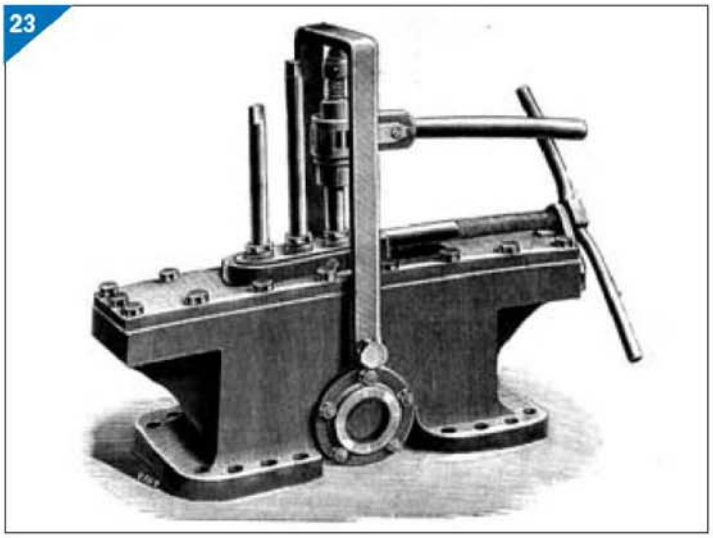


We make a return to other forms of machine tools in **fig 21** with these emery grinding machines. Long before it became possible to manufacture the safe compressed-grit grinding wheels so widely used today, machining of hardened steels was difficult and laborious even with specialised machine tools. The larger one here looks like and is based on a milling machine, but with a higher speed spindle on which is mounted a drum whose surface is covered in glue and impressed with carborundum/emery grit. In this example the wheel not only revolved at high speed but it was automatically imparted with an end-wise reciprocating movement by a worm and crank mechanism. The longitudinal table's stop mechanism is interesting in that these have grooves in the underside which engage pegs in the arm which in turn operated the belt striker and move the drive belt from the fast to loose pulley.

22

The smaller gear tooth cleaning machine was said to clean from 1,000 to 1,500 teeth per hour, and would accept gears from 2¼in. up to 24in. diameter. The emery disc was 12in. diameter. This machine reminds me of my late father; his works charge hand gear cutter, was sent to investigate the possibilities of a gear tooth de-burring machine, not dissimilar to this one in conception. He reported back to his superiors that due to excessive wear on the grinding wheels it would be impractical. However, his bosses over-ruled him and purchased the contrivance. They never did get it working successfully and the de-burring was returned as before to the lowly bench hand junior.

23



A much simpler device was this patent swivel toolholder by Gavin Jones shown in **fig 22**. A neat arrangement in which the tool could be taken out for regrinding without losing the setting, or conversely the swivel could be adjusted without moving the tool.

An apparatus for drilling into water mains while still under pressure is shown in **fig 23** and gave the operator the ability to fit a ferrule for a tap without interrupting the supply. The whole unit was clamped to the pipe in the desired position, sealed by a rubber saddle piece not shown in the engraving, and held on with chains. The three operating spindles were traversed by a screw and in turn drilled, tapped, and screwed in the ferrule by means of the ratchet. There is a viewing window in each side of the attachment. The hole in the unit's bottom was 2in. diameter so that any drill or fitting had to be less than this to pass through before the unit was clamped to the pipe. **Figures 24**, **25** and **26** show sectioned drawings of the unit.

At one club where I gave this talk, a member who had worked in the water supply industry assured me that a similar piece of equipment was occasionally used. That was in the early 1990s. In March 2006 workmen are currently replacing my neighbourhood water supply pipes with plastic ones but I haven't seen anything like it in their equipment.

Another machine tool was this vertical cylinder boring machine shown in **fig 27**, which I hope will be of interest. It's a whopper! Very substantial, it was capable of boring cylinders from 2ft. 6in. up to 12ft. diameter so if you would like one of these in your garden workshop, forget it. The central boring bar is 16in. diameter and its boring head would swing up to nearly 6ft. radius from the axis. A compound slide rest on the arm for machining the

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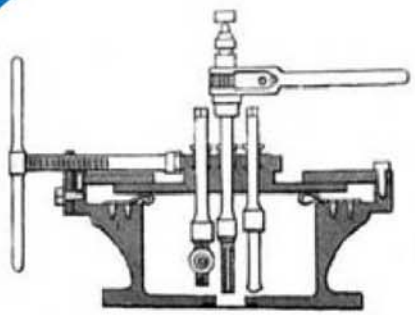

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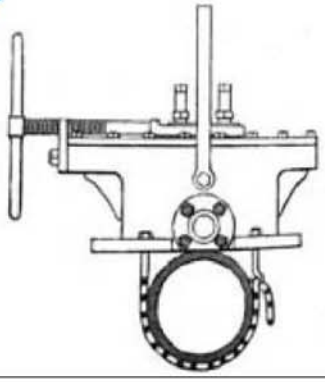

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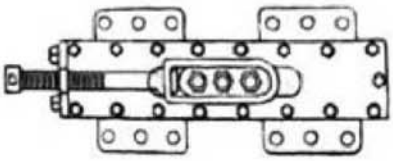

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end faces of the cylinders was also available. Its feed was self acting and from variable gear ratios feed rates ranged from 4 to 16 cuts per inch. The approximate weight was 33-tons, and it was made for a Spanish engineering company.

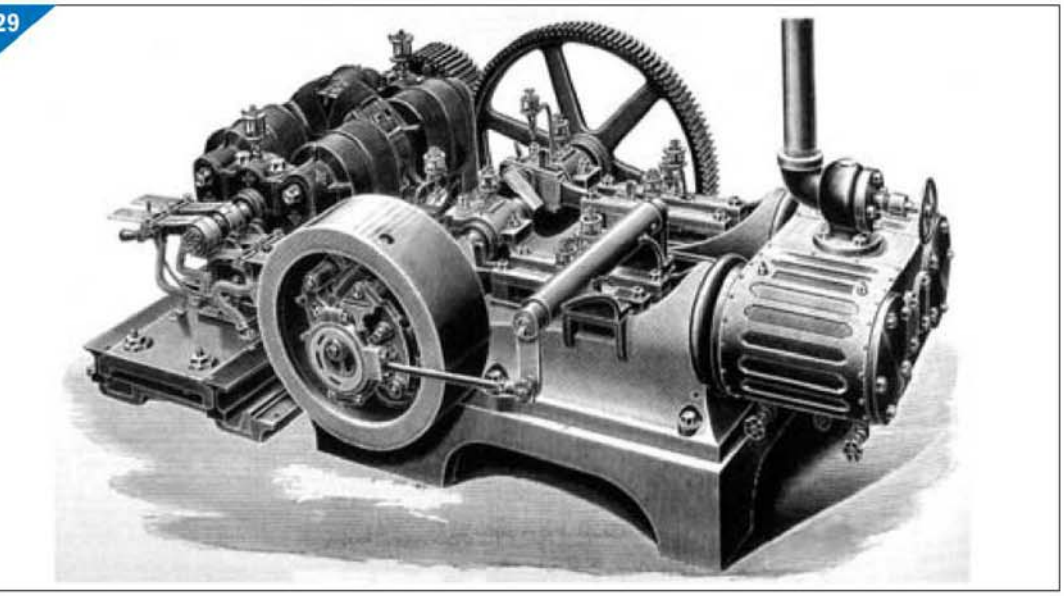
The 'Stark' Nut Lock in **fig 28** was an early method of retaining a nut on a bolt with a cotter pin but instead of across the bolt axis and nut with castellations this one went longitudinally along the bolt and through the nut. However, the nut was not broached right through but just grooved on the ends where the cotter would engage at each side of the nut. At another club where I gave this lecture, they had a member who had seen this device in regular use, though I have never seen it myself.

A horizontal steam engine from the United States of America was this one with a dynamo, **fig 29**. It was made for their cruiser 'Boston'. The engine was a basic 2-cylinder machine with a geared-up drive to the dynamo input shaft. On the nearer end of the crankshaft, there is a robust-looking flywheel inside which there is a mechanism known as the 'American' governor which has internal spring controlled flyweights which acted on the eccentric sheave, which in its turn had a variable throw. If the engine increased its speed then the mechanism shortened the valve travel.

Readers who have been taking *Engineering in Miniature* will locate in November 1985 photographs, description and a cover picture for a prize-winning 'Robey' vertical steam engine which had this same governor fitted to it. I recommend you to seek out this issue for details and more information.

