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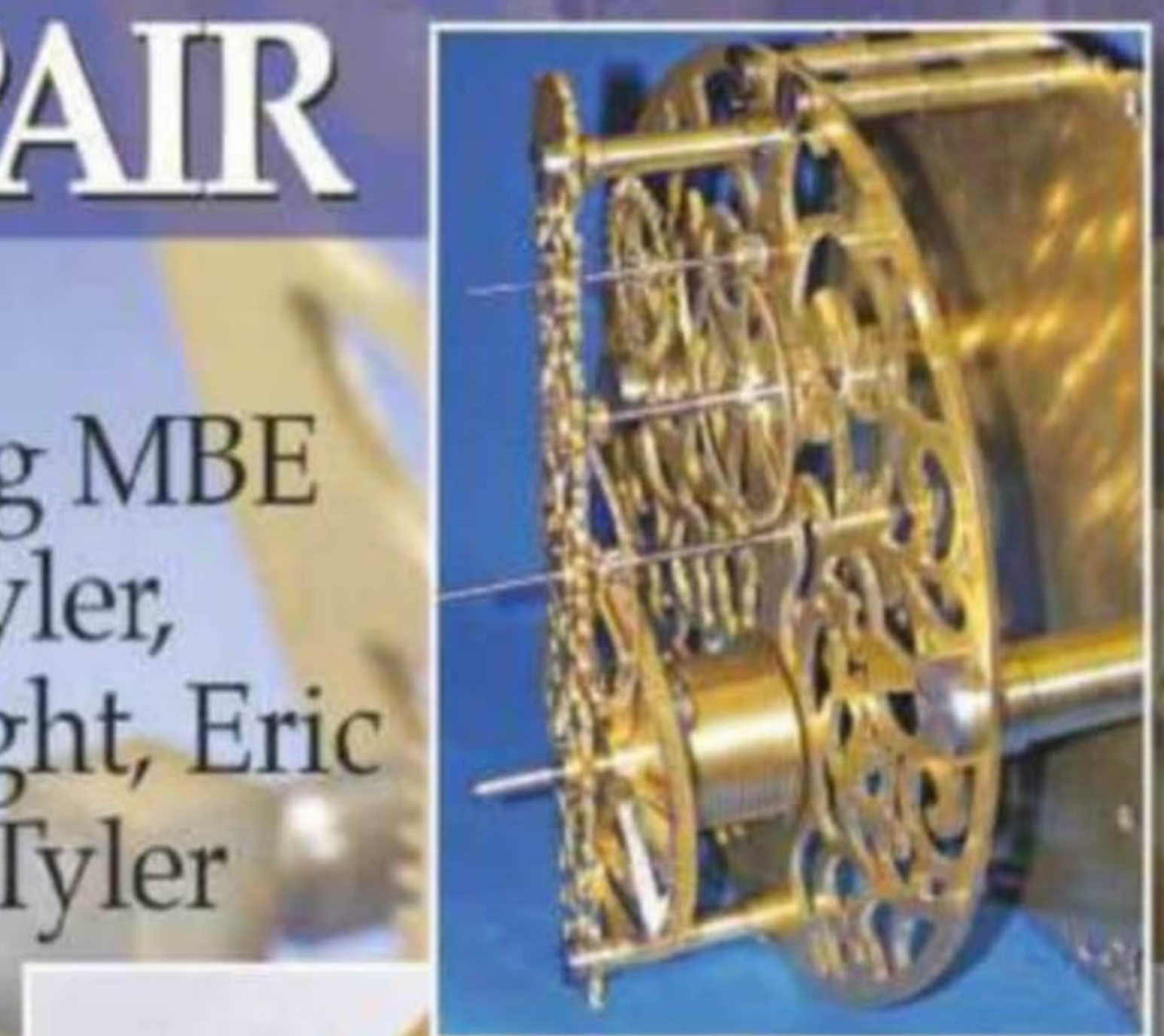
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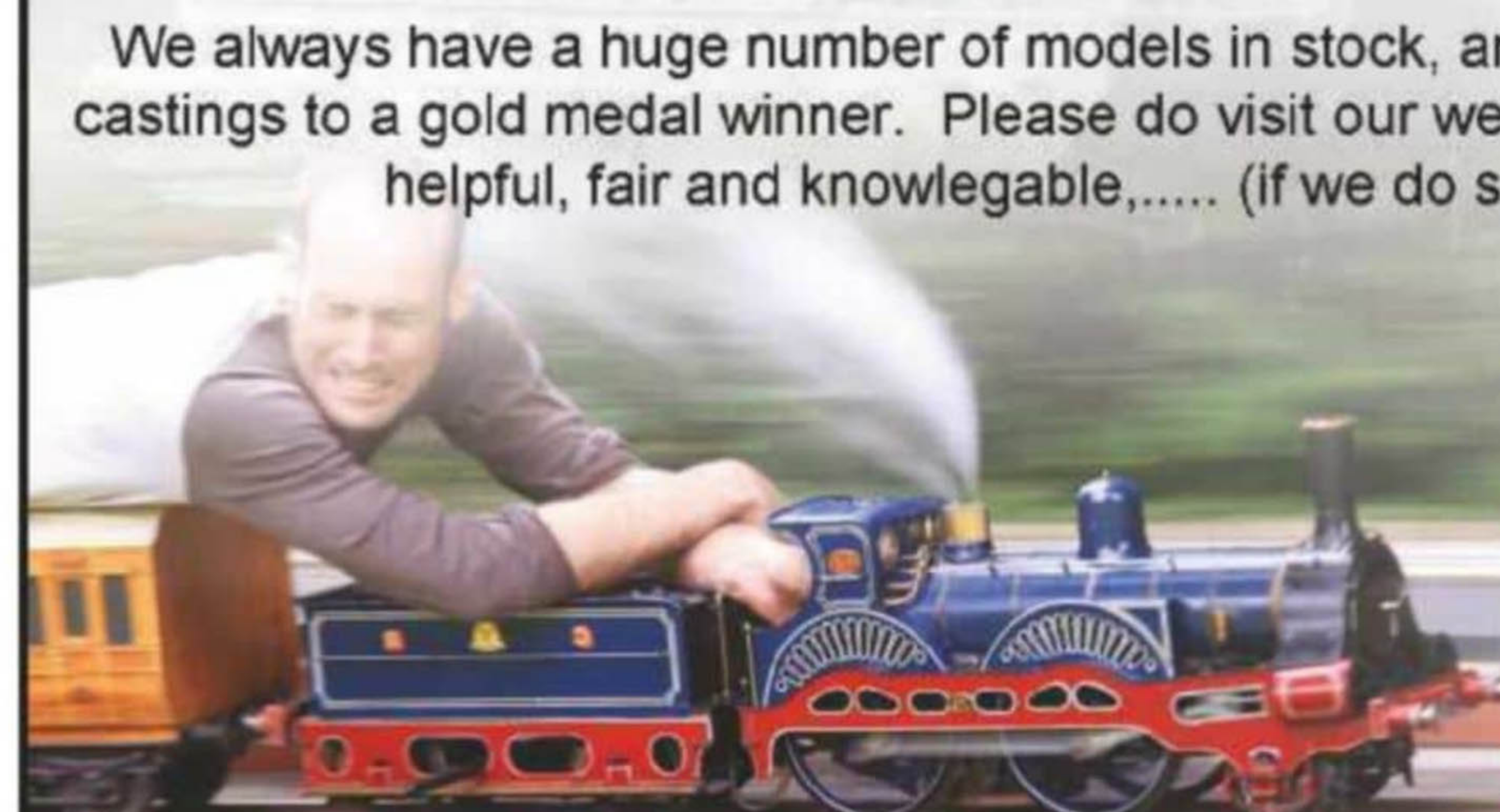
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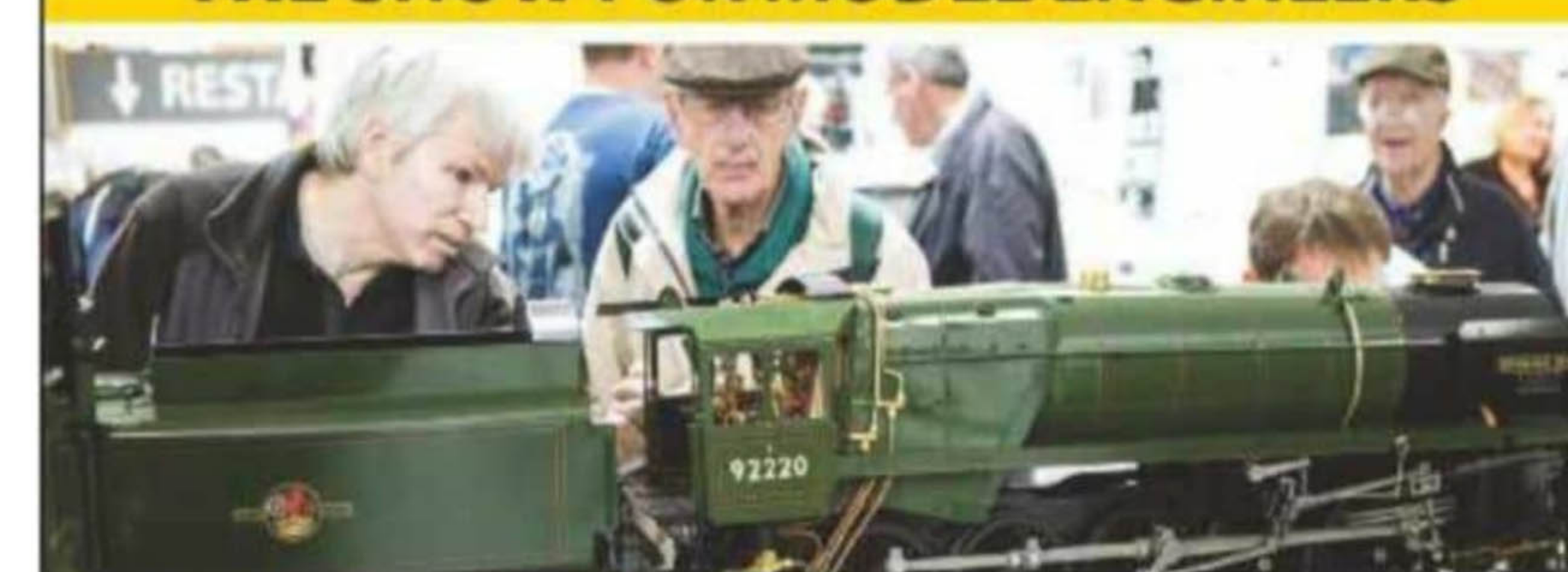
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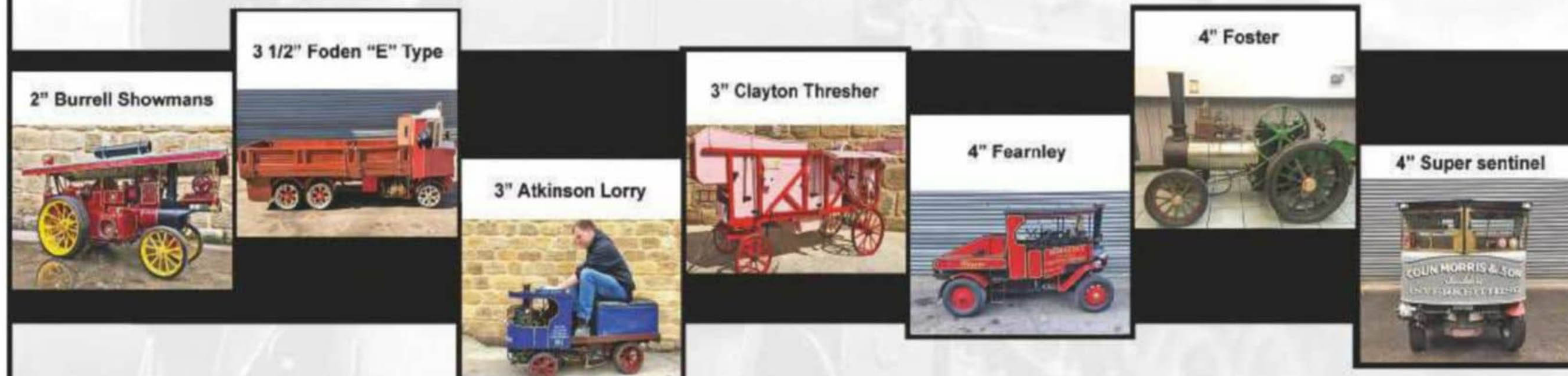
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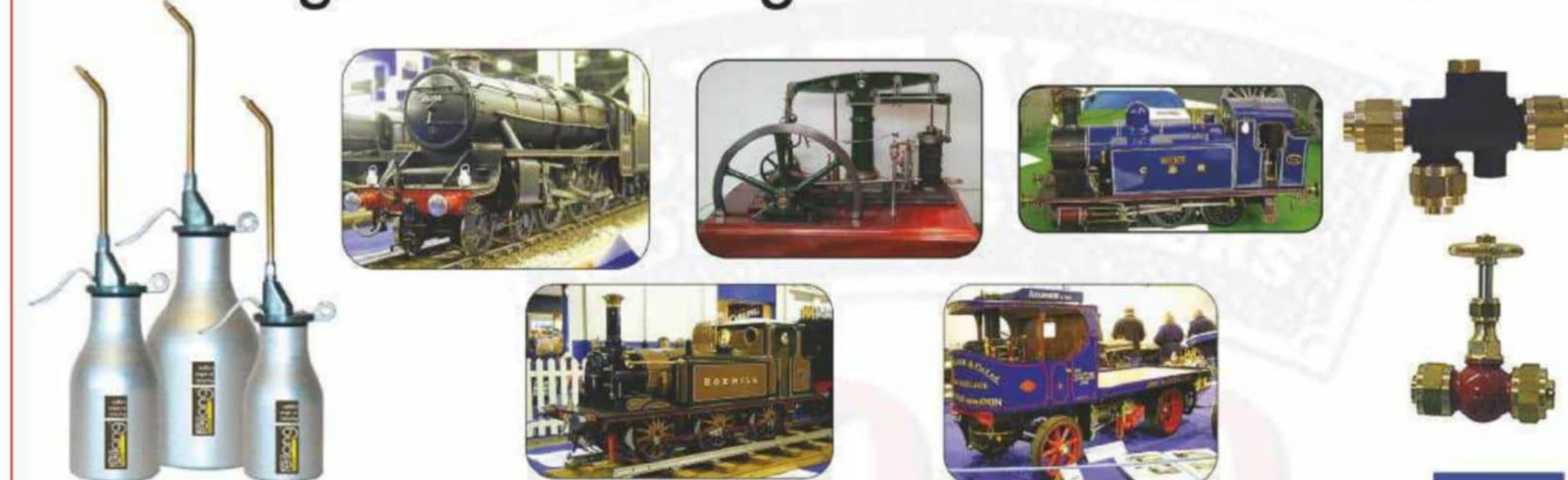
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Midlands Show

The Midlands Model Engineering Exhibition is just a month away now, taking place at the Warwickshire Event Centre, Fosse Way, from Thursday 17th October until Sunday 20th October. A special feature of this year's show is a rake of seven five inch gauge Pullman cars built by Brent Hudson and Ben Lyons. These are part of a total of eighteen Pullman cars built by Brent and Ben over the last few years. Four of them paid a visit recently

ABOVE: Brent and Ben's Pullman cars visit Nottingham. RIGHT: The Pullman cars are fully detailed.



to the Nottingham club track at Ruddington (photo 1). They are truly magnificent and, if five inch gauge railways are of any interest to you, then these alone will justify your visit. The build quality is superlative

and they are all fully detailed inside, down to the table cloths and working table lamps (photo 2).

Apart from the Pullman cars there are of course the usual club and trade stands and the 16 display and 16 competition classes. Outside there will be a gathering, as always, of the Fosse Way Steamers and the five inch gauge railway track operated by the Coventry Society of Model Engineers and the Polly Owners Group. To round all this off there is a full programme of lectures and demonstrations. It's a show not to be missed – further details may be found at www.meridienneexhibitions.co.uk/events/midlands-model-engineering-exhibition

A New Bandsaw for Model Engineers

The Axminster Tool Centre has announced a new bandsaw aimed specifically at model engineers (photo 3). The new Model Engineer Series AE1470B metal cutting bandsaw is small and simple; and its relatively light weight of 23kg makes it fairly portable. Taking up little working space, it is perfect for the home model engineer with a small workshop, but is also quite suitable for small trades where metal needs to be cut on site.

The simplicity comes from having a fixed cutting speed, direct drive to the band wheels and no electronic controls, meaning there are fewer things to go wrong. Built around a strong cast alloy base and blade bow, it is quite rigid giving firm blade control. Another advantageous quality is that it is powered by a 375W induction motor with a simple switch system, and features auto-shut off when the cut is completed. The saw bow swivels to allow angle cutting up to 45 degrees. In addition, there is a latch to hold the

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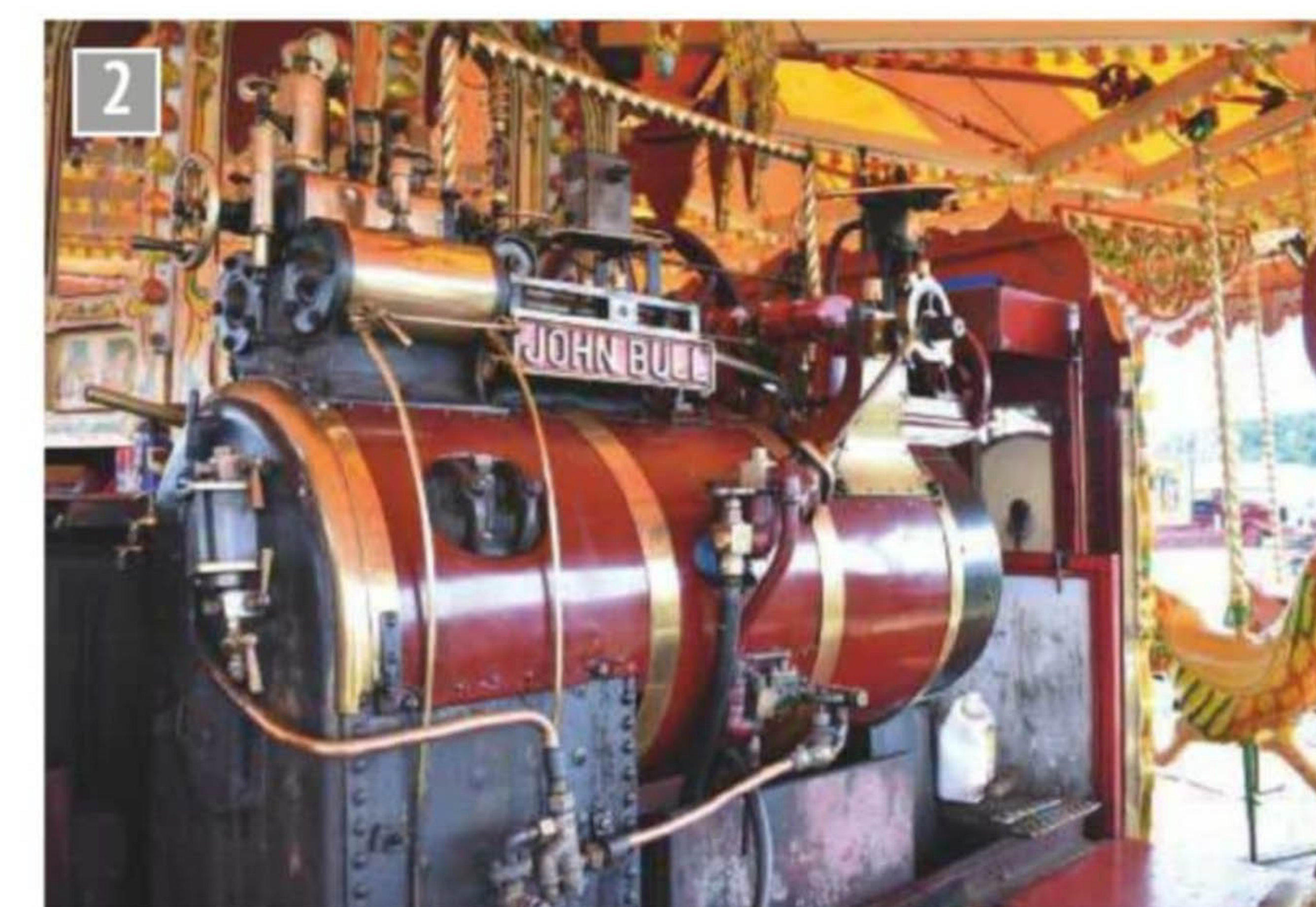
The preparations begin with three showman's engines getting the treatment. Closest is a Fowler, next is a Burrell and on the end is a Garrett.

Welland Steam Rally 2019

John Arrowsmith takes a trip to the Malvern hills.



The 55th Welland Steam Rally was again held on their large rally fields at Welland with the wonderful Malvern Hills as their backdrop. There were over ninety steam engines listed in the rally programme as well as over thirty miniatures. Add to that all the working stationary engines, the large collections of cars, lorries, motor cycles, military vehicles and a host of active demonstrations and you can see what an attractive and interesting rally this is. I was there early on Friday morning just as every engine and machine was being made ready for the day's visitors and the individual working time. There must be literally gallons of brass polishing compound being used to keep these veteran machines in the



The Savage centre engine on the 'gallopers' fairground ride.

splendid condition expected of them.

Old favourites mingled in with interesting newcomers and as the morning progressed so the whole site came to life.

I picked out three showman's engines which were being prepared to illustrate the quality finish on all of them (photo 1). Located behind these engines were the



This little portable engine was well made.



A very nice example in 2 inch scale of a Burrell road roller and living van built by Alan Bishop.

traditional fairground rides including the 'gallopers' with a large steam powered No. 6 Savage centre engine. It has been in the ownership of the present family since the 1940's. It looked in excellent condition and just added that extra bit of nostalgia to a familiar ride (photo 2).

A visit to the model tent is always an interesting place to

be and here there was a wide range of exhibits that provided entertainment for everyone from pure model engineering to the smaller collection type presentations. Among the model engineering exhibits was a nice little portable engine which showed some good workmanship (photo 3). A range of models by Kevin Gingell was well presented and



The Model Engineer beam engine as built by Kevin Gingell.



The 5 inch gauge 0-6-0 BR 1500 class locomotive owned by Miss M. Raynor.



The North Monmouthshire wagon was a good example of model wagon building.

I thought his Stuart 5A and his Model Engineer beam engine (photo 4) were fine examples of the prototypes. His James Coombes engine was another fine piece of work. From Burry Port in South Wales was a nice 5 inch gauge BR 0-6-0 1500 class locomotive brought by Miss M. Raynor (photo 5) and from Ammanford in South Wales a well made 4 inch scale

'Little Samson' showman's engine was displayed by Mr John Davies. In 2 inch scale was a fine model of a Burrell steam roller and living van built by Alan Bishop from Worcestershire (photo 6). A well-made example of a North Monmouthshire wagon circa 1911 was in good contrast to some of the other heavier engineering models (photo 7).



The little Beyer Peacock 0-4-0 locomotive waiting for its first passengers.



The Fowler crane engine preserved by the late Len Crane and now owned by his family.

I enjoyed a good chat with the organiser and driver of the little 0-4-0 Beyer Peacock locomotive originally built as a crane engine in 1879 which was simmering nicely on the length of standard gauge track (photo 8). This is now a permanent feature of the rally field at Welland and each year they have a guest engine to provide brake van rides along its length. Brought in from the Foxfield Railway in Staffordshire, this little engine was looking good in the sunshine and I enjoyed the short ride in an ex-GWR 'Toad' brake van where the engine was made to work as the line has quite an incline.

There was another 2ft gauge railway in operation on a short demonstration line where a fairly modern vertical boilded engine was part of an extensive road repairing demonstration using vintage equipment and

this little locomotive had a couple of tipper wagons in tow (photo 9). The engine was visiting from the Statfold Barn Railway but was built originally to a freelance design by the Will Brighton Wagon Works. When first built it had a gear drive but has been converted to chain drive. It has both a steam pump and injector and is also air brake fitted so that it can be used on the mainline at Statfold Barn. Working alongside it on the road building demonstration was a well-known crane engine once owned by Len Crane and still in the family (photo 10). A further demonstration of power was provided by a large steam excavator which was working hard moving soil. Watching the crew working this machine showed just how much effort was needed to work the digger compared to the modern equivalents (photo 11).



The 2ft gauge vertical boilded freelance locomotive working on the road making demonstration.



The Erie steam shovel (circa 1915) in action. This machine was restored at the Statfold Barn Railway.

By this time a number of miniature engines were driving round the rally field allowing the public to enjoy getting up close and talking to the drivers and for the miniatures to mix in with their full size brethren (photo 12). Some of the full size engines and vehicles were impressive and attracted a lot of admirers. Usually the front end or side

view of a particular exhibit is photographed but sometimes a look round the back can produce a totally different image. Take the Sentinel timber tractor, for example, just simmering away and looking like a number of other steam lorries on parade but round the back of the lorry it was a different story with a range of geared options including



Full size meets the miniatures during the regular steam trips on the rally site.



The interesting back end of a Sentinel steam lorry.



An immaculate Hornsby 3hp stationary engine.



The 6 inch McLaren showman's engine getting the treatment from a young engineer.



A good looking 6 inch scale Foden steam lorry at work at the rally.

a forward and reverse winch (photo 13). I don't know what all the ancillary equipment was for, there was no one to ask, but I expect some of our readers will. Among the numerous stationary engines working away on site I picked out a Richard Hornsby 3hp engine which had been very well restored and was looking immaculate in the sunshine (photo 14).

Once again it was good to see the number of younger people actively involved in all aspects of the show which augers well for the continued interest in these fine vintage machines of a bygone age. Thanks to everyone I spoke to for their patience and information - it was as always very much appreciated.



A rare model of a Suffolk steam dredging tractor in 4 inch scale owned by D. Staton.

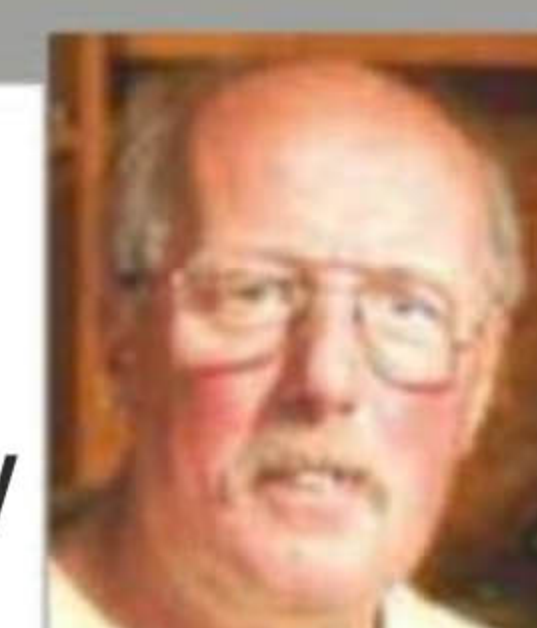


A fine example of a scratch built 4 inch Burrell makes its way out to the rally field.

Quarter Scale Bentley BR2 Rotary Aero Engine

PART 17

Mick Knights begins the final assembly of the engine.



Continued from p.324
M.E. 4619, 16 August 2019

If any readers intend using this piece as a reference for their own build then I would suggest that before assembly they drill and tap one end of each slave rod pivot pin before attempting to assemble the crankcase, as these are a close running fit to the bushes and proved problematic to extract. I had to resort to stripping the crankcase down and tapping them out using a pin punch through the air/fuel induction bores in the thrust box. **Photograph 275** shows the slave rod assembly with the pivot pin extraction holes. It's also a good idea to engrave or stamp individual components for their orientation and relevant cylinders so they go back in exactly the same position on final assembly.

When first setting the crankcase in the running frame it should rotate freely as it's rotating around the three main crankshaft ball bearings (photo 276). A little light oil should be applied to all moving components - I tend to



Slave rod assembly.

favour an aerosol spray as this deposits a finer film of oil.

With the slave rod assembly installed the rotation should still be free but there should be a little more resistance from the slave rod assembly's central bush rotating around the crankshaft. At this stage I checked that the crankshaft lubrication was working by inserting the small plastic tube on the aerosol spray into

the oil supply entrance at the rear of the shaft and giving it a quick squirt. Oil instantly flowed from all the lubrication points - one less thing to worry about!

One at a time, install pistons and cylinders, checking rotation after each one. Finally, fit all the cylinder head assemblies (photo 277).

The front cover, with its jack shaft gearing and rotary



Crankcase secured in the running frame.



Cylinder heads in place.



Front cover with its bronze rotary cam positioning pads.



Rotary cam in position.



Front cover secured to the crankcase.



First full engine assembly.



The induction ports and transfer pipes.

cam, are assembled next. If you're using the Hodgson plans these are fitted in their correct orientation to each other by aligning them with a 5mm dowel pin or, in this case, a drill shank, through their timing holes which were drilled and reamed during initial manufacturing (photos 278, 279 and 280).

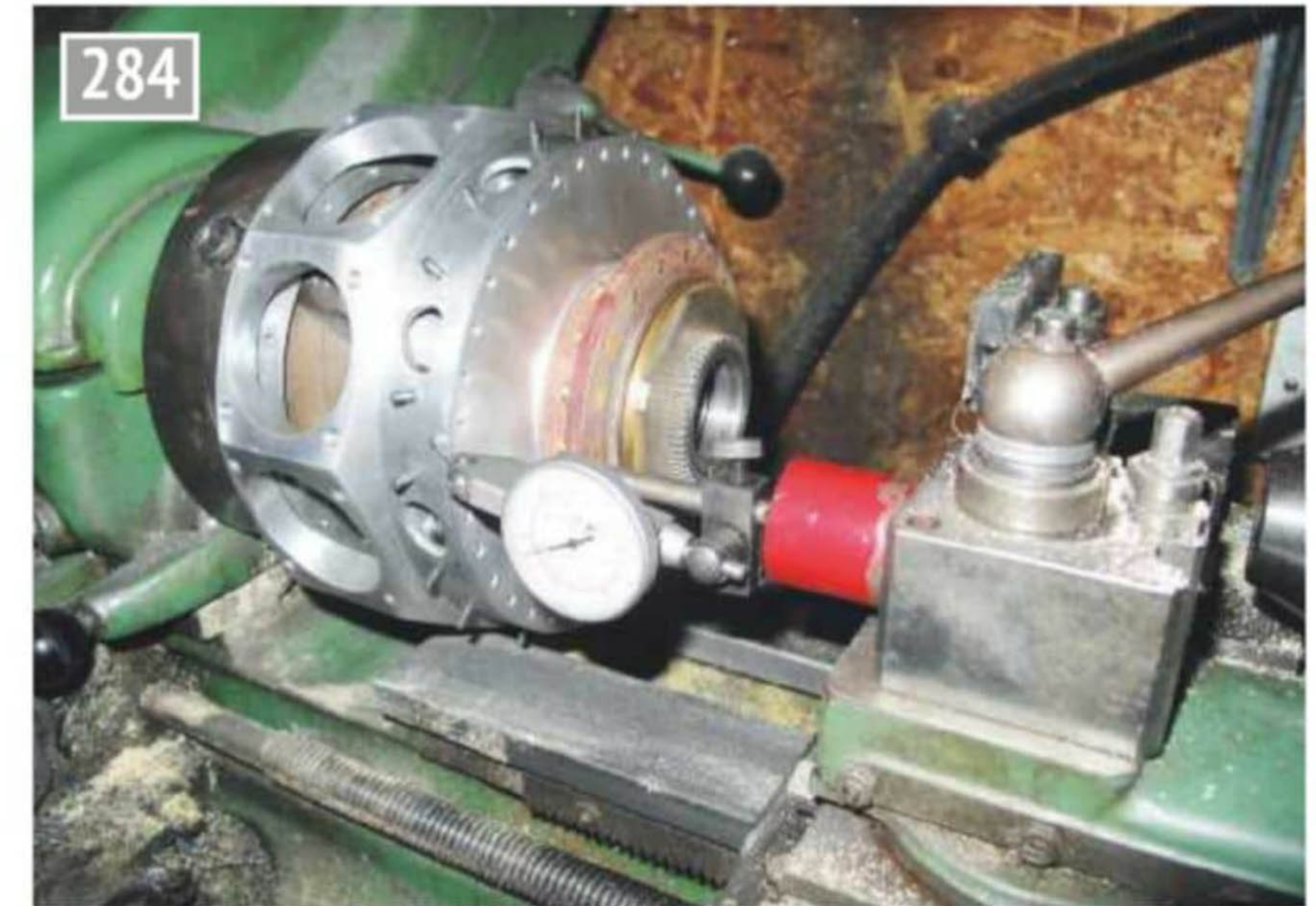
The cam followers and push rods are next to be fitted and their travel checked. There should still be some downward movement of the valve stem against the spring after the follower has crested the cam lobe. Finally, the propeller hub is bolted onto the crankcase. If the crankcase still rotates smoothly then it's a good time to assemble the fuel/air induction ports and check for alignment. I'll cover sealing the transfer tubes in the ports on final assembly (photos 281 and 282). **Photograph 283**

shows the cylinder heads with the volute springs in place.

With the ignition system I'm using the HT current to the twin spark plugs is delivered via brass contacts in the Tufnol slip ring. These have to be aligned with two carbon bushes mounted in the cover plate. These bushes are located either side of the engine's centreline and so, when a cylinder is also directly vertical at ninety degrees and the piston travel is at the top dead centre position (TDC) of the cylinder, the two carbon bushes should be directly in line with a pair of brass contacts in the rotating slip ring. Combustion, though, needs to occur at 10 degrees before TDC. With the Blackmore version, combustion occurs at twenty degrees before TDC, which I suspect would have been as it was on the original WW1 engine.



Cylinder heads.



Setting the thrust box true in the four jaw.

