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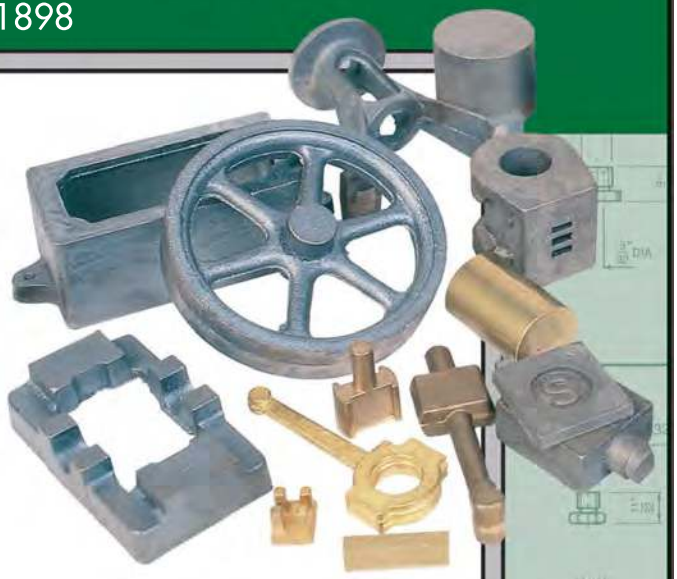

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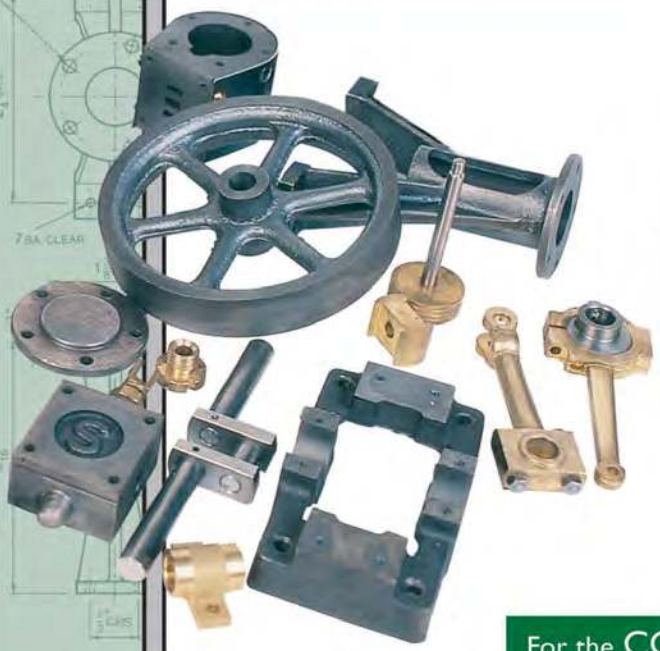

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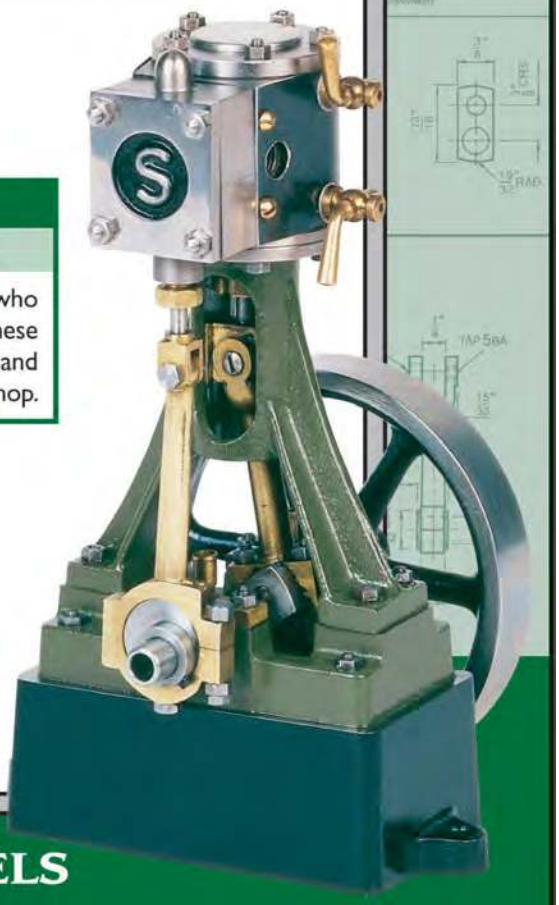

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CONTENTS

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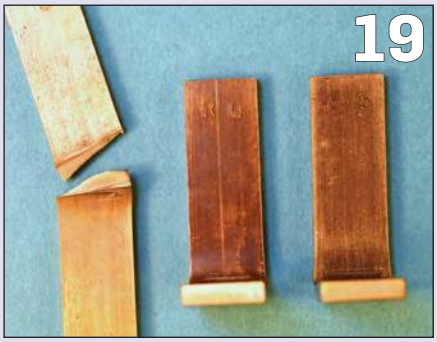

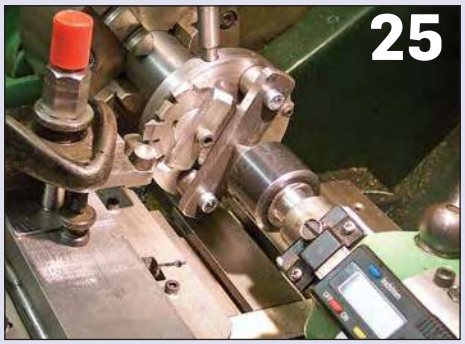

FRONT COVER

The weight of a large locomotive could force a model engineer to downsize – ideas such as this overhead crane could prevent this.

Photo: Bob Davies

EDITORIAL

Beating the weighty issue of big engines

Welcome to EIM and by the time you read this we will be heading into high summer, the clubs will be busy with visitors and lots of action to be had each weekend. In fact looking at the latest selection of excellent magazines and newsletters that we receive each month from the clubs, it's good to see some impressive new projects coming to fruition, and we highlight a couple – you have to be impressed by model engineers such as Worthing club chairman Kevan Ayling, who deciding he wanted to build himself a traction engine went straight for a 4-inch scale example! Certainly makes the pile of components for a 1-inch scale 'Minnie' that have occupied a corner of the editor's workshop for several years look very – small...

Of course big engines, whether rail or road, are impressive but they come with challenges, not least their weight, especially as we get older. So I was particularly pleased to receive the piece from Bob Davies that we publish this month, on building an overhead crane for the workshop. It's a brilliantly simple idea that could help a model engineer continue building the size of engine they are used to rather than being forced to downsize.

Such features are just the kind I like to use – while nut-and-bolt builds such as Martin Gearing's vertical boiler and Andrew Strongitharm's 'Dougal' (taking just a one-issue break this month) are core to the magazine, such 'useful variety' as the crane are just as important, as are in-depth studies for the experienced model engineer to get their teeth into, such as Brian Wood's trials and tribulations with gear cutting. And subjects such as Dave Rowe's automata provide something very different while equally valid – what lucky grandchildren he has, receiving such excellent pieces of home-built engineering as presents instead of some mass-manufactured modern piece of electronics and plastic.

Of course, such variety remains difficult to achieve, as stated last month we are always looking for good new features to interest our readers, and we pay for published articles! We've had some interesting stuff in since last month's request, but please keep them coming – your fellow model engineers want to hear about YOUR project!

Andrew Charman – Editor

The August issue of **Engineering in Miniature** publishes on 18th July.

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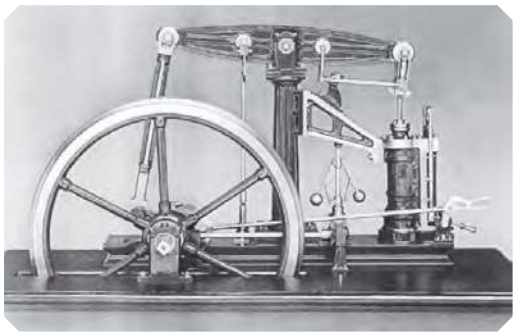

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National Model Engineering & Modelling Exhibition 2019

John presents the first of two reports on another successful Doncaster show.

BY **JOHN ARROWSMITH**

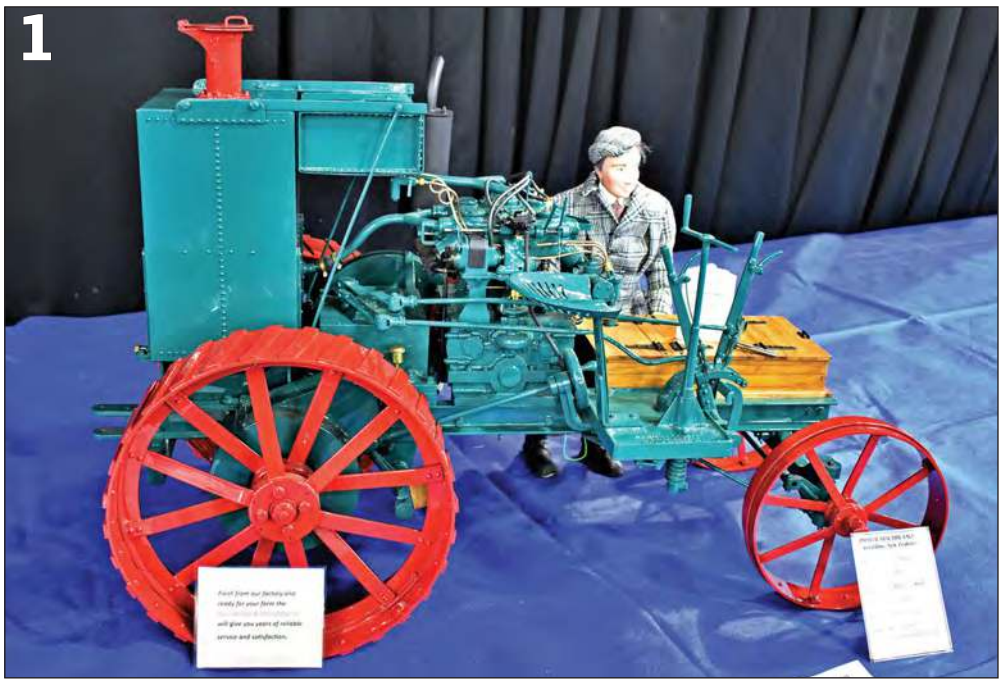


PHOTO 01: George Punter built the Duke of Edinburgh Challenge Trophy-winning Saunderson & Mills Tractor.