A device for milling machines where a precise width groove or channel was required in a length of metal was Addy's Milling Cutter shown here in **fig 30**. It will immediately be seen that this is where the 'wobble' saw was derived from. The width of cut was varied by the thickness ≫

29



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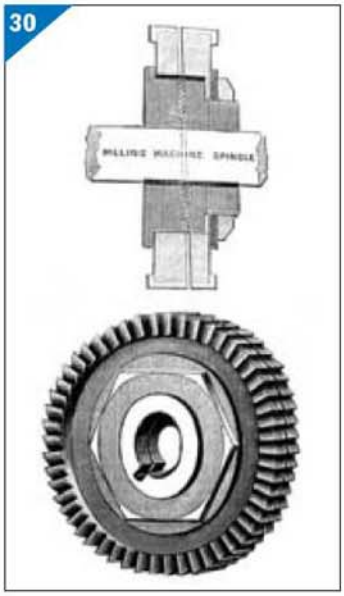
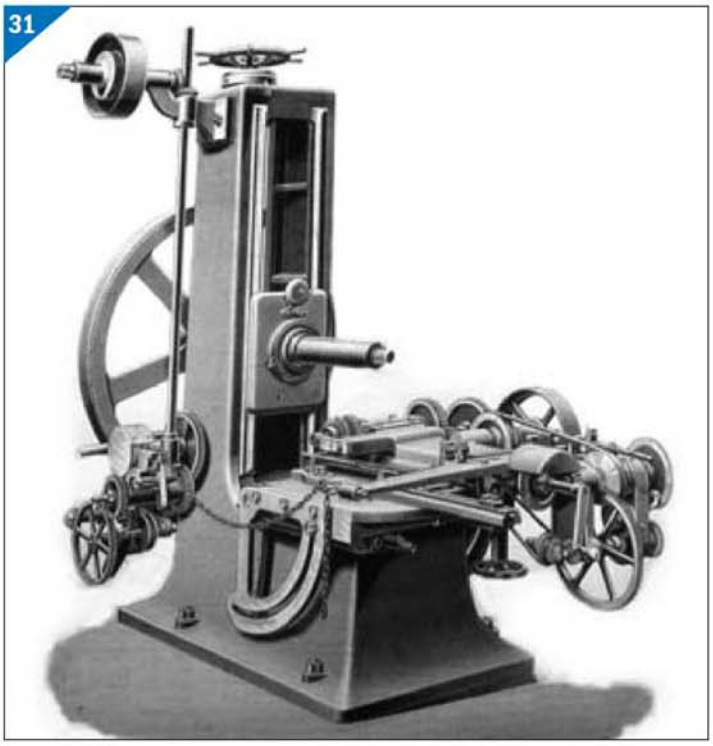
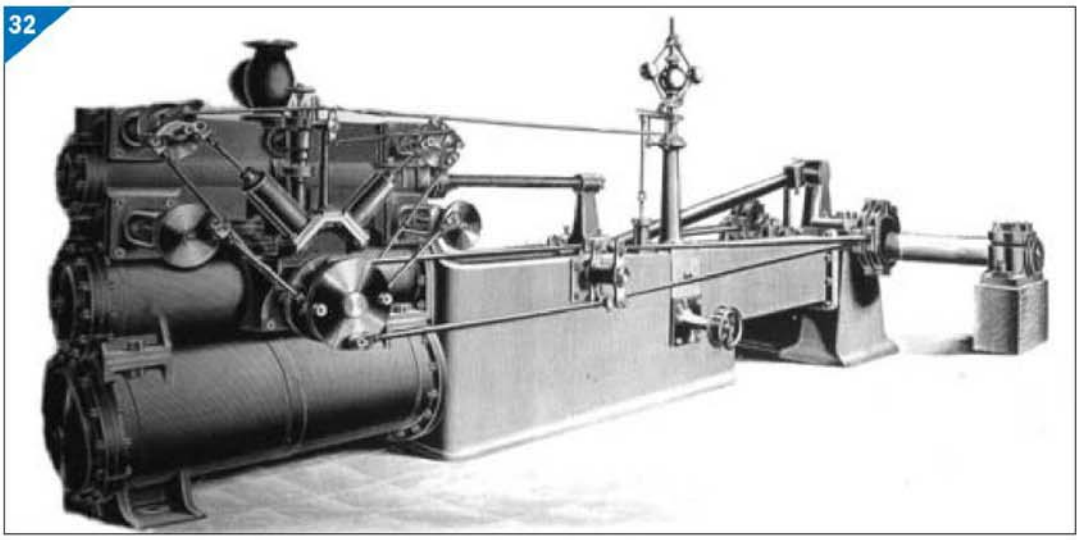


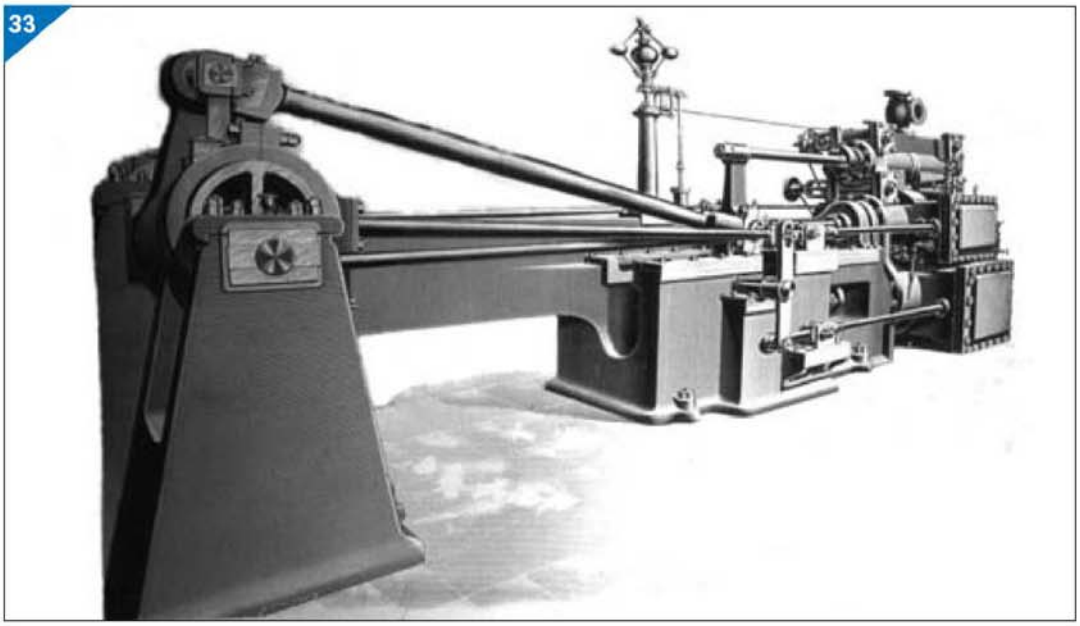


of flat washers inserted between the cutter's halves and, as the cutter was driven by a key in a keyway, the angled faces of the halves would remain in alignment as would the cutter's teeth. Obviously there would be a range of these cutters of differing widths as the adjustment is minimal. If a too-thick packing piece was inserted one could be left with a ridge in the middle of the machined channel.

While still with milling machines, next we have in **fig 31** Eberhardt's universal automatic gear cutting machine, which could be used to cut ordinary spur gear wheels, bevel gears, and worms and wormwheels. It would accept work up to 6 feet in diameter and on the back of the work-holding spindle is a worm and wheel indexing arrangement capable of all divisions up to 100, any number larger than that except for prime numbers, and certain divisions larger than that if required.

There were two cutters, one for roughing and one for finishing. The cutter head had a rapid traverse feed for the return stroke and could be angled on its sector frame for bevel gear cutting. Below the cutters was a trough, not shown, with an integral Archimedean screw for swarf removal.



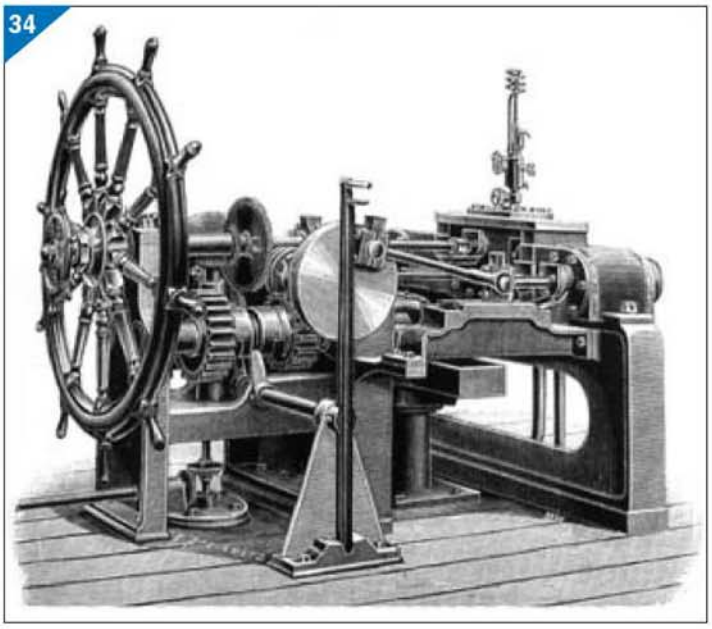


Figures 32 and **33** show what must have been a magnificent machine. A Triple Expansion Steam Engine made for a textile mill at Mytholmroyd near Halifax and was custom built to fit inside an engine house only 30ft. long and 8ft. 6in. wide. Its high pressure (HP) cylinder was 8¼in. bore high pressure; the intermediate pressure (IP) cylinder 13¼in. bore, and the low pressure (LP) 21in. bore, all driving on to a common and robust crosshead and with a stroke of 4 feet.