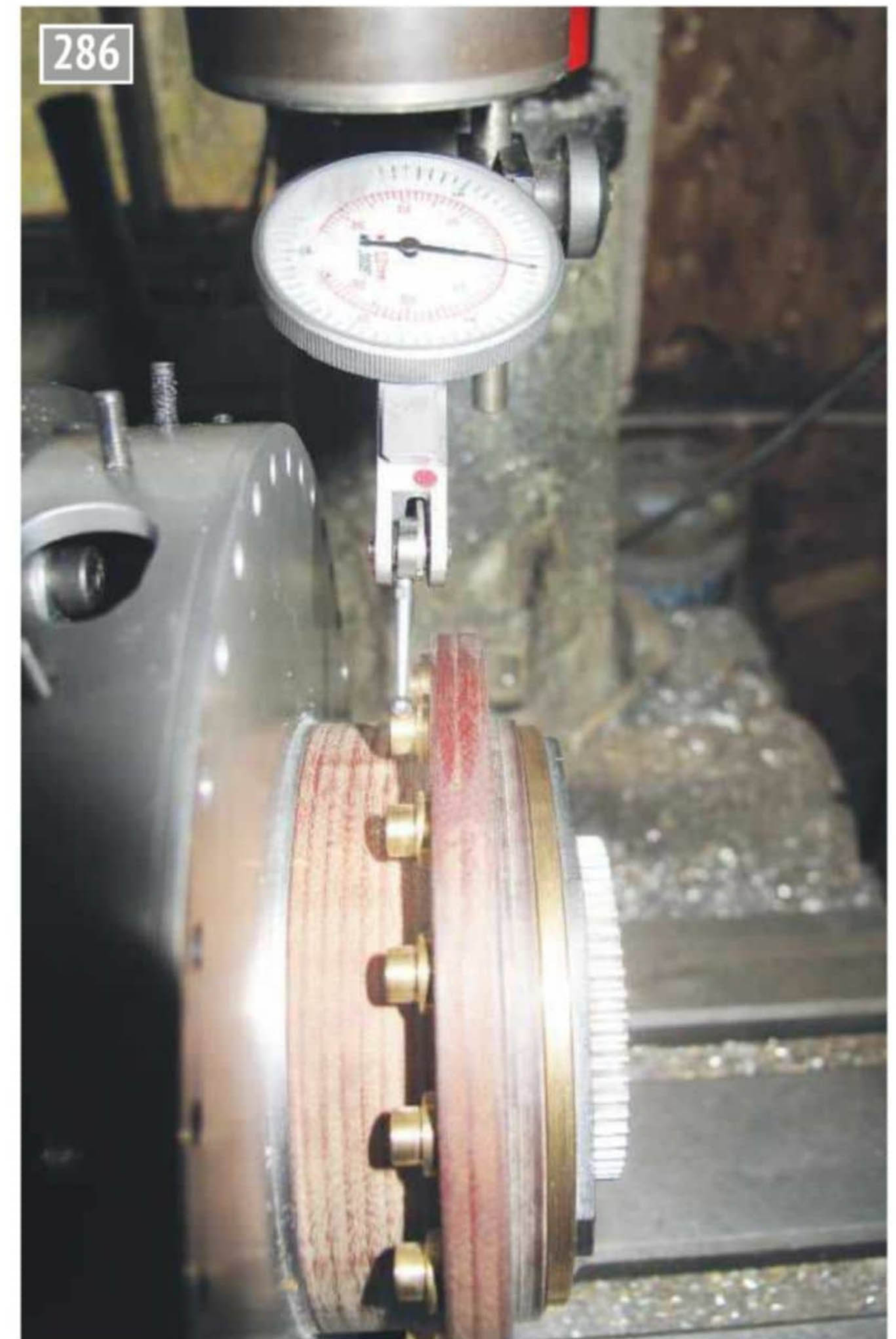


Setting No. 1 cylinder at 10 degrees before TDC.

Although the system has been successfully used many times in the past I could foresee a few problems in coordinating the two as well as setting the Hall sensor to discharge the current to the slip ring at this exact moment, so I thought about setting the first two conditions and then securing the slip ring to the thrust box ensuring a permanent setting no matter how many times the engine is disassembled. The only practical method I could see was to drill two holes on a 2.625 inch pitch circle. This would produce a semicircular form in both the slip ring and the outside diameter of the thrust box, allowing a couple of split roll pins to be tapped home once the assembly was fully tightened. One would locate the slip ring to the thrust box, while the second would be a belt and braces

measure to secure the locking nut in position once fully tightened. It would also ensure that the slip ring doesn't slip should the lock nut loosen when the engine is running; this would seem unlikely as the nut tightens in the direction of rotation but you never know. I trust this will all become clearer as we progress.

The first step was to set the thrust box (still attached to the crankcase) true in a four jaw chuck (photo 284) then transfer it to the dividing head, set up on the conventional mill. Once secured, the dividing head was rotated until a ten degree set piece, positioned on top the number one cylinder, was clocked true and the dividing head locked in that position (photo 285). If no angular set pieces are available then the No. 1 cylinder location could be clocked true and the dividing



Setting a pair of connectors in line.

head rotated through ten degrees. The slip ring retaining nut was loosened enough to allow the ring to be rotated until a pair of connectors could be clocked true in the horizontal plane. This would be the firing position of

cylinder No. 1 at ten degrees before TDC. The locking nut was fully tightened and the two connectors rechecked to ensure nothing had moved (photo 286). The thrust box was then set directly to the machine table and the bore



Setting the thrust box true.



Establishing the hole positions.



Roll pins in position.



Crankcase set at ten degrees before TDC with timing light attached to the Hall sensor.

clocked true to the spindle (photo 287). Two hole centres were established on the 2.625 inch pitch circle (photo 288) and two 0.104 inch diameter holes drilled to a depth of 16mm. **Photograph 289** shows the roll pins in position.

Now to adjust the Hall sensor to discharge when this setting is replicated on the running frame.

For any readers unfamiliar with Hall sensors, the HT current to the spark plugs is discharged when a series of magnets set in a non-conductive disc pass under the sensor - this replicates the distributor on engines using contact breakers and HT coil.

To check that the discharge occurs at exactly ten degrees before TDC. I set the crankcase at ten degrees using the angular set piece and checked the position using a small spirit level (photo 290). The

current will be discharged at the moment that the magnet completely passes the sensor, so in order to check this a small timing light is used which will illuminate when the magnet passes over the sensor and go out at the exact moment it has passed. There is also an audible buzzer that stops at the moment the magnet passes the sensor. You would be very lucky if all this happened without the need for some fine adjustment. The position of the sensor in relation to the magnets can be adjusted by rotating the sensor housing using two radial slots in the base until the light goes out and then locking it in position (photo 291).

The firing order is 1-3-5-7-9-2-4-6-8 and so when rotating the crankcase counter clockwise, after establishing the firing position of cylinder No. 1 at ten degrees before TDC, the timing light will illuminate again just after No. 2 cylinder reaches TDC and go out when cylinder No. 3 reaches its firing position at ten degrees before TDC. To check that current is being discharged when all nine magnets pass beneath the Hall sensor will require a couple of revolutions of the crankcase, with cylinders 1-3-5-7 and 9 firing on the first revolution and 2-4-6 and 8 on the second. The timing light I used was sourced from Roy at cncengines.com at the same time I purchased the spark plugs and CDI unit

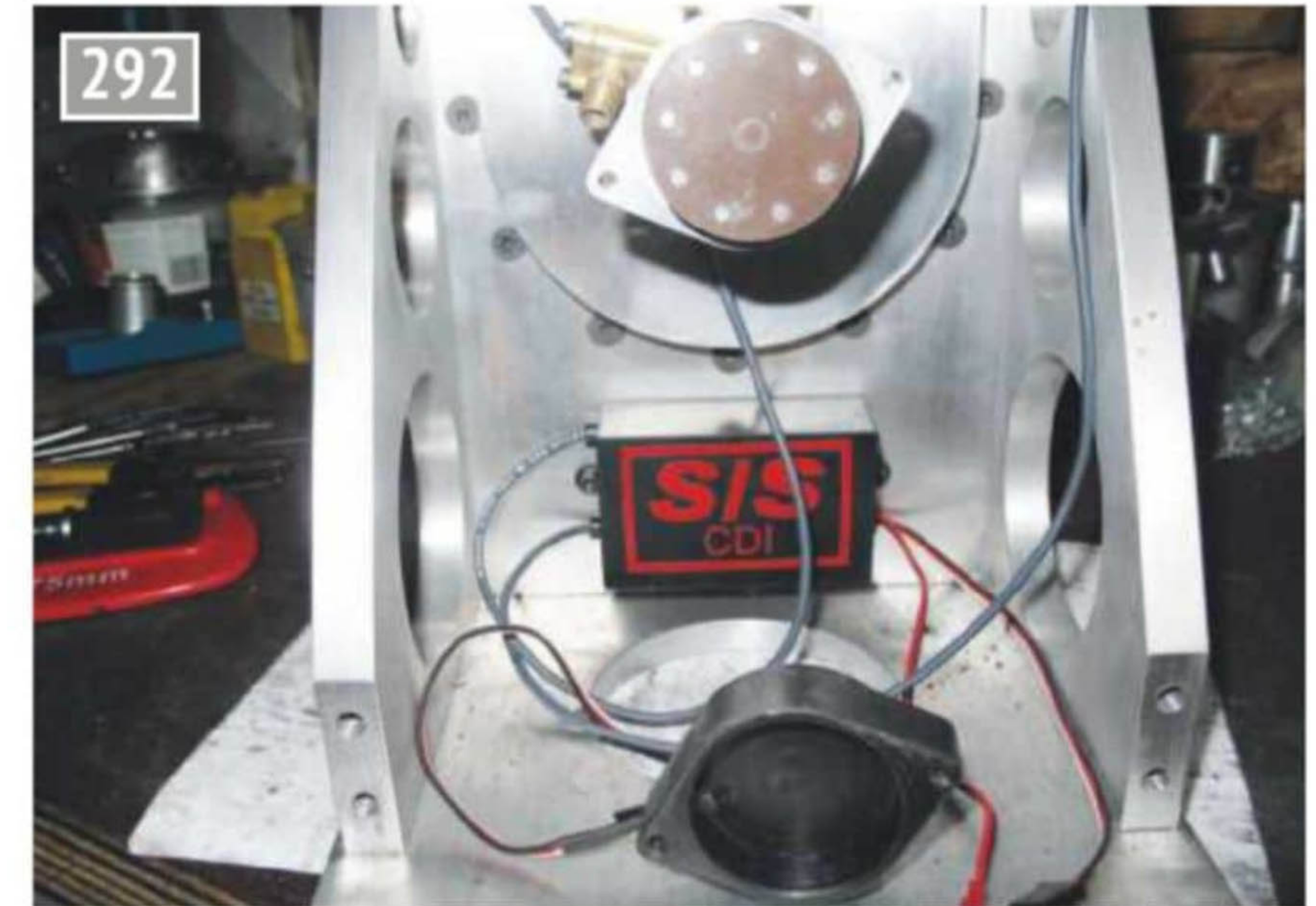
but different versions are also available from UK model supplies, such as Propguy. **Photograph 292** shows the nine magnets, while the Hall sensor can be seen inside the cap. The cap also needs to be produced from a non-conductive material, in this case black Nylon.

As I've mentioned before, in order to use the slip ring and Hall sensor I'm using the Hodgson running frame to mount the engine. However, this particular frame needs extra stabilisation which requires a second frame to bolt the Aluminium running frame to and so a suitable box section frame needs to be constructed. Strangely enough the cheapest 6 metre length of 25mm square x 3mm box section I could source was on Amazon, which at the time of writing was £27.50.

When fabricating any frame work it's a good idea to draw the frame full size on a convenient flat surface, in this case the bench top, along with the front view. I carried construction lines across to draw a side view. This enables exact sizes to be scaled and any angular stanchions, such as the side and rear support struts, can be checked for overall length and exact position by placing them on the drawing (photo 293). Also, when working with black iron, a piece of chalk is the best method of marking cutting lengths for sawing prior to machining to finished sizes.



Radial adjustment.



Inside the sensor cap.



Checking side support struts.



Setting the machine vice to produce the angled faces.



And I think to myself, what a wonderful weld!!

Using preferred angles makes setting up for machining straightforward. **Photograph 294** shows the machine vice set to thirty degrees using a set piece. The best milling cutter for this particular operation has to be a fine-tooth ripper. Once

the first thirty degree angled face has been produced on all four side struts the second face can be machined using a simple back stop to ensure uniform lengths. It's always a good idea to flush off all the welds on flat surfaces. These days I use a flexible



Finished support frame.

flapper disc with my small angle grinder as they produce a far better surface finish and are easier to use compared to the solid grinding discs. **Photograph 295** shows the welded frame prior to painting and **photo 296** the finished frame.

NEXT TIME

We complete the assembly and finishing of the engine.

●To be continued.



Georgina is seen here with a train of passenger coaches at Scalby Mills on the North Bay Railway during the day of its formal public launch, 23 April 2016. Note the need to provide buffers compatible with the line's existing rolling stock despite the fact that they do not sit comfortably with the locomotive's 'industrial' heritage.

A Brand New Bagnall for Groudle Glen

PART 1

Mark Smithers investigates *Oscar*, a new-build Bagnall locomotive constructed at the Scarborough North Bay Railway.



One of the basic locomotive specifications that has inspired a significant following amongst large-scale modellers of narrow gauge steam locomotives is the Bagnall 'Bullhead' 0-4-0ST. From 16mm to 1 foot scale ('O' or 1 1/4 inch gauge) right up to 7 1/4 inch gauge, we have seen a number of examples throughout the length and breadth of the British mainland at least, if not further afield. It is for this reason that the recent appearance of two full-size new-build specimens on home soil will be of considerable interest to both existing and

prospective modellers of these engaging little locomotives. The story of the replica locomotives begins at Scarborough's 20 inch gauge North Bay Railway. As part of a general 'revamp' following a change of ownership, the decision was taken to build a new 'narrow gauge' pattern steam locomotive to provide additional customer interest on a railway that had hitherto relied on internal combustion motive power. In pursuance of this end, a subsidiary company, N.B.R. Services Ltd. was formed during the early part of 2014. In addition to completing the projected locomotive, it

was also envisaged that that new-build and repair facilities would be made available to external customers. After looking around for inspiration for a suitable steam locomotive for the N.B.R., the choice eventually fell on the Bagnall Sipat class 0-4-0ST. This specification was the smallest of the standard 'Bullhead' Bagnall 0-4-0ST designs, being produced in three sizes: 10 HP, 15 HP and 20 HP (all 7 1/2 inch cylinder stroke, respectively 4 inch, 4 1/2 inch and 5 inch bore) weighing between 3 1/4 and 3 3/4 tons in working order. The earliest class member to be officially acknowledged



Various components that were later to be incorporated into Otter are seen here in January 2017 in the N.B.R.E.S.L. Machine Shop in Scarborough. They include brake blocks, brake shaft bearings and bellcrank, eccentric sheaves and the safety valve body casting.



This is a front left hand three-quarter view of the chassis of Otter in the Erecting Shop on the outskirts of Scarborough in January 2017. By this time, the chassis was at the 'rolling' stage with both of the left hand brake hangers and associated transverse rods already fitted.



This is Otter's leading axle stretcher which effectively envelops the axle. On the original Sipat design this would have been a casting, but on the new locomotive it is a welded fabrication.



The ribbed smokebox saddle referred to in the text in relation to the Sipat design has been faithfully reproduced on Otter but, in line with the general constructional principles of the new locomotive, it is of fabricated rather than cast construction. For a good illustration of the movement from plain to ribbed smokebox saddles on these small Bagnall locomotives at the turn of the 19th/20th Century, compare the Groudle Glen Railway 2-4-0T Sea Lion and Polar Bear designs.

as such was Bagnall works number 1868 of January 1908, a 10 HP specimen. The versatility of the basic specification was illustrated by the fact that the maker's catalogue stated that it could be built to gauges ranging from 1 foot 6 inch to 3 foot 6 inch. There were precursors of the Sipat class; the best-known of these on the domestic front was probably number 1560 of 1899 of 18 inch gauge for Brede Waterworks in Sussex, which was characterised by a plain, rather than ribbed, smokebox saddle and 'modified Baguley' rather than Bagnall-Price valve gear. From the point of view of evolutionary history, the change from plain to ribbed smokebox came earlier than the switch from 'modified Baguley' to Bagnall-Price valve

gear as evidenced by 18 inch gauge ancestor, *Ant* (No. 1651 of 1902) which combined the later pattern smokebox with the earlier pattern valve gear. One of the advantages of the Sipat specification from the constructional point of view is, of course, the use of the 'Bullhead' boiler rather than the conventional locomotive pattern, although on the debit side these boilers tend to be relatively slow in steam-raising when compared with the latter. The first Bagnall locomotive to use the 'Bullhead' pattern of boiler was No. 1416 of 1893 and the boiler design appears to derive its inspiration from the 'Britannia' or 'Colonial'-pattern cylindrical firebox boilers with enlarged fireboxes fitted to portable engines produced by

Marshall of Gainsborough which, in turn, were preceded by a boiler of similar pattern constructed by at least one German manufacturer. Such boilers also appeared on a small number of locomotives produced by Bagnall's Staffordshire neighbours, Kerr Stuart during the last decade of the nineteenth century. Following early work undertaken at the North Bay Railway's own workshops, the embryonic locomotive, *Georgina's* completed components were transferred to the Scarborough premises of N.B.R.E.S. Ltd. During the latter part of 2014 and by late November of that year, the chassis was ready for finishing

and compressed air trials. The locomotive's completion schedule had been somewhat shortened by the fact that a suitable pair of cylinders were ready to hand. These had originally been manufactured in Australia for a 2 foot gauge replica of New Zealand's Bagnall 0-4-2T *Annie* (the 'original' of which was Bagnall No. 1922 of 1911 built to 2 foot 6 inch gauge for Gisborne Borough Council's Gentle Annie Tramways). The cylinders were later used by Richard Booth of the Groudle Glen Railway for his replica of the same locomotive, completed in 1998. They became available for *Georgina* when Richard decided to manufacture a more authentic



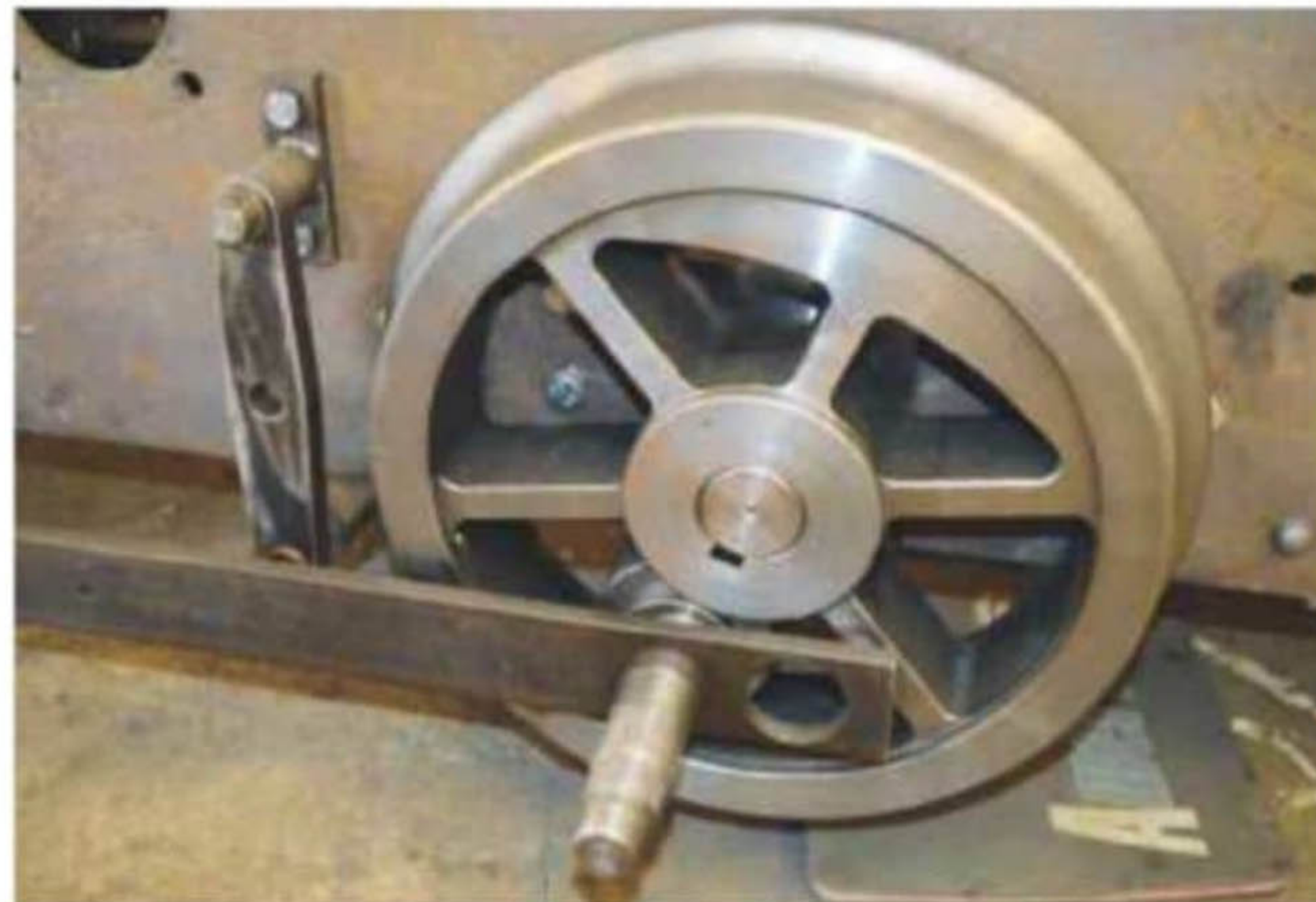
This view shows the trailing axle fitted with the eccentrics, along with its associated axleboxes and hornblocks (again fabricated items) and the rear right hand brake hanger resting on top of its associated hornblock.



This is the rear stretcher, which supports the 'bullhead' firebox. It is yet another fabricated item.

pair for his *Annie*. *Georgina* was largely mechanically complete by October 2015 when successful compressed air tests on the chassis were carried out. Between this time and the spring of the following year, the remaining 'finishing touches' were undertaken. Following a steam test on March 2nd 2016, *Georgina* was eventually 'launched' on the North Bay Railway on March 23rd 2016.

Amongst other projects undertaken by N.B.R.E.S.L., which included construction of a 7¼ inch gauge half-size replica of Sir Arthur Heywood's *Effie*, the decision was taken in 2016 to construct another Sipat locomotive, this time to 2 foot gauge. By the time that construction work was under way on this locomotive, the company's facilities consisted of two workshops in Scarborough, the smaller of which was the Machine Shop located close to the North Bay Railway's Peasholm Park terminus and the larger of which was an Erecting Shop, situated a short distance 'out of town' in an adjacent village. Most of the photographs of the second Sipat locomotive *Oscar*, taken whilst under construction, that accompany this feature were taken in the Erecting Shop. Unlike *Georgina*, the new locomotive was not initially constructed with a particular customer in mind and for this reason its construction proceeded



The leading right hand wheel of Otter is seen here – a faithful reproduction of the Bagnall original. Note the jig to hold the crankpins in position prior to the fitting of the coupling rods.



A rear right hand three-quarter view of Otter's chassis in January 2017. This picture gives a good idea of the relative positions of the rear stretcher, the leading axle stretcher and the smokebox saddle.



This is one of the blanks for Otter's coupling rods as seen in the Machine Shop in January 2017.

very much on a 'stop-start' basis over a period of three years, being fitted in as other jobs permitted. As can be seen in the accompanying photographs, much of the chassis was completed by the middle of 2017 but there was a relatively long pause until completion of the remainder of the locomotive. During this time, it was decided to relocate the company's manufacturing capability to Darlington for

reasons of convenience. The lack of a designated customer proved to be a major difficulty and by April 2018, thoughts were even turning to utilising the engine's components in a 15-inch gauge project. Fortunately more realistic arguments prevailed and it was realised that a buyer for the locomotive was likely to be one of three candidates: the Groudle Glen Railway; the Amerton Railway or Amberley



The casting for the locomotive's Ramsbottom safety valve column can be seen to advantage in this photograph.

Chalk Pits Museum. In the end it was the first of these venues that was able to allocate the necessary funds for purchase and the locomotive was completed in time for its running trials on a suitable stretch of track adjacent to Castleton Moor Station on the Middlesbrough-Whitby (Esk Valley) main line. These took place on 21/22 April 2019

●To be continued.

Lathes and More for Beginners

PART 48

Graham Sadler makes a couple of faceplates designed for repeatable holding of workpieces.



Continued from p.393
M.E. 4620, 30 August 2019

Some while ago I had a little project which involved the production of a batch of cylinders for oscillating engines with a ½ inch bore. At the same time, I wanted to resurrect an engineering oddity project of machining a 'Turner's Cube' which consists of three internally nested cubes cut from a single solid block of about 40mm, none of which can be removed. Both of these would need a considerable amount of use of the faceplate and angle plates along with a number of holding and locating jigs.

At about the same time I was talking to Alec, a member at my club (Chesterfield), who had just finished making a pump which involved over 20 faceplate operations. He stated that it was very interesting but very slow because of the difficulty of all the setting up procedures which had to defy gravity - and it took 'forever'. My two projects were stalling for the same reasons (and I couldn't work out how to do the cube).

Then with the knowledge of a daunting set up time I remembered two articles in the dim and distant past. One was a modification done to a faceplate using a key to guide an angle plate and the other about setting up a faceplate by having a fixture to screw it onto when mounted in the bench vice. The modification involved milling a slot in the faceplate, then doing the same with the angle plate and fitting a tenon. This did mean that when adjusting the plate in and out from the centre of the

lathe, at least it didn't twist and fall at all sorts of silly angles and the up and down settings could be easily fixed.

Both of these schemes had their merits, but both had their disadvantages. The vice fixture did help a lot to position the clamps, as all was horizontal, but did nothing for positioning with real accuracy. It used for a clamped scribing block for centring reference (I think). The angle plate trick was good, but for many of the tiny operations which have to be undertaken on the faceplate, like Alec making his pump, the standard 9 inch faceplate was far too big and angle plates too heavy with huge wide slots in them, needing a lot of washers and cumbersome balance weights for reasonable turning speeds, which always seem to get in the way. In addition, the cutting of a tenon slot along the existing bolt slot in the faceplate seemed to me to be making it rather fragile, possibly leading to a fracture of the faceplate.

So, after a while the thinking cap came out and I surveyed the 'junk box' of unused items for inspiration. It didn't take long; I spied the catch plate for the Myford, an item used only a handful of times since I purchased the machine new in 1982. What a nice faceplate this would make! Trouble is it has a great big slot for the pin which turns the work via the carrier and I didn't like damaging it. Then the penny dropped again. All I needed was a 5 inch chuck back plate and dedicated angle plates

made from aluminium, a much lighter material than the standard cast iron versions.

The plate can be purchased quite economically from our brothers in the trade and it is already machined to fit the spindle. For the angle plates, using aluminium will reduce the need for such heavy balance weights as the overall mass is so much reduced. The disadvantage of aluminium is that it is easily damaged by trapped swarf so special care is needed in both manufacture and use by carefully wiping all traces of swarf away when setting up. Although it is not as rigid as cast iron or steel, it is satisfactory in this application as the plate is intended for delicate work and very light machining.

I quickly realised that the angle plates could be odd lengths of square stock and the slot for the locating tenon could be quite small, unlike the full faceplate monster tenon which had to be wider than the cast slots. I use a lot of 2BA fixings for clamping small items and, with this method, tapped holes into the blocks can be placed where needed.

Problem one solved - the tenon guided angle bar/plate can move in only one plane so with this set horizontal, the front to back direction still remained and setting items true and to put holes etc. in the correct position will still take time. So, what I needed was a way of setting the piece to be machined e.g. the boiler fitting or the tee to be detailed later.

True - this simple component could be mounted in the four jaw chuck but it needs a lot



The full kit of parts.

of pesky packing pieces to protect it and it can take a while to set it in exact position - then repeated twice more. In addition, I had the cylinders and the cube oddity to think about. Once the tenon idea for the angle block was adopted an easy solution appeared. All that was needed was a sub plate also with a tenon enabling controlled adjustment in the other plane which can have the component bolted to it and that is dropped onto the fixture on the lathe. It also opened the door to quick and much easier semi-automatic positioning.

I now feel with hindsight that some of this design when I made it was over engineered. I'm not sure the tenons between the setting plate and angle plate are really needed, as almost the same result can be achieved by just making sure that the plate is pressed hard against the faceplate itself, thus maintaining positional accuracy, but they do make setting up easier and perhaps there would be less to resist the cutting forces.

Figure 43 and **photo 253** show the full kit. Note that several of the photographs you'll see are very recent and posed; I did these to check for you that the project could be completed on the lathe alone. Some of the photographs show finished parts in machining positions

as I didn't take enough at the time of manufacture for this article and are thus posed.

Machining is straightforward and simple. It can be produced on the lathe alone but many of the operations will be far easier with a miller. Dimensions are not critical so use whatever you have to hand and modify accordingly. One which is important is the length of the angle bar and plate. They should not be longer than the 100 mm especially if you are using a vertical and cross slide for production, as there is only just enough cross slide travel - the ML7 has 5 inches while the S7 has an extra inch to play with.

You can produce as many of the components as you need but I have used most of the parts. However, I have not used the 32mm angle plate narrow face up as originally designed and made, it being so close in size to the 25mm angle bar that it is not worth the effort and it makes the angle plate complex.

Begin by lightly screwing the face plate onto the lathe, engage the chuck removal spindle lock, then put a pencil mark in the 10 o'clock position to mark a convenient position to drill an 8mm hole for a tommy-bar in the periphery of the back plate so you can be certain of removing it. Countersink this hole for easy entry of the bar. Next face the

plate true. Lock the saddle while you do this.

I tend now to use inserted tools for most work as the spindle speeds can be much higher. Speeds of 180 to 890rpm should be used here but much lower with HSS tooling. For those of you like me who have fitted an inverter drive to your machine this is a quick task as the spindle speed is reduced with the turn of a knob while machining and continually stopping the machine to change speed is not required.

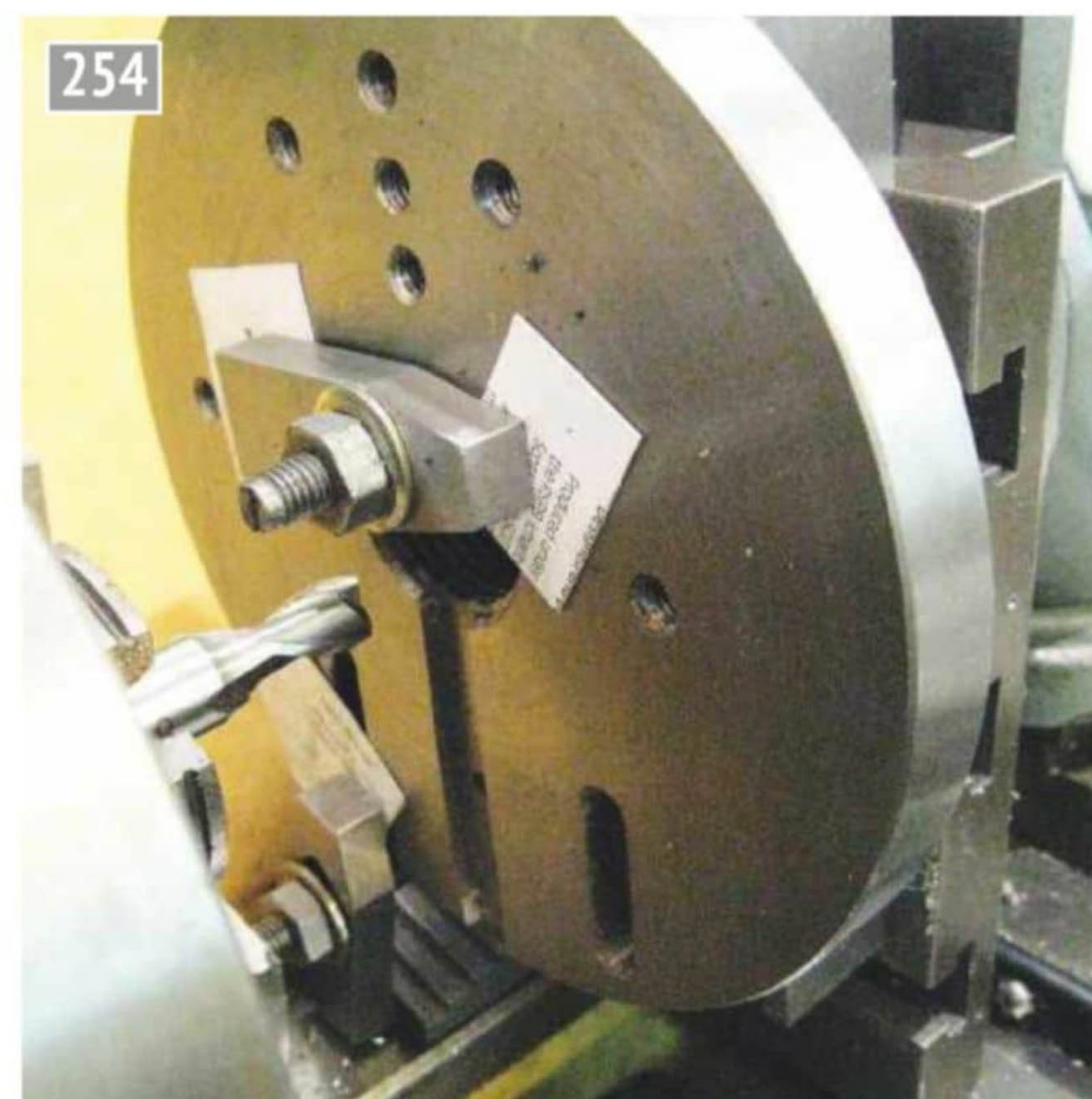
Before removal from the plate, engage the spindle lock again and, using a square on the lathe bed and a centre in the tailstock to find the lathe axis, scribe a vertical line up to the lathe spindle. This marks the position of the tenon and puts it in a vertical position, making subsequent setting up (when using the finished kit) a lot quicker; the spindle can be locked and the bolting face on the plates are very close to horizontal.

Bolt the plate down onto the miller table on parallels so clamps can be put at the edge, making sure that the marked line is square to one of the table axes. Use a centre finder or sticky pin for this (a blob of blue tack with a pin

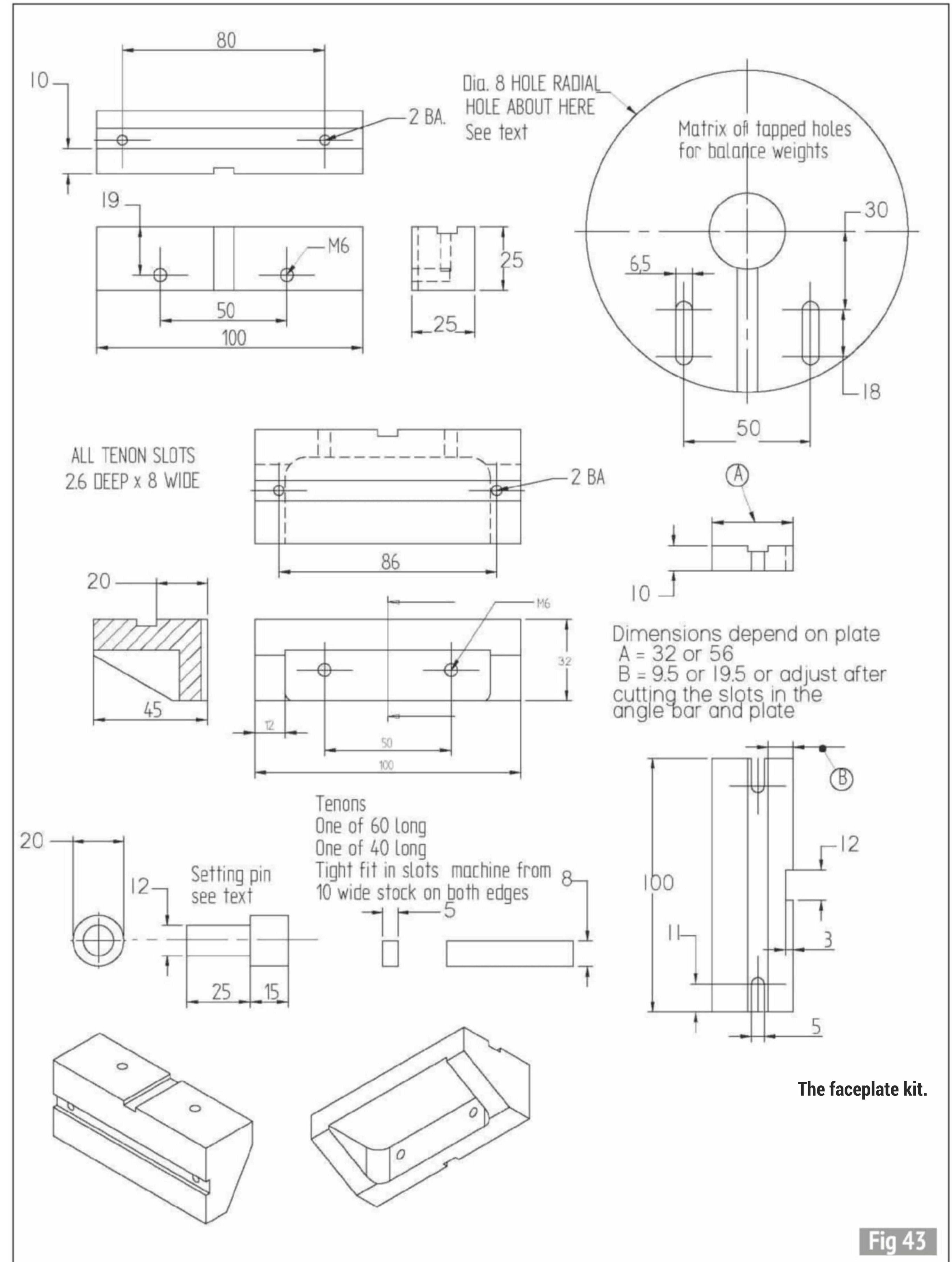
in it) - hold a rule against it with the machine running to make it run true. Centre the plate to the machine spindle by rotating the plate until the scribed line is true to the machine axis to ensure that the tenon slot is truly radial and the bolt slots are parallel to it. You may wish to pre-drill the slots with a 6mm drill to remove the bulk of the waste. Use a sharp slot drill for the tenon slot to ensure a good accurate width.