PHOTO 02: A superb 5-inch gauge GWR Achilles 4-2-2 loco built by Alan Crossfield won a Gold medal and two trophies.

PHOTO 03: Winner of a Silver medal was this fine Midland 4-2-2 locomotive in 5-inch gauge by Alan Boot.

PHOTO 04: Silver for a 7¼-inch GWR 4-4-0 Dukedog loco built by Richard Byram.

This fine three-day exhibition opened on Friday 10th May at its usual venue of the Doncaster racecourse. The main exhibition space was full with an excellent range of models, demonstrations and traders.

An added incentive for the competition sections this year was the introduction of all of the SMEE trophies to the exhibition which I hope will become a permanent feature for future shows.

With 16 classes of competition and 13 major trophies available to be presented, the exhibition judges had quite a task on their hands. All the usual features were also on show to visitors together with the outside steamers and flyers.

Competition Results

The Premier award was the Duke of Edinburgh Challenge Trophy and this was duly presented to George Punter who had flown in from Australia a couple of days before the show began. His quarter-scale Saunderson & Mills Tractor circa 1913 was a highly detailed and finished model of a machine that was built in Elford, Bedfordshire in the early part of the 20th century (Photo 01).

The railway locomotive section was a real competitive arena with four super models in Class B1. The winner was the GWR Achilles class 4-2-2 circa 1898, built by Alan Crossfield. This superb model also gained a Gold medal and the J N Maskelyne Trophy along with the Charles Kennion Trophy (Photo 02).

Three Silver medals were awarded to the other locomotives in this class, a 5-inch gauge Johnson Midland Railway 4-2-2 built by Alan Boot (Photo 03), a 7¼-inch gauge GWR 4-4-0 Dukedog (Photo 04) built by Richard Byram and last but not least an LNER V2 built from works drawings by Ian Spencer (Photo 05). All these excellent examples of the model engineer's art were worthy winners of the accolades they received.

In Class B2 for locomotives in smaller gauges an excellent example of a rare model was the 2½-inch gauge 2-8-0 Austerity built by R. Holland – he had really captured the outline of these once numerous workhorses and

a Bronze medal and the New Zealand Cup was his reward (Photo 06).

A Commended certificate was presented to P Wooton for his little 0-4-2 freelance tender locomotive built in 2½-inch gauge.

In Class BK2 for kit-built locos an excellent model in 5-inch gauge of a Class 37/4, No. 37674 'St Blaise Church', gained a Silver medal for Michael Lock (Photo 07).

Moving onto the large group of Class A categories, the General Engineering section A2 produced a Silver medal for Mick Keenan for his unusual Wasp Mill Corless Tandem Engine (Photo 08). Excellent workmanship included the difficult linkages for the Corless valve gear.

Best in show

Two outstanding models graced the Internal Combustion Engine class, A3. Winner of a Gold medal, the Bradbury–Winter Memorial Challenge Cup and the Barry Jordan Trophy for Best in Show was the model of a 1929 4.5-litre supercharged 'Birkin' Bentley engine built by Mike Sayers (Photo 09). This fully deserved all the accolades, it was worth the entrance fee on its own just to view it. The quality in this model had to be seen to be believed while it was also presented with many of the jigs, fixtures and tools which had to be made to build the engine, and these were equally as good.

The Second Gold medal and the ▶

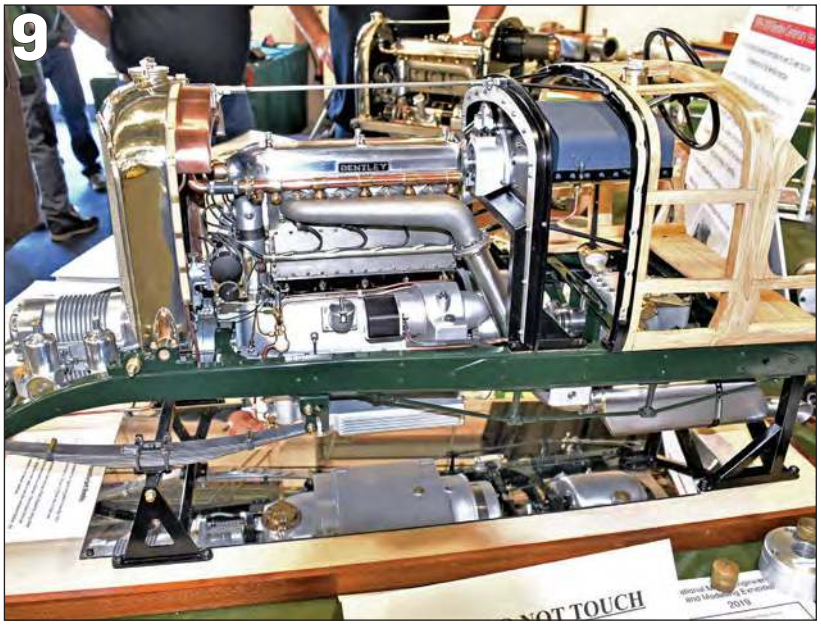
PHOTO 05: An excellent 5-inch gauge V 2 gained a Silver medal for Ian Spencer.

PHOTO 06: Winner of the New Zealand Cup and a Bronze medal was a 2½-inch gauge Austerity 2-8-0 built by R Holland.

PHOTO 07: This model of a Class 37/4 'St Blaise Church' won Silver for Michael Lock.

PHOTO 08: Silver for a Wasp Mill Corless Tandem Engine built by Mick Keenan.

PHOTO 09: Best in show was this fine model of a 4.5 supercharged Bentley built by Mike Sayers.



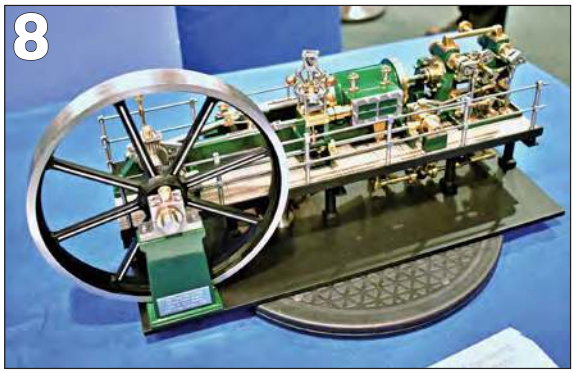


PHOTO 10: Tom Pasco's Gold-winning freelance 40cc supercharged I/C Engine.

PHOTO 11: George Punter's 30cc petrol engine was commended.

PHOTO 12: John Dickenson won Gold and a trophy for his 4-inch scale Foden Type C with van body.

PHOTO 13: A bronze medal went to David Hall for his 4½-inch scale Foden truck.

PHOTO 14: Very highly commended was this 4-inch scale Foster traction engine that Jonathon Gittins built.

PHOTO 15: Named best road engine in steam was this little 4-inch scale Ruston SD tractor built by D Newton.

Edgar Westbury Memorial Trophy in this class went to Tom Pasco for his immaculate Freelance 40cc Supercharged 60-degree V – twin i/c engine which showed all Tom's skill in machining such items as the difficult cylinder casings (Photo 10).

A Commended certificate was also presented to George Punter for his example of a Freelance Face Cam 30cc water-cooled petrol engine (Photo 11).

Quality road engines

The Class A4 Engineering Section for mechanical propelled road vehicles had three excellent models in competition. A Gold medal and the Aveling–Barford Trophy was awarded to John Dickenson for his Foden C-Type with van body circa 1929, again displaying excellent workmanship and attention to detail and finish (Photo 12).

David Hall received a Bronze medal for his 4½-inch scale Foden flatbed truck (Photo 13) and Jonathon Gittings received a VHC certificate for his 4-inch scale Foster (Photo 14).

The Raymond McMahon Trophy for the Best Road Vehicle in Steam went to D Newton for his 4-inch scale Ruston HD Tractor (Photo 15).

In Class A4K for kit-built road engines, the 4-inch scale Burrell showman's engine built by John Buckley received a Gold medal and the Bill Hughes Cup. Beautifully finished and presented with lots of polished brass and all lights working, it was a fine sight in the exhibition hall (Photo 16).

Class A5 for tools and workshop equipment attracted one competition entry, John Brittain receiving a Commended certificate for his nicely made dividing head (Photo 17).

In Class A6, Horological Scientific

& Optical, there were two completely different exhibits for consideration. The astro-photography telescope with a Crayford focuser gained a Silver medal for Neil Wyatt (Photo 18), and was displayed with a set of deep-space photographs taken with the device which were an impressive addition. The other exhibit in this class was the timepiece with date work built by James Buxton.

Three entries fought out the general class A7 with the 3-inch scale acetylene traction engine lamp built by John Dickenson receiving a Bronze medal (Photo 19). Commended certificates were awarded to Nicholas Farr for his basic magnetic compass (Photo 20), and to John Clarke for his automata, a British drummer boy of the Napoleonic War era (Photo 21).