The HP cylinder was fitted with Corliss valves of which the inlet were 4½in. diameter and 10in. long, and the exhaust valves were 5in. diameter and of the same length. The IP cylinder had two separate slide valves capable of being adjusted to give early or late cut-off equalising the work done in all three cylinders and its spindle having a screw and index setting device. The LP cylinder was fitted with a single slide valve worked by a rocking lever from the IP valve crosshead, both valves being driven from an eccentric on the crankshaft.

The engine was fed with steam at 150lbs per square inch pressure and under test at 63 revolutions per minute indicator diagrams gave 59.35, 60.05 and 68.2 horsepowers for the HP, IP and LP cylinders respectively. For the serious model engineer this would make a fine model, though the intricacies of the cross-porting within the cylinder block would have to be overcome by either complex coreboxes, or a sequence of cross-drilled passages. Regretfully the maker's name was not given in the paper of that time.

34



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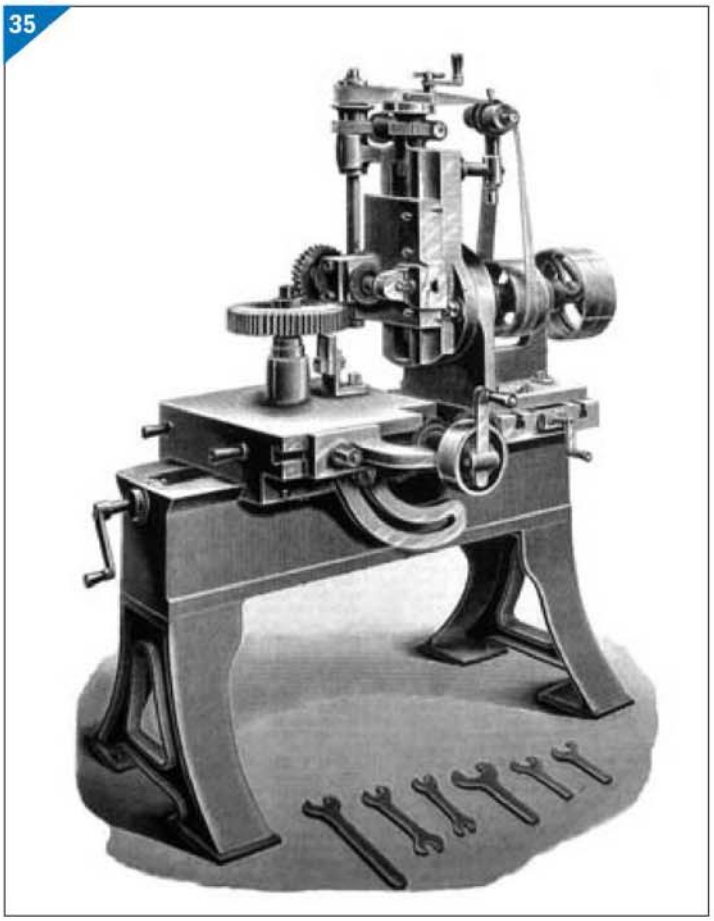

We should not forget that in the Victorian era "Britannia Ruled the Waves" - well an awful lot of it anyway - and nautical matters filled many pages of the engineering papers of that time. The act of steering large ships became a matter of importance especially when the steersman required a good view of where he was pointing his vessel and his stand on the bridge was far removed from the rudder below waterline at the blunt end. It seems that many devices were experimented with. The use of long chains from the power unit to the rudder was one popular method except that at night these clanked and rattled keeping passengers and the off-watch crew wide awake. The combined wheel and steering steam engine in **fig 34** was one alternative where the steersman could be positioned towards the rear of the ship. A right and left handed screw geared from the crankshaft connected directly to the rudder's crosshead. One clutch only had to be operated to change from hand to powered movement of the rudder and this would hold the rudder steady while the change was made. On the ship's bridge - presumably not far away - a small shaft led from there to the steering engines steam valve. No data was given as to how the unit was reversed from the bridge. It will be noted that even when steered direct using that very ornamental, expensively crafted 10-spoke wheel the steersman must have cursed the rudder shaft as he operated standing astride it.

The wheel cutting machine of 1889 shown here in **fig 35** is much smaller and thus a lot less expensive than Eberhardt's machine shown in fig 31 but was capable of the same types and class of work up to 24in. diameter. There was one feature in addition in that with the sideways swivel cutter head, skew toothed gear wheels could be produced such as those used by the late George Thomas' in his universal dividing head described in his excellent series first published in *Model Engineer* from issue 3605 Volume 145 for 1979.

Another Victorian out-of-the-ordinary product was this railway locomotive for the Indian State Railways, Sind Pishin Section built in 1889. Eminently suitable for hauling heavy trains but if reproduced for our miniature tracks, there is a problem of where to sit the driver. Perhaps this scheme could be described as a 'Fairlie Modified' for certainly the owners would get two locomotives for half the water and fuel capacity. These locomotives - or this one, as the description does not say if there were more - were to be used on a line with steep gradients varying between 1 in 100 and 1 in 60 over distances of 60 miles and a gain in altitude of 5,000 feet. Cylinders were 19 in. bore by 24in. stroke, coupled wheel diameter 4ft. 2in. and each power unit wheel base was 9ft. 2 inches. The manufacturer's name is not mentioned so perhaps they could foresee snags and preferred not to be widely associated with this project. Around this same period the English Great Northern Railway experimented with 'steam tenders' fitting one of their 0-6-0 freight locomotive's tender with steam cylinders for additional adhesion and power, **fig 36**. Unfortunately though the idea was quite practical, it strained labour relations considerably as the crews objected to the additional work involved. The problem was eventually resolved by Herbert Garratt with his articulated designs.

To be continued.

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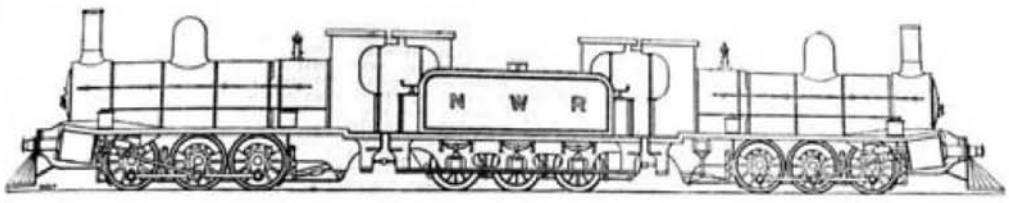


KEITH'S COLUMN

LILLIAN 7¼in. Narrow Gauge Locomotive

KEITH WILSON

Keith Wilson visits some miniature railways and discusses electronic motor speed control.

I thought that readers might enjoy a picture or two of some miniature railways around the South of England; it can be quite surprising that there are some larger locomotives bearing good resemblance to the prototypes they represent. Whilst of course there are locomotives for just plain passenger-hauling; in fact they are probably better if not exactly 'to scale' but non-prototype ones can put up a fine performance, possibly better than 'scale'.

It must not be thought that I dislike such engines - far from it - but I have stuck to fairly accurate GWR prototypes and gained some sort of reputation in that field. There have been a few exceptions; due to customers wants or needs (not always the same!).

Four Romulusses and two Hunslets come to mind, and my own final big'un *GWRILLIAN*. All the rest have been GWR with just two exceptions; my first was a 2½in. *Mary Ann*, a Darlington J39. (Designed by Curly, described January-May 1934). This particular design was also Martin Evan's first-built, and I often wonder if his worked any better than mine. The other exception was a Wainwright Class C, an 0-6-0 goods in 7¼in. gauge. It was built as one of a pair, the other being a Dean Goods. I cheated a bit on this one, using GWR works inside, with a reasonably true outside.