Something I didn't do because I never thought of it at the time is to drill the plate with a matrix of holes for bolting other pieces or jigs to it - you will see I have added a few holes as required. If you do this, decide on the matrix dimension and the thread for yourself but give it some thought. I have just drilled the plate as and when required. Deburr and the plate is finished. For the lathe only construction, mount on the vertical slide but ensure the scribed line is vertical (**photo 254**). This task is often a lot easier if the slide is removed and put in the bench vice so gravity is working for you. This task is at the limit of what is possible on the slide so proceed exactly as outlined above!

●To be continued.



Machining the slots on the faceplate.



Focas Oil Pump

PART 2

Peter Worden concludes his occasional series describing the building of his FOCAS engine.

Continued from p.300
M.E. 4619, 16 August 2019



Gear blanks turned double ended.



Cutting a gear in the indexer.

Gears

The two mild steel pump gears were machined back to back in one piece to enable them to be held easier for

gear cutting (photo 9). The gear blanks were held in an indexer to cut the teeth (photo 10). The reason the indexer was used instead of a dividing

head is because as there were only 12 teeth to cut it could be indexed in 30 degree steps so avoiding setting up a dividing head. Each gear was then parted off and finish turned to complete the job (photo 11). The wormwheel was made in phosphor bronze. I didn't have the necessary tools to cut a perfect wormwheel so I had to resort to cutting the teeth as a spur gear but on an angle to match the helix angle of the worm, which was screwcut on the crankshaft in a previous operation. The crankshaft in question was featured in an article in *Model Engineer*, vol. 204, issues 4499 and 4500, January 2015.

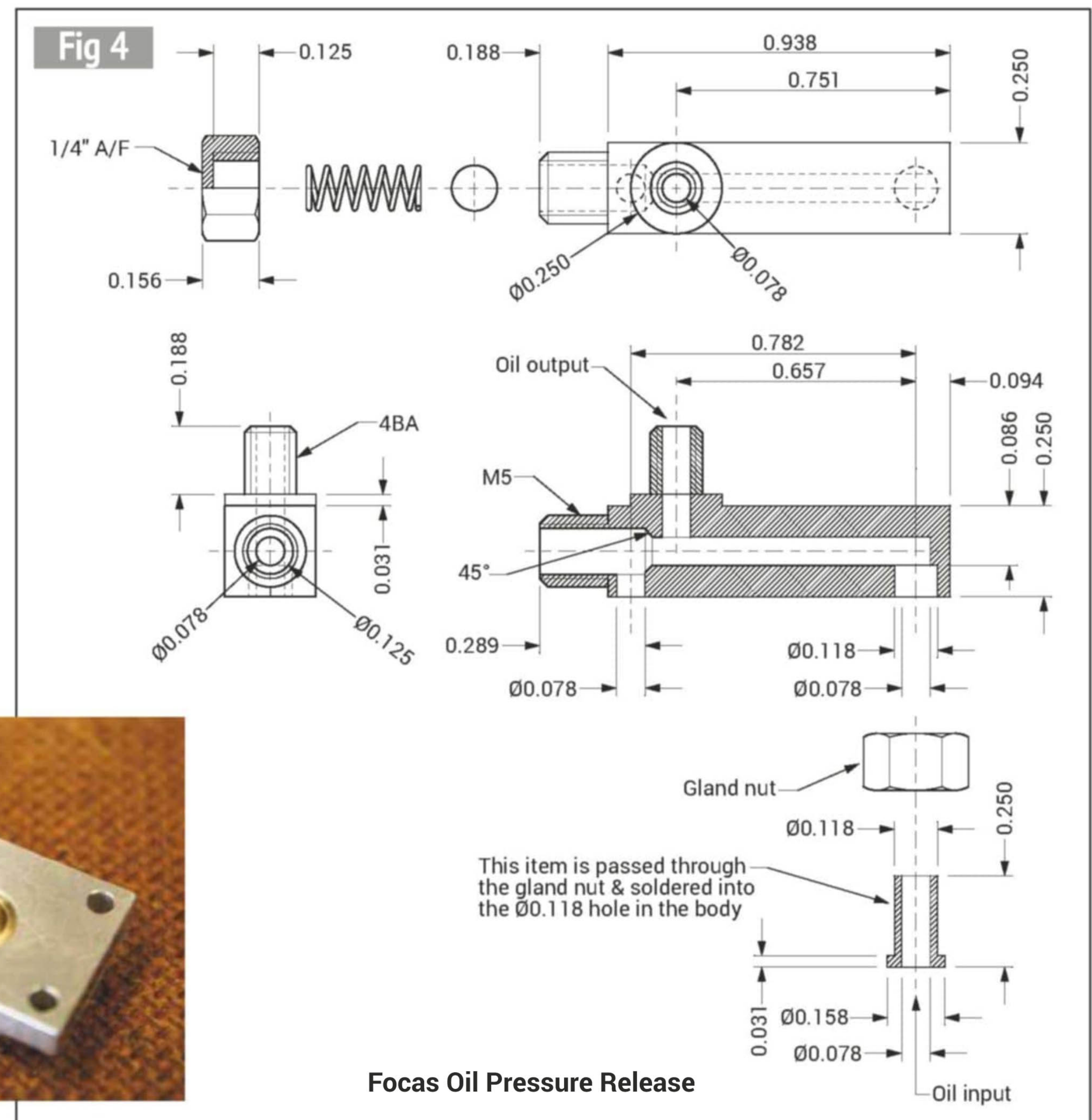
Gear cover

The gear cover was milled to the basic overall dimensions (fig 3) then four clearance holes for the 8BA fixing screws were drilled and two holes were bored on one side at a distance apart to match the centres of the pump gears (photo 12) to accept two of the un-flanged bushes, which were pressed in (photo 13). These bushes were intended to support the ends of the pump gears. I'm not sure if they were necessary but it seemed a good idea at the time. The other side of the cover was milled to produce the outside contour (photo 14). Four studs 8BA x 1/2 inch

long were made and screwed into the pump body. It was a bit of a fiddly job getting the nuts on the 8BA studs on assembly, as there's not much room for manoeuvre, but that's the price we pay I suppose for building miniature projects.

Pressure release valve

This item (photo 15) was made from brass because the connection, to enable it to be linked to the oil pump, had to be soldered in, as shown in fig 4. The workings of the release valve consisted of a steel ball held against the seating by a spring which was loaded by a blind nut. When the oil pressure reaches a pre-set limit, the ball is forced off its



Bushes pressed into gear cover.

seating against the spring and the excess oil is dumped back into the sump of the engine through a hole in the base (see photo 1). The pressure can be adjusted by turning the hexagon nut on the end of the body. This unit is screwed into the base platform (photo 16) and oil is forced up through a vertical hole in the platform (which is upside-down in the photo) into outside pipes which take it up to the cylinder head to feed the camshafts.

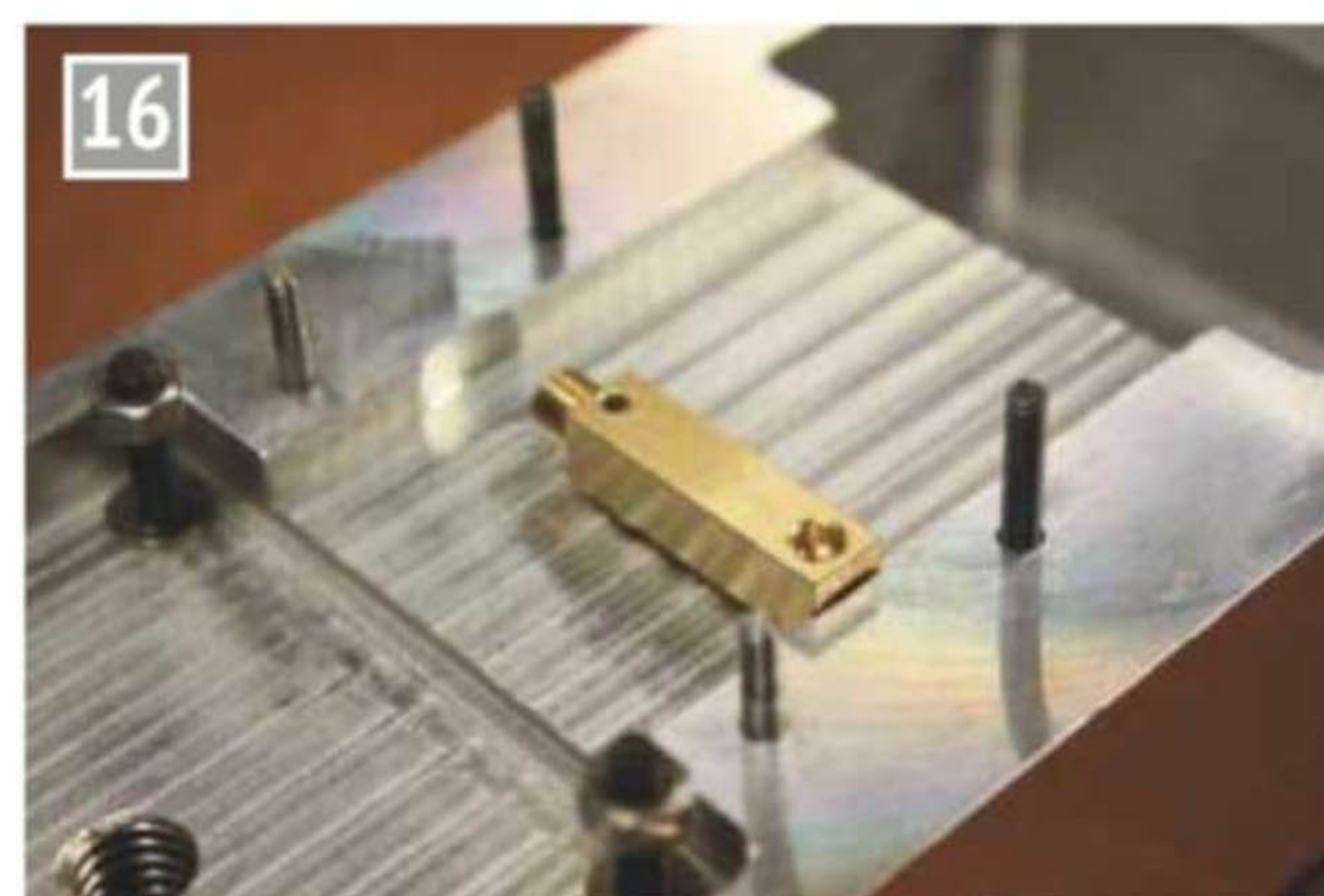
Photograph 17 shows the oil pump, without the gear cover, fitted to the base platform and straddling the crankshaft with the pressure release valve underneath. This is upside-down to how it will be in normal use. It was easier to photograph this way.



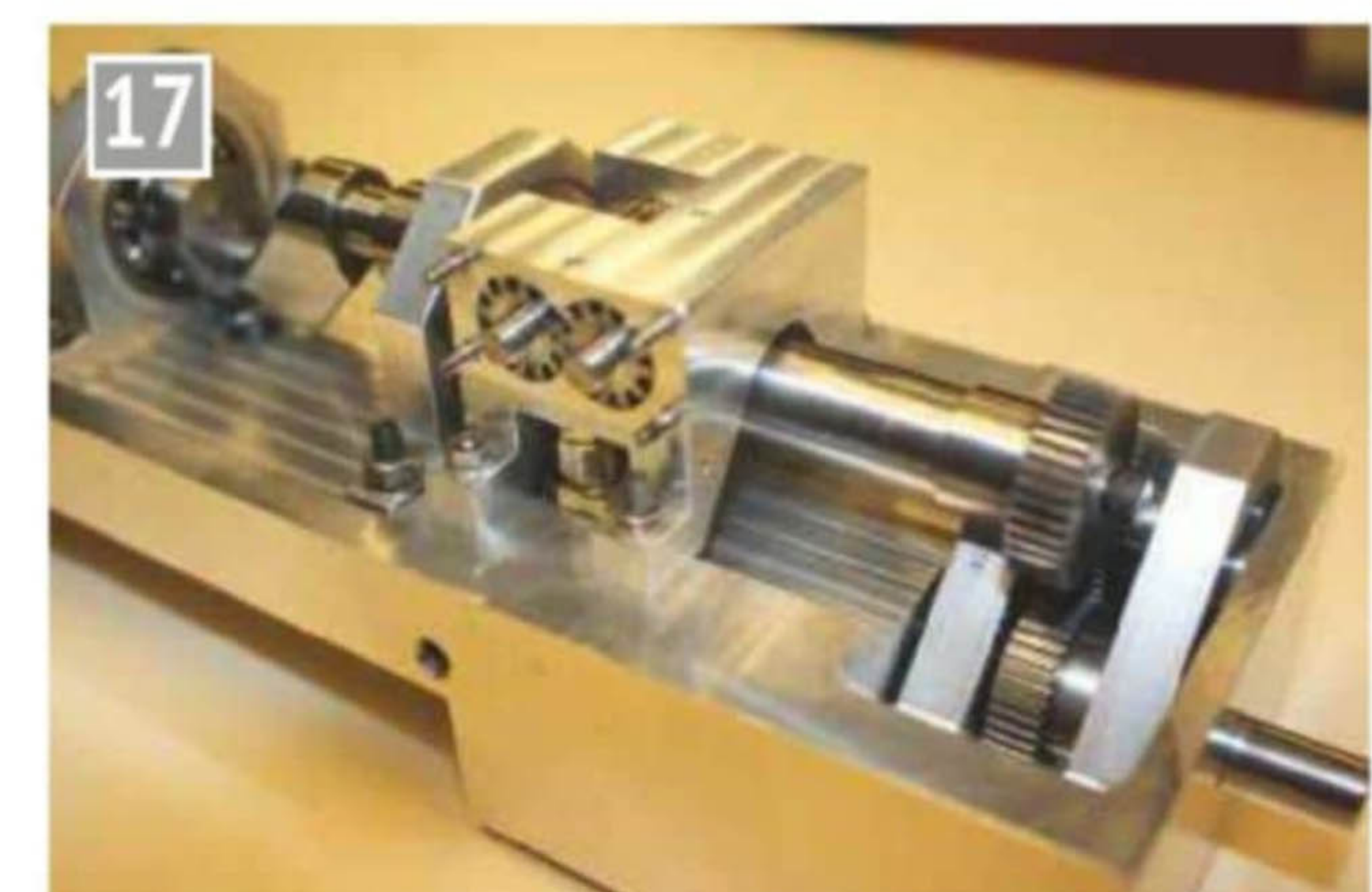
Cover with outside contour milled.



Pressure release unit.



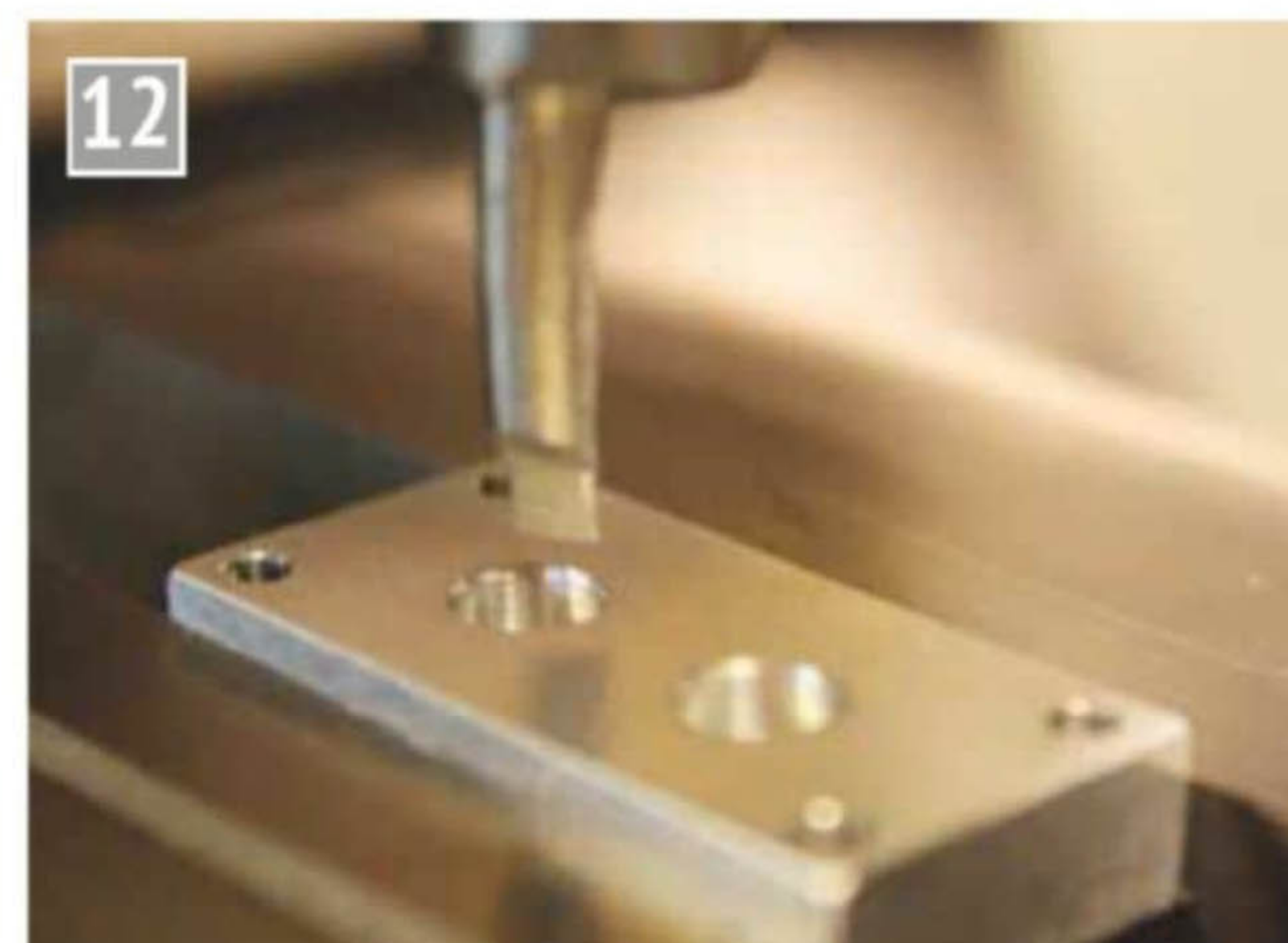
ME Pressure unit fitted to base platform.



Oil pump fitted to base platform.



Two gears and worm wheel finished.



Boring locating holes in gear cover.

Five Inch Gauge Garden Railway Design and Construction PART 1

Stephen Wessel considers the best way to achieve a stable and durable track bed for his garden railway.



Introduction

I have owned a 5 inch gauge ground level garden railway for over 40 years. It started in one county then moved with us some 24 years ago to another and was greatly expanded both in length and civil engineering features. It currently extends to just over a third of a mile, excluding sidings. Recently I have been relaying a short section with some friends, one of whom encouraged me to write down my overall experiences of the various methods and materials that I have used. This article is the result and I hope it may serve as a guide to others, both individuals and clubs, that may be poised to construct their own railway and are no doubt being battered by conflicting advice from all quarters.

Back in 1977 I had no knowledge of the subject and very little spare cash to spread, as it were, all over a rather unkempt garden. Although I had built a small locomotive many years previously, I had lost all interest in both it and the whole subject of model engineering. Joining a club never occurred to me. So, it took the urging of another friend at the time to get on and build a track in the garden. I am eternally grateful to him for rekindling my interest, for the railway has led to so many other friendships.

As a complete tyro I did the obvious thing by ringing up a well-known company (Cromar-White) and ordering about 100 feet of track parts; following their instructions, it was laid on a bed of rubble and stone chippings. Huge excitement, followed by the building of basic passenger wagons and a gradual extension as time and money allowed, resulted eventually in a decent track

with one set of points and an engine shed. In fact, I quickly discovered I could save a lot of money by making my own sleepers and buying screws from cheaper suppliers.

The problems of a small ground level track became all too apparent over the next few years. The chief of these are lack of stability and rot. I became aware of siren voices advising a larger gauge, steel rail, steel sleepers (no plastic in those days) and came into contact with people building much larger railways right up to 15 inch gauge. But for a small garden like mine 5 inch seemed a better size and gave the impression of a longer railway. It made handling easier and caused less disruption to the garden itself. So, I have stuck doggedly to that gauge ever since.

In this series I shall be examining the reasons why, in my opinion, we need to improve both the stability and longevity of our miniature railways. In doing so we can drastically cut the man hours spent on maintenance while ensuring the track remains safe. Later on, I will describe my efforts to produce a viable and cheap concrete sleeper that has several major advantages over all others, as most full-size railways have already discovered.

The basics

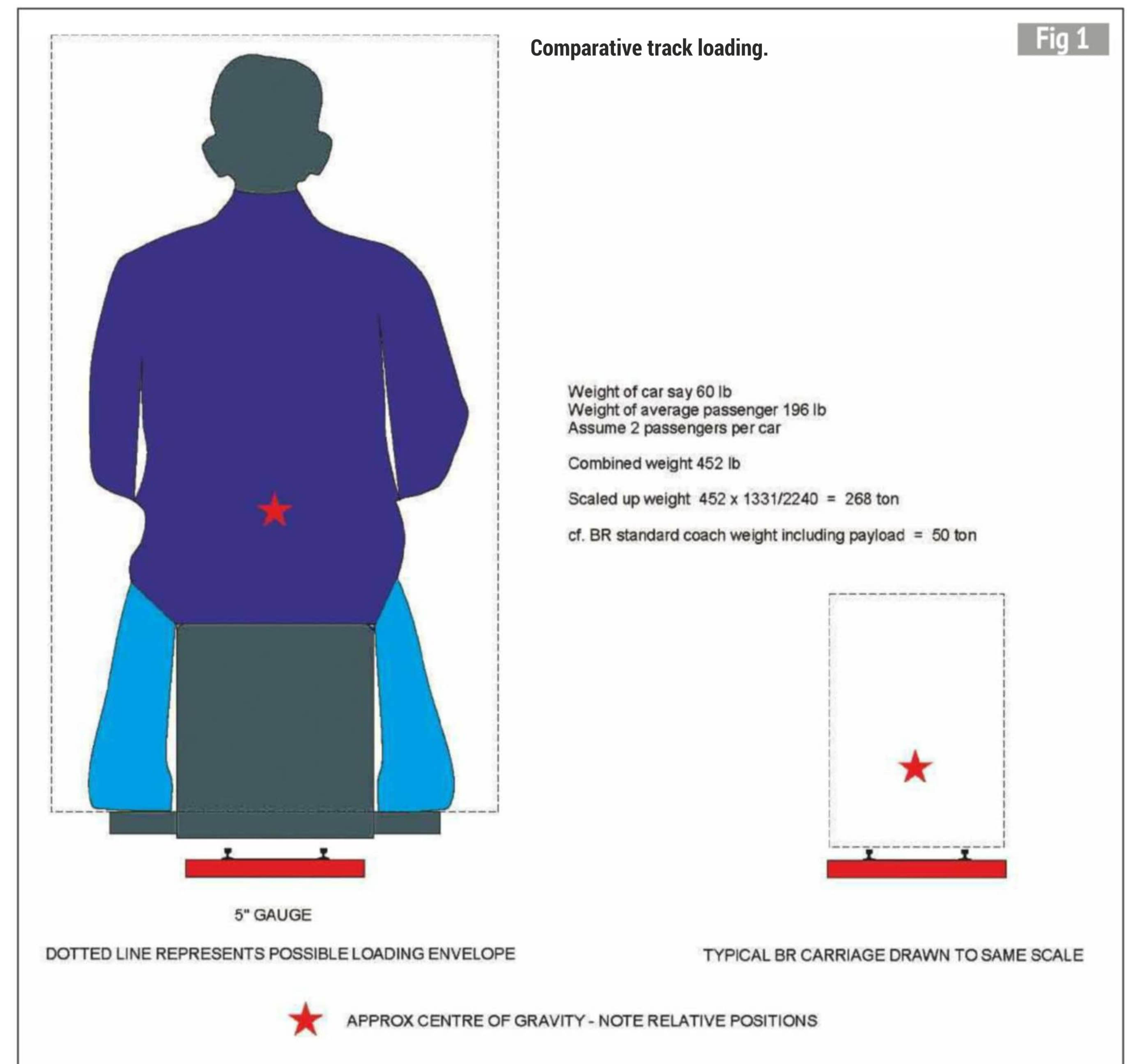
Take a look at any small miniature railway in action. What you actually see is a string of people of various sizes sitting upright being conducted slowly along a very narrow track. At the front is the hunched form of the driver looking down at his controls, seeming enormous relative to his engine both in height and width.

Standing in a siding nearby is another train, a rake of scale carriages coupled to a fine 5 inch gauge Pacific with no humans anywhere near. Unlike the other, it seems to fit the track more comfortably and looks capable of a fair turn of speed without spinning off into the bushes. Then along come six people; they climb on to these carriage roofs with a driver, who has to reach forward to set the train in motion.

It might appear to a disinterested observer used to travelling on full size trains that there was something very odd about this scene and potentially rather dangerous. Being an engineer, he does a quick mental calculation to find the scaled-up equivalent of the geometry before him. The result astounds him. Each passenger and driver would weigh around 100 tons and be sitting some 25ft above ground level. The widest part of the widest passenger would be about 24ft, about five times the gauge of the track. The combined centre of gravity of a carriage plus load might be at least 20ft above the track. He then asks himself whether he would be happy travelling on the Eurostar with such loads above and to the side of him and decided he would not.

If all this sounds a bit way off the mark let's look at the figures. **Fig 1** should help to clarify.

Sticking to 5 inch gauge for the moment, the linear scale factor relative to standard gauge of 56.5 inches is about 1:11. A typical large loading gauge on full size US railways is around 10ft wide and 15ft high – smaller in the UK. In very rough terms therefore the maximum loading gauge could be expressed as 2x



the track gauge for width and 3x for height. In 5 inch gauge terms this translates to only 10 inches width and 15 inches height. The scale factor for volume and therefore loading is 11^3 , or 1331. This means that an average person weighing say 12 stone (168lb) would scale up as follows: $168 \times 1331/2240 = \text{approx. } 100 \text{ tons}$

In 7½ inch gauge the scale factors are: linear 7.8, volumetric and loading 470. The scaled-up passengers and driver would weigh about 35 tons each.

"Ah but....", I hear you say, "We are basing our locomotive designs on *narrow gauge* proportions, not *standard gauge*. This means those scale factors are much smaller". Indeed it does but consider your 7½ inch railway as a model of any 2ft narrow gauge: linear factor is 3.3, loading factor is 36. So each passenger on the miniature track would weigh about 2.7 tons if scaled up and put on to say the Ffestiniog; still an immense load.

What all this amounts to is that the loading we put on

to our miniature tracks is, *in relative terms*, enormous. We also expect this track to cope with extremely wide loads with a very high centre of gravity. And then there are the fast drivers...!

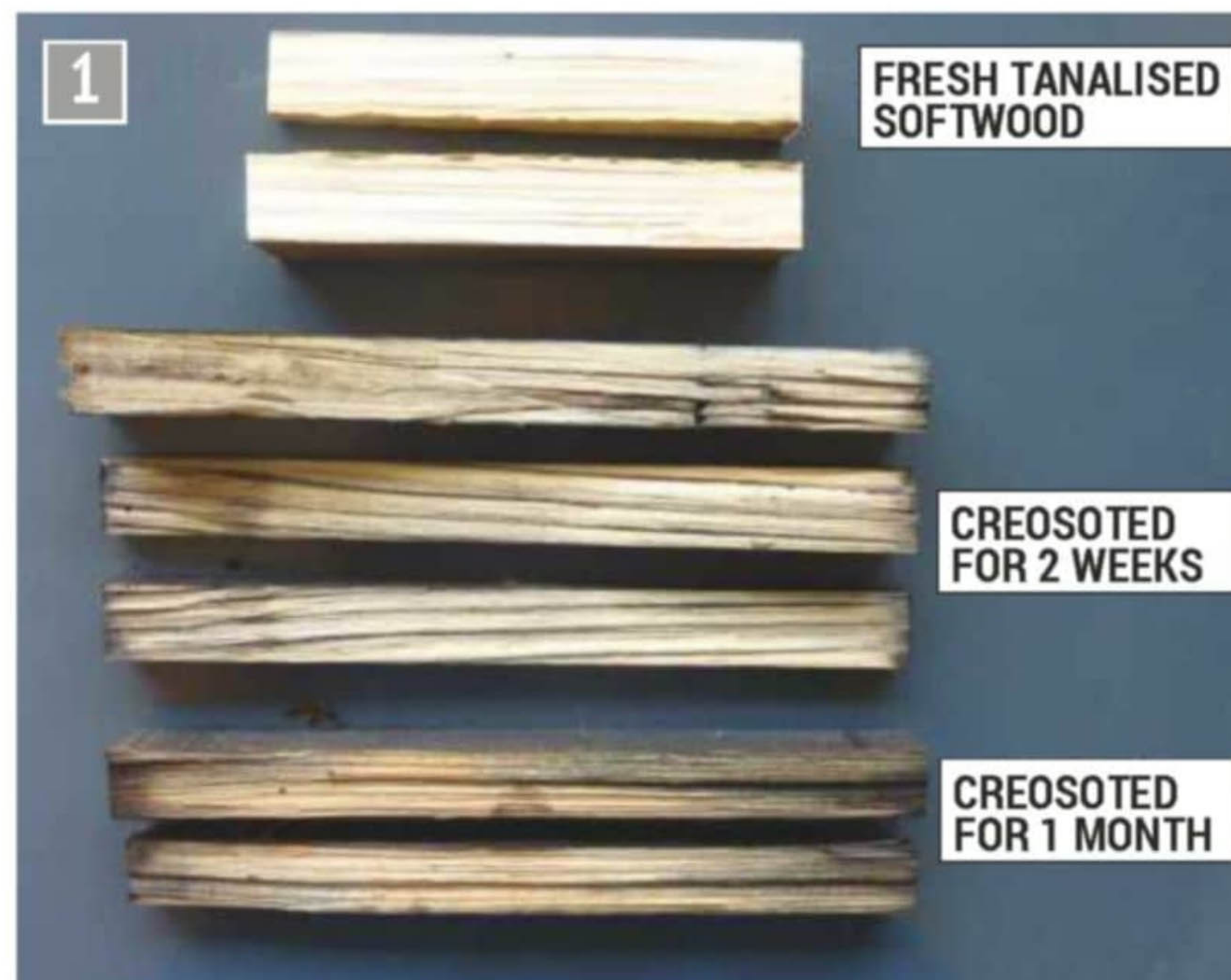
Is it therefore sensible to design and lay our small tracks as simple scaled-down versions of a full size one? We know that we *can* do it this way, as so many of us have, but the time and effort expended on maintenance can be considerable while those mysterious derailments show a tendency to continue.

The fact that derailments on a small railway rarely cause injury, damage to stock or loss of vital revenue means that the issue is generally tolerated. On any full-size railway just one derailment at speed is likely to be catastrophic.

Let us make a comparison between a modern standard gauge track and a typical ground level 5 inch gauge one.

Formation

This is the sub-base of crushed stone or rubble that lies directly beneath the ballast; its thickness will depend on



Tile batten and the effect of soaking in creosote. The lower ones have been split down the middle to see penetration.



Rotten sleepers.



More rotten sleepers.

the type of ground but it is there principally for drainage and to hinder the upward migration of fines such as clay into the ballast. The small railway builder might put in a fabric membrane between the two. Full size ballast will be sharp clean stone ranging from 1-3 inches laid to the top of the sleepers and given a heaped shoulder each side to discourage lateral movement of sleepers. The ballast will have been vibrated and compacted to lock itself as firmly as possible around the sleepers while allowing good drainage. The scaled-down equivalent in 5 inch gauge would be 2-6mm chippings, somewhere between the widely available 6mm clean stone and sharp sand. But we tend to use the much coarser 10mm or larger which, in this small scale, *does not compact*.

Shoulders, if we bother to add them, soon get destroyed by feet, birds and other animals that in my experience take a great interest in small railways. (Don't forget that a blackbird scales up to a large ostrich in weight while a cat would weigh in at ½ ton. I have seen foxes, badgers and deer happily keeping their feet dry by choosing my railway to walk on.) Installing boards or pavours either side of the track may keep it looking neat but certainly won't help ballast grip the sleepers – if the rail expands more than fishplates will allow, the whole track just lifts right out.

So while our 'miniature' ballast may have been carefully laid in the first instance, after a few years it will have been moved about and have absorbed much contaminating material such as weeds, worm casts, leaves and twigs, all of which turn to mud, the very stuff our expensive membrane underneath was supposed to keep out. Contrary to all I have read about geotextile fabric it actually does nothing to keep down weed growth, nor does it prevent the ballast accumulating earth, all of which is formed, or arrives

at, the top. Weed seeds germinate also at the *top*, finding a very accommodating growing medium just there. A membrane will do nothing to prevent this. You simply *cannot* rely on ballast alone to maintain alignment of 5 inch aluminium track. Multi gauge track using heavy steel rail provides much more weight but, as many clubs will testify, constant maintenance is still needed.

Sleepers

The traditional material is heavily creosoted softwood. Mainline railways nowadays mostly use concrete while our little ones often use either tanalised softwood, various hardwoods or, latterly, recycled plastic. We tend to use over-scaled dimensions and spacing to save money and assembly time. (I am excluding true scale track as might be used to display an exhibition model.) So, for example, a 5 inch gauge track might have 20 sleepers per 10 foot length, each one measuring 2 x 1 x 10 inches.