Just one entry featured in the marine model section Class C9, a USS Gato class submarine built by Christopher Behan, which was awarded a Bronze medal (Photo 22).

Horse-drawn battle

Class G1, for model horse-drawn vehicles, provided six interesting exhibits to be considered. Three Silver medals were awarded along with three Very Highly Commended certificates. John Castle won Silver for his ⅛th scale Conestoga Wagon, the original of which came from Canada (Photo 23) together with the Guild of Model Wheelwrights Trophy for best model. He also gained a second Silver for his ⅛th scale Northumberland long cart (Photo 24), and a VHC certificate for his example of a Northants water cart, again in ⅛th scale.

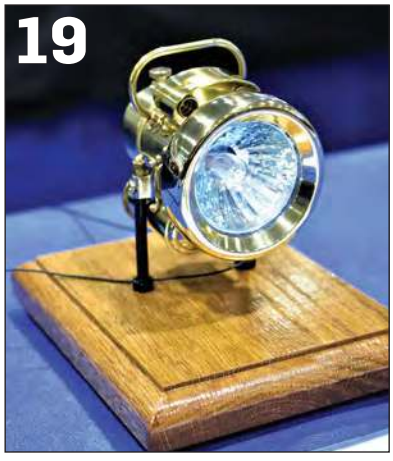


PHOTO 16: This 4-inch scale Burrell Scenic showman's engine won a gold medal for John Buckley.

PHOTO 17: A useful dividing head by John Brittain was Commended.

PHOTO 18: This astro-photography telescope and Crayford focuser won a Silver medal for Neil Wyatt.

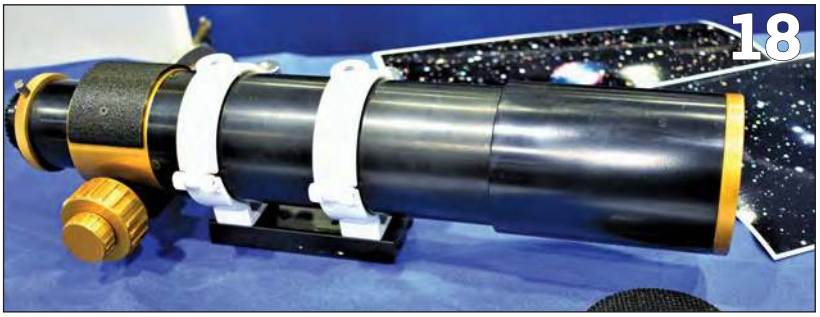
PHOTO 19: A Bronze medal was awarded for this acetylene traction engine lamp built by John Dickenson.

PHOTO 20: Commended, the little basic magnetic compass built by Nicholas Farr.

PHOTO 21: John Clarke's automata, a British drummer boy, was also Commended.

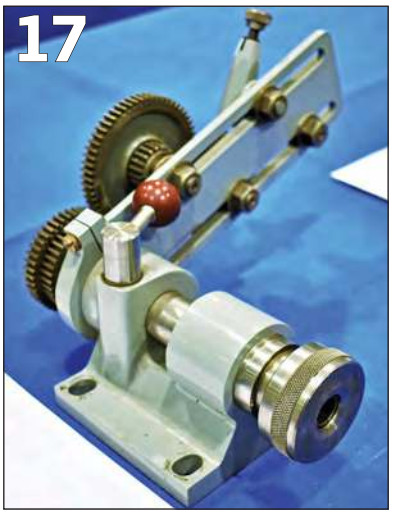
PHOTO 22: The sleek lines of a Gato-class submarine won Christopher Behan bronze.

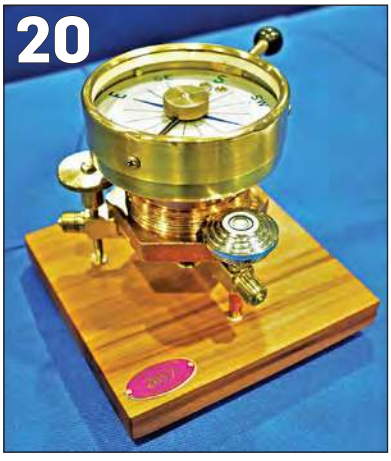
All photos in this feature by the author



The third Silver medal went to Mike Casey for his 2¼-inch scale model of a Merryweather 'Gem' fire engine (Photo 25), while Brian Young gained two VHC certificates for his horse-drawn sling cart and his Beach's jam wagon (Photo 26).

Class K1/1 produced an unusual model by Richard Foster of a scratch built futuristic flying car which gained a VHC certificate (Photo 27). ▶





Class K2/1 also produced an unusual model in the shape of a Russian ICBM missile transporter and rocket – very well made by Dave Gore it too gained a VHC certificate (Photo 28).

In Class K6 Richard Foster was again successful with his model of a Delorean car for which he received a Silver medal (Photo 29).

Class K7 for motor vehicles – functional vehicles contained a good selection of well-made models which produced a number of prize winners. A Gold medal was awarded to Christopher Behan for his Allis Chalmers M8 high-speed tractor which showed some excellent workmanship and detail and was finished in American army livery (Photo 30).

A Silver medal was presented to David Plant for a model of a Liebherr Lr 634 digger (Photo 31) and he also won a Bronze medal for his fuel-proof diesel bowser.

PHOTO 23/24: John Castle won Silvers for his Conestoga Cart and his Northumberland Long Cart.

PHOTO 25: Silver winner, Mike Casey's Merryweather 'Gem' fire cart.

PHOTO 26: All very highly commended were Brian Young's Beach's jam wagon...

PHOTO 27: ...a futuristic car scratchbuilt by Richard Foster...

PHOTO 28: ...and a Russian ICBM built by David Gore.

PHOTO 29: Richard Foster's Delorean took a Silver medal.

PHOTO 30: An Allis Chalmers M8 high-speed tractor built by Christopher Behan won Gold.

PHOTO 31/32: David Plant's Liebherr Lr 634 digger and Claas Xerion 5000 tractor were both successful.

PHOTO 33/34: Winning stands from Grimsby & Cleethorpes MES and Kirklees MBC.

Multiple winner

Prolific builder David Plant also gained three VHC certificates for examples of a Kane low-loader, a Krampe tipper trailer and a Fendt 930 tractor. He finished off the class with a Highly Commended certificate for his model of a Claas Xerion 5000 tractor (Photo 32) – a very successful presentation by David which added to the overall competition.

Winner of the N.A.M.E shield for the Best Club Stand was the Grimsby & Cleethorpes MES for a display which I think covered almost every model engineering discipline (Photo 33). Finally the winner of the Ship Model Society trophy was the Kirklees MBC for a very comprehensive collection of marine craft in many different scales.(Photo 34)

I hope I have presented a good selection of photos which show the quality that was at the Doncaster exhibition, next month I will cover all the club stands and displays which I hope will inspire you all to go along next year and see for yourself. EIM

Building a workshop overhead crane

Bob comes up with an excellent way to ease the moving of large heavy items in the workshop, and to avoid the potential for physical injury...

BY **BOB DAVIES**

Generally, most of the day-to-day lifting in a model engineering workshop requires little effort, beyond the handling of tools and materials during the manufacture of many small parts.

As a project grows, however, these parts can form into a single, bulky lump of considerable weight, needing a lot of man-handling.

During the later stages of a complete refurbishment of my 3½-inch gauge 'Britannia' locomotive, I routinely dragged it, in its crate weighing a total of 46kg, from my garage, through into the workshop and then lifted it manually onto the workbench so that I could work on it. Then, if I needed the bench space for other things, I had to reverse the procedure to return it to the garage.

The real problem was the floor-to-bench lifting and lowering and with my present project, a 5-gauge BR 1501 rapidly gaining weight, I could foresee a need to lift a weight exceeding 60kg. – I needed some mechanical assistance.

Practicalities

My workshop is tiny, measuring a mere 8 feet x 7 feet with no room for storing a lifting table. I contemplated a hoist of some sort, but with the only useful support structure at just 2.2 metres above floor level, a rope/chain hoist was out of the question.

After a thorough search on the Internet, I found an electrically operated hoist, of which there are many examples available, all of very similar, compact design and intended for overhead fixing.

With due regard to my particular requirement I decided that if the hoist could be suspended from a short, overhead track, it could then be traversed between the pick-up and put-down positions. So I next needed to checkout what I could use to support the track.

Structural consideration

My workshop occupies the partitioned-off, rear extension of a sectional, concrete garage, having timber rafters with collar-beams, supporting a pitched, tiled roof.

After consulting a copy of *Kempe's Engineer's Yearbook*, which contains tables of safe loading for rafters, with regard to cross-section, span, pitch-angle, spacing and such – and having a spare tile of the type used on the roof, I calculated that the area above where I wanted to put the track could support an additional 33kg per square metre, or 115kg overall.

HEADING: Locomotive 1501, raised to its full height above the bench via the overhead crane.

RIGHT: The complete overhead crane installed in the workshop.

All photos in this feature by the author.

The tables in *Kempe's* included an additional allowance for the roof being walked on, for maintenance, so I felt there was a good margin of safety, and, because the end wall and partition were of reinforced concrete, I could use these for extra support. As a final test, I hung my own 88kg weight at each intended support point. Everything seemed more than adequate for my aims and with a 100kg maximum load as my target, I decided to go ahead and placed an order for the hoist.

Track design

I first intended to make the track and support rollers myself, but then I remembered that the double, sliding-doors between our kitchen and dining-room hang on a roller-track.