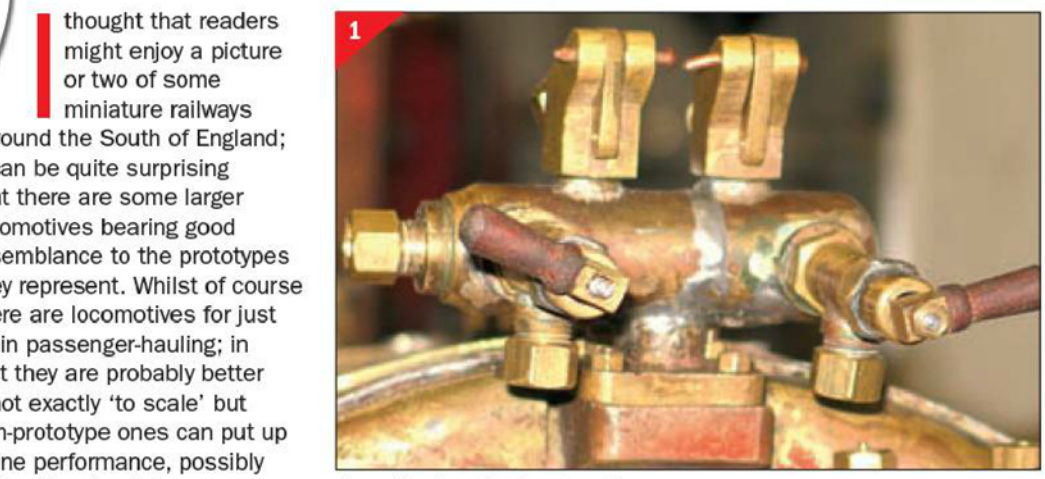
The locomotives that I saw on these visits were of 7¼, 10in. and 4ft. 8½in. gauges. On the 7¼in. railway at the Bentley Car Museum there was a nice 'Dart' but not in steam. The track was mostly double, with a return loop at the far end giving a continuous run.

For those who might be interested in vintage and/or veteran cars, the Bentley Car Museum is well worth a visit. Perhaps the most impressive was not there at the time of my visit. It is a Rolls-Royce Silver Ghost as far as I recall from a previous visit.

Next call was on the famous Bluebell line. I could not visit the sheds/workshop, because my electric chair doesn't like steps or heavy bumps. A special was provided for us (the Heywood Society) hauled by a Merchant Navy in immaculate condition, a fine sight. Limited to the Light Railway Speed, which I believe is only 25mph; of course 'she' didn't have to work hard.

After dark (not this time but occasionally) it is much harder to tell the exact speed and it is intriguing to note that with special (i.e. railway people) on board shall we say 26?

A main-line steam locomotive in immaculate condition is a lovely sight whether it is GWR or other. Regretfully I could not get the pictures I wanted, but hope the ones here are not too disappointing.



A machined casting for a fountain.

WILSON'S WORDS OF WISDOM

One of the worst attributes of democracy is that it puts a premium on stupidity.

Anon.

A Bulldog piloting a King at the Lancaster track. This was probably the first time that these two have been seen together in 58 years, for the last two Bulldogs (Skylark and Starling) were scrapped in 1951.

I had to cross the twin-track lines on the level; but a minor trouble arose. Whilst asking the correct place to cross, somebody said *"at the North end"* so off I went. There was indeed a crossing-place here, but not until I was in the 6ft. way (the gap between two tracks) did I discover that the crossing of the 4ft. way (between the rails) had been removed. Having first checked for any moving locomotives I was in no danger so I turned round and went back. It so happened that the crossing was at the South end of the station, so all was well. One of the end compartments on the train was fitted with a wheelchair lift so boarding was no great difficulty.

There is a fine 10¼in. track at Ingleigh (south-west of Horsham) it is private so not normally open to the public except on one or two days per year. Now I am not qualified to judge locomotives of 'other railways' but a pair of Stroudley terriers looked fine, as did Bob Symes' 0-6-0T. The biggest locomotive there was one of my two 47xx, and one of the society asked why it was steamed and the owner said that he hadn't dared not too! I think he must have known that I would be there!

In the afternoon we visited the South Downs Light Railway, in a garden centre a couple of miles west of Pulborough. Here we found some nice prototype locomotives, a nice 'King Arthur' (*Sir Sagramour*), a *Flying Scotsman* which I was told was built from photographs only 'down under' in Australia, and a Royal Scot. Two 10¼in. 'Tinkerbelles' double-headed a big train throughout the afternoon.

It was on this visit that the electric chair's battery starting sulking, in fact it was so bad that I had to be pushed back to our car.

It is intriguing to note how many garden centres go hand-in-hand with miniature railways; I do not know how many but I have visited several in my time.

Merchant Navy works.

In the workshop

A device that I have found outstandingly useful is the electronic motor speed control. Giving mandrel speeds from very low (inching) up to over 2,000rpm. Also there are pre-set speeds available, but I have never used them: the variable is much more useful. Running in both directions is easy; in fact when using a die as a thread chaser or any particular operation that requires reversing, the lathe can be started, the reverse switch operated and all that needs to be done when reversal is required is to press the start button again; lathe slows down and quietly reverses and run-out occurs. On rare heavy

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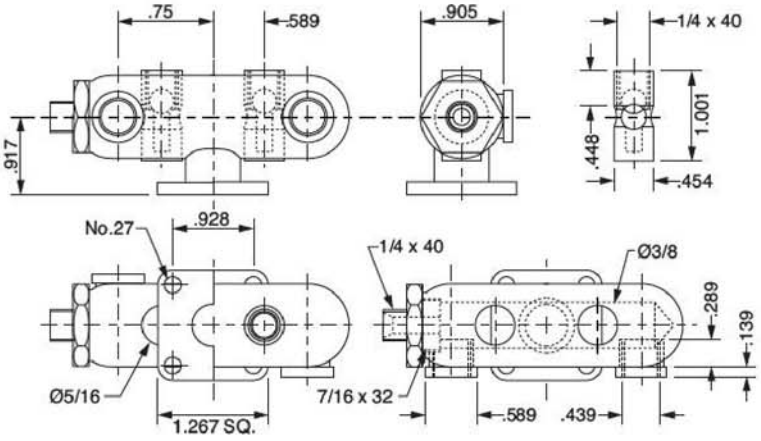
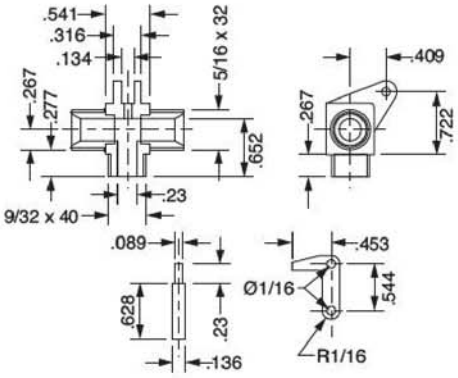
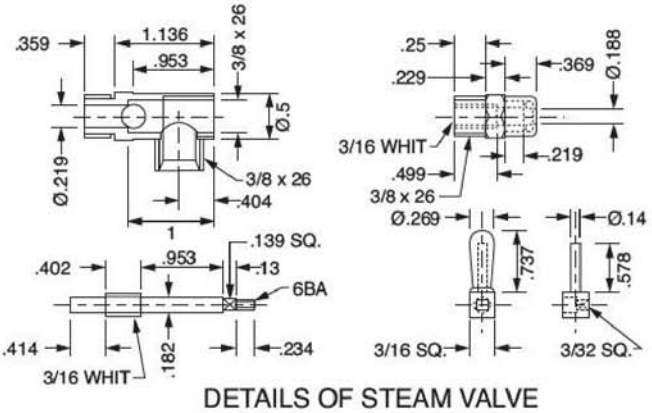
Fig 1



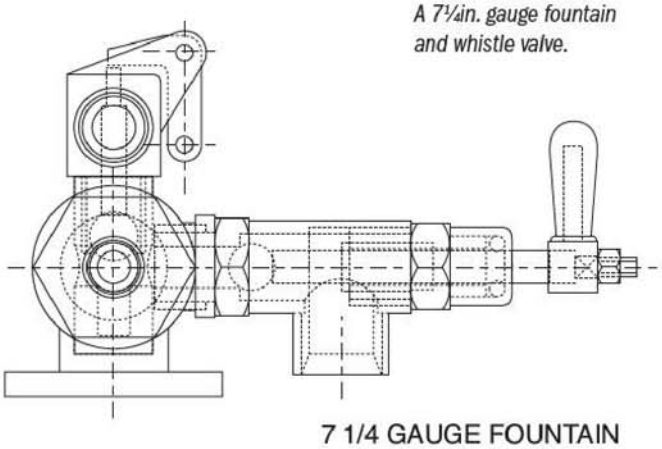


DETAILS OF WHISTLE VALVE



DETAILS OF STEAM VALVE

A 7¼in. gauge fountain and whistle valve.