On cost grounds alone there really is nothing better than creosoted softwood (**photo 1**). I use standard tile batten cut into 10 inch lengths which are then steeped in real creosote (yes you can still get it) for about a month. This extra treatment is vital as the commercial, pressure treatment of ordinary building softwood is not intended for wood in contact with the ground. Agricultural timber used for fencing is treated to a higher specification but the sizes available are inappropriate for sleepers. While a fencing rail for example could be ripped down to suitable sections, these would then need further treatment on the cut surfaces anyway. The soak time is very important as the creosote must penetrate as deeply as possible, although it will never reach the centre without heat and pressure. All fixing holes should be drilled in advance.

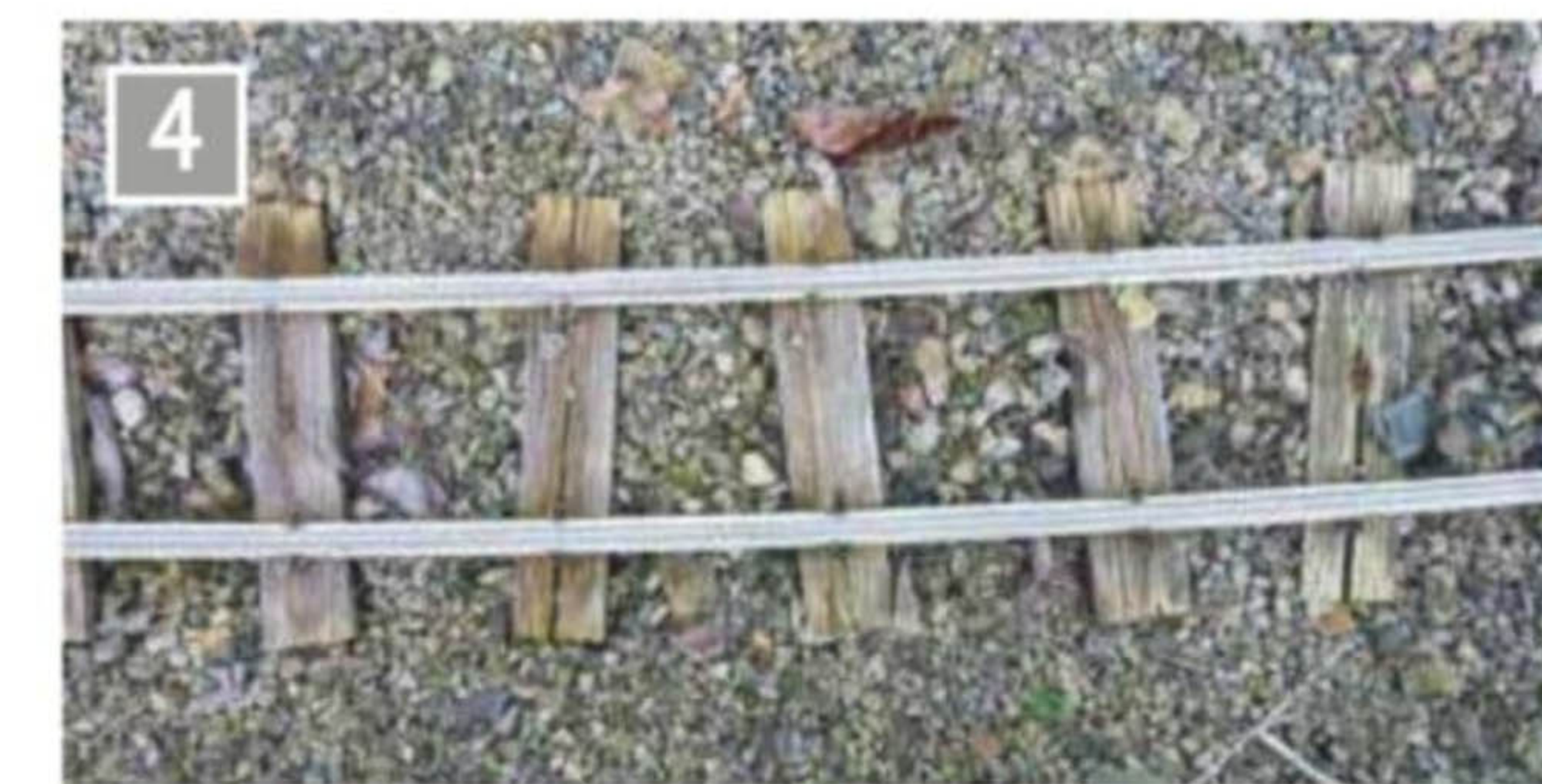
In service, softwood stands up reasonably well but several

types of deterioration set in after a few years according to their exact environment: in well-drained sunny areas they tend to shrink in thickness and split through the fixing holes. In shady, permanently damp areas they rot, usually at the ends first (**photos 2 and 3**). Life expectancy seems about 10-15 years and is very dependent on creosote immersion time. On bridges where drainage is perfect or inside a tunnel they will last much longer. The density of the wood gradually reduces to something like balsa while the thickness shrinks to about 75% of the original. Larger sleepers should last a bit longer, by having more bulk in relation to surface area, but only if they have been properly pressure treated with creosote.

Sadly, the quality of ordinary building softwood has greatly deteriorated in recent times due to the speed at which trees are now grown and the way it is cut. Its density is less and it is sold with the warning that it is unsuitable for use in contact with the ground. More durable softwoods like pine or Siberian larch are more easily available nowadays but probably more expensive.

The other big problem with softwood is that the screws work loose, chiefly due to variations in humidity, so in hot dry weather they rattle around on the rail then tighten a bit during winter. The result is that unequal expansion movements in each rail cause sleepers to wander as in **photo 4**. The gauge may not be affected much but ballast is grossly disturbed and the track becomes unsightly in the extreme. These sleepers have in effect lost all contact with the ground and just hang on the rail, providing no stability whatsoever.

I have used various types of hardwood of which Iroko is one of the best. However, they will not absorb creosote so one relies on their natural oils for resistance to decay. Unless you can find a source of second-hand timber or off-cuts, hardwood is likely to



Wandering sleepers.



Old hardwood sleepers.

be extremely expensive. If not well drained, they will rot very quickly and some hardwoods like Keruing go brittle with age, snapping at fixing screws for example. Hardwoods tend to rot from underneath so you may not notice until the whole sleeper either snaps or collapses into dust (**photos 5 and 6**). In general, all hardwoods should be avoided in my opinion, especially if you don't know the exact species.

Recycled plastic is now the favoured material for most club railways. It has the obvious advantage of lasting for a very long time but is surprisingly expensive and there are many reports of melting or even catching fire when hot ash is dumped on them. I suspect that in very hot weather the rail screws will soften the plastic around them, gradually loosening their grip. It is heavier than softwood but if cut to the same size, e.g. 2 x 1 x 10 inches, will still not offer real stability with aluminium rail if just laid in ballast.

Rail

The classic full-size steel rail in the UK was 60 feet (18m) long before CWR (continuous welded rail) came into universal use. Expansion gaps were provided at these intervals. Scaling down to 5 inch gauge, this translates to a gap every 5–6 feet (1.5–1.8m). In practice though we use 10 feet or longer (3–5m) rails and often choose aluminium. Regardless of the cross-sectional shape or area, a piece of steel 5.5 feet long (the scaled down length, 60/11) would have an expansion range up to 0.02 inch for a temperature

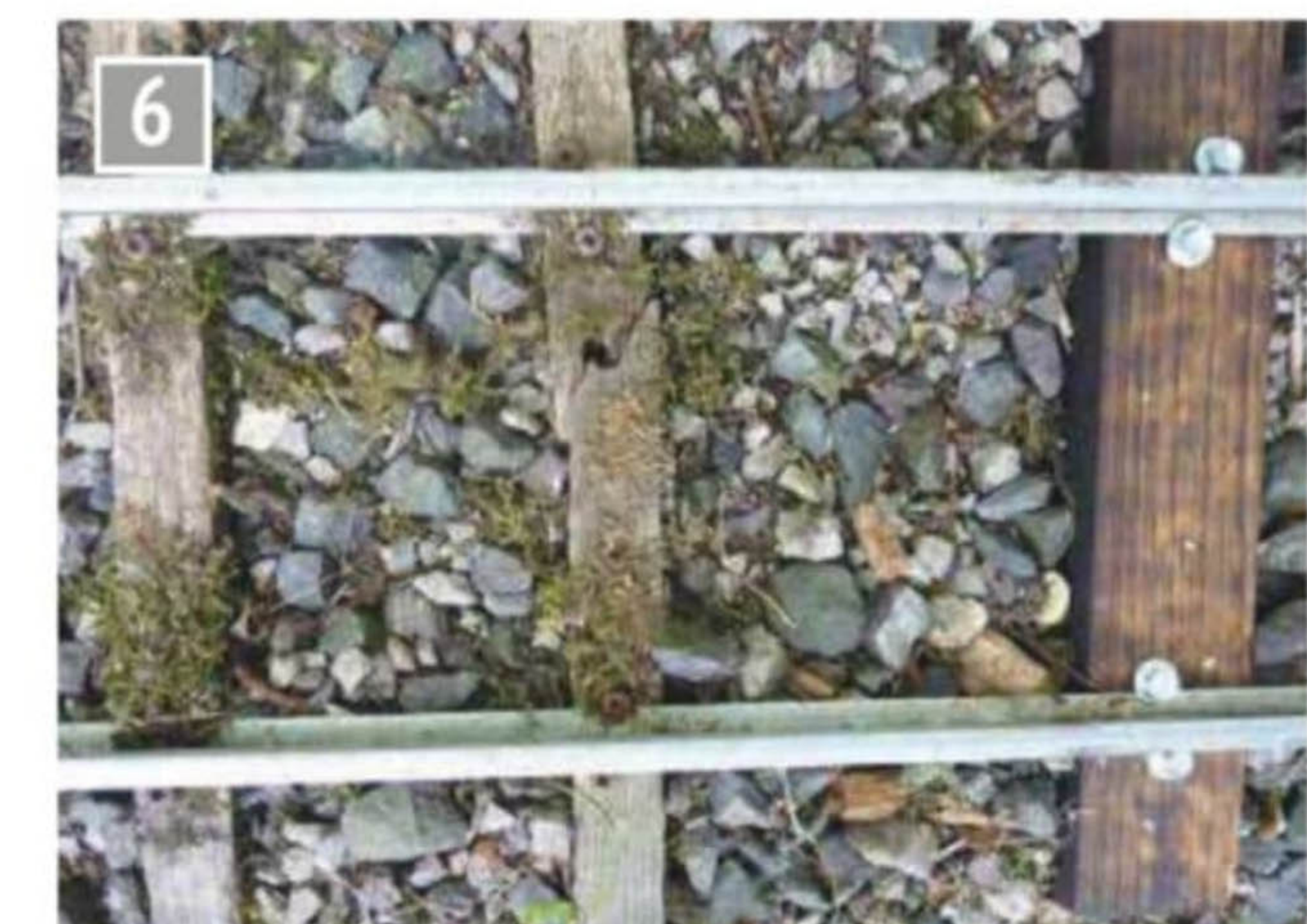
variation between -10 degrees C and 50 degrees C. By comparison, an aluminium rail 10 feet long would expand ¼ inch, nearly 10 times as much. Such a temperature range is quite realistic as I have measured it. Remember that metals exposed to sun absorb heat, reaching temperatures way above ambient. This means that in theory anyway, fishplates need to accommodate this movement. In practice they often don't, either because the holes aren't big enough (they should be slots) or bits of stone have got into the space, or the plate has jammed solid with corrosion.

Full size CWR is laid under tension, either by heating the rail or pulling it hydraulically prior to welding. On a hot day this tension will dissipate leaving the rail either unstressed or under very slight compression but, except in unusually hot weather, not enough to cause buckling. More common in very cold climates is rail cracking due to shrinkage. Track circuiting allows such cracks to be spotted remotely. Our miniature rail however is more likely to be laid during the cooler months

with no pre-tensioning. When it gets hot there is a lot of expansion and if the joints are not free and open the extra length is absorbed by all the curves opening out and the track moving sideways. Long straight sections may well buckle or lift clear of the ballast. When things cool down the sleepers do not settle back into their old positions but sit astride bits of ballast that have trickled down into the grooves. The track is now loose, unstable and poorly aligned yet we still expect it to cope with the outrageous loads outlined above.

A different approach is needed. Sadly, this is likely to cost more both in time and effort but I can assure readers that the result will be more long-lasting and far safer. The clue lies in those full-size concrete sleepers, their principal function being to give the track *weight*. It has been obvious to me for many years that small passenger-carrying 5 inch tracks, especially those using aluminium rail, need to be much heavier. I will show how this can be achieved while drastically cutting down on maintenance.

● To be continued.



Broken hardwood at centre. Recent replacement at right. Note larger width and modern coach screw fixings.

An Oscillating Beam Engine

Our 'man in a shed', James Wells, emerges from a sandstorm and goes all non-parallel.



The beam engine seems to be an almost perennial favourite with regular examples at most shows and in the pages of *Model Engineer*. Although the *Model Engineer* design beam engine is an excellent, well proven design the complexity would be almost frightening to the beginner. Having completed a series of experiments with marine style oscillators I was looking for another project.

I don't have any great interest in beam engines but when a piece of two inch square bar suitable for a beam support and a piece of joist for a base came my way from a nearby building site I decided to build just one example of a freelance beam engine and try and simplify construction.

Reading through the past issues of *Model Engineer*, I soon became aware of the complexities of Watt's parallel motion. Even after several readings I'm still not sure if I completely understand how the whole thing works anyway.

Deciding then not to immediately pursue a possible simplified version of a beam engine I went on to other work. It was during my employment in the Middle East that the original idea was almost accidentally resurrected and set me head scratching.

A sudden sand storm erupted over the whole area and it was like watching a yellow wall coming down the road. There were terrific lightning flashes which demonstrated that dry dust is an excellent conductor of electricity. When the power inevitably went off it was necessary to find something to occupy the time and I returned to possibly simplifying the beam engine design.

Later news reports stated that the dust storm could have been seen from Mars. After the dust storm was over the hoses came out to swill everything



Photograph by The Photographic Lounge, Billericay.

down and within days the whole storm was forgotten.

After considerable thought, and a couple of mock-ups, it seemed that the well-known principle of an oscillating cylinder could be adapted, avoiding the much more complex parallel motion system altogether. As always, having only minimal access to machine tools, most of this project had to be designed to make maximum use of hand tools - more DIY than model engineering. A large downtown tool store stocked a line in good quality cylindrical cast iron plumb bobs and I was a regular customer for these for pistons, liners and bearings etc.

Although I had to adjust the position of the crosshead joint from the original estimated position, to ensure a complete oscillating movement, the whole idea seemed to work better than I'd originally expected and could probably be made to work as a double acting system.

The project was at the final stages with the engine turning over reasonably well and connected to a small electric motor as a simulated

generator when a Health and Safety proverbial bombshell dropped. I had hoped to display a working model at a local show when I was advised that insurance no longer covered steam boilers and probably compressed air either under the 'excludes all pressure vessels' category. The only possibility was to simply run the engine on the electric motor which at least showed the whole thing turning over.

One of the more intriguing experiences with the disposal of such engines has been the interest shown by the most surprising people. Needing some large pieces of wood for my shed refit, I suggested to a local builder that I would trade him the engine for some of the larger pieces of wood left over from a nearby large roof replacement. Immediately agreeing, he not only gave me the wood, which made some excellent shed storage shelves, but the same builder also gave me a large pile of other scrap wood for my workshop wood burning stove. All I need now is a cold or wet winter!

ME

Building the Model Engineer Beam Engine

PART 10

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



Continued from p.309
M.E. 4619, 16 August 2019

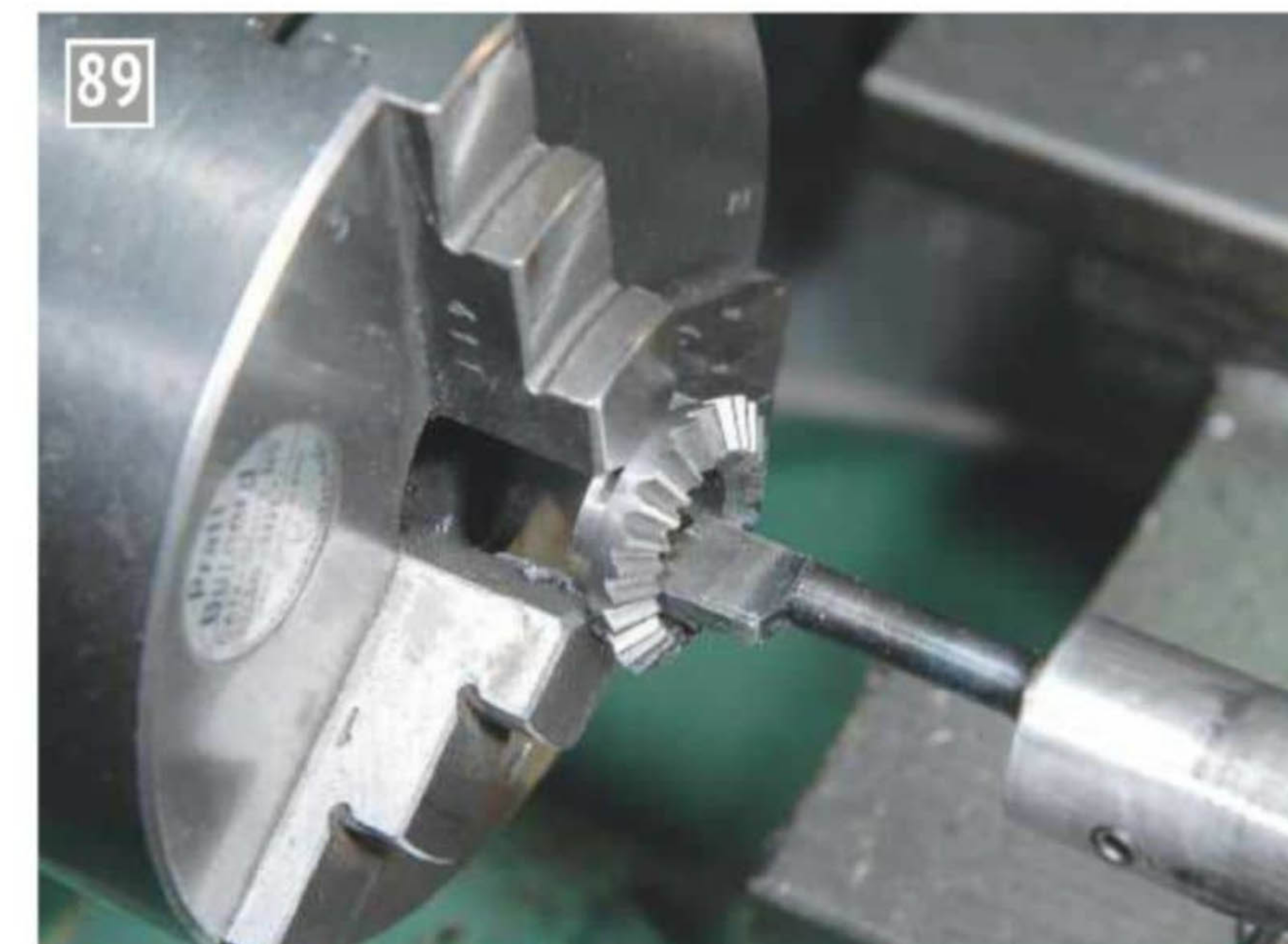
Governor

I decided to make and fit the governor the next as, when this is fitted, everything on the driven end of the engine would be complete. Everything would be able to be mounted on the crankshaft and I could move to the 'steam end' of the beam. Observant readers will have noted that I painted many parts of my engine as I went along. Perhaps not the most time efficient method, but if you are hand painting as opposed to spraying, the time difference is slight and if you are a slow builder, as I am, then it helps to keep the satisfaction levels high. The base plate will be spray painted when the engine is completed and all holes have been drilled.

The (purchased) bevelled driving gear came with a ½ inch bore, which was convenient, but it was first necessary to put a keyway in this. There is not much room on the boss to get hold of this but it can just be held by the boss in the three jaw chuck (photo 89) and the keyway planed as outlined in the description of the flywheel construction.



Governor stand with cast-in bridging piece.



Bevel gear.

The governor itself is full of complicated little parts to machine and forms a challenging project in itself. The governor stand comes as an iron casting and the two feet are cast with a bridging piece between them to strengthen the casting while it is held for machining (photo 90). The main governor column is shown on the drawing as being from cast iron or mild steel and I spent a while considering which would be best and easiest to make. Like all governors, the secret is in constructing them with no play but with minimum friction in use. Either play or friction would cause the engine to 'hunt' with the governor being late in controlling the steam valve when the engine speed changes.

The central spindle of the governor is ⅛ inch diameter and I proposed to make this from silver steel which would be easy to keep absolutely straight. The centre spindle runs in a small brass or bronze bearing at the bottom end,

just above the driving bevelled gear, and is supported by the top of the main column, forming the top bearing. If the main column were made from steel, then it would not be a good idea to have a steel shaft running in a steel bearing, so it would need to have a bronze bush set into the top of the column. The top of the column is ¼ inch diameter and the shaft running through it is ⅛ inch so there is not much room in which to fit a bronze bearing without risking breaking out into the surface of the column. I decided to make the main column from cast iron, which would have to be turned down from a length of 1 inch cast bar. This would mean that I could use the cast iron as the top bearing, cast iron being a fairly durable bearing material. Cast iron is always satisfying to machine into curved shapes and is an easy material on which to obtain a good finish. I did not intend to paint the column, providing I did not encounter any blow holes in the cast bar.

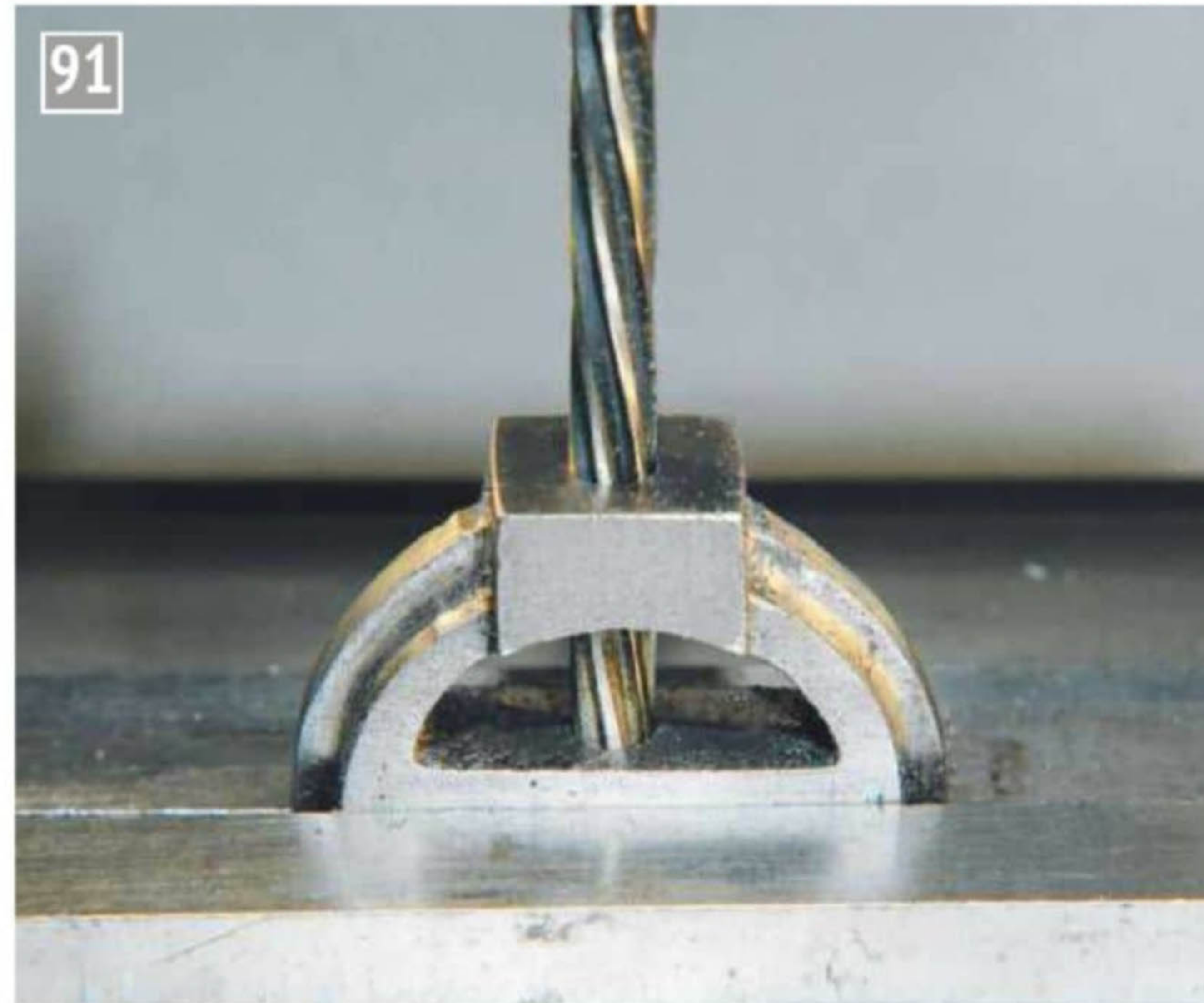
Governor stand

Obviously, the bevelled gear at the bottom of the governor shaft has to mesh accurately with the bevelled gear on the main crankshaft; with the bridging piece still in place between the feet of the stand, it is impossible to place the governor stand in place without removing the crankshaft. I decided to carry out most of the machining of the stand, remove the crankshaft, fit the bevelled gear and then see if I had a problem with meshing the two bevelled gears together. I know of one builder of this model who had to raise the governor onto a metal plate in order to get enough room for the gears to mesh correctly. As I prepared to start work on this I was unsure how much room my casting would give me in this respect.

The main column attaches to the stand by a $\frac{3}{8}$ inch x 26 thread. This was a size for which I had neither taps nor die and I suspect that $\frac{3}{8}$ inch BSF or $\frac{3}{8}$ inch x 32 ME would suffice. However, I sent away for the required taps and die in 26 TPI, which is a BSB (Brass) thread. The casting should be brought to a suitable finish by filing, the actual sizes being non-critical. However the top and the feet should be parallel to each other in both planes so these should be milled. I

mounted mine upside down in the milling vice, with parallel packing at each side, and took a light skim across the feet and the bridging piece. The stand was then inverted in the vice, ensuring that the feet stood firmly on the vice bed, and the top was similarly milled flat.

The main governor column and the bottom bearing *must* be absolutely true and in line with each other so mark out the centre position on the top face, mount truly vertical in the machine vice again and carefully centre drill the top. The aim here is to ream a $\frac{7}{32}$ inch hole in the cross member to take a bronze lower bearing bush that is in direct line with the mounting for the main column. Drill a hole $\frac{1}{16}$ inch through both the top and through the cross member. Take it very slowly when starting the lower hole, as you cannot use a centre drill - unless you have a long centre drill with a body less than $\frac{7}{32}$ inch diameter. I used a fast speed, gentle touch and let the top hole guide the drill for the hole in the cross member - which worked well. Follow up with a $\frac{7}{32}$ inch machine reamer, at slow speed, as in **photo 91**. I am never too sure whether or not one should lubricate a reamer in cast iron but I normally ream dry, relying on the carbon in the cast iron



Reaming the hole in the governor stand for a brass bush.

to lubricate the reamer. At the same setting, with the table locked, gradually open up the hole in the top plate using successively larger drills, finally using an 8.5mm drill and tap the thread, as shown in **photo 92**. Obviously, if you are using a different thread, then the tapping drill required will probably be different. Whilst set up in the vice, I ran a $\frac{3}{8}$ inch reamer just a short way down the hole to remove a few threads so that the column would be able to seat correctly when the threads on the column did not reach the shoulder. Follow up again with the tap if you do this. The stand at this stage is illustrated in photo 90 and is ready to have the bridging piece removed and the bottom bearing fitted. I waited until I could mesh the gears as a trial before finalising the bottom bearing.

In order to work out the exact position of the governor and the height of the driven bevelled gear on the governor shaft, the driving bevelled gear must first be fitted to the main crankshaft. This gear must have a keyway planed into the bore. There is just enough of a collar to enable the bevelled driving gear to be held in the three jaw chuck as illustrated in photo 89. The keyway was planed using a home-made slotting tool and, as the gear is made of steel, plenty of neat cutting oil was used. I also

decided, whilst I was working with the slotting tool, to fit a key and keyway into the crank arm. Naturally both the lathe mandrel and the lathe saddle were locked during the slotting process. As the crank arm is made from a casting, this was slotted dry.

After making the tiny key from $\frac{1}{8}$ inch square key steel and temporarily fitting the bevelled gear to the crankshaft, I realised that the positions of the eccentric, the bevelled gear and the flywheel on the crankshaft are extremely ambiguous on the plans. Whilst the good Mr. Gentry, who created the drawings, bombards us with a myriad of measurements for the individual parts, he gives us hardly any measurements regarding the relative placements of the various items as they fit together. The positions of the flywheel and the spur gear on the crankshaft are approximately determined by the cut-outs in the baseboard, but the location of the eccentric and the bevelled gear are open to question.

On the drawing of the spur gear and the bevelled gear, the items are clearly shown with a hub boss. However, on the general arrangement drawings, they are shown with no hub boss and, conveniently for Mr. Gentry, are shown without any key heads or keyway details. The small boss on the

eccentric appears to be next to the bearing on the end view, but appears to be next to the governor on the plan view. I am of the opinion that the boss on the eccentric should be next to the main bearing as otherwise the eccentric strap is in danger of hitting the base plate when at the bottom of its travel.

The driven bevelled gear on the governor shaft also has a substantial boss, as supplied, and looking at the relative heights of the governor stand and the crankshaft gear, it was apparent that I would, possibly, have to either raise the governor stand or remove the majority of the bevelled gear boss if the two bevelled gears were to mesh correctly. In view of the fact that the horizontal position of the crankshaft bevelled gear, and the vertical position of the governor bevelled gear were fairly critical, I decided to fit the $\frac{7}{32}$ inch bush to the cross member of the governor stand and to make a temporary brass bush to fit in place of the governor collar, so that the exact preferred locations of the various parts could be assessed.

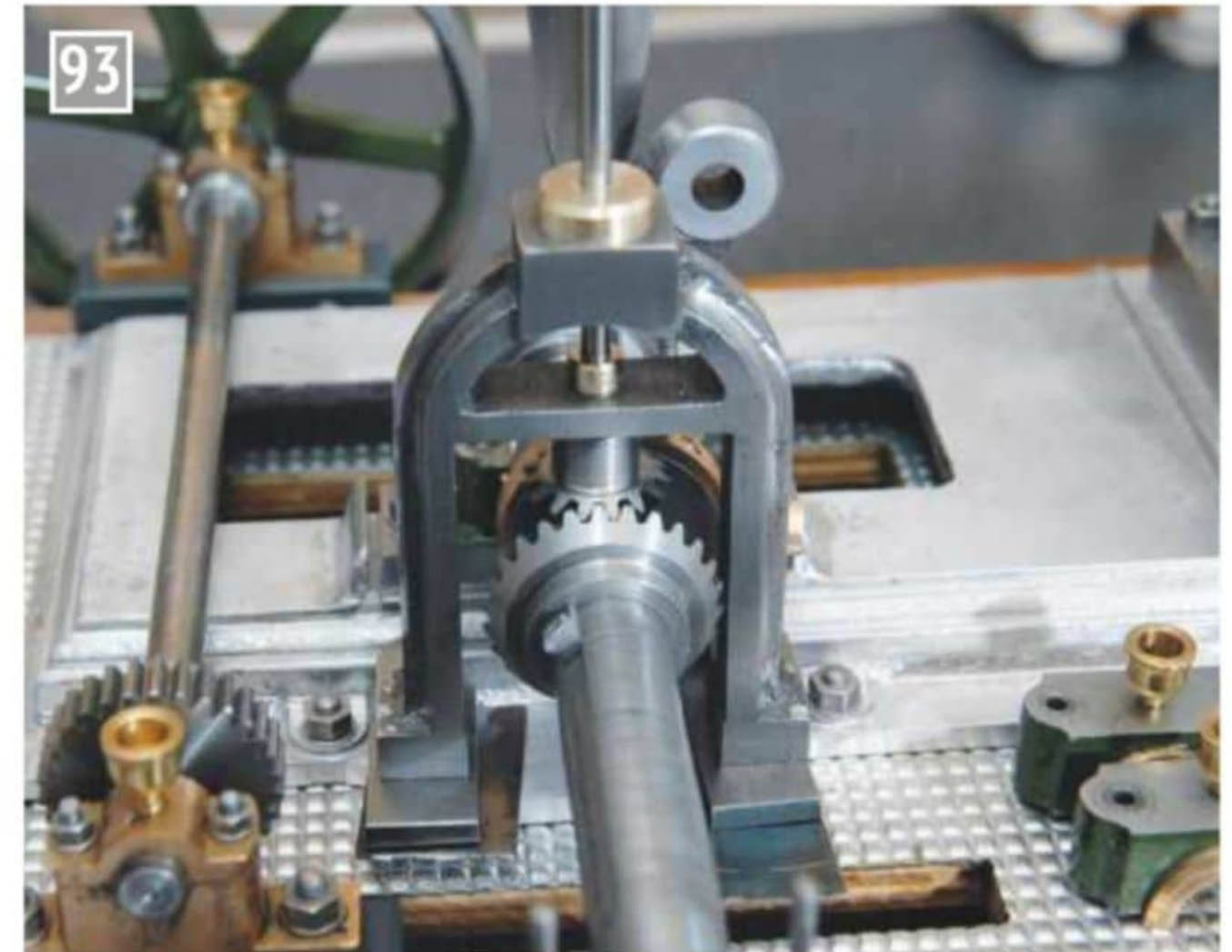
Photograph 93 shows the set-up used to calculate the positions of the governor and the bevelled gear. The temporary threaded brass bush has been screwed into the governor base in place of the governor column. A length of $\frac{1}{8}$ inch silver steel has been used as a temporary spindle and the governor placed loosely *in situ*. It was necessary to pack the governor stand on shims to the thickness of 0.160 inch in order for the gears to mesh correctly. It followed that I had to make either a shaped base plate of similar thickness for the governor stand to sit on or, if possible, remove the same amount from the bush on the governor bevelled gear. Either solution would be acceptable. I know of at least one other builder who encountered this problem and it would be great if, for the future, Reeves increased the length of the 'legs' on the stand casting. The bush on my bevelled gear was 0.233 inch long so reducing it

by 0.160 inch would only leave me with a bush of 0.073 inch through which to pin it to the governor shaft. I decided to risk this. And if it proved impossible to pin the shaft, I could always cheat and Araldite the gear to the shaft. This, to me would not really be acceptable as it would not be an authentic, prototype method. Probably no-one would know ... but I would always know that I had cheated.