After another web search I found a supplier of industrial roller-door gear, which enabled me to select and place an order for the parts I needed;

2m	150kg/m track
2	roller hangers
4	track support brackets

When the piece of track arrived, I tested it for bending with an 88kg (my weight) load at the centre, when supported on either side at 1.2-metre centres. A deflection of 3mm suggested to me that if supported it as I intended, the load would be spread fairly evenly between support points.

I duly installed the track and for good measure, included an anchor-point on the concrete end-wall behind the bench.

Hoist fixing

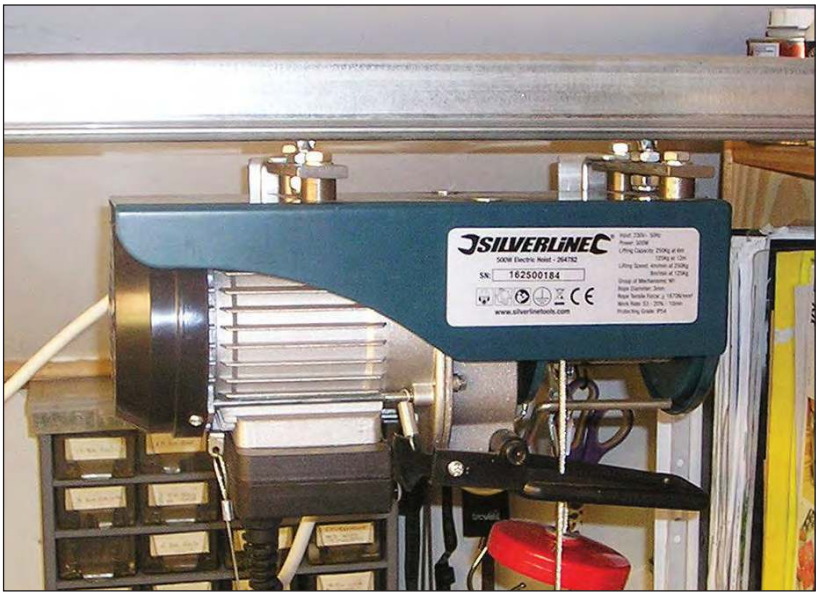
The hoist had to be hung from the roller hangers, so adaptors were needed. These were just a couple of 1-inch x ¼-inch steel bars, each 5 inches long with two holes matching the threaded attachment points on the top of the hoist and a central hole to fit the threaded hangers of each roller.

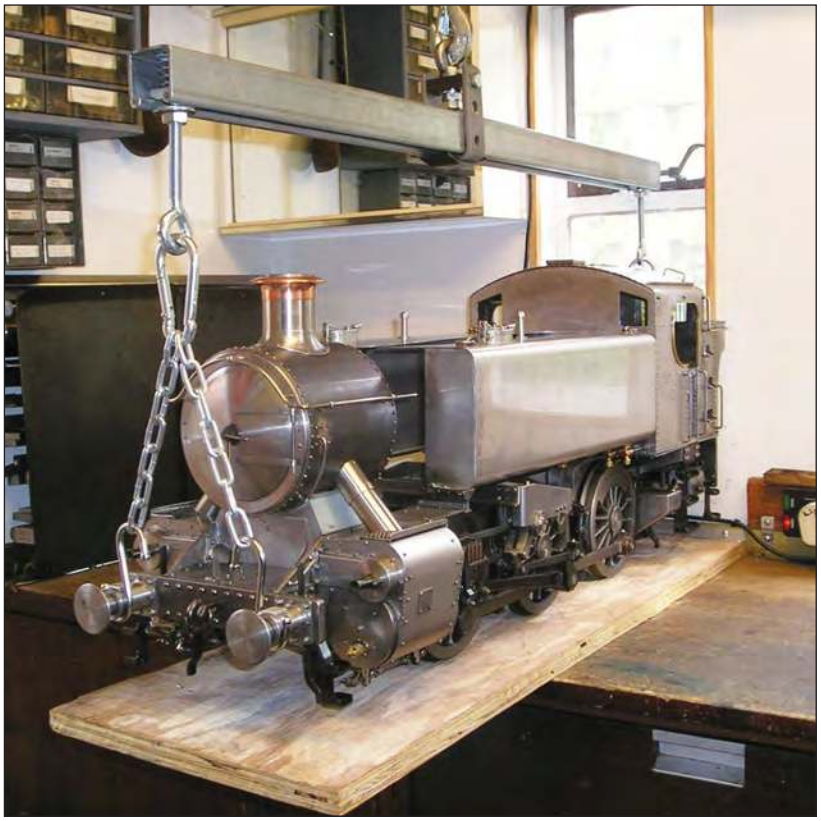
To gain as much height as possible, I cut the hangers short to bring the hoist closer to the track. The adaptor bars were then clamped tightly to each hanger between two locknuts, then bolted to the top of the hoist, with ½-inch long spacers to provide clearance for the lower locknuts.

My hoist came with a very short mains cable which I replaced with a much longer one of the same rating. This allowed me to arrange for loops in the cable that would allow free horizontal movement along the track.

The control pendent cable was, by comparison, much too long for my application, and had to be shortened to a much more useful length.

The hoist offered two operating modes – **Direct mode**, with a capacity of 125kg @ 8m/min, and **Indirect**





TOP: The track – one of the support brackets is visible as are the hangers for the hoist.

UPPER RIGHT: The hoist mounted on hangers, with the adapter bars visible.

RIGHT: 1501 sits on the 'Pier' platform, making working on both sides of the loco an easy process.

LEFT: The hoist, parked out of the way with its control pendent neatly stowed away.

LOWER LEFT: 1501 lowered for transport – transferring a heavy loco to the floor is an easy process that no longer requires major muscle use!

mode, using the pulley option, with a capacity of 250kg @ 4m/min.

I found 8m/min in the direct mode much too fast, making inching difficult without incurring a sudden snatch when lifting or a bump when setting the load down, so I settled for the 4m/min of the indirect mode, which is not so fierce and easier to control when inching.

Testing

With a suitable sling attached, I tested the setup by applying increasing loads up to 100kg, checking for any downward deflection of the track. Nothing significant was noted.

The final test was the lifting of the crated 'Britannia' from floor level and placing it safely onto the bench. This went as smoothly as expected.

Now, I had a crane, I needed a few extra items for attaching things to it. Picking-up a crate by the handles is easy, but lifting a part-built, front-heavy loco by the buffers presents a severely unbalanced load, so I made a lifting-beam out of a length of heavy-duty 'unistrut'.

I made the centre shackle moveable, so I can slide it to the point where the load hangs level. It is also supported by a swivelling eyebolt, which allows the loco to be turned around its vertical axis.

An unexpected bonus is that when a loco is supported horizontally by the lifting-beam, the position of the centre shackle reveals the approximate horizontal centre of gravity. I'm hoping that when 1501 is finished, the shackle will be right over the driving axle.

In Use

Apart from its original purpose of lifting heavy things on and off the bench, I'm now using the crane almost on a daily basis, to manoeuvre the loco while I'm working on it.

Not having a walk-around bench has always meant a good deal of effort to turn a loco around to get at both sides, Now, with the crane, I can turn it around quickly, making the job of detailing much easier. I can also lift it high onto support stands for working on the underside.

To make things even easier, I've made a removable 'Pier' platform, which pushes under a ledge at the back of the bench and projects out at 90 degrees to it. With the loco lifted onto this, I can work on it at either end, around both sides.

Conclusion

I've had the use of this crane for nearly two years now and it's like having someone else in the workshop to do all the heavy lifting. What more could you want? EIM

A diesel-outline battery loco

Jan-Eric continues the build of his easy-to-run battery loco, this month detailing the superstructure that he built in the opening episode last month.

BY **JAN-ERIC NYSTRÖM** Part two of a short series

Detailing the body

Having completed the basic superstructure of the locomotive at the end of last month's opening feature, at this stage, the smooth cab and hoods didn't look like much, they needed quite a bit of small detailing. The most difficult parts were the ventilation openings on the side of the front hood – I had to think quite a bit over how to make them.

I finally constructed a small 'tool-and-die' punch, seen in **Photo 20**. The die is just a piece of plywood with a slit routed out with a mill bit, and a piece of steel plate ground to a 45-degree angle at one end. Note the routed-out top part of the brown plywood, as well as the strips on the side that hold the top piece in place.

Photo 21 shows the tool in operation; a good whack with a hefty hammer will punch a neat, long hole into the 0.3mm thick aluminium plate – a piece from a discarded offset plate I got from a friendly printing company, years ago. It is very important to tighten the top plywood part securely (I've used the hold-downs of my mill table), otherwise the thin aluminium plate will buckle when it is punched.

Photo 22 shows the result of a few hammer whacks – the spacing between the 'slits' is automatically maintained by placing the edge of the previously punched hole against the lower edge of the routed-out area, above the slit in the bottom plywood piece. **Photo 23** shows the aluminium plate from the front. A few trials on a piece of scrap quickly taught me how to get an even, consistent result.

In **Photo 24** I've glued the doors and ventilator plates to the plywood side of the engine's hood with two-component 'Quick-Epoxy', which hardens in about five minutes, so I had to work pretty fast. Some of the pieces show the images on the printing plate – but they were soon painted over!

In **Photo 25**, the ventilator plates already have a primer coat, and even though the result is not as smooth and refined as in a factory-made product, I was pretty satisfied with what could be done with a couple of simple pieces of plywood as a former.

The front of the prototype loco has movable louvres for the cooling system, but I decided not to copy that exactly. Instead, I just simulated the looks of the closed louvres by gluing strips of aluminium (yes, printing plate again) to the front and sides of the hood. **Photo 26** shows the strips 'raw', and **Photo 27** after an epoxy primer coat (a friend told me I'd only need to add the classic 'RR' logo to the top of this front, and my loco would look like a very expensive, famous British car...).