7 1/4 GAUGE FOUNTAIN

operations it is sometimes necessary to engage back-gear (belt slips), but you can't win 'em all.

This reminds me of a rare (thank goodness!) case where I had to screw-cut a left-hand internal thread in a near-blind hole. The smallest task I ever machined was a new winding-stem for a wristwatch, a small diameter of 0.015 inch.

Having to drill lots of holes for riveting, a few notes on this matter may prove beneficial. One way of locating such a hole accurately is to carefully mark out and centre-pop; however there are easier (and far more accurate!) ways. Way back in time a reader got going with lining up his jig between lathe centres and having a guide sleeve mounted on the cross-slide of the saddle, this guide had a well-fitted centre-punch in it. Engaging the drive lock and moving the saddle via a graduated hand-wheel at the far end of the feed-screw then set out the hole locations with good accuracy.

There are, however, some ways of still greater accuracy. If an embryo jig is mounted in a vice on a vertical slide (this is a lathe method) and a small centre-drill is in the lathe chuck, then the use of the cross-slide plus a bit of saddle moving produces greater accuracy, for clearly the fewer operations the better. Of course, if you have access to a milling machine then the task is a bit easier. If fitted with digital read-out box-of-tricks then so much the better.

Just about the finest method is the use of a CNC controlled milling machine. A friend of mine has made up a jig with 3/32in. holes at 0.625in. spacing for my present riveting work for 1/8in. rivets. Discrepancy in size? Not so, for unless such jigs are hardened then they will gradually wear out. It follows that the holes may be deliberately enlarged using the next larger size drill as wear takes place; of course using this next-sized drill to drill the plates concerned.

A point to note is to make this jig substantial. I learned this long ago, for I had made a jig too thin, due to the shape of the end of the drill. Wander was possible, nay, inevitable and so accuracy was lost. The minimum thickness for such a jig must be a good bit more than the distance from the point of the drill to where the drill is size (I hope that's clear). For a really hefty jig - such as one for the locating of crankpin holes in driving wheels, then use if possible hardened bushes of at least two sizes: one for a pilot hole and one for the final size, although this latter is not indispensable. For if the pilot hole is positioned accurately, the chances of the reaming-sized hole following the pilot hole are very good.

A guide for the size of a pilot hole is that the pilot drill should exceed the size of the chisel-point of the reaming-sized drill.

For the multiple-hole jig (such as for a riveting jig) use of bushes would be rather time-consuming; therefore at least 3/16in. thick is recommended.

Bearing in mind that 'our' riveting lines are almost certainly more accurate than full-sized the locating of the jig is important (if you don't believe me then next time you see a full-sized locomotive then put your head close to the row and look along it rather than at it.

About the only way is to mark out the position of a hole at one end of the jig as accurately as you can and use a bolt through this hole to fix one end of the jig, and then drill another hole as far away as you can, using the jig, then another bolt.

Double-heading a narrow gauge train.

In the case of my jig mentioned above, friend Ralph left the jig in a semi-finished state i.e. centre-drilled only. It was left to me to drill the holes right through, and I chose a No. 34 drill for this; it follows that a 6BA bolt would be used.

To try to use the jig by holding it with toolmaker's clamps alone for the entire operation is tricky, for the vibration of actual drilling could easily cause the jig to shift. Since every rivet-hole will need to be opened out in the operation of riveting, it follows that the use of smaller-sized holes is logical. Obviously, de-burring is required, no problem.

The worst case of rivets being out-of-line is on the left cab step on the *City of Truro*! There may have been a reason for it, but the fact remains that the rearmost rivet of the three in the top row is about half its diameter too high. Not of course that it will affect the operation of driving, but it might as well be noted. This beauty has different style frame stiffening plates on each side.

The recent photograph of an *Anna* on the track at Leyland somehow got itself reversed left-to-right. I thought at first that it was a printing error (rare but not impossible) but checking showed that the error was in my computer. Now I wouldn't know how to do this, and I have never had it happen before, so apologies, but it only affects the picture in a minor way. So I wonder how it happened!

In my recent article I noted that although I wrote on steam valves, I did not show a drawing thereof. Machining is mostly lathe work, but some things are worth mentioning. The full-size fountains were castings in gunmetal, but in our sizes it is not quite so easy. A. J. Reeves provided a gunmetal casting which had to be sawn in half, the insides drilled out, and then the two bits were silver-brazed together. Take your choice but my way is a bit easier. It doesn't look too far out, only at the left-hand end; but this could be turned away once assembled. Remember that Kings have two steam valves; other tender-type locomotives (Castles, Halls etc.) required three. I am not certain about tank locomotives, but two is a good guess.

The steam valves are tricky, for the Whitworth thread requires fairly deep threads, and it is somewhat easier to break the tap. Could use BSF threads, but I went for the quicker opening. So it follows that with Whitworth a simple operation to make the threads shallower pays off. Use the Whit taps to make a die, but without the full depth thread; this will leave the stem much smoother for the O-ring. The handle is wooden in full-size, but a Tufnol handle is better. It is as well to make the square a close fit where possible.

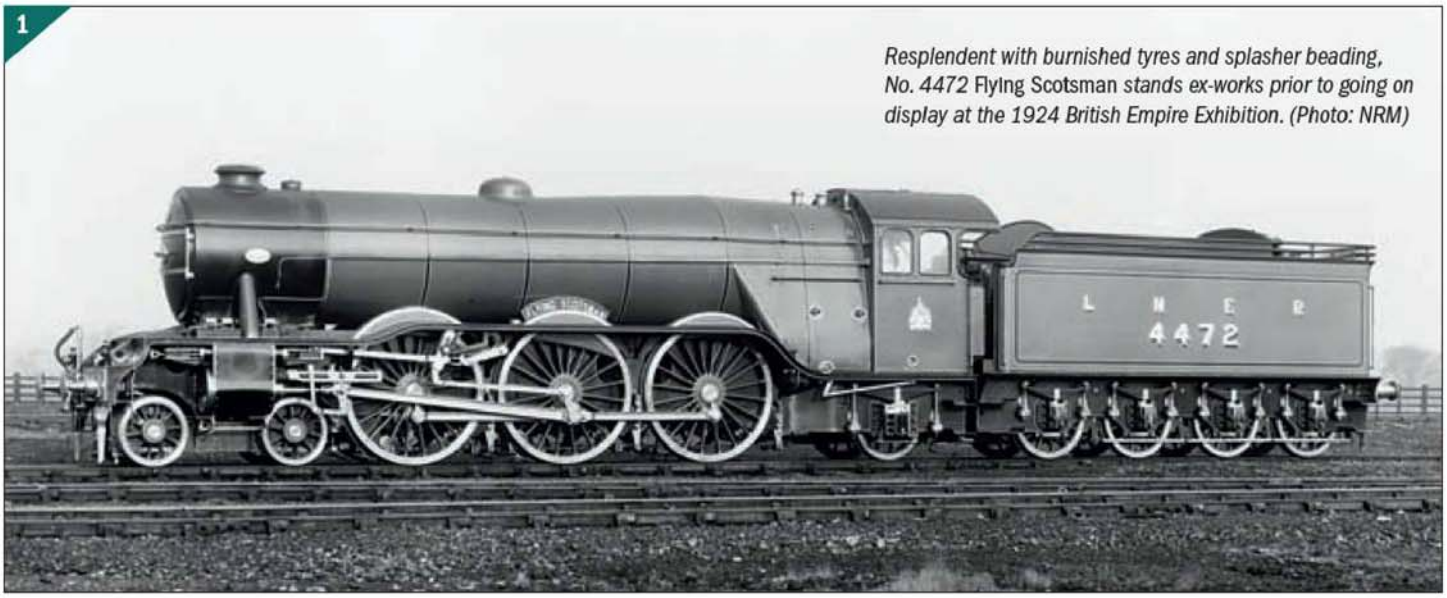
I was recently driving a very fine locomotive with beautifully-made brass handles on the steam valves, 'double-ended' to boot. Alas, drivers - including me - had to wear a glove on one hand.

The end-cap on the steam valves is soft-soldered onto the spigot; take care not to use too much and so choke-up the o-ring groove. It is well to use Loctite to keep the valve body firmly in place during operation; Loctite 532 does the job nicely.

Two items do not appear on the drawing, the little springs that keep the balls in the whistle valves tight under zero pressure. Although in full-size the outlets from the whistle valves point forwards, it is easier in our sizes to make them point sideways, for there is not much room to use spanners etc. on outlets to the whistles.