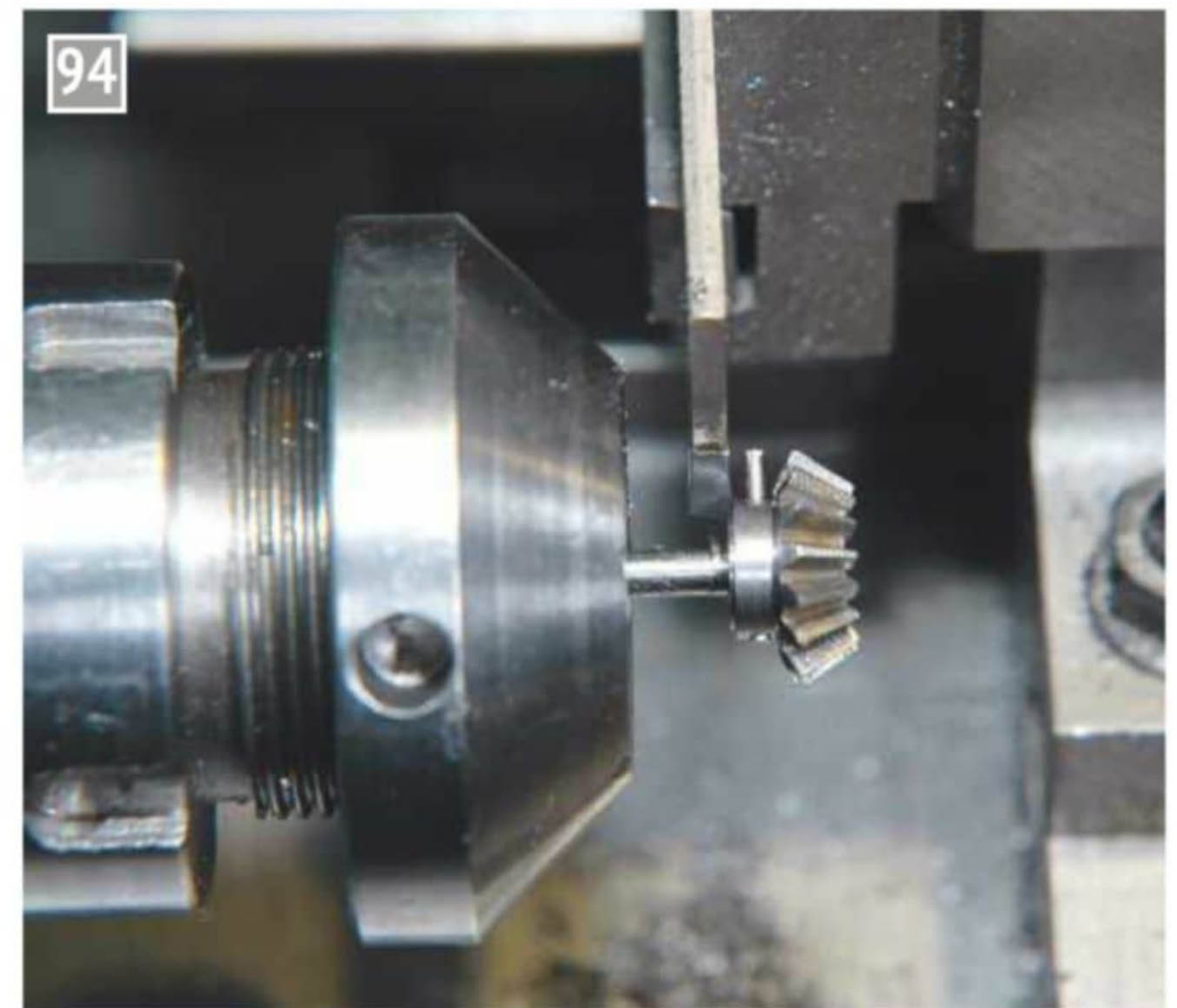
Whilst the governor stand was set up, I also measured the distance from the crankshaft bevelled gear to the end of the crankshaft, which in my case was 2.492 inches. This was going to make it difficult for me to find room for a key head between the bevelled gear and the spur gear.

Reducing the length of the boss on the governor spindle gear could be done by mounting the bevelled gear on to a tapered mandrel to turn away the excess, however I proceeded as follows:-

The governor spindle is shown on the drawing to be $\frac{55}{64}$ inches long with a 7BA female thread on the bottom end. My bevelled gear was supplied to fit directly onto a $\frac{1}{8}$ inch shaft and, to be frank, I didn't understand the need for tapping the bottom of the spindle 7BA. I proposed to pin the gear to the spindle and I cut a 6 inch length of $\frac{1}{8}$ inch silver steel for the spindle. The governor bevelled gear was mounted onto the end of the silver steel with the spindle horizontal in the machine vice. Using an edge finder to find the *exact* centre of the spindle, the bevelled gear was centre drilled carefully as near to the edge of the teeth as I dared to go. A No. 55 drill was taken through the gear and spindle, as one unit, and this was followed up with a tiny tapered reamer using lots of oil and a light touch on the small tap wrench. A $\frac{1}{16}$ x $\frac{1}{2}$ inch taper pin was driven home. I left the excess on the taper pin at this stage in case I wished to remove it, and later cut it off with a Dremel cut-off disc. The silver steel spindle, complete with gear was then mounted



Trial assembly of the governor stand.



Trimming the gear bush.

on the lathe in a collet chuck and the excess material in the gear bush was carefully turned away using a rear parting tool as shown in **photo 94**. Obviously, it is important to use very light cuts here.

I only managed to reduce the bush length by 0.0157 inch but found that with the gear teeth correctly meshed, it was possible to bolt down the governor stand onto the base plate without causing anything to bind.

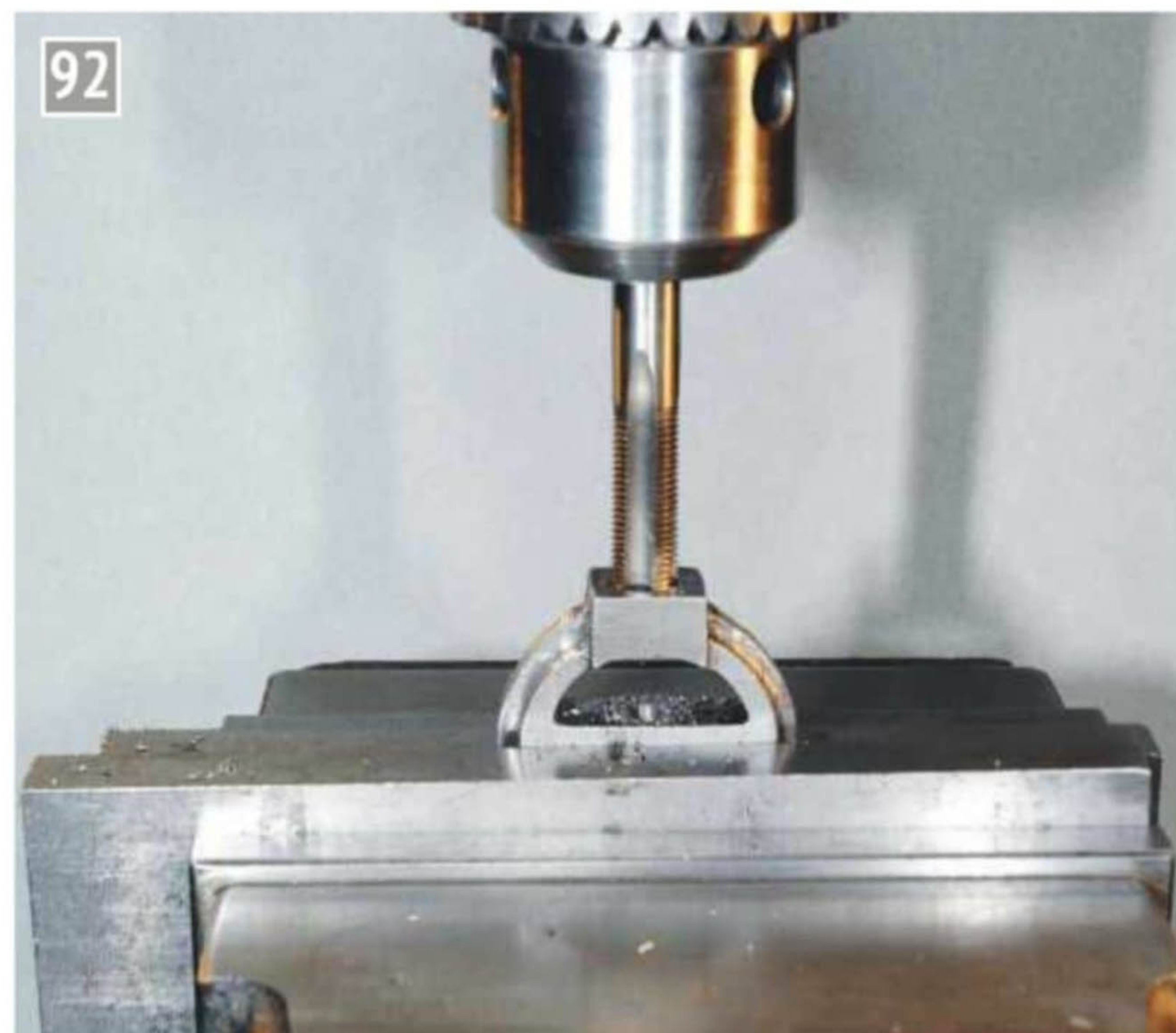
The bridging piece was cut away from the governor stand and mounting holes drilled in the feet. The stand was placed in position straddling the crankshaft and the meshing of the bevelled gears checked.

Once happy with that, the position of the mounting bolts was marked on the base plate ready for drilling. I made a small transfer punch out of silver steel in order to mark the hole positions. The base plate was drilled 2.1mm and tapped 7BA. Two 7BA bolts were then screwed up through both the baseboard and base plate to form the mounting studs for the governor.

●To be continued.

NEXT TIME

There's more work yet to do on the governor!



Tapping the hole for the bush.

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

PART 13

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

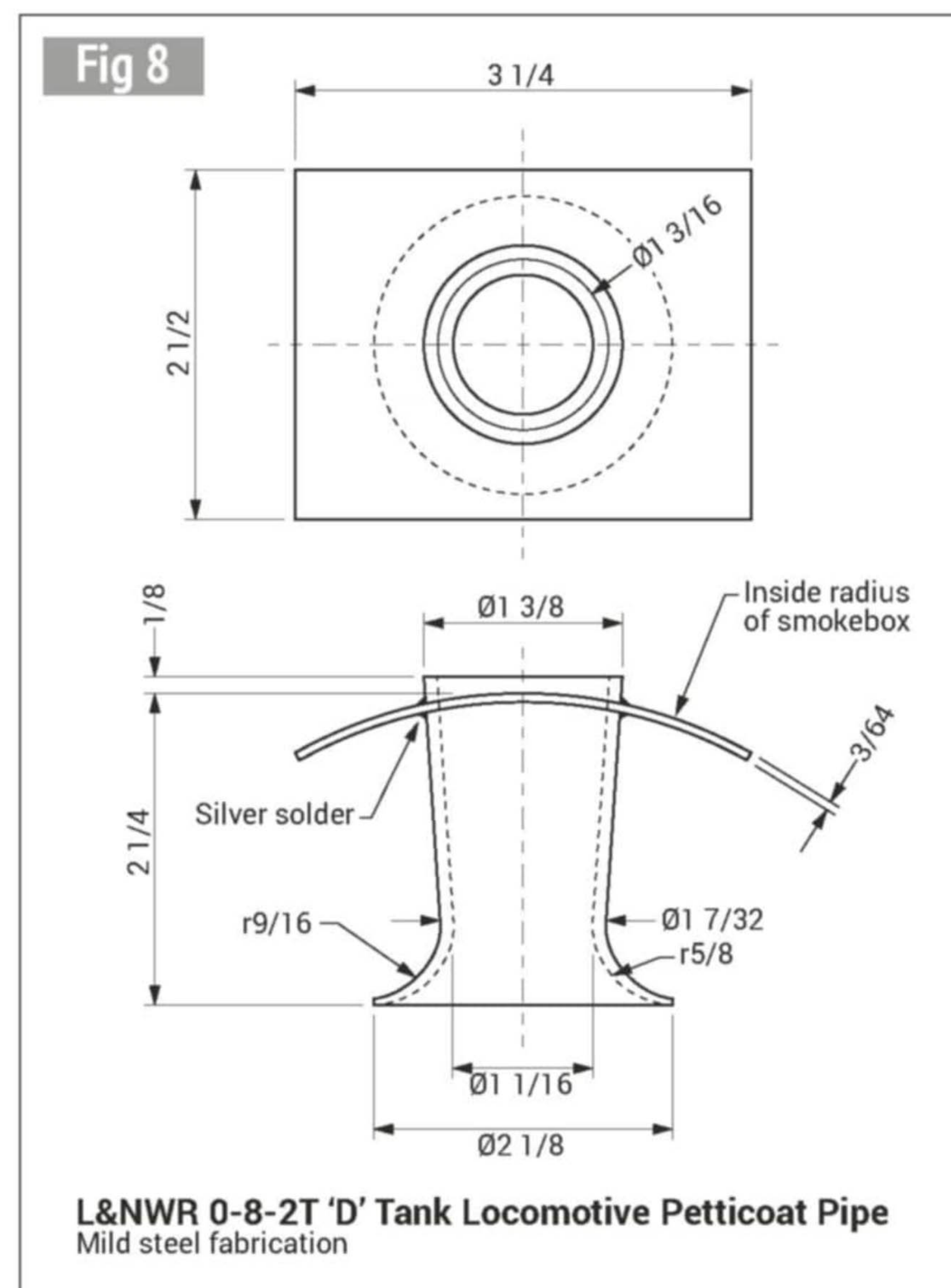


Petticoat pipe and chimney

To begin with let me just describe the assembly of these two parts. Both of them need to be attached to a curved section of steel plate that will match the inside and outside radii of the smokebox wrapper respectively and be bolted together as a sandwich with ten small bolts placed on either side of the hole already made. I had originally considered using cast iron for these parts but now both sections will be from steel bar and silver soldered to the curved steel plates. Bronze could be used if preferred but steel takes the paint more reliably, especially on a hot surface. It is also necessary for the appearance of the chimney to make the base of the component as thin as practicable to simulate the sheet metalwork used on the prototype.

I have included the first of two sketches to indicate the dimensions of the petticoat pipe viewed in side section (fig 8). As I have indicated previously, the proportions are being taken from my drawing of the prototype and although I have not included the precise angle of the pipe bore, the sizes given should assist with the machining. Within the limits of setting of the top slide angle, 2 degrees is a good start for this component and dimensional checks are required to confirm it. The chimney sketch will follow next time.

Before doing any turning, I cut out the two pieces of steel plate that are needed for the assembly of the parts. The inner one is in 1mm material and measures 2½ by 2¼ inches and will be bored to be attached to the top of



L&NWR 0-8-2T 'D' Tank Locomotive Petticoat Pipe
Mild steel fabrication

the petticoat pipe. The outer plate is only ½ inch thick and is 2½ by 2¼ inches. This will be silver soldered to the underside of the chimney and it represents the lower section of the sheet metal casing that was used on these locomotives. It is slightly rectangular because the longer dimension will allow for the curvature, reducing the actual overall length to 2¾ inches as it should be in plan when finally assembled.

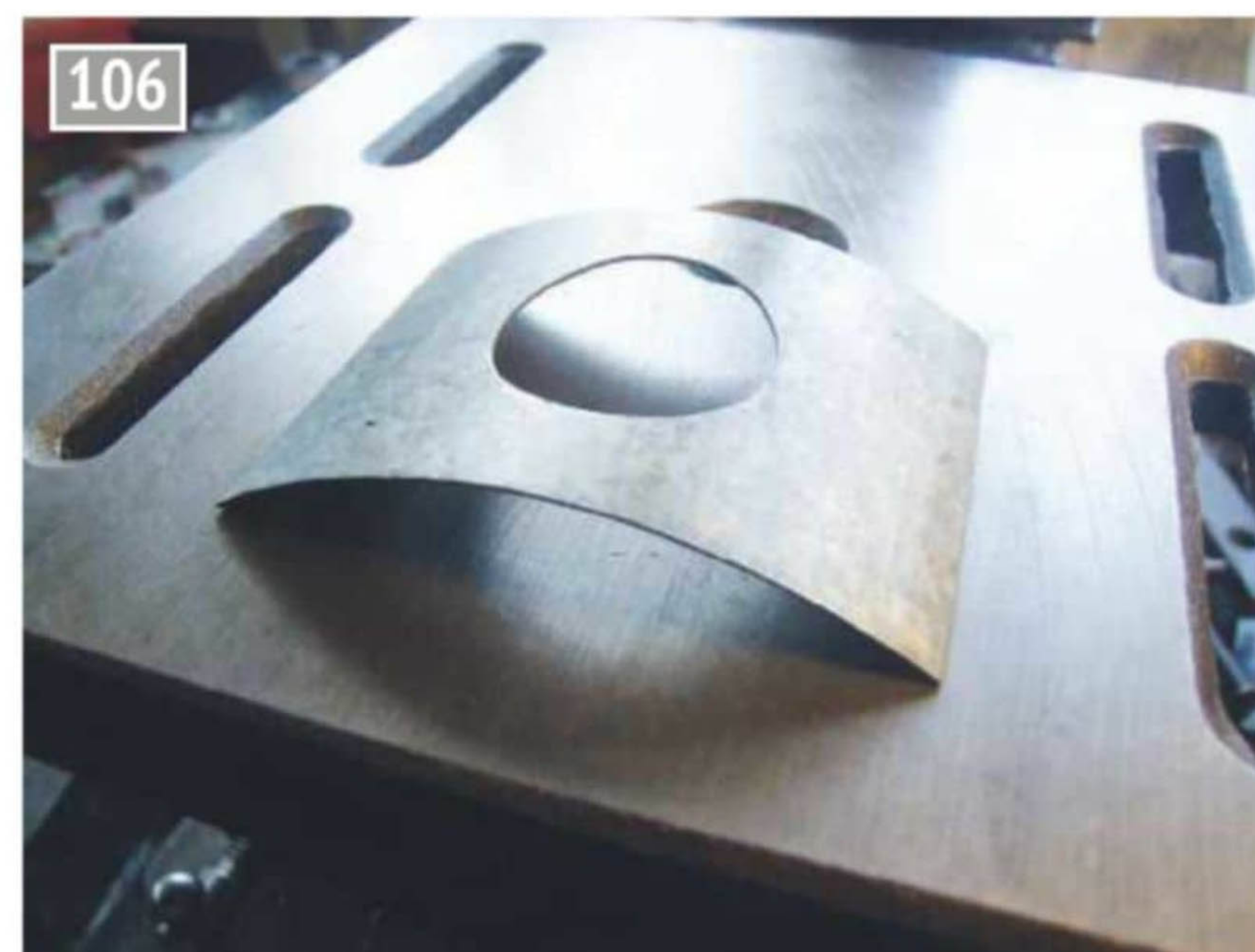
Before forming the curves the thicker inner plate was set up and bored to create a 1¾ inch diameter hole to match that on the smokebox. Such a size is not easily

'drilled' so clamping it to a wooden back plate is wise, so that drilling and boring will bring the hole up to the size needed. **Photographs 104 and 105** show the simple set up I used. This is much safer than trying to drill such a hole on the drilling machine. Carefully remove the burrs round the hole afterwards as the boring head will leave very fine burrs around the edge which can bite you!

It will be appreciated that each plate has to be given a slightly different radius and mine were curved in a small set of rolls held in the bench vice. Unfortunately, my rolls are ungeared and with



The set up used to produce the large hole for the petticoat pipe plate showing the drilling and boring operations.



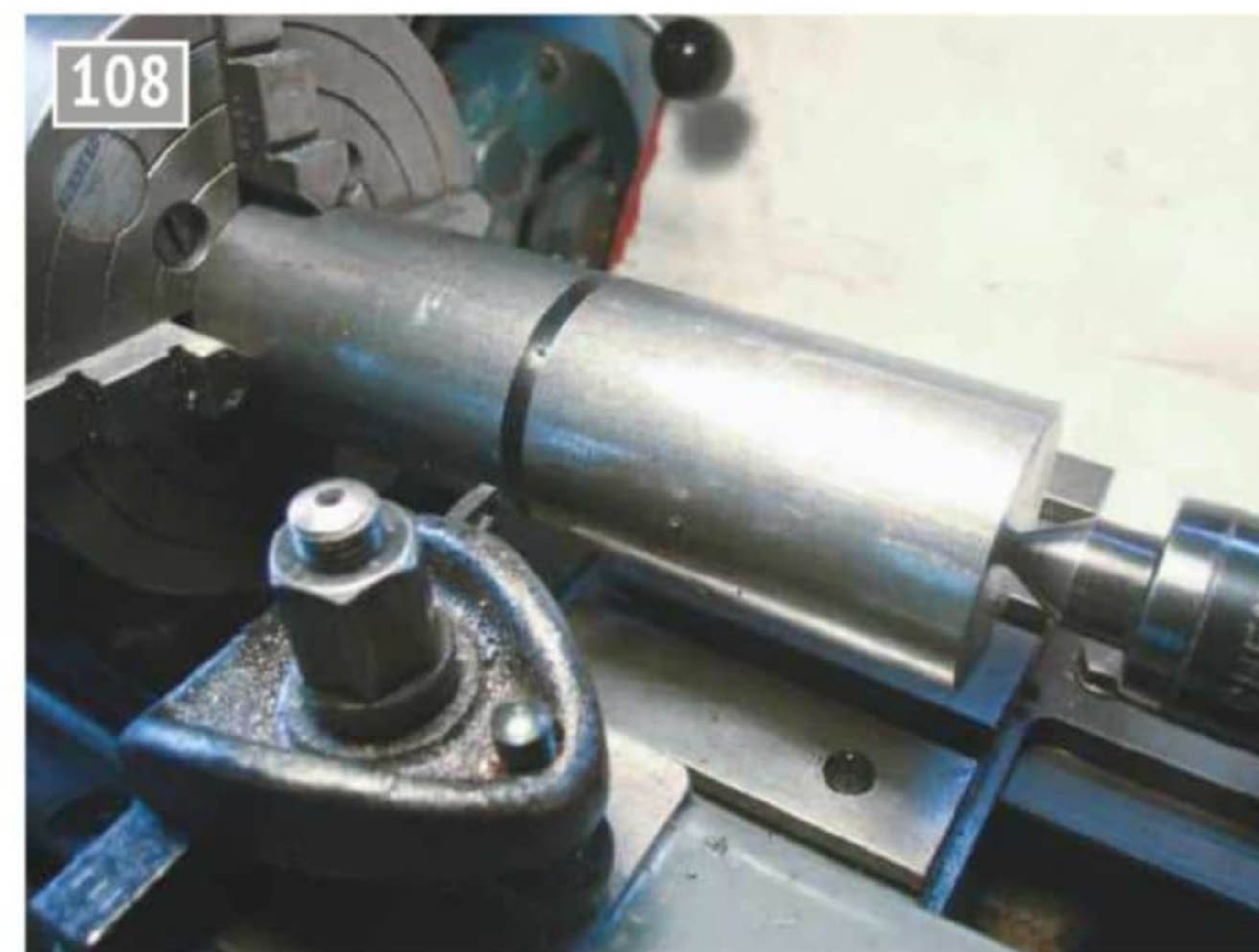
The two plates formed into their curved profiles for the inside and outside of the smokebox wrapper.

such small pieces of steel the task was not as easy as I had hoped, so I ended up completing the curvatures by hand and then using the outside of a 6 inch chuck body and a hide mallet to obtain a smooth radius; **photos 106 and 107** show the results. The final check has to be that each plate sits closely to the outside and inside surfaces of the smokebox wrapper.

I was able to obtain a piece of 2½ inch diameter steel bar 7 inches long and to start with I set it up accurately in my four-jaw chuck with a tailstock centre and, to cut it in half later, I made a parting tool (photo 108). This was followed by drilling a 7/8 inch diameter hole into the outer section just 2½ inches deep. After removing so much of the core of the

material I set it up and fly-cut the radius on one end to be the base of the chimney and this matched the thinner section of steel plate already formed to go onto the smokebox. The thick-walled tube made this task much more straightforward; **photo 109** shows the operation. My small milling machine managed it eventually by taking light cuts of 0.005–0.010 inch with plenty of cutting oil and fortunately the pieces of hot swarf were directed away from me. At this point I took a hacksaw and cut the bar stock into two pieces. The chimney section was put to one side as I wanted to produce the petticoat pipe section first.

So, the other half of my stock bar was set up to run truly concentrically and a tailstock rotating centre was



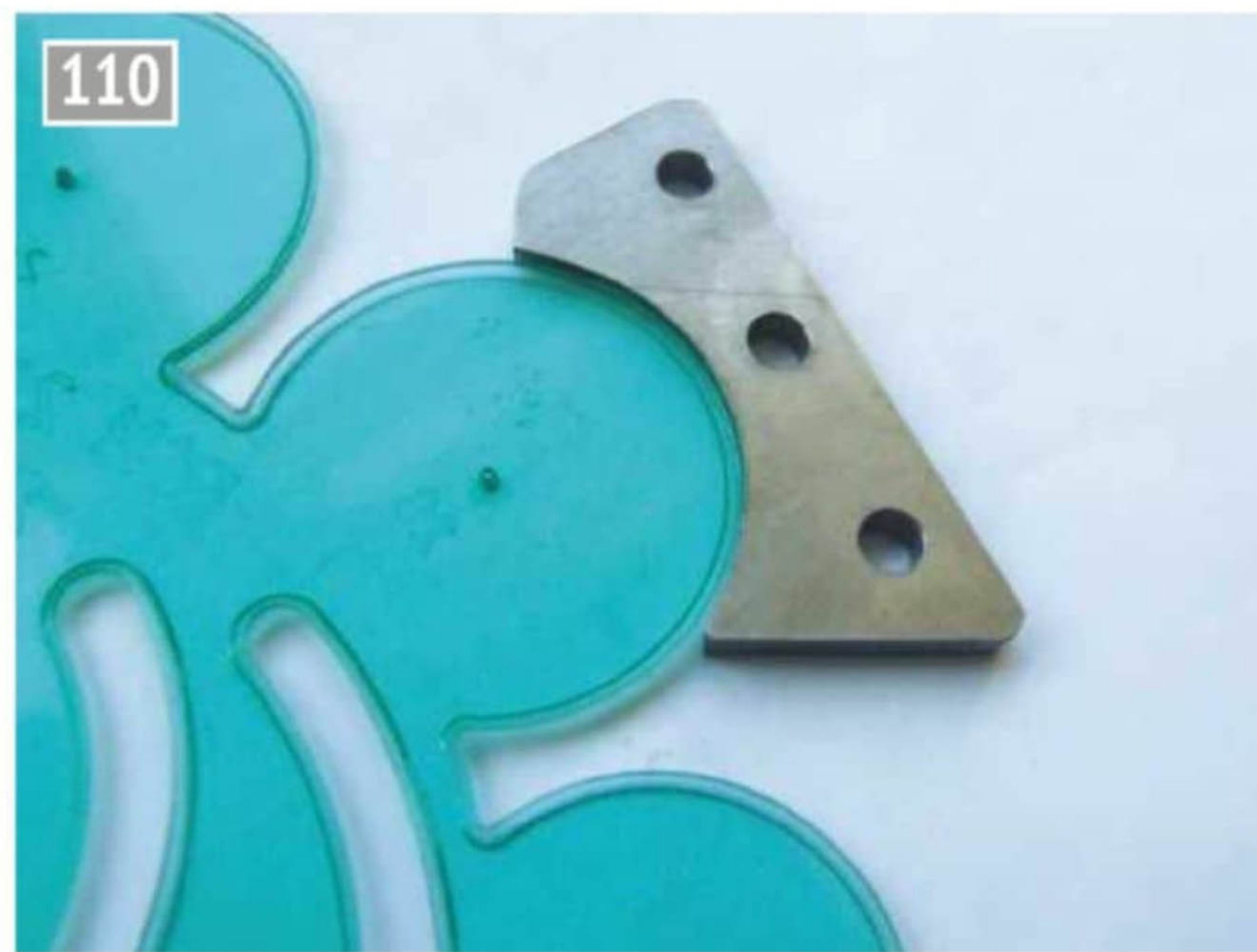
A substantial parting tool being used to divide the two halves of the steel bar down to a diameter of about 1¾ inches. Such a cut makes the later final hacksawing much quicker.

also used. From my sketch it can be seen that the upper end of the petticoat pipe needs to have a very short parallel

section to fit into the underside of the chimney as a location spigot. It is also clear that the skirt of the petticoat pipe is



109 The steel bar in the milling machine vice and the rather long fly-cutter used to create the radius under the chimney section. The cutter had to be made from silver steel plate as the standard tool was not long enough!



110 The special piece of 1/2 inch thick silver steel profiled to form the internal radius at the base of the flare on the petticoat pipe.



111 The external profiled form tool used to produce the radius on the outside of the flare. This tool was easily made from a standard left-hand tool on the hand grinder.

flared and although the outside curve is straightforward enough, the inside one would be difficult without a special turning device. This curvature should be as smooth as possible for the passage of the exhaust gases so I decided to make a form tool.

A piece of 1/2 inch thick gauge plate was used as the tool steel and filed up to include the curve required, which is 1 7/32 inch radius, and I used a drawing template to check the arc (**photo 110**). Whilst the tool section was still attached to the parent stock, I also drilled the holes for the three 2BA Allen screws that would be used to clamp it to a piece of old lathe tool shank. The curved section is the most important

aspect of the form tool and the finish should be as bright and as smooth as possible with a front rake angle of about 10–15 degrees. However, as the minimum diameter of the pipe will be around 1 inch, I increased the front rake to be 20–25 degrees at the very front of the tool form.

Heat treatment was carried out by placing the piece of tool steel up on a firebrick so it could be heated up to bright red and tipped into a dish of cutting oil. I always keep a dish near the lathe and any contamination of the oil is of no consequence. Once cool enough, I took the tool and cleaned off the scale with fine emery tape and checked the edge for hardness with an old



112 Taking off the bulk of the material from the inside radius of the flare before using the form tool and finishing the curved edge.

file; the file just ran off the material without making any marks so it was hard enough for my purpose.

My drawing suggested the angle of the both the inside and outside of the petticoat pipe needed to be 2 degrees so the lathe top slide was set up to do a trial and check the dimensions achieved. On my Myford the travel of the top slide is over 2 1/2 inches so this is just right for the cuts involved. With the bar set up to run truly using a dial gauge, the outer end was given a centre for tailstock support and the face was turned true. The first cut to shape the part was made on the outside near the base of the component to create the large radius and bring the

outside diameter down to 1 7/32 inches, at about 5/8 inch up from the lower face (**photo 111**). Then the angled turning was progressively carried out along the side so the overall length was 2 3/8 inches, finishing at the chuck end with a parallel section 1 3/8 inches in diameter. This is slightly too long, for parting off later.

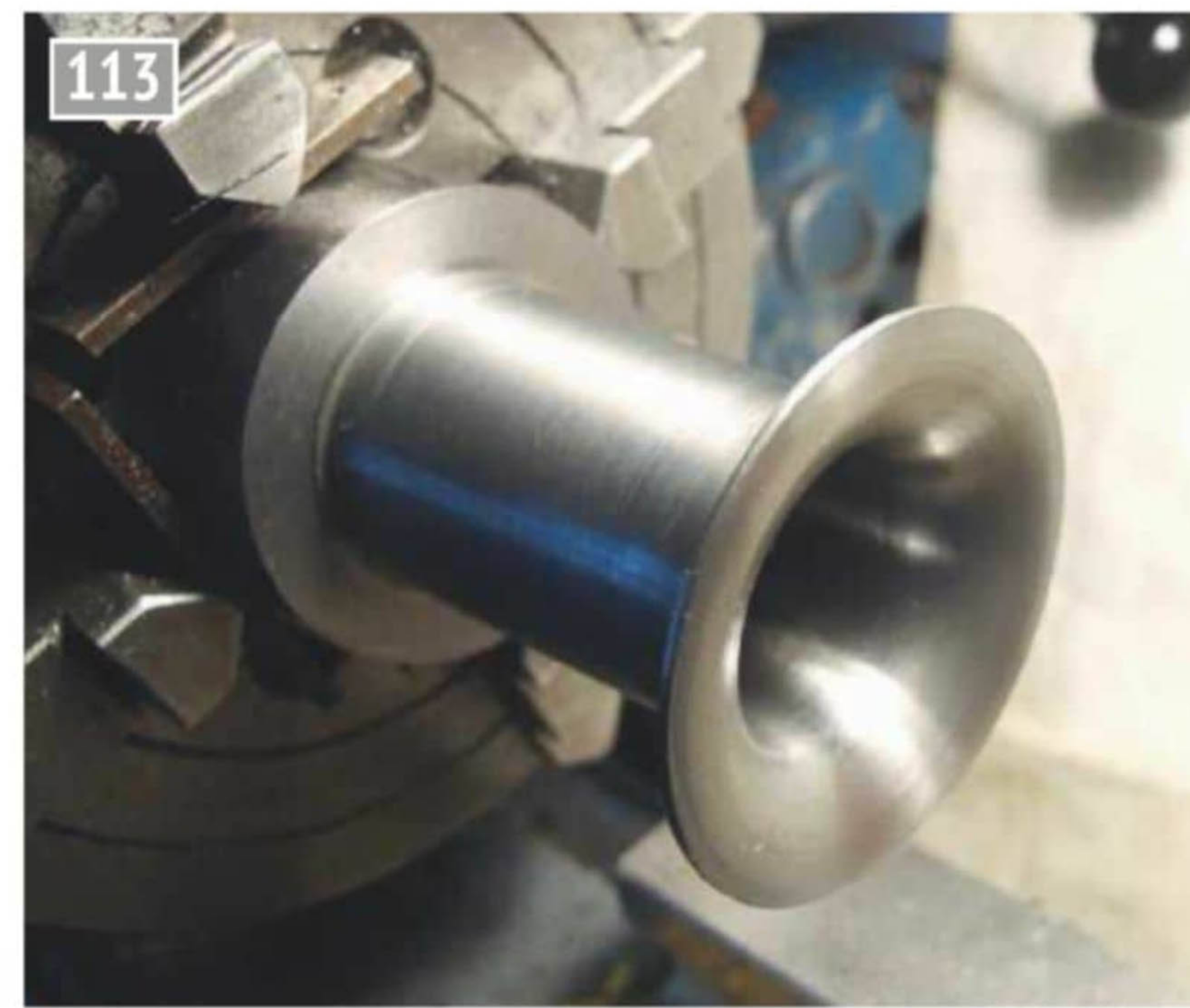
The next operation was to drill into the bar to a depth of 1 1/4 inches with the largest available drill (mine is 7/8 inch) and begin the internal profile. The purpose of this partial drilling was to retain as much rigidity as possible for the form tool, turning on the progressively thin material. Taking care not to disturb the top slide setting some

initial cuts were taken with a narrow pointed tool. The task was eased by taking as much material as possible from the inside corner by manipulating the lathe tool with the lathe hand wheels and by altering its clamping position (**photo 112**). It would have been very easy to lapse and change the angle of the top slide instead. The form tool was then used with the lathe running at its slowest speed and with plenty of cutting oil. To complete the turning, the internal hole was drilled to a depth of 2 1/2 inches and bored parallel initially and then finished at 1 1/4 inches diameter with the top slide in its fixed position.