I had bought a one-litre, two-can set of the epoxy primer, intended for maritime use; it adheres to otherwise very difficult surfaces, such as glassfibre and polyester, so it was ideal

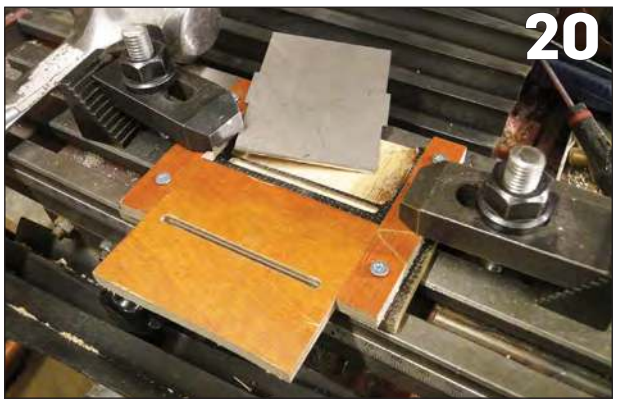


PHOTO 20: A quickly built tool to punch the ventilation openings into thin plate of aluminium.

PHOTO 21: One whack of a heavy hammer punches the tool through the plate. Note how the top plywood piece is tightly clamped to the bed.

PHOTO 22: The cut-out in the bottom plywood piece helps in ensuring the ventilation slits are spaced at equal distance.

PHOTO 23: The slits seen from the front side of the aluminium plate. It is important to punch them as evenly as possible.

"The most difficult parts were the ventilation openings on the side of the front hood – I had to think quite a bit over how to make them...."

for my marine plywood, which is coated with a tough, but somewhat slippery phenolic coating. I did sand it down to a matte finish, just to be sure the primer would adhere well. The instructions told me simply to mix the contents of the two cans, but since I applied the primer coating only a little at a time, I measured out small amounts of paint and hardener in the correct proportions – only as much as I needed for the area to be coated – otherwise, I'd have had a litre of solid epoxy in the can the following day...

Photo 28 shows the entire superstructure in the primer coat. The wheels are loosely placed under the base, just to give me an early impression of the whole engine. Photo 29 shows it from the back – the lid on the back hood is still not painted. All necessary controls will be hidden under this lid; the driver will hold a little 'remote box' in his hand when running the engine.

A very distinctive feature of this loco type is the 'chimney' – even diesels need them! Photo 30 shows how I constructed it – a piece of high density urethane foam, as used for foundry pattern making, was formed to the characteristic rounded shape, and two miniature, non-operating horns were quickly turned on the lathe and attached to it.

The bell (also non-operating) was turned from the same foam material, but ordinary hardwood would do, just as well. The loco will have a signalling horn, but hidden inside the hood – more about this in an upcoming issue. All details were painted with auto ▶

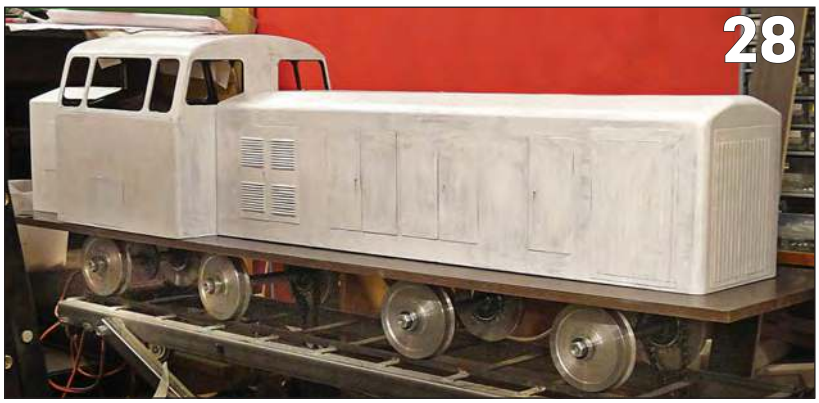


PHOTO 24: All of the decorative plates are epoxy-glued to the side of the hood.

PHOTO 25: The ventilator slits are painted with epoxy primer.

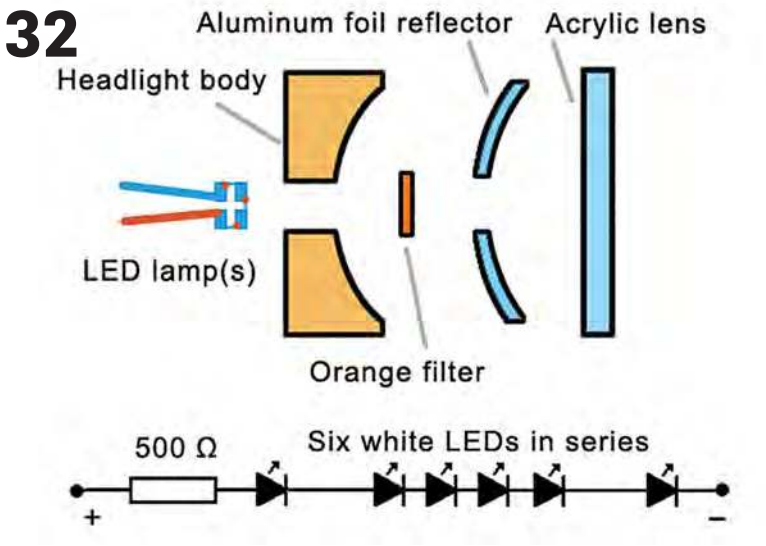
PHOTO 26: Front and side louvres are glued on.

PHOTO 27: With a RR logo, the front of the engine would look like a Rolls-Royce!

PHOTO 28: The right side of the loco structure, painted with epoxy primer.

PHOTO 29: The top of the rear hood will be hinged, to conceal the electric switches of the controls.

PHOTO 30: Small details make the miniature look more like the full-size prototype.



spray paint in shades as close as possible to the original.

Photo 31 shows the distinctive chevron pattern present on the front of most Finnish diesels; I cut a mask from self-adhesive plastic to the correct pattern, and could then spray paint the shape. The photo also shows the as yet unfinished headlights; the basic 'bodies' are turned from the same material as the chimney and the bell, and then epoxied to the hood.

Working headlights

The headlights contain LEDs, and will light up as soon as the engine is powered on. The method of construction is simple – see Figure 32. The main headlight contains four LEDs, the smaller ones contain one LED each. They are inserted in holes drilled all the way through headlight and loco front, the leads protruding on the inside.

All the LEDs are connected in series with a 500-ohm current-limiting resistor, and a cable is attached inside the top of the hood, going all the way into the cab. The 'reflector' is ordinary household aluminium foil, pressed and glued into the bowl of the headlight. This caused a few wrinkles, but they became invisible when I added the 'lens' made of clear acrylic plastic, sold as Plexiglas, Lucite or Perspex. How come, you may ask – well, I filled the entire cavity of the headlight with hot glue! When it cools, it has a slightly milky appearance, nicely diffusing the light from the LEDs, and being only half-transparent, it also hides the wrinkles in the foil.

"The headlights contain LEDs, and will light up as soon as the engine is powered on..."

PHOTO 31: Headlights are attached to the front.

FIGURE 32: The headlight construction.

PHOTO 33: Turning acrylic sheet to a circular shape. Hot glue is used for work holding.

PHOTO 34: Completed hood and cab.

The little orange filter piece (which could be cut from a strip of unexposed, but developed colour negative film, usually found in the beginning or end of a roll, or other similarly coloured plastic) will alter the bluish-white colour of the LEDs to a more natural, warmer colour, simulating the incandescent bulbs used in these more than 50-year old engines.

The acrylic lenses can be turned to size on the lathe, but work holding presents a slight problem – you can't both hold and turn the outer diameter of a thin piece by just gripping it in the chuck... so hot glue to the rescue again!

While the hot-glue gun was warming up, I turned the end of an aluminium dowel flat, and could attach a roughly-sawed out piece of acrylic with a little blob of hot glue. This has to be done quickly and carefully, since the glue will congeal in just a couple of seconds – it is better to squirt the blob on the piece of acrylic, and then press that onto the dowel as centrally as possible.

Taking shallow cuts, I could turn the lenses to shape very easily, Photo 33. If you take too deep a cut, the plastic will melt and deform at the turned edge. You do need a bit of force to break off the finished lens from the dowel, and some glue may stick to it, but it can be carefully peeled off.

After assembling the headlights, and adding narrow aluminium rims on the outside (printing plate again...), I could power on the lights and sit back and enjoy the looks of the superstructure, now also equipped with handrails and a ladder, Photo 34. These are made from 4 and 5mm round, mild steel. Nuts on the rear side hold them in place. The hatches and vents on top of the hood are still missing – as you will note if you compare this to the original prototype in Photo 1.

Some other differences are intentional, for instance, the height of the handrails. I have modelled the original, low handrails from 1963. They were later changed to higher ones, with an extra bar in the middle. The single large top headlight was also changed to a pair of smaller ones at one point. EIM

NEXT MONTH: Faced with expensive laser cutting, Jan-Eric plasma-cuts steel parts for the bogies.

■ Part 1 of the series appeared last month. For back issues go to www.world-of-railways.co.uk/engineering-in-miniature/store/back- issues/ or call 01778 392484.

To quench or not to quench...

The latest of John's useful workshop tips focuses on methods of annealing.

BY **JOHN SMITH**

I undertake annealing and silver-soldering in the open air to avoid noxious fumes in the workshop. My 'forge' consists of a metal stand for an Axminster scroll saw, to which a piece of MDF is bolted. A paving slab is laid over the MDF and a few refractory bricks are placed on the top to form the base, sides and back of the forge (Photo 1). The resulting forge is at a perfect working height.