To be continued.

1



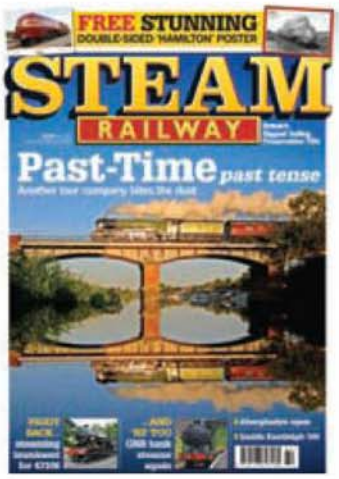
Resplendent with burnished tyres and splasher beading, No. 4472 Flying Scotsman stands ex-works prior to going on display at the 1924 British Empire Exhibition. (Photo: NRM)

Steam Railway magazine

Engineering news from the big railway

DANNY HOPKINS

Firebox problems have hit Scotsman overhaul... but NRM are still aiming for a 2010 return.



The much-anticipated overhaul of the National Railway Museum's celebrity Gresley A3 No. 4472 *Flying Scotsman* has suffered an unexpected setback after faulty welds were discovered in the rebuilt copper inner firebox. The discovery was made after the boiler was delivered from Devon to Ian Riley's works at Bury, prompting the NRM to order an independent examination by non-destructive testing specialist, Frazer Nash of Bury. The firebox has subsequently been returned to the contractor, Pridhams of Tavistock, where repairs have been carried out - at the time of going to press it had not returned to Bury.

Speaking to *Steam Railway*, Helen Ashby, Head of Knowledge and Collections at the NRM, said: *"The NRM is committed to delivering Flying Scotsman to the highest quality and standards. In the absence of any set UK standards for welded joints to copper boiler components, we are setting our own high standards with the advice of the VAB Boiler Inspector. The strict standard set for all welds is ASME IX (American Society of Mechanical Engineers). ASME IX requires a 100% pass rate on all welds. No. 4472's copper firebox has thus been subjected to a series of X-ray inspections of the welded joints to identify any anomalies. Defective areas have been ground out and re-welded, followed by a final X-ray inspection to confirm the new weld quality."*

The firebox faults can be added to a growing list of unfortunate and unforeseen delays that have beset No. 4472's overhaul. These have prompted some parties to once again publicly question the NRM's decision to use the original spare A3 boiler (which *Scotsman* carried from 1964 until the 1970s) and not the A4 boiler it was carrying when the museum purchased the locomotive in 2004.

Meanwhile, Ian Riley and his team have started the process of joining the outer firebox to the boiler, marking the first stage in the reassembly of the genuine Gresley riveted boiler. A discovery made during this process is that the A3 foundation ring, which is due to be replaced, was not actually made from an LNER drawing, and varies in certain details. The new foundation ring, like all of the new components made by Pridhams, will be manufactured using the original Doncaster drawings to ensure an authentic 'Gresley job'.

2

The replacement right-hand cylinder from A3 No. 60041 Salmon Trout after re-drilling and fitting to No. 4472. (Photo: Gary Boyd-Hope/SR)

Work on No. 4472's chassis is also progressing well at the NRM's workshop at York, under the scrutiny of Chief Engineer Rod Lytton. The badly-cracked right-hand cylinder has been replaced by another from A3 classmate No. 60041 *Salmon*

Flying Scotsman's centre driving set is examined in the NRM's wheel drop pit. (Photo: NRM)

Trout, allowing the three sets of valve gear to be overhauled and reassembled to pinpoint accuracy. The job was not helped by the fact that the positioning holes on the replacement cylinder did not match those on No. 4472's frames.

Below the running plate all new bogie axleboxes are being prepared prior to the overhaul of the driving wheel axleboxes. Having these in place will allow for the in-frames turning of the driving wheel tyres, the bogie and cartazzi wheel sets having been turned off site.

When these works are complete the NRM will commence the overhaul of the air brake apparatus, and hopefully integrate the combined air/vacuum brake apparatus being funded by *Steam Railway's 'Flying Scotsman* VAC Appeal'.

Other jobs that the museum hopes to finish in the coming weeks are the building up and re-facing of the overhauled A3 header, including the re-blinding of the old cover plate holes. These had enlarged over the years, preventing a satisfactory seal. A new cast regulator body is ready for machining, while oil lines and pots, splashers and running plates are ready to go back on.

The 'Steam Our *Scotsman*' appeal, which the NRM controversially launched in January to raise an additional £250,000 towards the overhaul of No. 4472, has now passed the £68,000 mark. Also, *Steam Railway's* own appeal to put vacuum brakes onto the locomotive has more than £3,000 in the pot. Despite the setbacks the mood at the NRM remains positive, and the museum is working with two operating partners on a draft operating programme for 2010 onwards.

Gary Boyd-Hope

A close-up view of the outer throatplate of the A3 boiler, after replacement of the lower section. (Photo: NRM)

The backhead and sides of the outer firebox during a break in work at Riley & Son's works at Buckley Wells, Bury. (Photo: K. Williams)

Nottingham SMEE

This is our final visit to **Nottingham SMEE** and we take a look at the extensive gauge 1 track and the other end of the 7¼in. gauge line, Parkgate Station.

The gauge 1 trackwork is a recent addition to the Nottingham facilities. It has a long track length some of which is double with the remainder either triple or quadruple track. This part of the club, like the rest, seems to be very well supported. Members bring their locomotives and rolling stock for a run on the track and it looks as though there are many skilled modellers amongst them. The Midland Railway 2-4-0 *Novelty* looks superb in Midland colours.

Parkgate Station

This is a terminus on the 7¼in. gauge railway at Nottingham. It ends in a passing loop with a siding to the left. There is a superb scale model of a signal box in the station. It is mounted on rails and is rolled into the station building and locked up at night for protection. It is fully detailed inside and includes the signal box levers and a scale model signalman. Looking out of the station towards the main railway track, you can see the level crossing gates. Nottingham is a great society; it has loads of facilities for the model engineer. If I lived within about 50 miles of Nottingham, I would certainly become a member. See **www.nsmee.com** for full details.

Club pages - news wanted

I have covered **Bournemouth**, **East Somerset SMEE** and **The Nottingham SMEE** recently. I have another piece of club news from **East Somerset** covering HRH Prince Charles and the 'new Royal Train' but after that, I have nothing in hand.

Publicise your local club, write it up and take a few photos.

Supply club contact details and you could see it in *Model Engineer*. I have not had any feedback from the clubs featured but I am sure they will have gained a few new members.

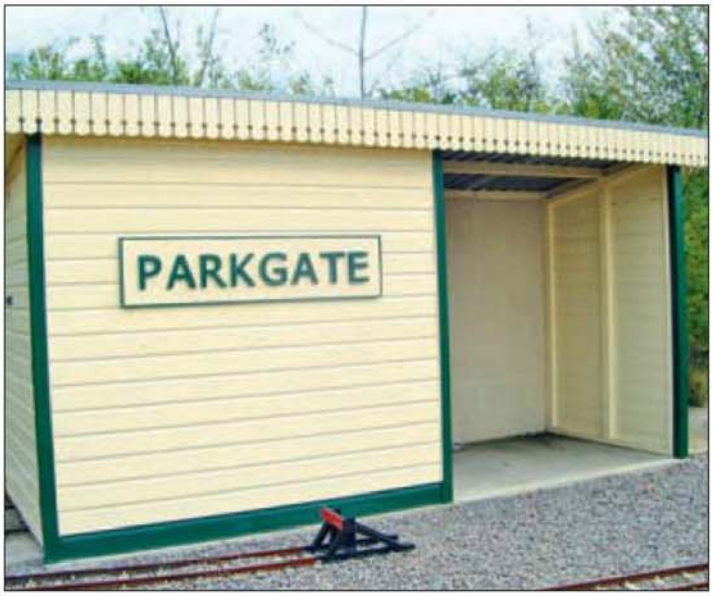
The club will also be featured in *Steam Railway* magazine and I am sure you will get some visitors even if you don't get new members.

I can go back to the old club pages if readers prefer but even then, I would like a club member to supply a photo or two and some text.

I am sure most clubs have some sort of publicity officer. Now is you chance to get your club on the map.


5036


PARKGATE STATION


PARKGATE

JULY

3 **Aylesbury (Vale of) MES.** Track Night. Contact Andy Rapley: 01296 420750.

3 **North London SME.** Working Models. Contact Rachael Chapman: 01442 275968.

4/5 **British Columbia SME.** Annual Meet & Triennial Ramble. Contact Sean Laurence: (604) 931 1547.

4 **Chichester DSME.** Club Barbecue. Contact Bill Gage: 01243 824473.