Some smoothing was carried out with a fine file and emery tape before parting it off a full 2 3/8 inches from the lower face (**photo 113**).

The last operation was to silver solder the petticoat pipe into the thicker of the mounting plates and my set up to do this is shown in **photo 114**. I used metal supports for stability and accuracy rather than firebricks as the heating was very localised around the diameter. The final result was satisfactory (**photo 115**) and I wondered how much point there would be in cleaning up those splendidly turned surfaces!

● To be continued.



113 The final form achieved without mishap.



114 Here is the set up for the silver soldering of the petticoat pipe to its mounting plate and the tidy ring of solder at the expense of a very black pipe.

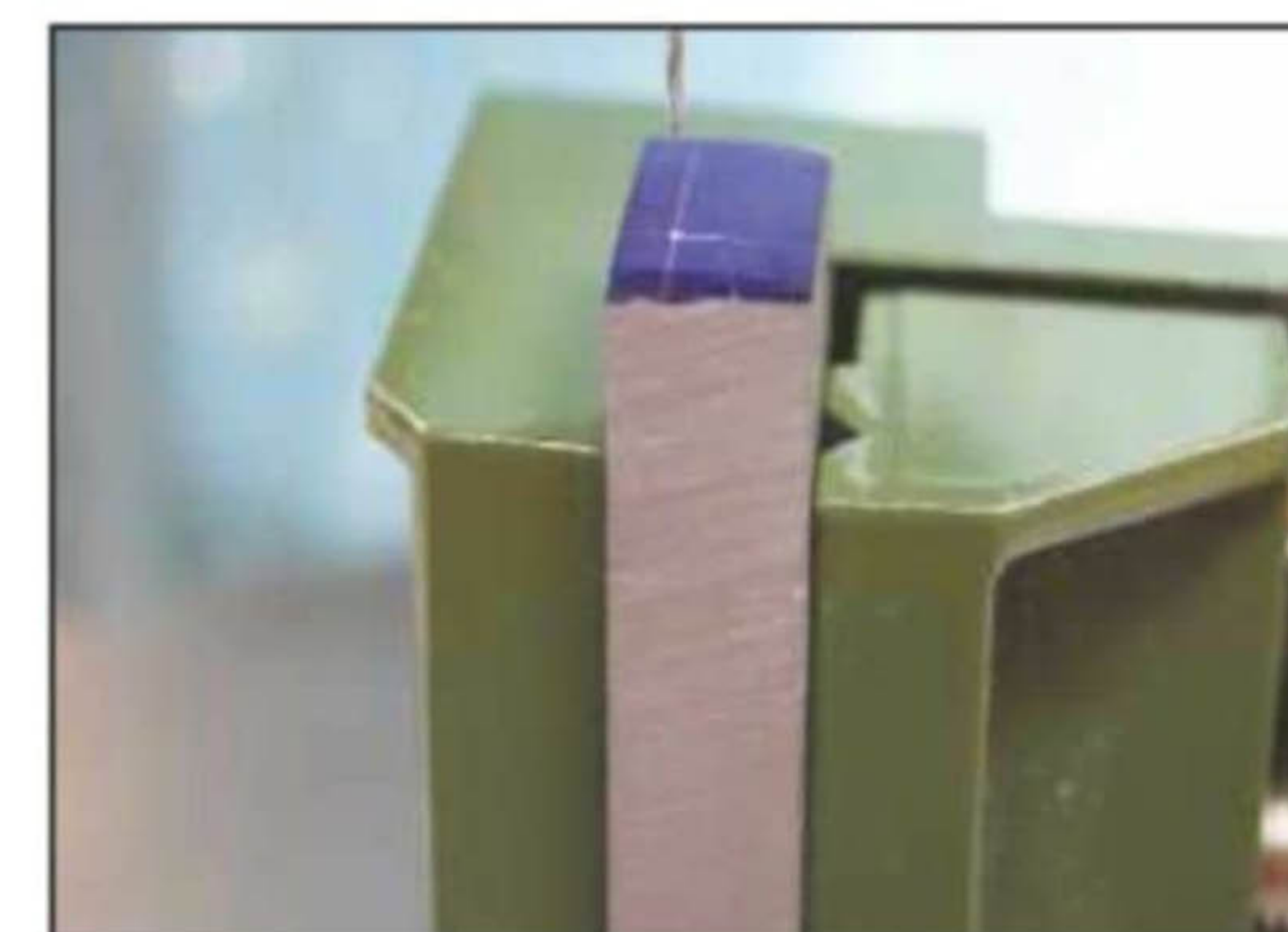


115 The final result of the silver soldering, showing a satisfactory joint.

No.284

MODEL ENGINEERS' WORKSHOP

September's issue, number 284, returns with more great content, including some handy tooling to make yourself:



Make **Derrick Marsh's** flexible scribing blocks



The Story of a Shed - **Des Bromilow** builds his dream workshop



Stewart Hart's One Handed Depth Gauge

Pick Up Your Copy Today!

Building Bridget PART 2

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

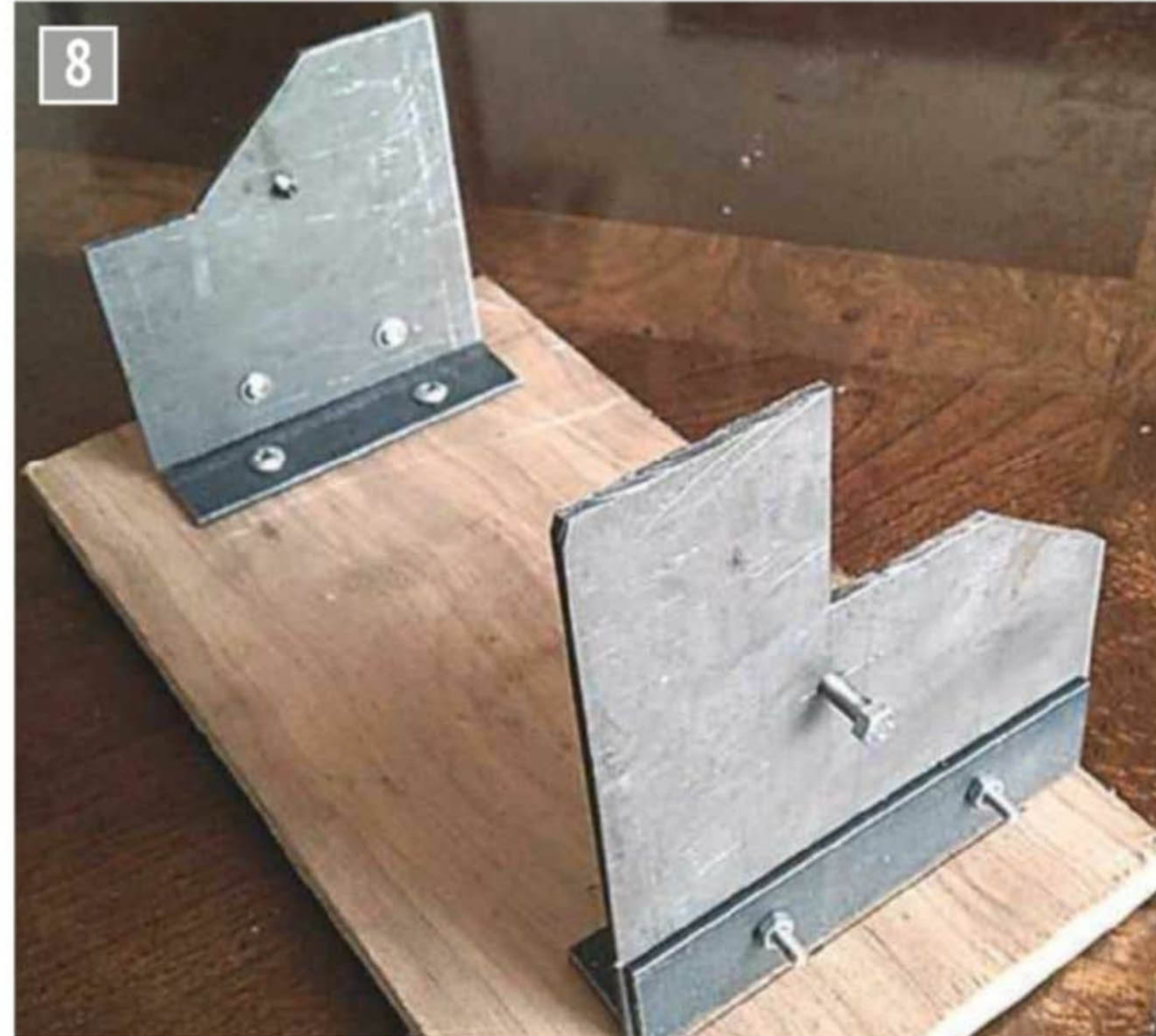


Quartering

As is well known, the driving wheels of a loco need to be 90° out of phase, with the right hand crank leading – in other words the crank pins on the right will be in the furthest forward position when the crank pins on the left side are in the top position. This is fundamental to the ability to start from stationary in any position.

There are two considerations. The first is that the wheels must be placed on the axles so that there is a 90 degree difference between the crank pins but, even more importantly, all the axles must have *precisely* the same difference side to side. It doesn't matter too much if the difference is 89 degrees instead of 90 degrees (although try not to do this) but if one axle is 90 degrees and the other 89 degrees you will have an interesting time fitting the coupling rods!

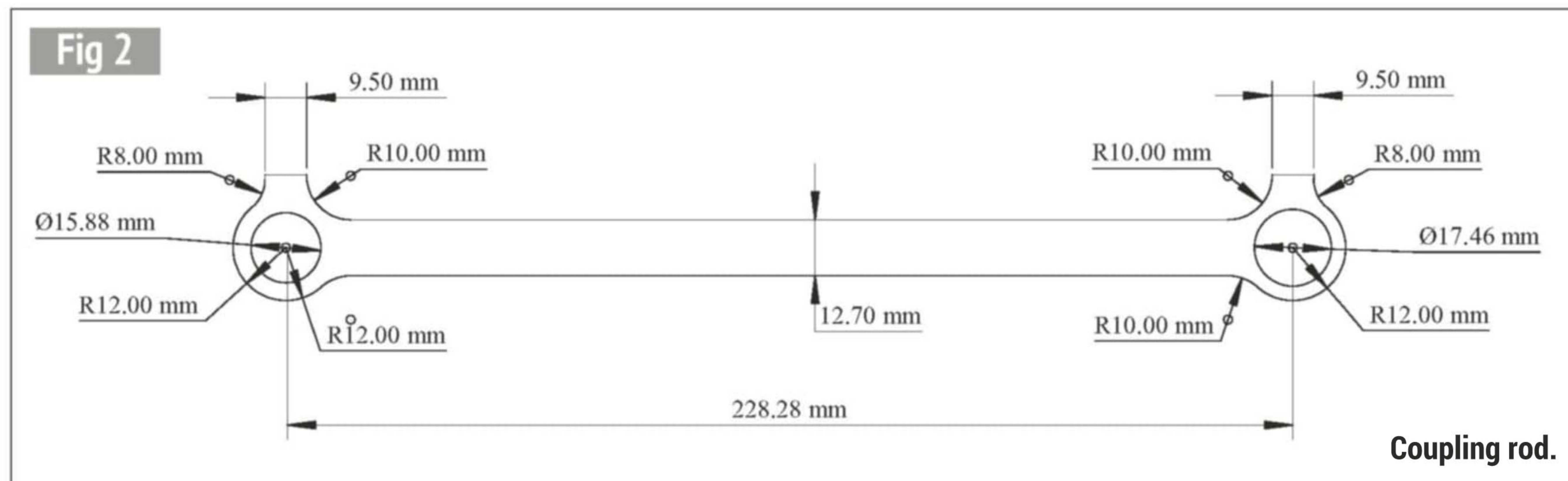
To ensure consistency between the axles, I followed the advice of all the books and built a quartering jig as shown in **photo 8**. The two edges of the jig are separated by 90 degrees, so providing the correct relationship when the axle and wheels are placed in the jig. The two screws in the sides are ground to a point and located in the



Wheel quartering jig.

centering holes on the end of the axle. Doing this when using press fit wheels must be very difficult but since I was using adhesive it was very easy. The hardening time for the adhesive gives about ten seconds to attach the wheels, place in the jig and rotate so that the crank pins are against the jig. I used rubber bands to keep the pins against the jig while the adhesive cured. Fortunately, I had remembered to put the bearing blocks on to the axles before attaching the wheels. That would be a very annoying error to make!

Once the adhesive was fully cured I was able to mount the axles between centres on the lathe and give a very light skim to the wheel treads to ensure concentricity. I then had the satisfaction of putting the axles into the horn blocks, inverting the frames onto some actual track and pushing my nascent locomotive up and down. One of the great pleasures of model engineering for me, and I suspect most people, is not the final result but the hundreds of little victories along the way. Without these I doubt anything would ever get completed!



Coupling rods

Having now put the four wheels with crank pins on the frames, the obvious next step was to make the coupling rods and find out whether all the care I had taken in placing the crank pins had worked. I know that water cutting or laser cutting is commonly used these days for coupling, connecting and motion rods but I was still at the stage where the novelty of machining metal had not yet worn off and I wanted to prove to myself that I could just make these from slabs of steel bar. If I live long enough to make another locomotive I will probably do it differently next time!

The *Bridget* coupling rods are a nice simple shape and do not require longitudinal lightening grooves which are hard to get right. The basic coupling rod is shown in **fig 2**. I prefer to work in metric and so, with major parts, I usually start by making a CAD drawing from the plan and labelling in metric – rounding for non-critical dimensions. Figure 2 is an example of this.

My approach to making the rods was by chain drilling using a milling table. The best advice I ever read on the use of a milling machine was 'get a DRO'. As purchased, my milling machine only had a vertical DRO so, after about six months, I purchased a two axis DRO and fitted it to the machine. Wow – what a difference! Of course, accuracy was dramatically improved but, in addition, features of the DRO such as locating holes in a circle or a line opened up a whole range of machining options not previously available. By clamping a piece of bar on the table (on top of a piece of sacrificial aluminium) I was able to mark out all critical dimensions, rough out the bearing holes, drill out the transition curves on the ends and chain drill the length of the rod in one go. Not one quick 'go', mind you – it took many hours. There were nearly 100 holes to be drilled and I started each one with a



Testing the quartered wheels.

centre, then drilled a 3mm hole and finally a 3.5mm hole to reduce the webs. Altogether, 300 operations and moving the table between each one. But eventually I finished, could remove the bar and cut out the chained holes to get the outline. Then back on the table to mill the sides smooth and to the correct width (12.7mm).

But there was more to do. Not shown in **fig 2** is the fact that the ends of the rod are $\frac{3}{8}$ inch thick while the central rod is reduced to $\frac{3}{16}$ inch thick so 2.4mm has to be milled off each side of the centre rod using an end mill. When turning over it was necessary to insert a spacer underneath to support the cutting operation. After much further finishing up using files of progressively finer grade, carborundum paper and eventually diamond paste, I got something approximating a satisfactory job. The final steps were (1) to make the phosphor bronze bushes with a size to give a firm press fit into the holes, followed by final reaming, and (2) to drill and tap the holes for the lubrication cups and, of course, make and fit these. All in all, this was a lot of work and hence my reappraisal of the value of water cutting!

So, after all this did they fit the crank pins? Amazingly, yes they did and the coupled wheels turned quite satisfactorily without binding. In fact, to celebrate, I took the little chassis out to my garden track and had my electric locomotive tow it round a few times to make sure (**photo 9**).

You will notice that the pony truck is also completed and operating. I have not described this since the processes for the axle and bearing are



The brake ring casting.

essentially the same as for the main axles but smaller and simpler. The pony truck itself is able to swivel side to side, sliding on a large piece of phosphor bronze.

The brakes

Now that the wheels were on, the next logical step was to install the brakes. Although the brakes are simple in design with cast iron shoes on the main wheels pulled on with rods, there are very many parts and it was a lot of work. There are the shoes themselves, the supporting links, cross-links, adjustable rods, operating shafts, levers, bushes, the cab manual brake control and a steam brake cylinder. This was a good month's work for me.

The shoes are cast iron and delivered on a ring as shown in **photo 10**. In fact, there are six shoes on the ring although only four are needed but this means the ring can be mounted on the lathe face-plate (with suitable spacers) and the centre can be bored to match the wheel treads prior to cutting into individual shoes.

Although there are many parts in the brake system, most are simple linkages and pretty tedious to fabricate. The only interesting aspect



The steam brake cylinder.

was that that the ends of each pull rod need to be threaded in opposite directions (left and right). The threads are then joined using short lengths of hexagon bar, with a hole also threaded right and left at the ends. These joiners are then turned to adjust the shoes relative to the wheels and each other, then secured with a lock nut.

The brakes can be applied manually using a cab control of the screw handle type. Alternatively, they can be applied via a steam brake. The steam brake cylinder was machined from a gunmetal casting as shown in **photo 11**.

It's quite hard to test the brakes because, until the locomotive is completed and has the full weight, almost any application of the brake just locks the wheels, which then slide on the rails. I guess this will need further attention when ready to run.

●To be continued.

NEXT TIME

I produce the cylinders and pistons.

An Engineer's Day Out

Poppleton Community Railway Nursery

Roger Backhouse visits a unique community venture near York.



Red carpet and Loweco await the Lord Mayor of York. Visitors on Heritage Open days can see the original British Railways red carpet.

Don't be misled by the title, *An Engineer's Day Out* - a visit to Poppleton Community Railway Nursery could take under an hour to look round, including enjoying refreshments, but it is a special place, unique in Britain as a former railway nursery with its own 2 foot gauge railway now under community management.

This nursery celebrated 75 years' operation in autumn 2016 with a visit by the Lord Mayor of York (photo 1). It was established by the London and North Eastern Railway in 1941 to grow fruit and vegetables for railway hotels and refreshment rooms, later growing flowers for station hanging baskets. The nursery also grew trees

to help stabilise railway embankments following war damage to these features.

The nursery railway is easily accessible. It is next to Poppleton Station, the first stop on the line from York to Leeds via Harrogate, where it occupies part of Poppleton's former goods yard. Poppleton's level crossing retains hand operated gates



Poppleton's hand operated crossing gates and signal box. These have now been replaced by lighter metal gates.



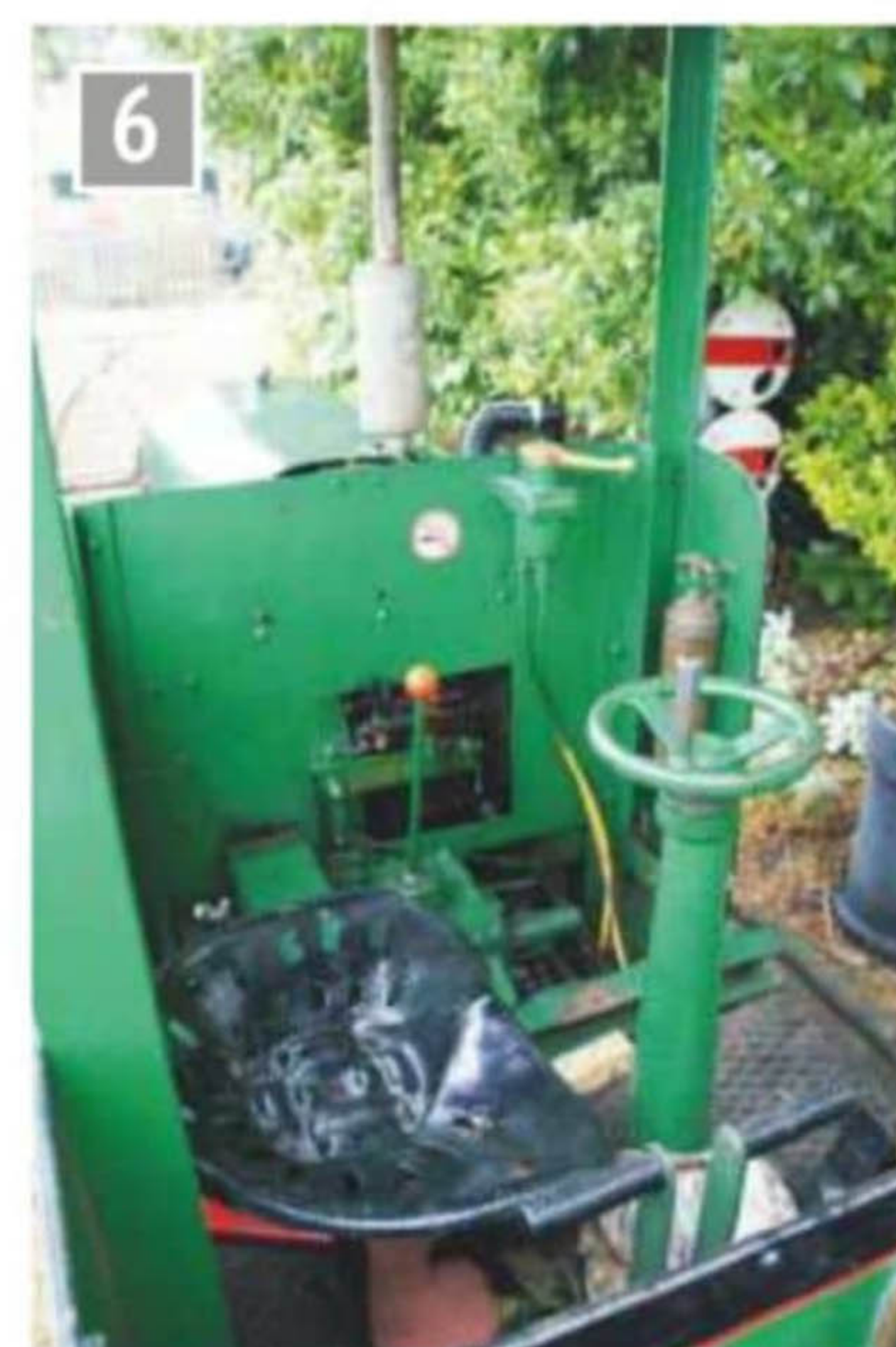
Wagon turntable built by apprentices at York's former British Rail Engineering Works



Plants for sale at the Railway Nursery among the railway relics.



Bob Brooks' Loweco diesel has a Lister engine. It came from the now closed Abbey Light Railway in Leeds.



Driver's eye view from the Loweco diesel.



Motorised wagon named Terry Stanhope after its builder.



'Complete with all the bells and whistles', audible means of approach on Terry Stanhope.

and a semaphore signal. It is the block post for the single line to Hammerton (photo 2).

Little is known about the nursery's early days but British Railways continued operation. A later manager, Graham Warner, arranged construction of the nursery's 2 foot gauge railway between 1985 and 1986 enjoying an official opening by popular TV gardener, Geoffrey Smith in 1988. As today, the railway relied mostly on people power, but sometimes used a diesel locomotive.

Graham Warner used redundant track parts from York's parcels depot. Older readers might remember this depot on the north side of York station. When British Rail had a carriage works in York apprentices made a wagon turntable, still in use (photo 3). A storage shed is believed to

have come from Knottingley Station.

Privatisation forced the closure of the nursery and the railway in 2006. Aware of the nursery's unique nature, however, concerned local people took over both the nursery and the railway. Poppleton Community Railway Nursery now runs both, as a charity involved in therapeutic activities. They work with local health agencies which find horticultural skills training greatly helps adults recovering from mental health problems. Even learning simple DIY skills enhances career prospects.

Now with regular open days during the year there's a chance to view the narrow gauge railway, visit the small museum, admire two model railways, enjoy refreshments and of course buy plants.

There's usually a good selection for sale.

About the narrow gauge line

Just outside Poppleton station and next to a small, attractive amenity garden there are 2 foot gauge sidings and a locomotive shed serving a balloon loop around the nursery past greenhouses, cold frames and stores (photo 4).

Previously the nursery extended some distance towards Harrogate and used both sides of the standard gauge line. Railway safety restrictions and steel fencing, however, now prevent access to former nursery beds across the tracks.

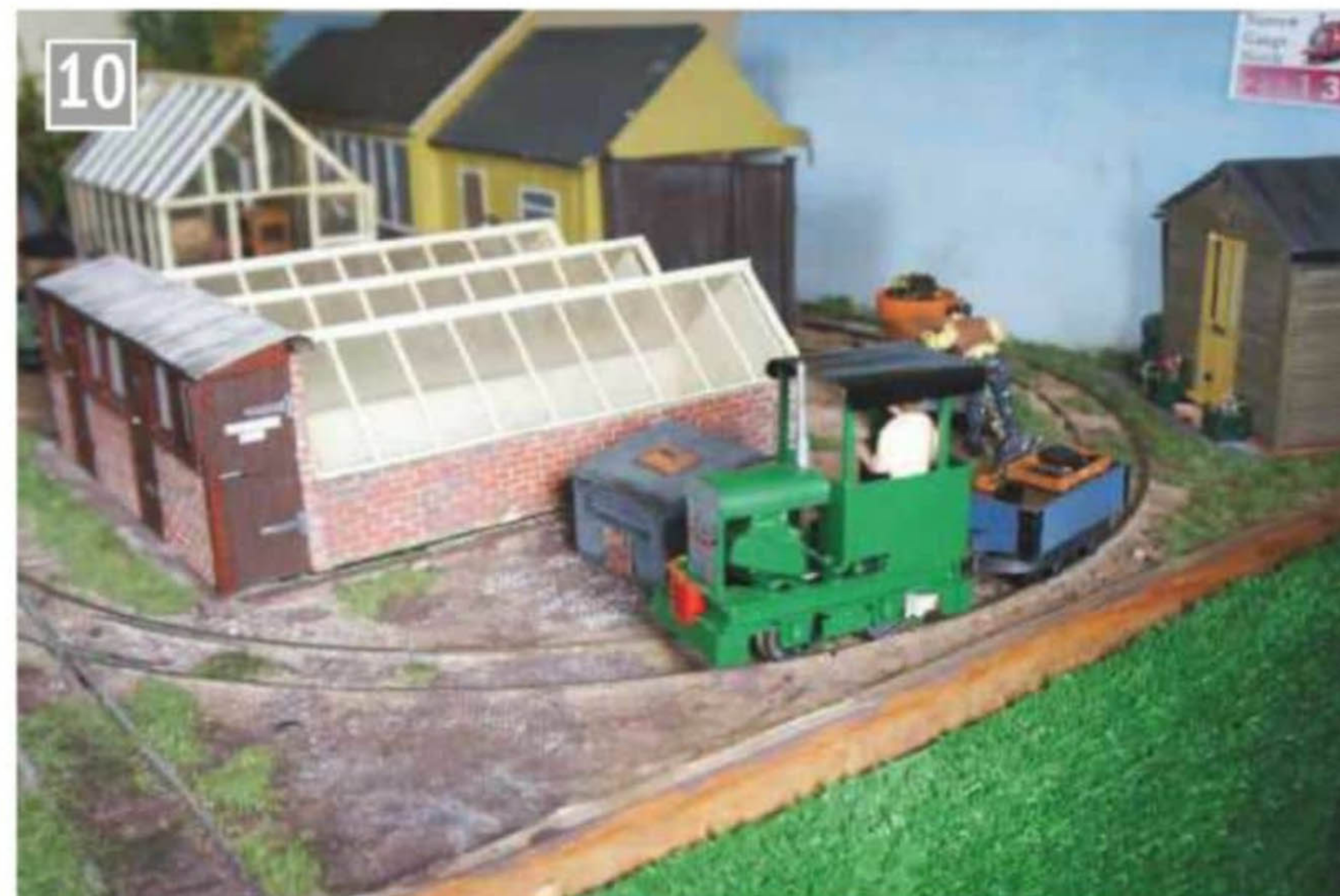
Bob Brook, a regular volunteer, owns the line's main locomotive, a Loweco Lister diesel fitted with a Petter engine (photo 5). He

Privatisation forced the closure of the nursery and the railway in 2006. Aware of the nursery's unique nature, however, concerned local people took over both the nursery and the railway.

obtained this from the now closed Abbey Light Railway in Leeds (photo 6). There's also a motorised wagon, named *Terry Stanhope* after its builder (photos 7 and 8). There are tipper wagons, flat trucks and a rebuilt wooden wagon.



16mm scale model railway gives an impression of the nursery. Few model railways have live plants!



Detail of this enjoyable model railway.



The garden railway is 45mm gauge with a mix of stock owned by volunteers.

Model railways

David Dawson and Bob Brook built the 32mm (16mm scale) indoor model railway on an old door. As you might expect from a railway nursery it features real plants (**photo 9**)! Although not an exact model, it enjoyably recreates the style of the Railway Nursery and observant visitors see many similarities.

David hand built the track using copper clad sleepers. Points are hand operated using a slider. Visitors particularly like the rebuilt model greenhouse made of perspex sheets with painted plastic strips stuck on to replicate glazing bars (**photo 10**). The model is often taken to local model railway exhibitions.

David's model of an Orenstein and Koppel Midget is radio controlled, with the radio hidden in the freelance water tank attached. He's also made a model of *Terry Stanhope*, the

motorised wagon (described in *16mm Today* No. 160; November 2016). One curiosity is a short third rail section with a model man-powered truck operating independently.

Visitors particularly like the model flowers. (Railway modellers note; they are made from necklace beads sold by Wilkos and others from broken up earrings sold at Claire's Accessories!)

There's also a 45mm gauge garden railway outside on a raised bed with a plastic track snaking through rocks and miniature plants (**photo 11**). There are other attractive uses of miniature and rock garden plants in a tipper wagon just outside, perhaps inspiring creative planting for a garden railway (**photo 12**)?

Poppleton Station has been adopted by the Railway Nursery volunteers who look after the station garden and stock the tubs, keeping the



Creative planting in a former tipper wagon could inspire planting for a garden railway.

look of a traditional country railway line where station staff enthusiastically competed for best kept station awards. The Railway Nursery has also provided attractive hanging baskets for stations on the Embsay and Bolton Railway.

Besides the cafe open on event days there's a small railway museum with pictures of the station and nursery plus artefacts found around the site (**photo 13**). This is built on the former station cattle dock, a reminder of the days when

country stations catered for a variety of traffic.

Sometimes the Nursery displays the British Rail red carpet which it traditionally stored. The carpet used to be sent to stations for use by visiting dignitaries. Weather permitting, this is a highlight of Heritage Open Days.

Poppleton decoy

Poppleton was a site for a wartime decoy, created to divert enemy bombers from their intended railway targets



In the small museum, volunteer Tim Ellsworth shows off a ballast measuring tin, used when packing measured quantities of ballast.

in York. Low level lighting - that could be switched on if an air raid was expected - was installed to give the illusion of a blacked out railway yard. Thanks to research by Anthony Crawshaw there are now details of the decoy on the Nursery website (**ref 1**) although nothing is

visible today. (Information about many other decoys and deceptions, though not Poppleton, can be found in Colin Philpott's book, *Secret Wartime Britain; Hidden Places That Helped Win the Second World War*. Pen and Sword Military, 2018. £25.)



Knaresborough Viaduct seen from the castle. September 1983.



ME Water wagon and greenhouses.

Other attractions in the area

York has many other attractions including the National Railway Museum, Holgate Windmill, Yorkshire Museum of Farming and Yorkshire Air Museum at Elvington. The railway to Leeds through Poppleton is surprisingly scenic even if not as well known as the Settle and Carlisle. After traversing part of the former Marston Moor, battlefield trains cross three major viaducts including the spectacular crossings of Wharfedale, Crimble Beck and the River Nidd via the much photographed Knaresborough Viaduct (**photo 14**). Bramhope Tunnel was an early feat of railway engineering but sadly several navvies were killed during its construction. They are commemorated by a monument in Otley Churchyard in the shape of Bramhope Tunnel entrance.

Opening

The nursery is open on spring and summer Saturday mornings (10.00 am - 1.0 pm) for plant sales. Free admission but donations are always welcome.

Getting there

The Nursery is next to Poppleton railway station. There's an hourly service from York to Leeds via Harrogate. The scenic rail journey onwards to Leeds is recommended. Alternatively, No. 10 bus from York Piccadilly (every half hour on weekdays) passes near the main railway station and the Railway Museum. Alight

at Upper Poppleton Green and it's a five minutes walk - or just under 10 minutes walk from Poppleton Park and Ride. Nos. 142/143 buses from York to Boroughbridge and Ripon are less frequent; alight at Wyevalde Garden Centre then it's a five minutes walk. There is a small car park at the station or on-street parking nearby.

Special open day in 2019

Saturday 5th October Autumn Open Day 10.00 am - 4.00 pm.

Thanks to volunteers, Bob Brook, David Dawson and Tim Ellsworth (**photo 15**) for information in this article and to Anthony Crawshaw for his researches into the history of Poppleton Decoy Site.

Volunteers are welcome to help this friendly group with nursery and railway maintenance. For more information visit the website (**ref 1**).