Refractory bricks are heavy ceramic bricks containing alumina and designed for a maximum working temperature of 1600 degrees C. They have high strength and a relatively high thermal capacity so, once hot, they retain their heat better than lightweight insulation bricks. The latter can be used in a home forge, but they have low heat capacity and are prone to crack and crumble. Both kinds of brick are available in small quantities from Vitcas.com.

A commercial 'full anneal' of brass will heat the brass to 580 to 600 degrees C, hold it there for about an hour in an inert atmosphere, and then allow the brass to cool slowly.

A 'good enough' anneal is achieved by heating brass with a propane torch to 'black heat' and then allowing the brass to cool slowly. My artful dodge, given to me by master coppersmith Trevor Tremblen, is to anneal in the dark.

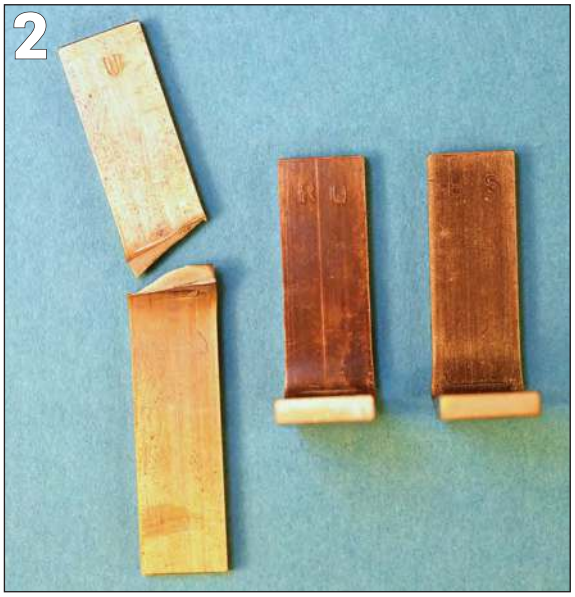
Heat the brass, removing the torch from time to time to see if the brass is just at the point of turning dull red. When the dullest of reds is visible, apply sufficient heat to hold the brass at the same temperature for just a minute or two. Then let the brass cool. It is not necessary to surround the brass with refractory material; the high thermal capacity of refractory bricks facilitating slow cooling.

There is a mountain of contradictory advice on the Internet, mostly from the US and mostly concerning the annealing of cartridge cases. Some sites will tell you authoritatively that the process I have just described should be used to harden brass. Many sites will advise you to heat the brass to red heat and then quench it in cold water. Either the laws of physics are different in the US, or people are giving us duff advice. I decided to conduct an experiment to see which approach works better.


1

Three 3-inch long pieces of ½-inch x ⅛-inch brass flat (CZ121) were cut from the same length of material. Each was stamped to identify the treatment to be applied (U for untreated; RQ for red heat + quenching in cold water; BS for black heat and slow cooling). Test-pieces RQ and BS were heat treated. Then each test-piece was bent in the fly-press. The results are shown in the table below and in Photos 2-4, in each of which the untreated test-piece is on the left, the RQ test-piece is in the centre and the BS test-piece is on the right.

The test proved to my satisfaction that my recommended method achieves a better (softer) anneal than the quenching approach. This means that less force is required to bend the brass and there is less risk of the workpiece shearing. EIM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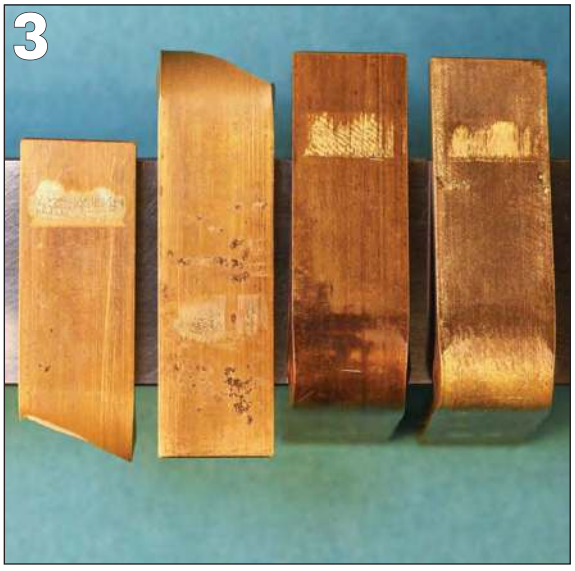
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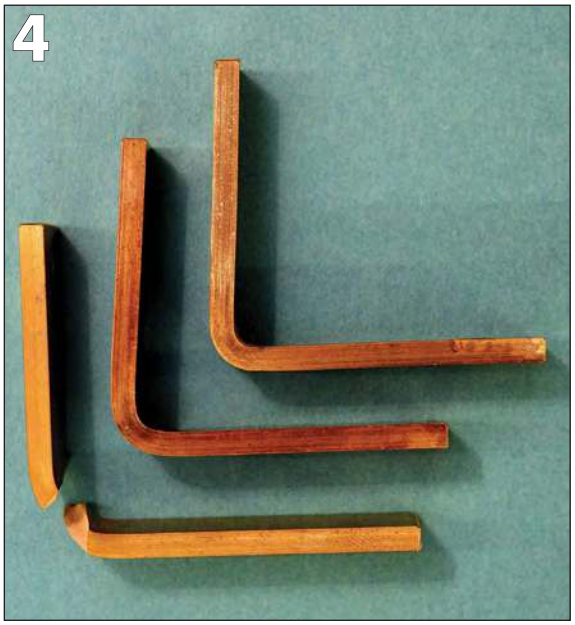
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Test-piece	Results of bend test
U	The test-piece sheared into two pieces. This was expected (cold-rolling work-hardens brass.)
RQ	A 90-degree bend was achieved but a lot of force had to be applied, and the bend had a larger radius than test-piece BS
BS	A 90-degree bend was achieved with substantially less force than test-piece RQ, the bend having a tighter radius than test-piece RQ

Gas-fired vertical boiler for the EIM Steam Plant

Martin constructs the display base of the EIM Steam Plant project.

BY **MARTIN GEARING** – Part Ten of a series

The Display Base

Refer Drawing B23

To overcome the possibility of the firebox mounting pads charring the wood in the event of the Steam Plant being operated for long periods, the firebox is mounted on a 6mm thick heat-resistant mill board as used in laboratories to protect work surfaces when putting down/dealing with hot items. The material is available as a small sheet (275 x 200 x 6mm) that may be cut and drilled easily.

The overall size and style of the base is a matter of personal choice, but I have included the dimensions for a suggested base of workable proportions allowing sufficient space for the engine to operate an item of personal choice such as a small generator. Whatever form the base takes, **it must include the 6mm thick heat-resistant mill board, 100 x 135mm, as a minimum**, to which the firebox is fitted.

Cut the millboard sheet supplied to provide a rectangle **not less** than 100 x 135mm. Position the base/gas burner assembly onto the rectangle so that the base diameter is in the centre of the width and there is 15mm of millboard showing in front of the base. Check that the gas tube/mixer body lays parallel with the long sides of the rectangle.

Mark through the four 3mm diameter holes onto the millboard. Remove the base and drill at the four marked positions 5mm diameter. Drill 2.8mm diameter and countersink at the six positions indicated for wood screws to secure the mat to the base.

Heat Resistant mat

VERY IMPORTANT: For safe operation of the Steam Plant Boiler, it is a **requirement** that the boiler is secured to 6mm thick heat-resistant millboard as specified – and that this is fitted to the display/operating base with a **minimum radius** of 17mm from the centre of the four mounting studs removed from the wood of the display base.

It follows that the boiler mounting pads/washers **must not make direct contact** with the wood base **for a distance of 8mm or more**.

A reasonable quality of exterior grade 16mm thick plywood is an ideal material for the base, with strips of hardwood glued to the outer cut edges to improve the appearance.

"For safe operation of the Steam Plant Boiler, it is a requirement that the boiler is secured to 6mm thick heat-resistant millboard..."

All photos and drawings in this feature by the author

PHOTO B86
Setting up the smokebox cap on the rotary table.

Ideally the heat-resistant mat should be located in a 6mm deep recess routed/milled in the base so that it sits flush. I used a sharp 10mm diameter slot drill running at top speed in the mill to produce the recess with the base clamped to the mill table, working to the dimensions suggested, (or those of the mat if larger) squaring the corners with a small wood chisel.

Transfer the positions of the four 5mm diameter holes in the heat-resistant mat onto the wood of the recess and using a compass draw 17mm radius circles at the four points. I found the easiest way of marking out prior to removing the wood of the base, so that it was 17mm clear of the boiler mounting stud centres, was to mark two rectangles drawn with lines running horizontal and vertical touching the extremities of the two pairs of circles.

Clamp the base onto the mill table, with **wood packing between the wood base and mill table**, and remove the wood contained within the rectangles using a sharp 10mm diameter slot drill running at the fastest speed the mill will go. Be sure to remove all sharp edges before applying a finish of your choice.

Remember – it is essential that there should be a **minimum** of 17mm of the wood base removed **completely all around** each mounting stud centre.

Fitting Firebox to Millboard

Refer Drawing B23.

Install the four Mounting Studs B20 through the Base B18 and secure with (ideally) stainless M3 nuts. Install on each of the four studs a Pad (B21) and locate the four studs through the 5mm diameter holes drilled in the Millboard. Fit a Washer (B22) over each of the protruding threads followed by an M4 plain nut. Check that the position of the Base/Burner is as described when marking the position for the four 5mm holes, before tightening the four nuts. Place the Mat/Firebox assembly in the recess and secure with six countersunk or pan-head brass or stainless screws of suitable length, taking care not to over tighten.