4 **Ickenham DSME.** Public Running. Contact Phil Wimbush: 07759 275353.

4 **Lancaster & Morecambe MES.** Open Day. Contact Mike Glegg: 01995 606767.

4 **SM&EE.** Mike Horne & Richard Coleby: 5AT Locomotive. Contact Maurice Fagg: 020 8669 1480.

4 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.

5 **Frimley & Ascot LC.** Public Running. Contact Bob Dowman: 01252 835042.

5 **Leicester SME.** Public Running. Contact John Lowe: 01455 272047.

5 **Mini Train des Marais, Normandy, France.** Steam Sunday. Contact Michael Honeybun: 00 33 2 33 07 91 77.

5 **Nottingham SMEE.** Running Day. Contact Pete Towle: 0115 987 9865.

5 **Pinewood MRS.** Members' Running. Contact Paul Archer: 0118 989 4516.

5 **Reading SME.** Public Running. Contact Ian Fothergill: 0118 9421679.

5 **Warrington DMES.** Running Day. Contact Duncan Webster: 01925 262525.

6 **Lancaster & Morecambe MES.** Informal. Contact Mike Glegg: 01995 606767.

6 **Peterborough SME.** Bits & Pieces. Contact R. A. Meek: 01778 345142.

7 **North Cornwall MES.** Meeting. Contact Geoff Wright: 01566 86032.

7 **Romney Marsh MES.** Track Meeting. Contact John Wimble: 01797 362295.

7 **West Wiltshire SME.** Track Meeting. Contact R. Nev. Boulton: 01380 828101.

8 **Bradford MES.** Steam-Up & Get-Together. Contact John Mills: 01943 467844.

8 **Brighton & Hove SMLE.** Wrinklies Day. Contact Mick Funnell: 01323 892042.

8 **Hull DSME.** Martin Cope: Visit to a Garden Railway. Contact Tony Finn: 01482 898434.

8 **St. Albans DMES.** Philip Birtles: Mosquito. Contact Roy Verden: 01923 220590.

9 **Leyland SME.** Let's Go with a DRO! Contact A. P. Bibby: 01254 812049.

9 **NW Leicestershire SME.** Ploughmans Supper. Contact Jamie Wilde: 01530 273270.

10 **Polegate & District MEC.** Clive Groom: Express locos of the Big Four. Contact D. F. Pratt: 01323 645872.

11 **Erewash Valley MES.** Barbecue. Contact Peter Siddall: 0115 9255397.

11/12 **Nottingham SMEE.** Kit Builders Rally. Contact Graham Davenport: 0115 8496703.

11 **Romney Marsh MES.** Track Meeting. Contact John Wimble: 01797 362295.

11/12 **Southport Model Engineering Club.** Open Weekend. Contact Gwendoline Baguley: 01704 568456.

12 **Bedford MES.** Members' Running Day. Contact Ted Jolliffe: 01234 327791.

12 **Bristol SMEE.** Running Days. Contact Trevor Chambers: 0145 441 5085.

12 **Cambridge MES.** Public Open Day. Contact Tim Coles: 01954 267359.

12 **Cardiff MES.** Steam-Up & Family Day Picnic. Contact Don Norman: 01656 784530.

12 **Leeds SMEE.** Running Day. Contact Geoff Shackleton: 01977 798138.

12 **Leicester SME.** Ladies Day & Public Running. Contact John Lowe: 01455 272047.

12 **Manx Steam & MEC.** Meeting. Contact Richard Rake: 01624 840211.

12 **SM&EE.** Visit to Sir William McAlpine's private railway. Contact Maurice Fagg: 020 8669 1480.

12 **Welling DMES.** Public Running. Contact Bob Underwood: 020 8859 6919.

12 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.

13 **Bedford MES.** D. Abbott: Marine Matters. Contact Ted Jolliffe: 01234 327791.

14 **King's Lynn DSME.** Members' Fun Run. Contact Ben Cannell: 07963 093270.

14 **Romney Marsh MES.** Track Meeting. Contact John Wimble: 01797 362295.

16 **Warrington DMES.** Natter Night. Contact Duncan Webster: 01925 262525.

17 **North London SME.** Barbecue. Contact Rachael Chapman: 01442 275968.

18/19 **Guildford MES.** Rally & Exhibition. Contact Brian Jones: 01483 531485.

18 **NW Leicestershire SME.** 2½ Gauge Society Running Day. Contact Jamie Wilde: 01530 273270.Contact Jamie Wilde: 01530 273270.

18 **Romney Marsh MES.** Boiler Testing. Contact John Wimble: 01797 362295.

19 **Hull DSME.** Dove House Charity Running Day at West Park. Contact Tony Finn: 01482 898434.

19 **Leicester SME.** Public Running. Contact John Lowe: 01455 272047.

19 **Leyland SME.** Charity Day. Contact A. P. Bibby: 01254 812049.

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19 **Rugby MES.** Public Running. Contact Ken Eyre: 01788 842709.

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20 **Lancaster & Morecambe MES.** Col Steve Davis: The Sierra Leone Railway Museum. Contact Mike Glegg: 01995 606767.

21 **Chesterfield & District MES.** Alan Rutherford: Steelworks Apprentice. Contact Mike Rhodes: 01623 648676.

21 **North Cornwall MES.** Meeting. Contact Geoff Wright: 01566 86032.

21 **Romney Marsh MES.** Track Meeting. Contact John Wimble: 01797 362295.

21 **West Wiltshire SME.** Track Meeting. Contact R. Nev. Boulton: 01380 828101.

23 **Leyland SME.** Panic in the Workshop Night! Contact A. P. Bibby: 01254 812049.

25 **Brighton & Hove SMLE.** Public Running. Contact Mick Funnell: 01323 892042.

25 **Chesterfield & District MES.** Public Running. Contact Mike Rhodes: 01623 648676.

25 **Kent's Garden Railway Show** presented by G Scale Society Kent Group supported by Swale Borough Council at the Alexander Centre, Preston Street, Faversham, Kent ME13 8NZ. 10am-4pm. Adults £3, Children £1, Family £7.

25 **Leyland SME.** Learner Drivers Afternoon. Contact A. P. Bibby: 01254 812049.

25/26 **Oxford (City of) SME.** Dreaming Spires. Contact Chris Kelland: 01235 770836.

25 **SM&EE.** Gauge 1 informal meeting. Contact Maurice Fagg: 020 8669 1480.

26 **Bedford MES.** Public Running. Contact Ted Jolliffe: 01234 327791.

26 **Bristol SMEE.** Running Days. Contact Trevor Chambers: 0145 441 5085.

26 **Cambridge MES.** Members' Running Day. Contact Tim Coles: 01954 267359.

26 **Cardiff MES.** Open Day. Contact Don Norman: 01656 784530.

26 **High Wycombe MEC.** Public Running. Contact Eric Stevens: 01494 438761.

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

- SL *Florence* - a water taxi by Martin Ranson
- Neville Evans on *Stowe*
- Ashley best on Tramcars
- Empire Building
- Fitting a Clarke milling attachment to an older lathe

Neville Heath gives us a look at his 1:8 scale Douglas motorcycle model.

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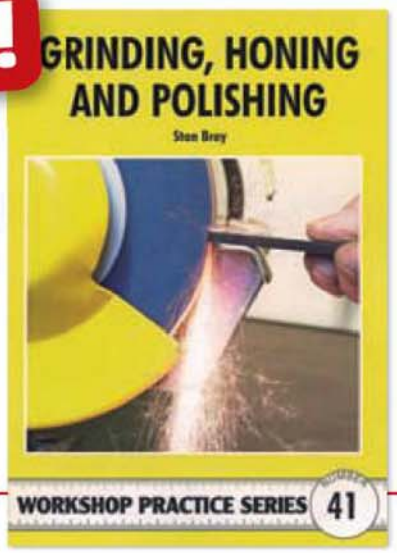