REFERENCE

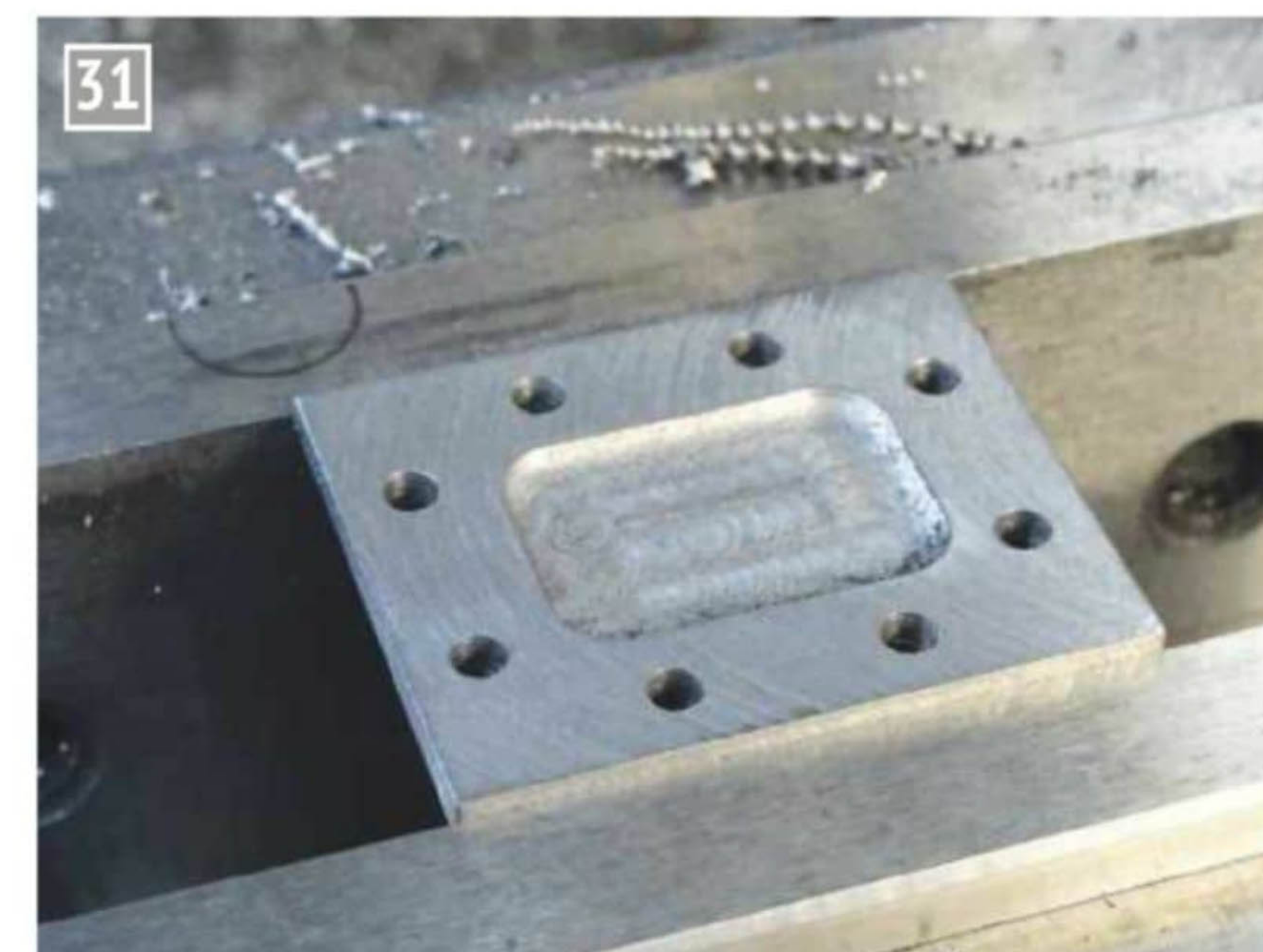
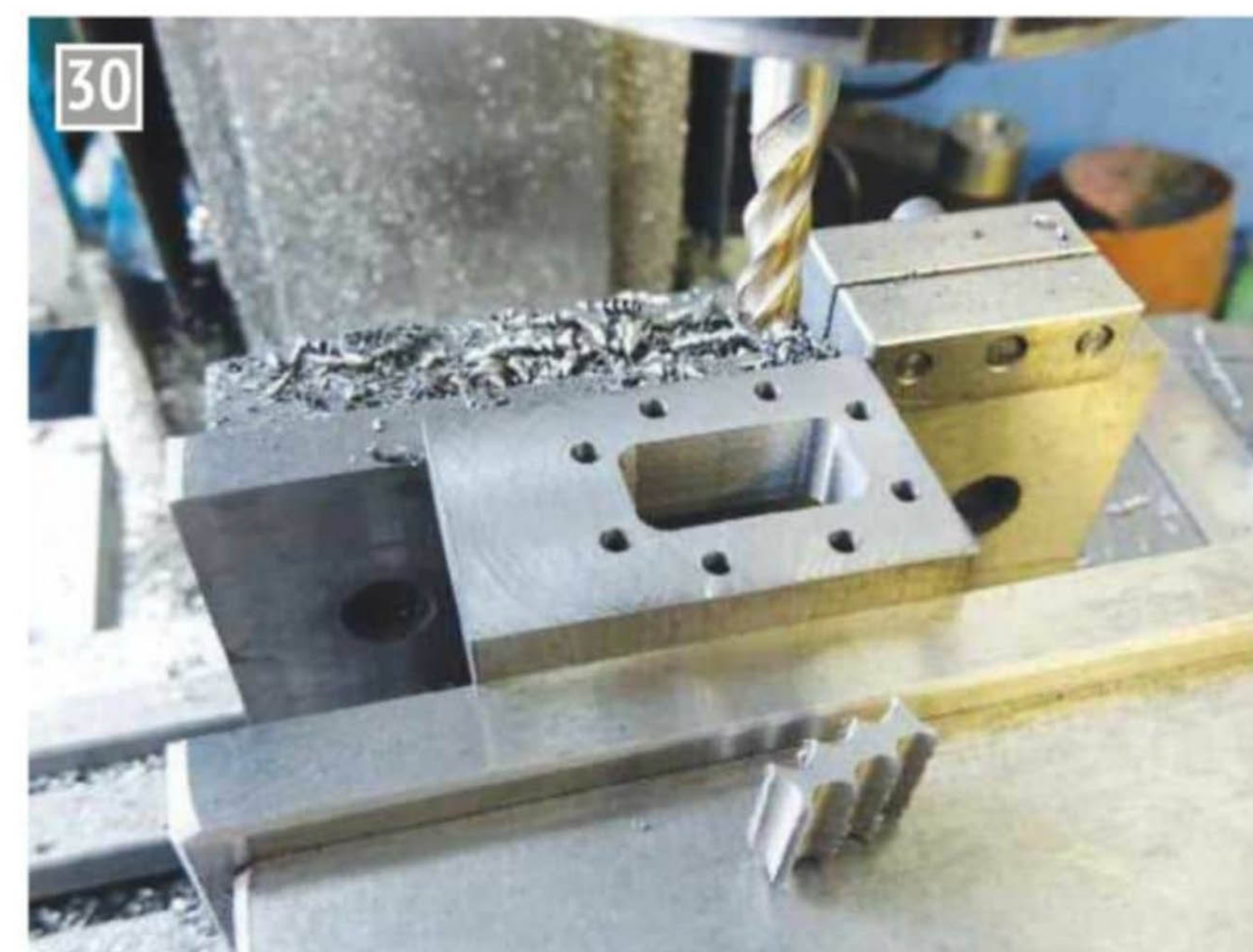
www.poppletonrailwaynursery.co.uk
Tel 01904 797623.
Email pcrn.info@yahoo.co.uk



**Valve chest and cover
(and gland) (fig 7)**

As the chest shares a lot of the same sizes as the cover it would be best to prepare the two pieces of metal first and work on the two at the same time and this is how I will describe them (**photo 29**). The gland can also be worked at the same time as the chest.

Start by drilling out the waste material and then mill the chest cavity to size; the corners will need filing out



Decorative cavity to chest cover and clearance holes drilled.

later. Follow this by drilling the stud holes. Add a vice stop (**photo 30**) before removing the chest then replace with the cover to drill a similar pattern of holes. The cover can then be completed by milling the decorative recess (**photo 31**).

Starting with 16mm diameter stock, turn the spigot of the valve rod gland and drill and ream the hole. While still attached to the bar, transfer to the mill, locate the centre and drill the two stud holes (**photo 32**) before sawing/parting off and cleaning up the cut face of

the flange. The gland is printed on a later drawing but, for those who don't want to wait for this part to be printed, I have put up an extract on the forum.

Hold the valve chest on end, locate the centre and then drill and ream the rod hole followed by the counter bored hole for

the gland then the two tapped holes either side. Without disturbing this set-up fit the gland with some temporary screws and set up the boring head with a suitably ground cutter for external cuts. Make a series of 3mm deep plunge cuts, slowly reducing the

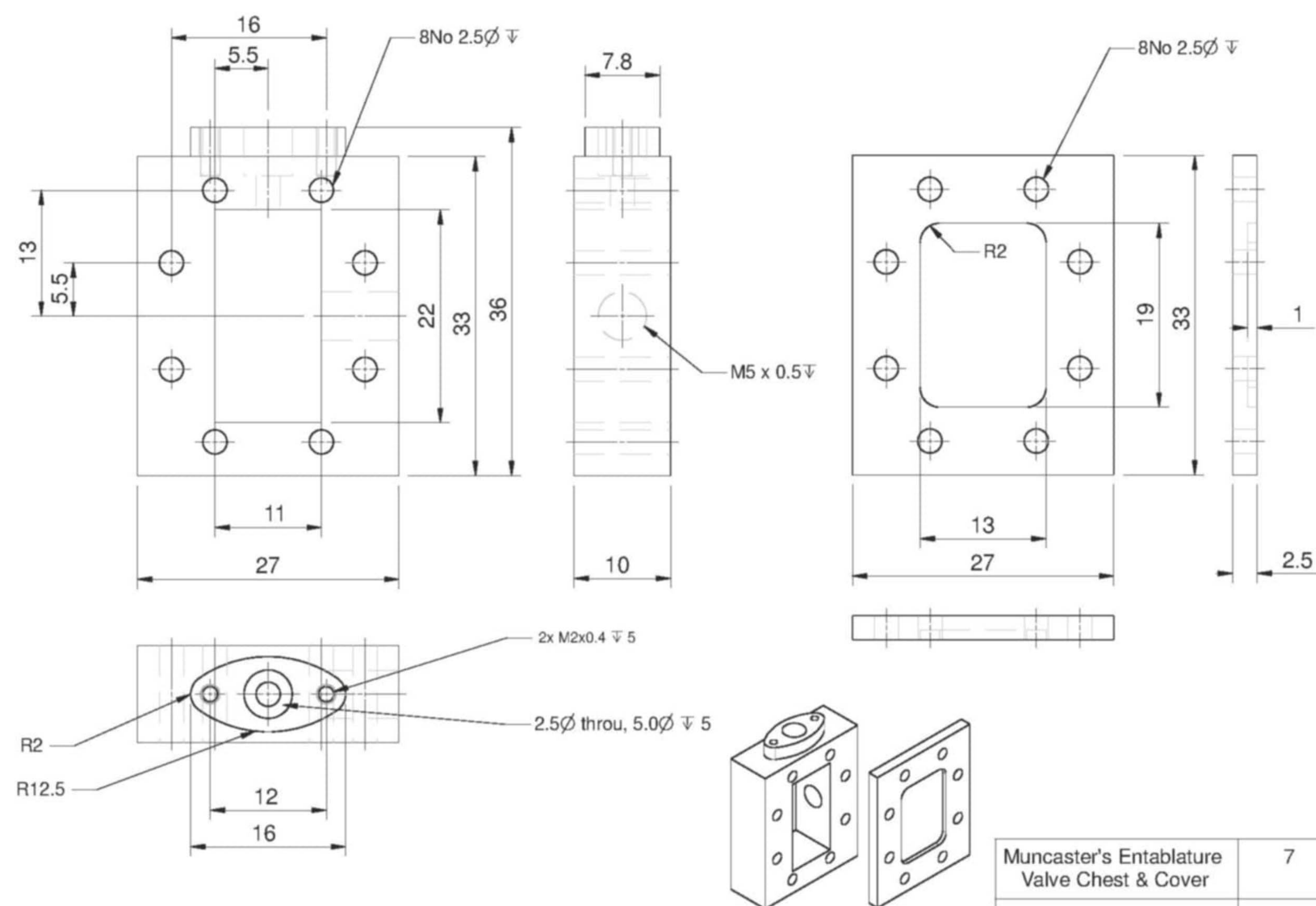
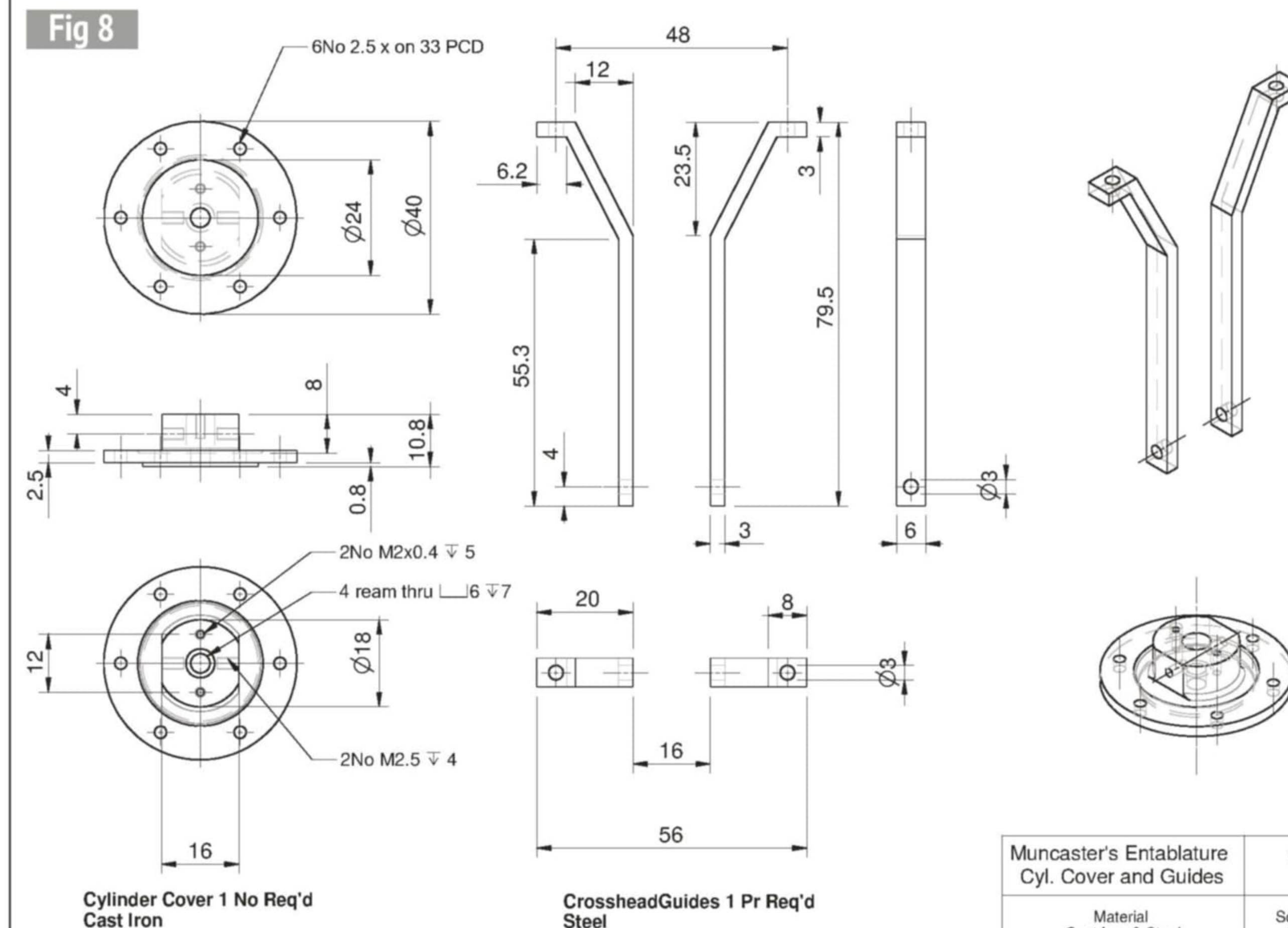


Fig 7

Muncaster's Entablature Valve Chest & Cover	7
Material Cast Iron	Scale 2:1



Muncaster's Entablature Cyl. Cover and Guides	8
Material Cast Iron & Steel	Scale 1:1



36

Model Engineer 13 September 2019

The Brushless Brute

PART 8

Jon Freeman describes a powerful, dual gauge petrol-electric locomotive using brushless motors for tractive power.



At last, we cut metal

Satisfied everything could be made to fit, pieces of 50mm by 25mm by 3mm thickness steel tube were cut with square or angled ends ready to be welded up to create the main frame members. Two sets of suitably scaled 2D CAD drawings of bogie frames and equalising bars were emailed with an order to the laser cutters, the 5 inch size in 8mm steel, the larger set in 12mm (which with hindsight was perhaps too heavy - these could also have been 8mm).

Eight wheels were machined for each set, from billets of 160mm and 110mm diameter EN8 steel. These were sawn using a bandsaw allowing a small margin on length sufficient to make certain both sides could be faced off cleanly and to design thickness. There was a lot of metal to remove but the method described here made the job not too painful.

After facing and drilling an under-size hole through the centre, the wheels were rough machined leaving a little more metal to remove all over, but making lots of swarf quite quickly.

The wheels have a deep recess on one side between the hub and tyre. Not too much time was spent machining these to depth across some of the width using a boring tool set to about 45 degrees (**photo 30**). The radius at the edges of the recess could have been machined using a profiling tool with circular insert but a problem would have been the need to set the tool way above centre height to finish the outer limit so that the tool clears the work. The tool would then have to be set back to centre height to profile the hub. But as this feature is largely decorative (apart from the desirable objective of reducing unsprung mass), the

outer radius was machined by freehand knob-twiddling using the boring tool set back to the normal angle parallel with the bed. Then rather than finding another tool to finish the hub radius, the tool was moved behind the job (**photo 31**) and machined with the lathe running in 'reverse' (please do not try this on any lathe with screw fitted chuck!).

Once the recess looked about right, the next job was to rough the tread down to a little oversize leaving the flange comfortably over thickness. The final roughing operation was to set the lathe to reduce wheel thickness at the rim and tyre to a tiny bit over size. Then with the saddle locked, each wheel was chucked and the rim and tyre faced. This ensures all wheels are now the same thickness.

Next the axle bore and flat wheel face were machined. With a boring tool set carefully



Boring tool angled to recess the front of the wheels.



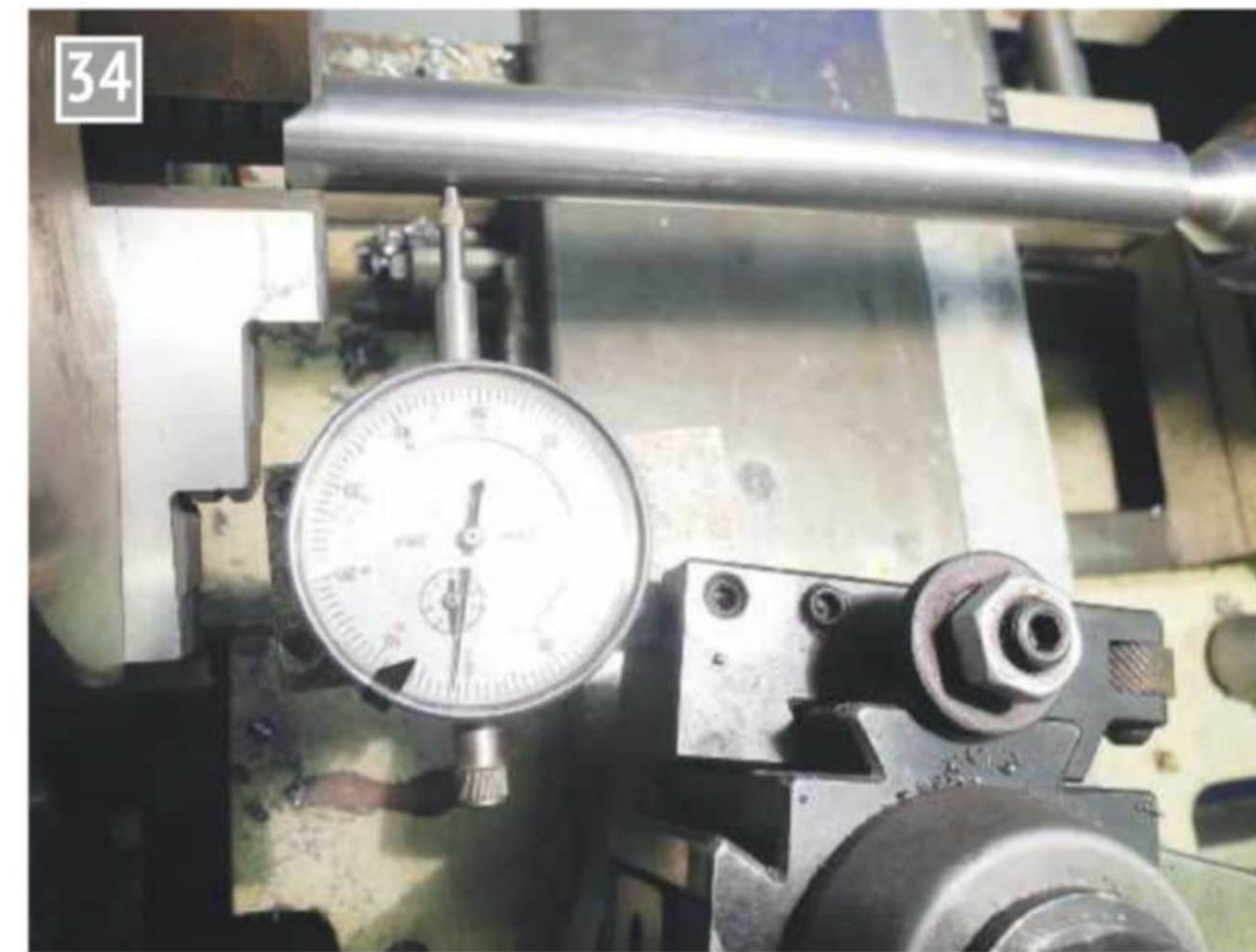
Profiling the hub by using the tool 'wrong side'.



Facing the back of the wheel.



Reaming a wheel for its axle.



Using a DTI to check the run-out of the three-jaw chuck.



Roughing out an axle.



Roughed out wheels on finished axles.



Wheel turning jig.

to the best angle, it can be used both to finish the bore to within a few thou of final size and also to skim a few thou off the flat wheel face (**photo 32**). Using a DRO or carefully noting dial settings, the bore is finished a few thou undersize and finished using a machine reamer (**photo 33**). The boring tool can then face the wheel back taking off just enough to ensure the bore is perfectly perpendicular to the plane of the wheel. Finishing the bore with a reamer gets the bores the same size, saving time later not having to find best matches of wheels and axle ends.

This is as good a point as any to machine the axles.

Axles

Axles were machined from bright mild steel. The material was sawn a shade over length,

then faced both ends to exact length. Both ends were centre drilled to the same depth. For greatest accuracy axles are best turned between centres but using a DTI to check how true the three jaw chuck runs on this lathe showed a remarkably good runout of only $\pm 0.03\text{mm}$ (**photo 34**). Machining the axles as seen in **photo 35**, with the perfect wheel perfectly fitted, being of diameter similar to the track gauge, the flange would be expected to run out of true to the measure of about half this at the flange. This is not worth the extra time it would have taken turning between centres. Holding just a short length in the chuck, pushing the axle onto the tailstock centre while tightening the chuck sets the job right enough every time. The bearing and wheel fit

diameters were finished to size and a light clean-up cut taken to just over half way along the centre part, thus ensuring axle roundness and concentricity of wheel bearing, wheel and motor plate bearing surface (**photo 36**).

Finishing the wheels

Returning to the wheels, a jig was machined (**photo 37**). The centre spigot is machined a close but not tight fit to the wheel bore. The surrounding plane is not quite flat - there is a slight undercut at the spigot root to ensure the wheel does not locate on a radius left by the tool. Then the rest of the area out to within around 3mm of the edge is undercut by a couple of thou or 0.05mm or so. This is so that once a wheel is secured using the stud and nut at the centre,

most of the friction force acts as far from the centre as possible. This holds the wheel securely enough for all finishing operations (**photo 38**).

The final profile was finished using a round profiling tool. A little time was spent with 2D CAD drawing the tool tip at a



Machining the wheel tread to the final diameter.

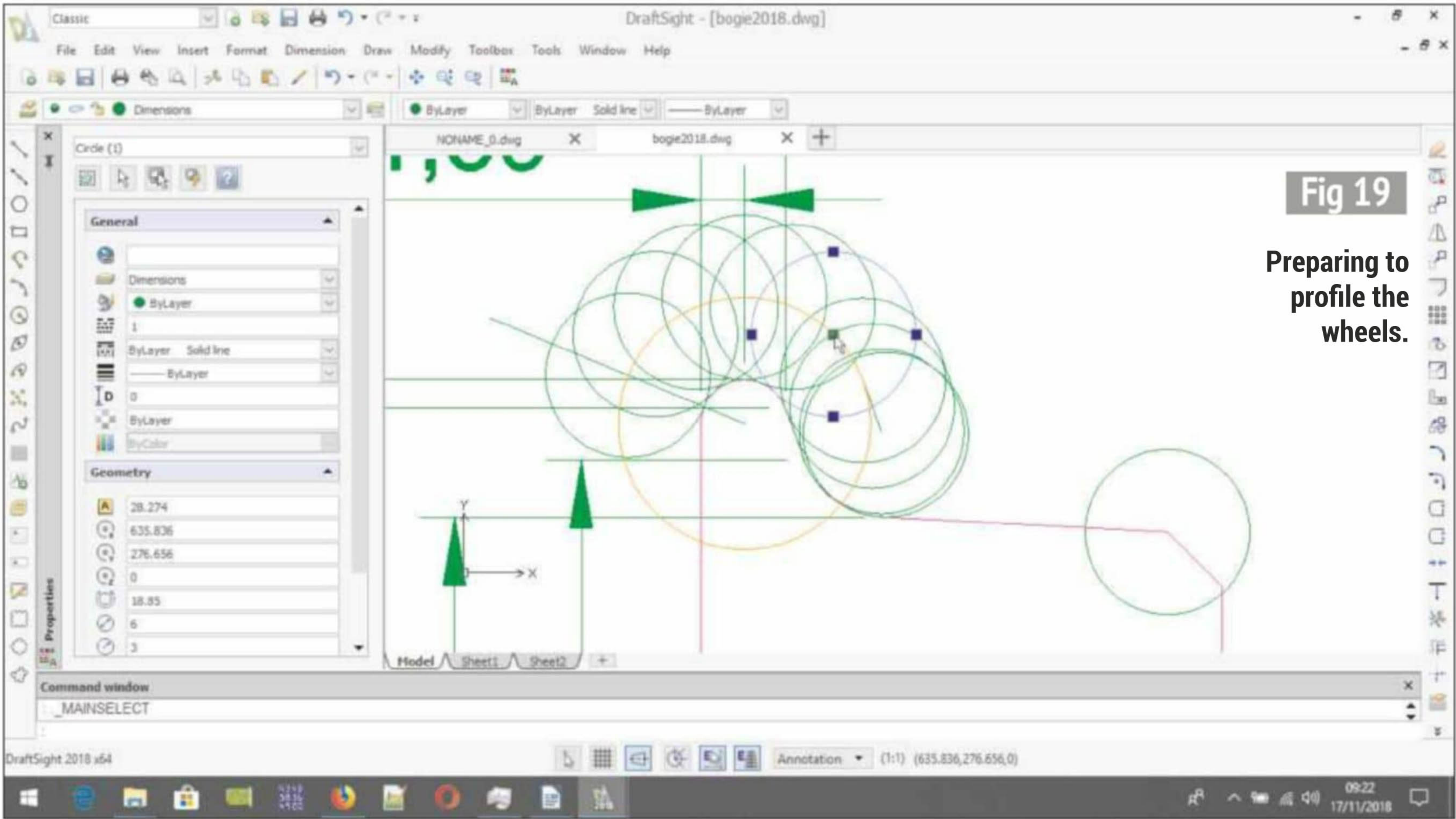


Fig 19

Preparing to profile the wheels.



Finishing the wheel profile.

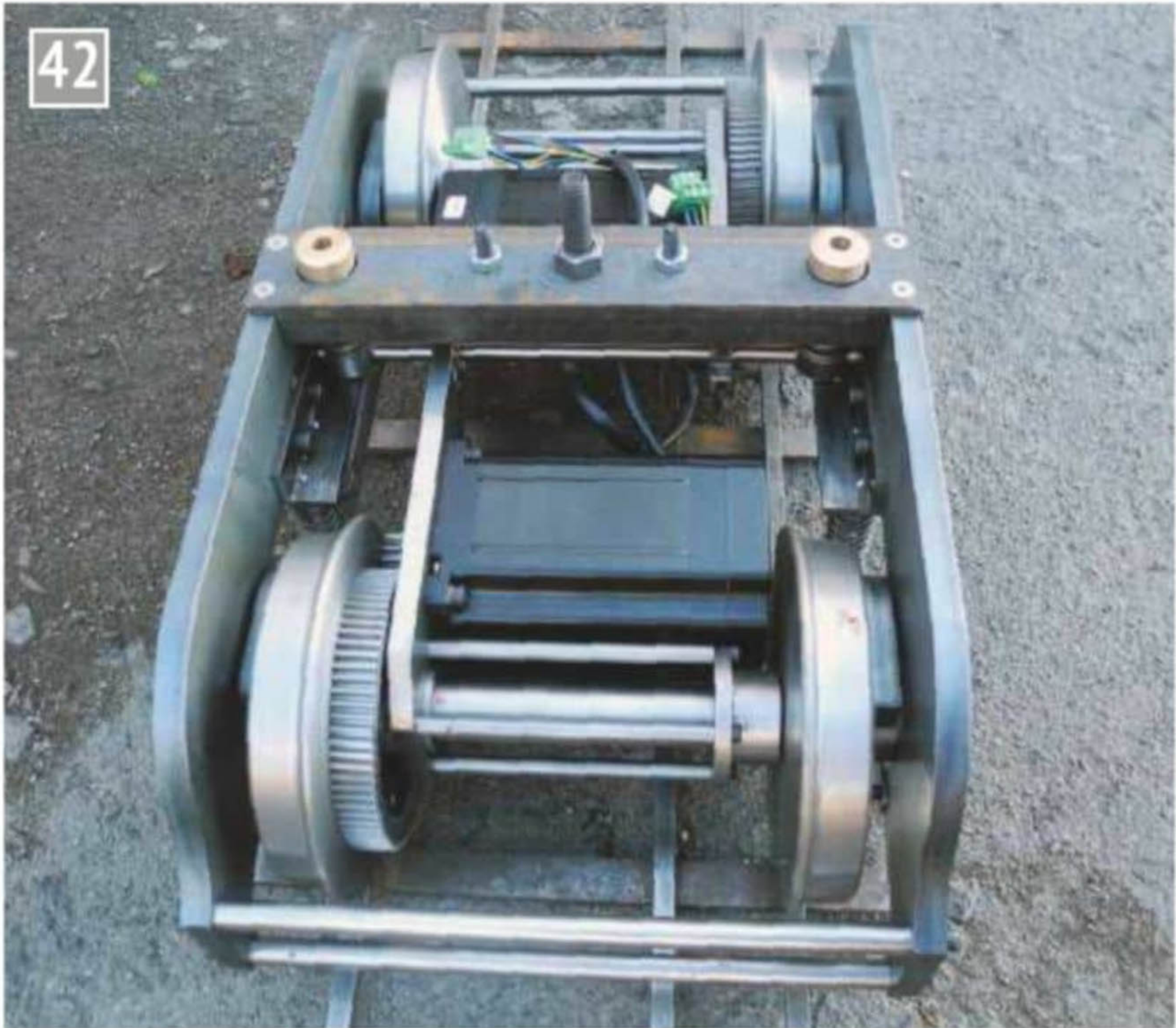


Finished profile close-up.

number of positions around the profile (fig 19), noting the X/Y coordinates for each and converting to X/Z coordinates corresponding to settings on the lathe (by convention a lathe cross-slide moves in the X axis and the saddle moves along the Z axis). A list of ten or so coordinate pairs were written down, the saddle moved to the first Z position then the tool moved in to cut to depth. This is repeated



Finished wheels and axle.



A completed 7 1/4 inch bogie.



Attachment points for the bogies.



The complete chassis.

down the list of coordinate pairs.

The tool radius was close to the final root radius and this made it necessary to do this in several goes, alternately approaching from the X and Z directions taking a small cut each time until close enough to finished. This is a way to avoid tool chatter leaving marks on the job. Creating a longer list of coordinates and taking more time gives a finer finish but this number was judged to be sufficient, giving the result shown in photos 39

and 40. Of course the whole set should be finished before removing the jig from the lathe (photo 41).

Bogies

The 7 1/4 inch bogies, along with much of the rest of the locomotive, were put together before a start was made on the 5 inch set. 1.5 MOD gears were used on the 7 1/4 gauge bogies but the finer 1.0 MOD size, as ordered for the smaller sets, would have been more than chunky enough. Photograph 42 shows a 7 1/4

bogie almost complete. Just visible are parts of two of eight coil springs. These are components of the 'primary suspension'. The round bronzes projecting above the cross piece in photo 42 are bearing pads on top of a pair of quite hefty springs - these form the 'secondary suspension', the purpose of which is to keep the chassis more or less level on a level track, but making allowance for the fact that on a real track, one bogie may be riding on track tilted in one direction while the other is

tilted in the opposite direction. The hope is to keep all eight wheels in contact with the track at all times.

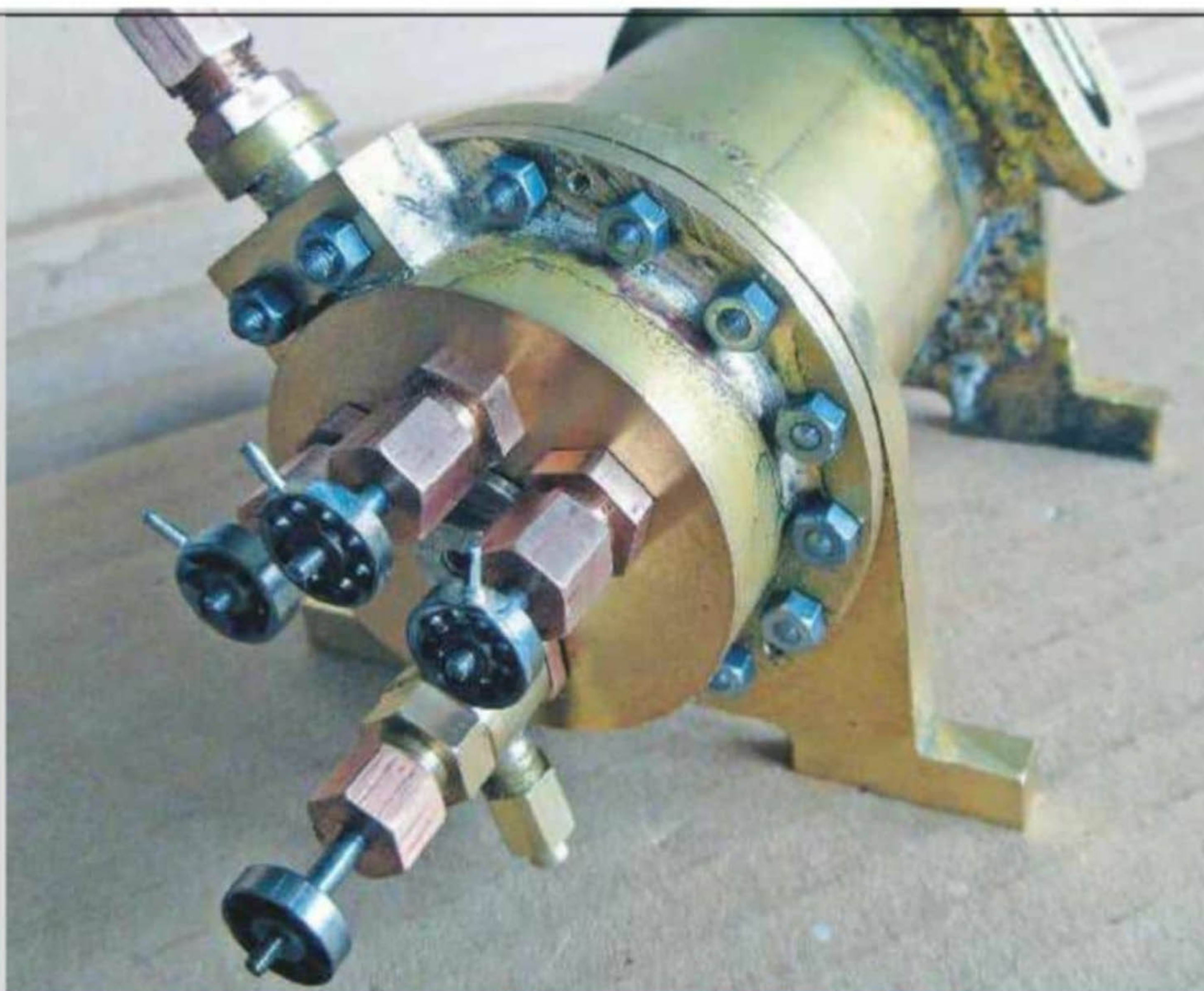
Photograph 43 shows how simply the bogies attach. The two smaller studs serve to limit the bogie steering range. The power unit is shown in photo 44 with the generator in its original position. This was subsequently lowered by some distance to good effect.