Smokebox Cap Former

Refer Drawing B23A

The manufacturing of the Smokebox Cap (B24) compared with the boiler tube plates that you have completed differs only in dimensions and that the material is 16swg brass.

Brass differs from copper in that it work hardens faster when worked, so be prepared to anneal the blank more often as soon as it begins to show any 'resistance'. It is also slightly more difficult to recognise the colour changes when heating so any heating should be carried out away from any direct light source.

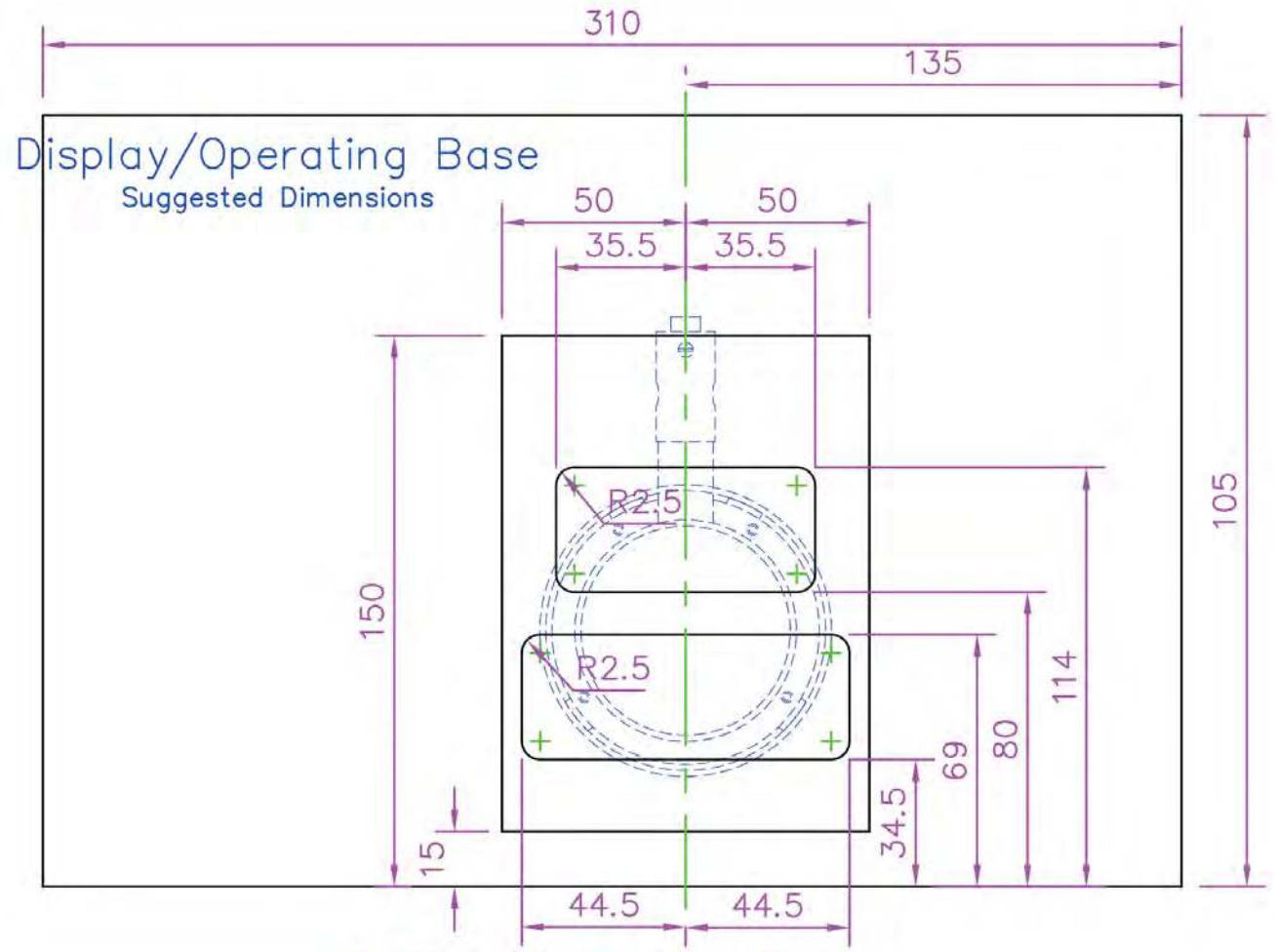
The former should be made from hardwood or birch ply, at least 16mm thick and turned to 76.2mm diameter +0.15 -0.00mm, the 2mm radius formed as shown, with a 3mm diameter hole drilled through the centre. Onto this is fitted an 80mm diameter extraction plate made from 3mm thick aluminium (or mild steel) with a 3mm diameter hole drilled centrally, that should be secured, using six wood screws, positioned equally on a 54mm PCD.

A backing disc 78mm in diameter is also required from manufactured board or similar, at least 16mm thick with a 3mm hole drilled centrally. In use the former, annealed brass blank and backing disc are located together with the aid of a 30mm long 3mm diameter pin that is pushed through the three items, making up the sandwich as before.

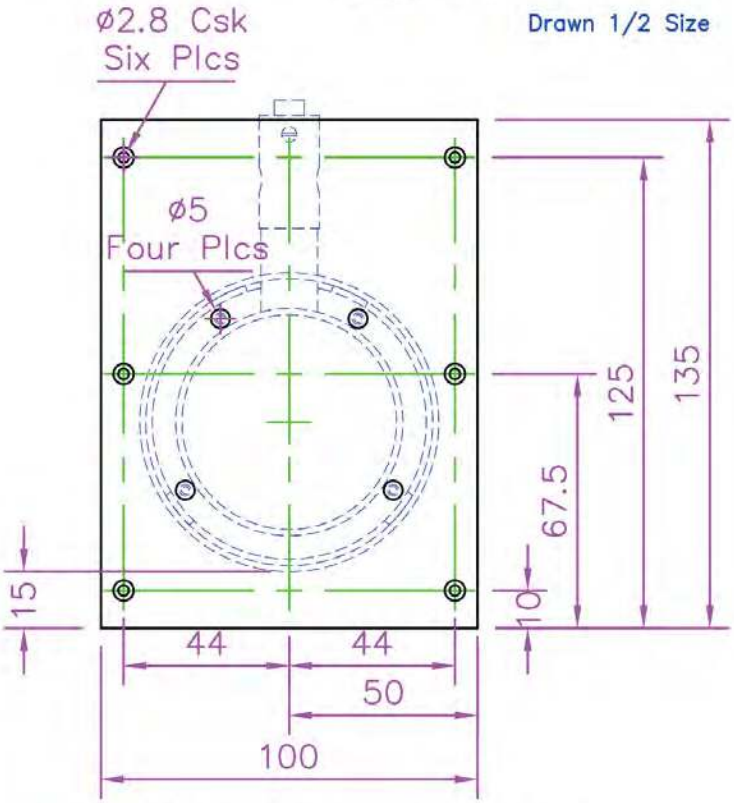
Smokebox Cap

Item B24 – 16SWG Brass
Refer Drawing B24

Repeat the flanging process in the



Display/Operating Base
Suggested Minimum Sizes



Heat Resistant Millboard
Item B23
Mounting Dimensions Drawn 1/2 Full Size

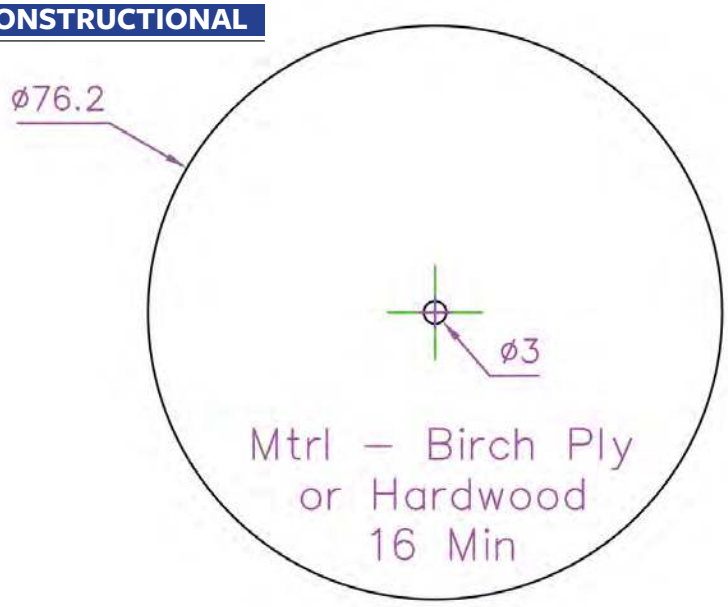
same manner as carried out for the two boiler tubeplates, bearing in mind all that has been previously stated about how brass differs from copper.

After flanging is completed, check that the cap is able to be fitted onto the smokebox end of the boiler shell, without excessive slack or the need for excessive force.

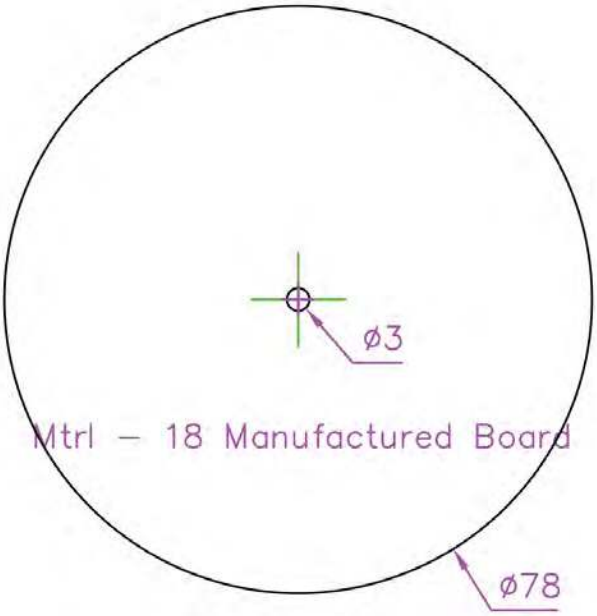
Return to or reinstall a rotary table (or dividing head with spindle vertical) set up as before.