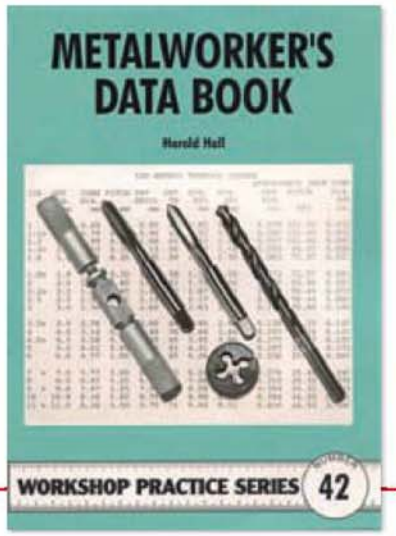

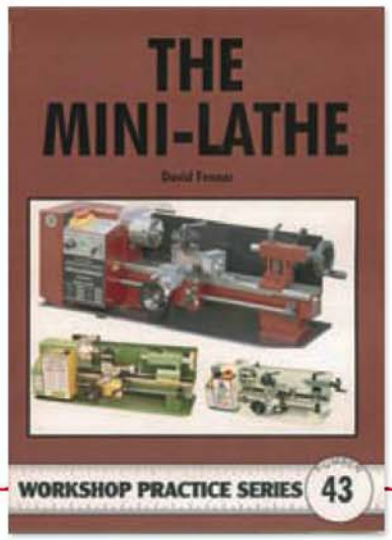

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DERBY Derwent St.	01332 290931	MANSFIELD 169 Chesterfield Rd. South	01623 622160	WOLVERHAMPTON Parkfield Rd. Bilston	01902 494186
DUNDEE 24-26 Trades Lane	01382 225 140	MIDDLESBROUGH Mandale Triangle, Thornaby	01642 677891	WORCESTER 48a Upper Tything	01905 723451
EDINBURGH 163-171 Piersfield Terrace	0131 659 5919	NORWICH 282a Heigham St.	01603 766402		

Maximum call charges from a BT landline are 5p/min to 0844. Calls from mobile & other networks may vary.

HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

144 Maidstone Road, Foots Cray, Sidcup, Kent DA14 5HS

Telephone: 0208 300 9070 - Evenings: 01959 532199 - Facsimile: 0208 309 6311

www.homeandworkshop.co.uk • stevehwm@btopenworld.com

Opening Times: Monday-Friday 9am-5.30pm - Saturday Morning 9am-1pm

10 minutes from M25 - Junction 3 and South Circular - A205

Eagle 5W (wet) surface grinder

Leyton 50" x 3" set of slip ended rolls

Harrison M250 5" x 30" lathe

Colchester Chipmaster lathe

Tom Senior M1 milling machine

Boxford 1130 lathe (not finished)

- Colchester Triumph 2000 lathe £2450
- Colchester Triumph 2000 lathe £4250
- Elliot Sturdimill *(coming in)* £3450
- Elliot 18" shaper *(coming in)* £650
- Waltons 40" x 16g guillotine + all the guides £1250
- Eagle surface grinder £645
- Elliot 10" shaper £375
- Marlco keyway broaches *just in!*
- Harrison L5/L5A/140/L6 T/steadies
- Harrison D14 faceplates
- Eclipse De-magnetiser £80
- Hofmann dividing head + gears £625
- Flamefast double hearth £95
- Clarkson Autolock chucks Selection
- Colchester Triumph 2000 fixed steady £245
- Harrison M300 Ainjest attachment £345
- DS120 hearth £140
- Myford Super 7B lathe (1997) gearbox, power crossfeed, stand £3450

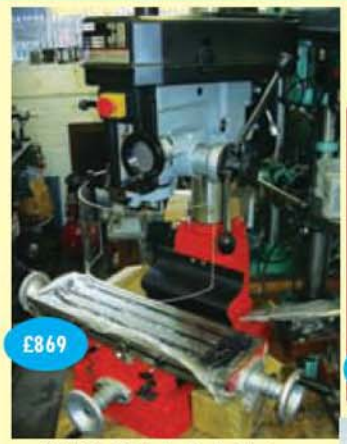
RJH bench grinder / buffer - 240 volts

Milling/Drilling ground X-Y table

Harrison 140 lathe + gearbox & power cross feed

Bridgeport slotting head

Jones and Shipman (swivel base) 4" machine vice



SIP NEW mill, Twain, Grade A factory
Limited stock/special price

Colchester Student 1800; 6" x 24"+ gap bed, 3 & 4 jaw chucks + 240 volts!

Fobco pedestal drilling machine

Colchester Triumph 2000 rear tool post

Boxford AUD 4 1/2" gearbox, power cross feed

PVE 200mm sine centres (extremley rare)

Waltons 50" 16g guillotine + stops

Colchester Triumph 2000 faceplate

Bridgeport heads also fit A&S 2E mills

Harrison L5 lathe

< Myford (never used) dividing head + four plates

PLEASE PHONE 0208 300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST

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

Just a small selection of our current stock photographed!

We have wood lathes, saw benches, bandsaws, morticers and Record vices etc - large selection!

DELIVERY £15 TO ALL E.U COUNTRIES
Free Delivery UK Mainland

SEE OUR WEBSITE www.chestermachinetools.com FOR OUR EXCLUSIVE ONLINE OFFERS

Chester Machine Tools

DB8VS LATHE

~~£969.65~~ £775.00

FEATURES
- Digital Speed Readout
- Variable Speed Spindle
- Metric and Imperial Thread Cutting
- Hardened and Ground Bedways
- Cast Iron Construction

Centre Distance	400mm
Swing	210mm
Speeds	Variable 50-2000rpm
Motor	750w
Weight	110kgs

HV128 BANDSAW

~~£239.00~~ £219.00

Capacity Round	5"/128mm
Capacity Rectangle	4" x 6"/100 x 150mm
Speed Range	65/95/165fpm
Motor	1/3hp
Net weight	62kgs

CENTURY MILL

~~£1049.00~~ £899.00

FEATURES
- Variable Speed Spindle
- Digital Depth Readout
- Fine Feed Quill
- Heavy Duty Cast Iron Construction

Max Drilling Capacity	20mm
Max End Mill Capacity	22mm
Max Face Mill Capacity	70mm
Table Size	600x180mm
Cross Travel	200mm
Long Travel	350mm
Taper	MT3
Speeds	50-3000rpm
Size	720x565x1020mm
Weight	135kgs

CHAMPION 16VS

~~£699.00~~ £629.00

FEATURES
- Variable Speed Spindle
- Dovetail Column
- Tilting Head
- Wide Spindle Speed Range

Table Size	500 x 140mm
Spindle Taper	MT2
Speeds	Variable 50-2500rpm
Motor	600w
Weight	90kgs

DB11VS

Centre Distance	700mm
Swing over Bed	280mm
Spindle Bore	26mm
Motor	1200w
Spindle Speeds	125-2500rpm
Net Weight	180kgs

FEATURES
Digital Speed Readout • Variable Spindle Speed • Metric & Imperial Thread Cutting

STANDARD ACCESSORIES
3-Jaw Chuck • 4-Jaw Chuck • Coolant Tray • Rear Splash Guard

~~£1469.00~~ £1199.00

100mm 3-Jaw Chuck
~~£69.00~~ £60.00

Mag Base and Dial Gauge
~~£35.00~~ £30.00

100mm 4-Jaw Independent Chuck
~~£64.00~~ £55.00

Boring Tool Set MT2
~~£59.00~~ £51.00

Quick Action Vice Low Working Height
£39.00

T1 Quick Change Toolpost and 5 Holders
~~£128.00~~ £115.00

Machine Angle Level
~~£69.00~~ £60.00

5" Bench Hand Shears
~~£44.95~~ £40.00

6" Bench Hand Shears
~~£54.95~~ £50.00

V Blocks and Clamps 1" Capacity
~~£12.00~~ £10.00

Slip Rolls
12" £109.00 / 16" £199.00
20" £249.00

Magnifier Lamp
£40.00

Centre Punch Set
£4.50

Hoist 250kgs
~~£69.00~~ £60.00

DT8300D Multi Meter
~~£8.89~~ £7.00

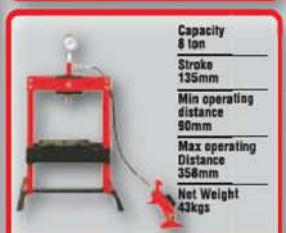
Disc Size 6"
Belt Size 4"x36"
Table Size 216 x 146mm
Motor 370w
Net Weight 25kgs

4" x 6" Belt and Disc Sander
~~£74.99~~ £69.00

MY64L Multi Meter
~~£35.54~~ £15.00

Working Speed	0-14000rpm
Power	1/10hp
Drive	Flexible Shaft
Drill Chuck	0.3-4mm
Net Weight	2.3kgs

Flexi Drive
~~£109.00~~ £89.99



Capacity	8 ton
Stroke	135mm
Min operating distance	90mm
Max operating Distance	358mm
Net Weight	43kgs

8 ton Press
~~£134.95~~ £119.00

Lifting Capacity	1ton
Lifting Range	0-2150mm
Working Range of Boom	960-1240mm
Net Weight	25kgs

1 ton Crane
~~£177.00~~ £139.00

All prices include VAT. Delivery Free to UK mainland – excluding certain Scottish postcodes. (Unless otherwise stated) Prices valid for duration of this issue only.

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