●To be continued.

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- **Beam Compass**
Stewart Hart needed to draw some large arcs and so made a beam compass to do the job.
- **Garrett 4CD Tractor**
Chris Gunn now reaches the point of final assembly and painting of his 6 inch Garrett 4CD tractor.
- **GWR Pannier Tank**
Doug Hewson goes into the business of making 5 inch gauge coupling rods.
- **Steam Turbines**
Mike Tilby discusses the design of model steam turbines.

Content may be subject to change.





Paint your wagon... from the G3 Newsletter (photo courtesy of Ted Sadler).

Somebody asked me why I was still working at 73. In brief, my reply was "It keeps me in Creme de Menthe and bonbons."

Ilmor (once associated with the Mercedes F1 team) have designed a 5-stroke engine, which it claims offers significant gains in several fields. To learn more, go to YouTube at 'Ilmor 5-stroke engine'.

Following my remarks about coastal defences in the Baltic, I was contacted by a reader who suggested I join the Fortress Study Group. I had never heard of them, and their website looked interesting, so I tried to join, only to find that their application for membership seems to be as impregnable as

the subjects of their studies! The situation is ongoing.

The Model Engineering Exhibitions may be a staid event for some but not so Yarningham in July, says Deborah, who was there. Just after Debs and her knitting enthusiasts left for a pub lunch, a *fracas* broke out, which first kicked off on social media. They joked, "It's a bit rich when the knitting show is more rowdy than the pub!"

In this issue: Odin, the other L&B, modern maintenance depôts, thermal photographs, a Myford stand, and an online camera manual.

The Gauge 3 Society summer Newsletter has arrived. Now in A5 format and full colour, it begins with Peter Korzilius

writing about making coach bogies with full suspension, which becomes easier in G3. Bruce Lake built a garden railway in G3, using several ingenious ideas to fit into his small (about 20 feet square) space, and Mark Pretious built three Walsall Industries coaches, a BSO and two TSOs. This finely lettered goods train is enhanced by the central wagon, by Shaun Undercliffe. Asked if he had a 'low point' when making it, he sighed, "Starting the second side". I think it is excellent (**photo 1**). Don Crouch wanted LCDR coach buffers but found the commercial items rather too complex so he designed 'a better mousetrap' and it may soon be available commercially. **W. www.gauge3.org.uk**

G1 North took place in Bakewell, and I'm sure there were more stalls this year. I certainly enjoyed it, although the 'I built it myself' display was not present, which I enjoy. I was particularly impressed by John Fownes's display of cardboard locomotives and rolling stock. They are electrically powered - coal firing is rather ambitious, so far... A scene from Midsomer Norton is possibly depicted here (**photo 2**).

W. www.g1mra.com

Ian Beech, Chairman of **Manx Steam and Model Engineering Club**, says in *Peveril*, June,

that their first running day of the year was without serious incident, except for Odin's ammeter releasing the magic smoke. (Odin is the Norse God of magic, how appropriate - Geoff) They also displayed the Wagstaff Collection in the engine shed. However incident-free the club, Mike Casey's garden was not so serene, as one day his wife, Olive, informed him of a large white bull in it. Further inspection revealed that *El Toro* had entered via Mike's miniature railway, which was not equal to the task. Not only that but Mike's grass was greener and it was not to be moved. The farmer was called and he arrived with his teenage daughters. One young lady embraced the quadruped, whispered sweet nothings into its pedigree ear and he was led away to his cows. Sadly, a few weeks later, he tried another adventure, injured himself and had to be euthanised. The railway? After a little work, assisted by visiting Jack Dibnah, it was fine. Howard Bishop writes on the famous Listowel and Ballybunion railway, which was recreated in 2003 with 1000 metres of track in Listowel and an authentic-looking but diesel-driven locomotive.

John Beddows writes regarding my reference to Walsall in ME4615. He grew up in that fair city and says that its name does indeed relate to a hall back in the mists of time. Whose hall, or for what purpose, is not recorded. (It was just a flight of fancy on my part. I'm OK if I keep taking the tablets...) John also says he made a coaxial sleeve aerial (don't ask...) for the 2m band by soldering together four non-corrugated food cans (also ME4615).

The Prospectus, July, from **Reading Society of Model Engineers'** Monthly Newsletter, begins with more notes from '61249' on the subject of visiting depôts. Whilst it is true that they are far cry from steam sheds of old, or even oily, grimy, diesel ones, the modern electric variety may not be

all it seems. Never mind the shiny new stuff being thrust under your nose but look in the corners for cannibalised trains, pantographs in the scrap bin, etc., which will show you what is really going on there. Observe their new '*in situ*' wheel lathe - is its scrap bin full of rusty swarf (good) or discarded wheel sets? (Double plus ungood.) The reason for this is that modern traction systems don't like wheels of different sizes - often more than 10 thou difference across adjacent wheelsets. And, wheelsets are expensive, about £6k. You do not put the wheel lathe operator on a production bonus! David Scott suggests that Swindon had a way of differentiating locomotives in the dark, very useful to yard men and footplate crews when they made everything from standard parts. The end squares of the buffer beams have a pattern of rivets or bolts, possibly unique to the type of locomotive. Go and have a look! John Spokes describes electric locomotives at the French railway museum at Mulhouse.

W. www.prospectparkrailway.co.uk
B&DSME News, July, from **Bournemouth & District Society of Model Engineers**, updates us with Joel's apprenticeship. He is currently milling a 'Typhoon' jet from the solid and is also required to make an '*objet de vertu*' which has no real function, apart from confusing potential applicants, as it involves measurements with tolerances of 0.0002 inches.

W. www.littledownrailway.co.uk
Ryedale Society of Model Engineers' Monthly Newsletter for June tells us that the Driver Training Day had more trainers than trainees but he was quite good and learned fast. Mike Aherne brought his newly-acquired 7¼ inch gauge *Rocket*, which produced a realistic 'chuff' (as far as we know...). News of Douglas, a junior member some years ago; he is now at 19 a fireman at Aviemore as



Bill's 'Black 5' in heat (photo courtesy of Nigel Kerr).

well as NYMR. Mike Aherne is building a Fell locomotive. This 4-D-4 is 5 inch gauge and powered by a Honda 50 engine. That day, just as they were contemplating closing for the day, a minibus full of schoolboys appeared. They were from Gresham School, in Holt, Norfolk, visiting Ampleforth, so were offered a free ride. They had called once before but on a non-operating day.

Two visitors from the IoM brought 35031 (*IoM Steam Packet Company*) and Beyer Peacock *Peveril*. That particular Merchant Navy locomotive never existed in real life but we can dream... Nigel Kerr photographed Bill Putman's 'Black 5' with his thermal camera and he says, "As well as viewing pure IR, the camera has a useful option to add visible detail (as in the image of your loco) and this gives a better idea of what you are looking at. My reasoning behind taking the thermal camera to steam events is to see if it might offer some diagnostic function. The image I took of Bill's Black 5 was the first time I had tried this but I was so busy with my own locomotive that I didn't really have a chance to take any more. However, I will be bringing my camera again to the mainline rally in August and will carry out some 'proper' tests. My intention is to see the difference in the images under certain conditions, e.g.

with and without injectors running, etc. If anyone would like to have their locomotive photographed in this way I would be delighted to do so." (**photo 3**).

W. www.rsme.org.uk

Model & Experimental Engineers, Auckland, July missive, has Ken Pointon noting that *The Shed* magazine in Australia/NZ covers the Newcomen engine that he was involved with a few years ago, with photographs. (This magazine seems to cover more than just woodworking, but the whole panoply of making and repairing mechanical items, whereas the UK Men in Sheds magazine does not - Geoff) Richard Street has converted his Myford lathe floor stand to a 'drawers' configuration, since the cupboard arrangement is prone to collecting dirt and rust and is awkward to use. "Sub optimal" is his phrase. Graham Quayle is re-engineering the throttles on a friend's 30 foot yacht, which has been fitted with two diesels. This is an electrical system and the pedal travel is reduced from the original engine control system. Murray has changed his camera, a Sony a57, a veteran of 15,000 photographs, to a Canon M50. The English instructions occupy seven pages but the online version extends to 314 pages. Access is similar to a smartphone but Murray is not conversant with this concept and has to call on his son, a

Geoff Theasby reports on the latest news from the Clubs.



GTN, Midsomer Norton?

computer engineer, for help. (Every home should have one, a computer engineer, that is – Geoff)

Steam Lines, from **Northern Districts Model Engineering Society**, Perth, for July-August, says the AMRA exhibition went well, with 33 models on the NDSME stand. A 'first' this time was a 'make your own wagon' which was popular. Members visited Toodyay Mini Rail where, on arriving after a ride on the track, the locomotive is uncoupled and run onto a turntable ready for its next departure. Meanwhile, another locomotive has taken the train on its journey back round the 1.2km circuit. A tip from Lindsay Lockhart – to keep your chimney fan from being clogged with damp and oily soot, use oven cleaner on it, then hose it off. NB, do not use a caustic soda (sodium hydroxide) type if your fan contains aluminium parts. Phil Gibbons has built an O&K 0-4-0+0-4-0 Mallet, a compound, and he has an O&K catalogue which gave him dimensions. The boiler is fixed to the front of the rear chassis and has slides fore and aft. The weight on the front bogie can be adjusted (**photo 4**). An item on good procedures is illustrated by a case from my own Sheffield SMEE. **W. www.ndmes.org.au**

Grimsby & Cleethorpes Model Engineering Society's *The Blower*, for July, says that contractors arrived on site with a digger, power shovel and roller, and were almost finished after four days! Martin Reed built a 3D printed, solar powered tram. (My 2011 solar train used IP Engineering parts – Geoff)

W. www.gcmes.com
PEEMS Newsletter, July, from **Pickering Experimental Engineers & Model Society**, says that of nine entries for the Mike Sayers Trophy, the winner was Chris Bramley with his Ransome's threshing machine. Ransome's last real one was built in 1954 and Foster's in 1961. Mike said that this competition was one of the best trophy nights he had seen in modelmaking quality. Paul Windross was at Elvington on 16th July. Fastest man on the day was Guy Martin at 257mph. (That man knows no fear! - Geoff) Our attention is drawn to a symposium on Joseph Bramah and precision engineering, on 5th November in Sheffield, at Kelham Island Museum, arranged by the Newcomen Society.

Stamford Model Engineering Society, July newsletter, begins with editor Joe Dobson's report of his river cruise from St Petersburg to Moscow. He noted a 'Meteor'



Phil Gibbons's O&K Mallet at NDMES (photo courtesy of Steve Reeves).

hydrofoil which joined them at one point. I saw one in May crossing St Petersburg harbour - very impressive it was. Probably the 'Raketa 101', *Mikhail Kalinin* which can travel at about 40 mph. I have no

photographs as we were told not to take pics in the harbour area, but Google it, and this is from Pixabay – it's the one on the left (**photo 5**).

Men in Sheds *Shoulder to Shoulder* July issue reports on a visit to Street Men's Shed by Kate Humble, who was struck by the friendship and camaraderie shown by the members. They had never met before and all said that MiS had transformed their lives. Ticket applications were invited for Shedfest in early September, in Worcester. Dalbeattie Men's Shed is rebuilding a Skeoch cyclecar. **W. dalbeattiemensshed.co.uk/skeoch**
And finally, from a radio amateur posting, "My wife adores my hobby... bodybuilding."

Contact:
geofftheasby@gmail.com



St Petersburg hydrofoil (photo from Pixabay, copyright free).

DIARY

SEPTEMBER

- 13 Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre, Tiverton, 7.30pm. Contact Chris Catley: 01884 798370.
- 14 Cardiff MES.** Steam Up & Family Day. Contact Rob Matthews: 02920 255000.
- 15 Guildford MES.** Public open afternoon 2-5pm. Contact Mike Sleigh: pr@gmes.org.uk
- 15 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 15 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 15 Oxford (City of) SME.** Running Day, 1.30-5pm. Contact: secretary@cosme.org.uk
- 15 Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com
- 15 Plymouth Miniature Steam.** Public running, Goodwin Park (PL6 6RE), 2 – 4pm. Contact Rob Hitchcock: 01822 852479.
- 15 Rugby MES.** Public running 2-5pm – visiting locos welcome with boiler certificate. More info. at rugby mes.co.uk.
- 17 Romney Marsh MES.** Track meeting, 11am onwards, and BBQ, 5pm. Contact Adrian Parker: 01303 894187.
- 18 Bristol SMEE.** Autumn auction. Contact Dave Gray: 01275 857746.
- 19 Leeds SMEE.** Meeting night – 'The LMS 1831' – Malcolm High. Contact Geoff Shackleton: 01977 798138.

- 21 Westland & Yeovil DMES.** Track running day 11am – 4.30pm. Contact Bob Perkins: 07984 931993.
- 21/22 Lincoln DMES.** Open weekend at North Scarle, LN6 9ER. More details at www.lincolnmes.co.uk
- 22 Bedford MES.** Public running, from 10.30am at Summerfields Miniature Railways. Contact Brian Walton: 07498 869902.
- 22 Cardiff MES.** Open Day. Contact Rob Matthews: 02920 255000.
- 22 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 22 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 22 Pimlico Light Railway.** Public running 2-5pm. Contact John Roberts: 01280 850378
- 22 Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com
- 22 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 22 Welling DMES.** Public running at Falconwood 2-5pm. Contact Martin Thompson: 01689 851413.
- 24 Romney Marsh MES.** Track meeting, 11am onwards. Contact Adrian Parker: 01303 894187.
- 24 Wigan DMES.** Presentation by Mr P Mills on 'Deltic Engine Rebuild'. Contact Kevin Grundy: 07877 634184.
- 28 Romney Marsh MES.** Track meeting, noon

- onwards. Contact Adrian Parker: 01303 894187.
- 29 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.
- 29 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 29 Oxford (City of) SME.** Running Day, 1.30-5pm. Contact: secretary@cosme.org.uk
- 29 Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com

OCTOBER

- 1 Romney Marsh MES.** Track meeting, 11am onwards. Contact Adrian Parker: 01303 894187.
- 2 Bradford MES.** Talk: 'Electricity Before Electricity: Water Hydraulic Power in the 19th Century' – Ron Fitzgerald, 7.30-10pm, Saltire Methodist Church. Contact: Russ Coppin, 07815 048999.
- 2 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.
- 2 Bristol SMEE.** Talk: 'Modernising our Rolling Stock' – Gary Locock and Bert Roberts. Contact Dave Gray: 01275 857746.
- 3 Cardiff MES.** Talk: 'Steam Launches' – Richard Harvard. Contact Rob Matthews: 02920 255000.
- 3 Leeds SMEE.** Meeting night – 'Land Rover – the Troubled 1970's and Beyond' – Jonathan Stockwell. Contact Geoff Shackleton: 01977 798138.
- 3 South Lakeland MES.** Meeting in the pavilion, 7.30pm. Contact Adrian Dixon: 01229 869915.
- 4 North London SME.** Work in progress evening. Contact Ian Johnston: 0208 4490693.
- 4 Portsmouth MES.** Club night: 'Around the Cans' – RC model yachts, 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com
- 5 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 5/6 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 6 Cardiff MES.** Open Day. Contact Rob Matthews: 02920 255000.
- 6 Guildford MES.** SMSEG open meeting 2-5pm. Contact Mike Sleigh: pr@gmes.org.uk
- 6 Oxford (City of) SME.** Running Day, 1.30-5pm. Contact: secretary@cosme.org.uk
- 6 Plymouth Miniature Steam.** Public running, Goodwin Park (PL6 6RE), 2 – 4pm. Contact Rob Hitchcock: 01822 852479.
- 6 Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com
- 6 Welling DMES.** Public running at Falconwood 2-5pm. Contact Martin Thompson: 01689 851413.
- 7 Newton Abbot & District MES.** Running day at Lindridge Hill. Contact Ted Head: 07941 504498.



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BRAND OF THE MONTH: MAMOD



Mamod have been manufacturing live steam models since 1936. Based in Birmingham, Mamod continues to produce high quality steam engines as it did when it was first established by Geoffrey Malins. Although the Mamod range has expanded vastly since those early years, it still produces engines with all the passion and quality engineering that was first seen during those founding years of Mamod.

Telford	MTLGO	£452.00
MKIII	MK3	From £336.00
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Brunel	MBrunelOG	£440.00
Boulton	1351BO	From £325
Tram	1351TR	£495.00
Brunel Goods Set	BGS-CC-N	£520.00
Tender	MTDR	£39.00
Tanker	MTNK	£39.00
Goods Wagon	MGWN	£44.00
Guards Van	MGVAN	£50.00
Telford Tender	MTDR-T	£45.00



*In stock as of 08/09/19, please note these loco's may no longer be available, check stocks online or call.
Please note basic range takes 4 weeks from initial order and other locomotives are in batches.
Batch dates will be in product description. Locomotives in stock will state instant dispatch available.

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Flexi Track - 12 Pack	SL600x12	£110.00
Flexi Track - 4 Pack	SL600x4	£38.00
Flexi Track - Single	SL600x1	£10.00
Setrack Curve - 6 Pack	ST605x6	£48.00
Setrack Curve - Single	ST605x1	£8.50
Setrack 38 Radius Curve - Single	ST607x3	£48.00
Setrack 38 Radius Curve - Six Pack	ST607x6	£48.00
Right Hand Point	SL6995	£45.00
Left Hand Point	SL6996	£45.00
Y Point	SL6997	£45.00
Small Radius Right Hand Turnout	SL6991	£45.00
Small Radius Left Hand Turnout	SL6992	£45.00
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Rail Joiners - 24 Pack	SL810	£3.50

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Jennie	Blue 32mm	£765
Little John	DHR Blue, Red Buffers	£602
Clarence	Brown, R/C, Insulated wheels	£1,710
Lilla Maroon	R/C Insulated Wheels 32mm	£1,809
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Billy	Due Aug 2020	
Lilla	Due Aug 2020	
Silver Lady	Due Aug 2020	
Russell	Due July 2020	
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Ceramic Gas Burner Set	DSUPGBS	£90.00
Three Wick Meths Burner	DSUP3WMB	£45.00
Dead Leg Lubricator	DSUPDL	£29.00
Small Brass Chimney Cowl	DSUPSRK	£38.00
Brass Cab Hand Rails	DSENSMCWL	£4.50
Brass Side Tank Hand Rails	DSENSHTR	£5.20
Brass Smoke Box Hand Rails	DSENSBXHR	£3.10
Cylinder Covers	DSENCYCV	£12.00
Brass Sand Boxes	DSENSBX	£12.50
Brass Tank Tops	DSENWTT	£9.40
Lubricating Oil	SWLUB30	£3.00
Meths Burner Wick	DSWWK6	£1.90
Curve Tipped Syringe	DSWCTS	£2.10
460 Steam Oil 500ml	DSW460SO500	£5.50
220 Steam Oil 500ml	DSW220SO500	£5.50
Solid Fuel Tablets	980001	£3.50
Water Filler Bottle	DSWWFB	£4.00
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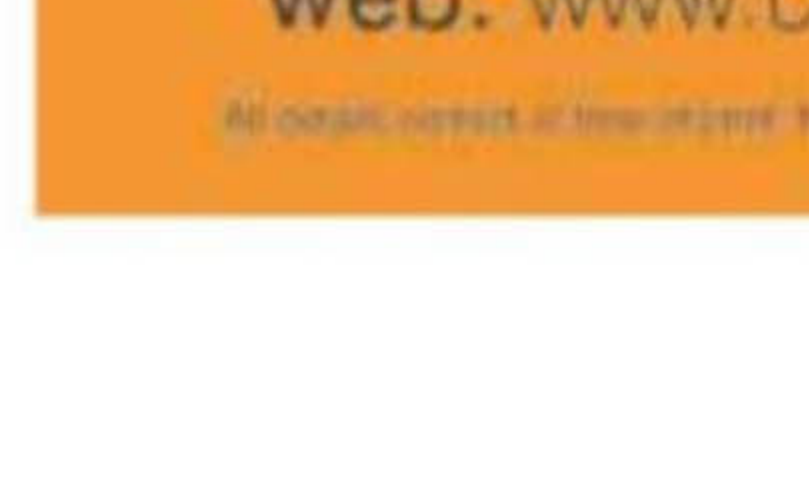
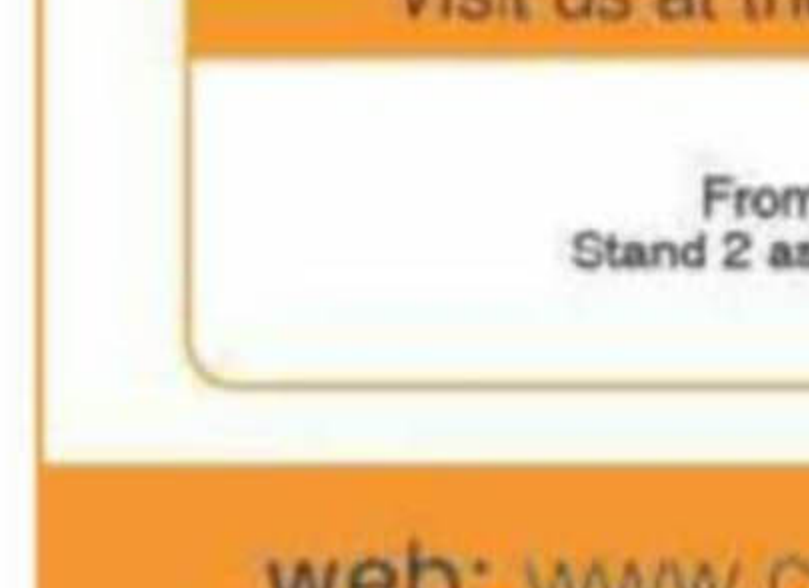
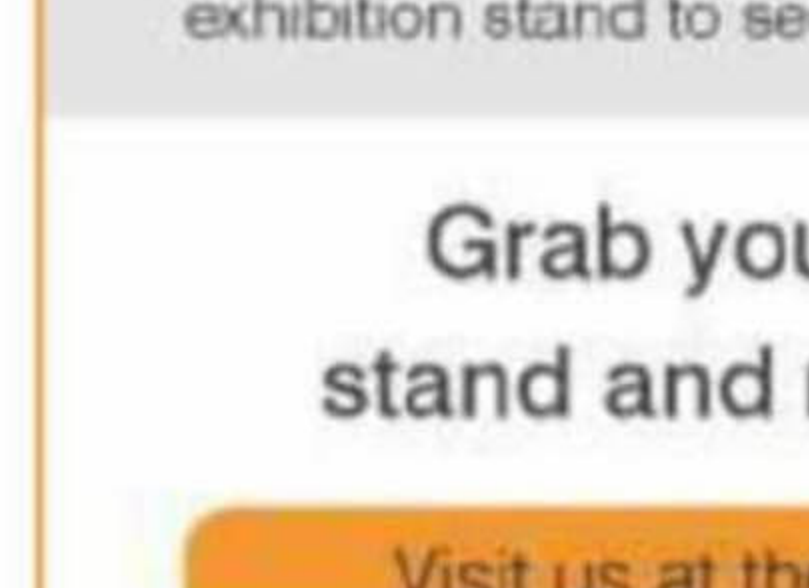
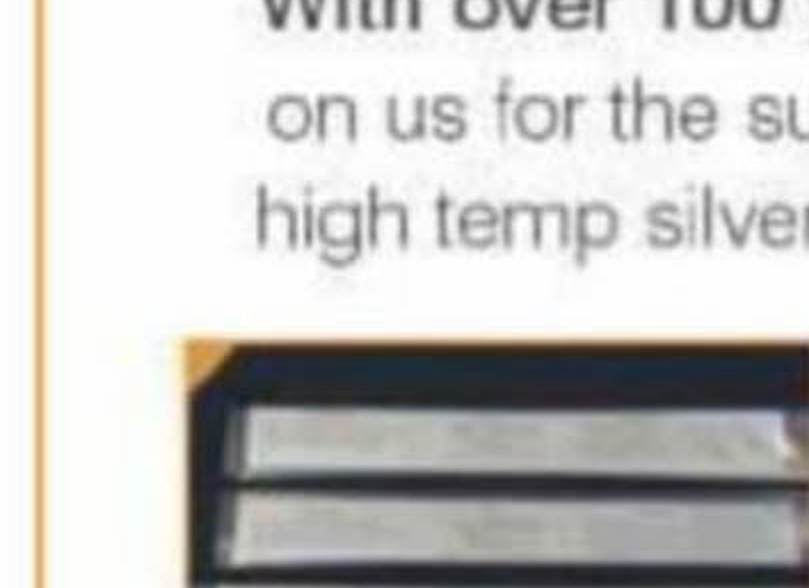


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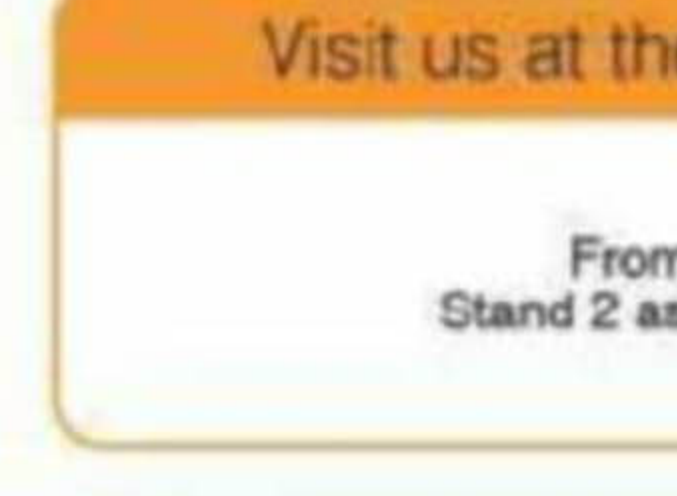
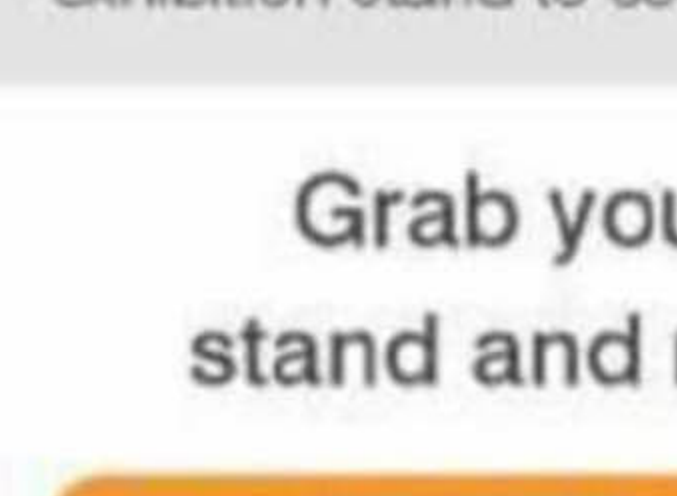
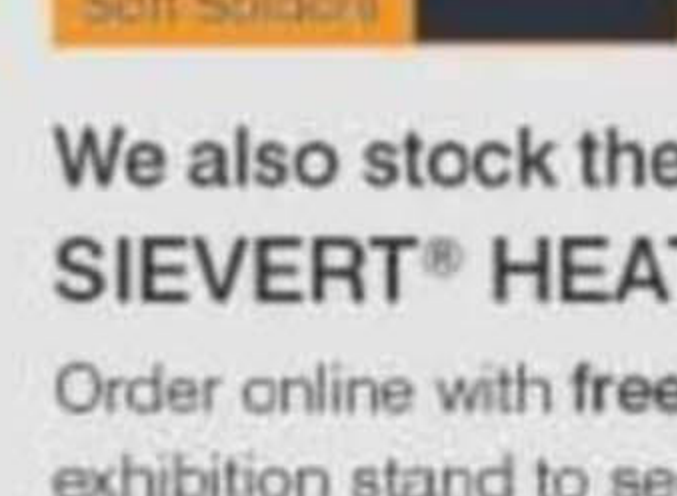
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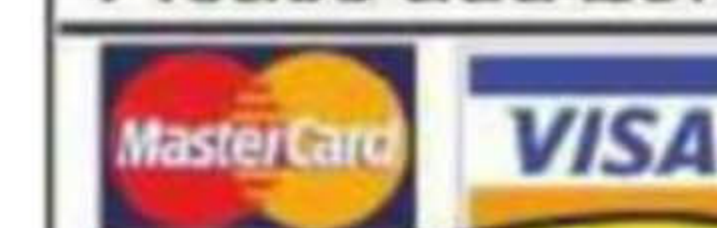
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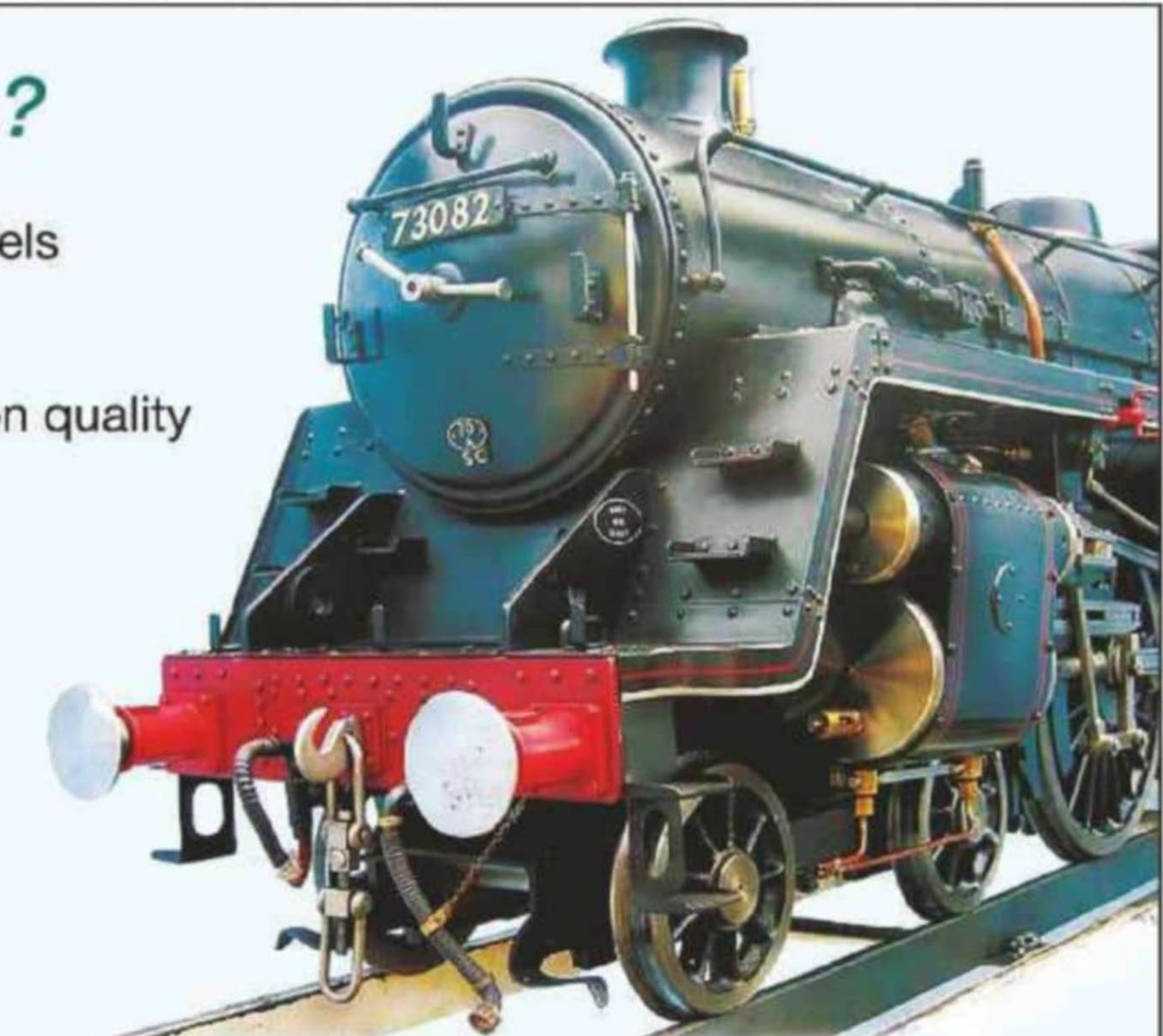
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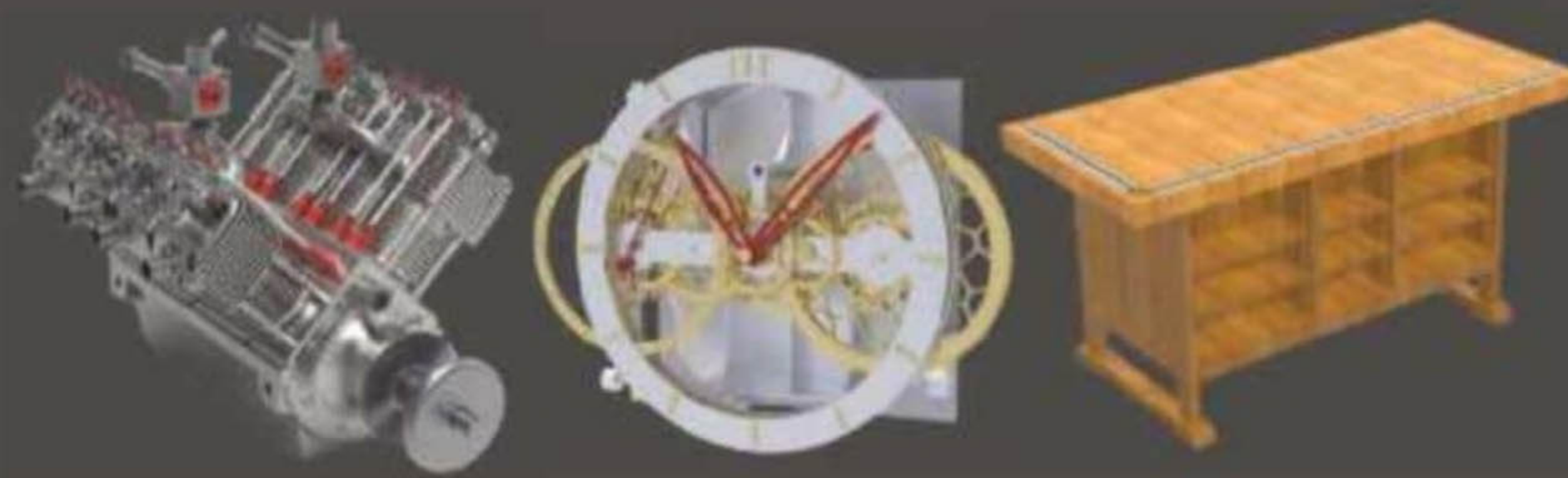
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Colchester Bantam 2000 fixed steady £375

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Myford gearbox, leadscrew and guard £725

Harrison M300 large 18" faceplate £295

Emco Unimat accessories Boxed! £1275

Startrite 275 12" saw bench cuts up to 4 1/8" thick! £1275

123 blocks £30 each

R8 collets 6mm 10mm 12mm 16mm set £40

R8 collets 1/4" 3/8" 1/2" 5/8" set for £40

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