Align the centre of the table true to the spindle by means of a 3mm pin held in the spindle chuck located in the 3mm hole drilled previously for this purpose, in the centre of the wood disc clamped on the table.

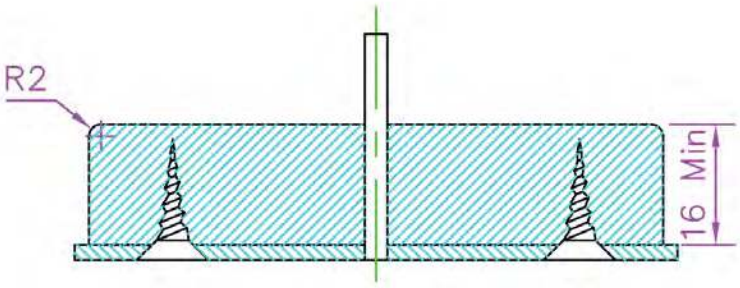
Locate the smokebox cap (flange facing upwards) by means of a pin held in the spindle chuck passed through the central 3mm hole into the corresponding hole in the centre of the wooden disc. Fit the clamps and tighten sufficiently to allow for the drilling, but not so tight as to distort the flanged edge (Photo B86). ▶



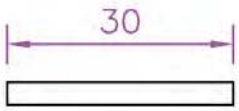
Smokebox Cap Former



Former Backing Disc

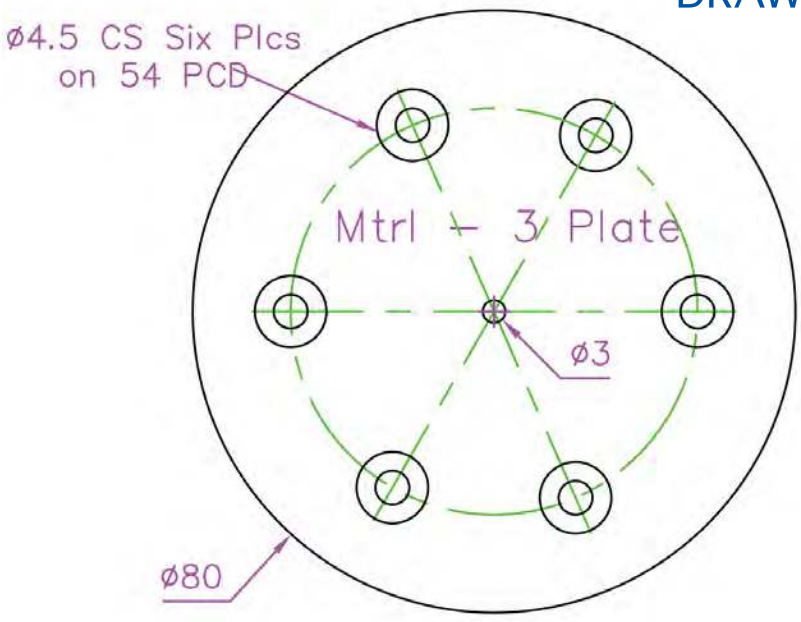


Sectioned View of Assembled Smokebox Former & Extraction Plate



Mtrl – ø3 MS
Aligning Pin

DRAWING B23A



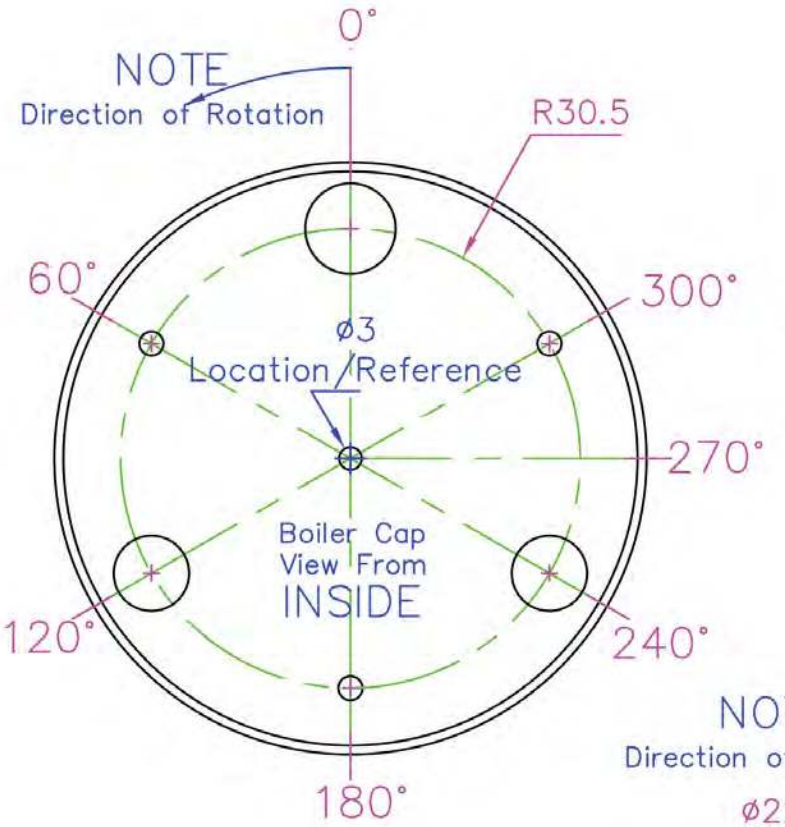
Extraction Plate

Boiler Cap Drilling

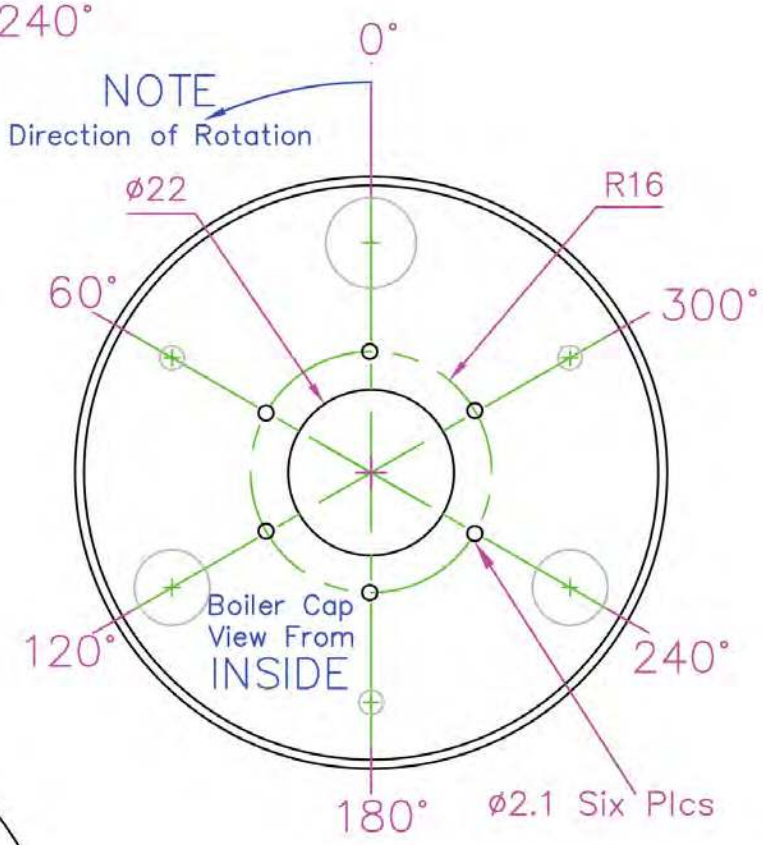
Life will be made very much easier if the 'extravagance' of a long series No 2 (3/16-inch/5mm) centre drill can be tolerated! (Photo B87). In the absence of such a centre drill you will have to release each clamp in turn if it conflicts with the drilling– replacing the clamp immediately afterwards. This only is a problem when using a standard length centre drill.

Stage one

1) Move to 30.5mm on X axis and clamp slide. Centre drill at the three radial positions indicated OP1 to OP3, clamping table at each position. Leave table clamped at OP1.3.
2) Change to a 3.5mm diameter drill. Drill at radial positions OP3 going back to OP1 then onto OP.2.
3) Remain at 30.5mm on X axis. Centre drill at the three radial positions indicated OP4 to OP6, clamping table at each position. Return table to OP4 (0 degrees) and clamp table.
4) Change to 12mm diameter drill, and drill at **OP4 only – remove drill**.
5) Move to radial position OP5 (120 degrees) and clamp table.
6) Using a 10mm diameter drill, drill at OP5 then OP6 (240 degrees) **Remove drill**.
7) Move to radial position OP7 (270° degrees) and clamp table.
8) Centre drill. Change to 6.4mm

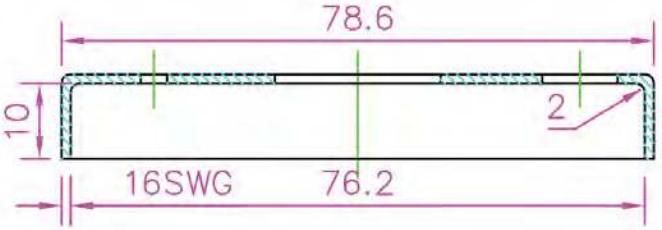


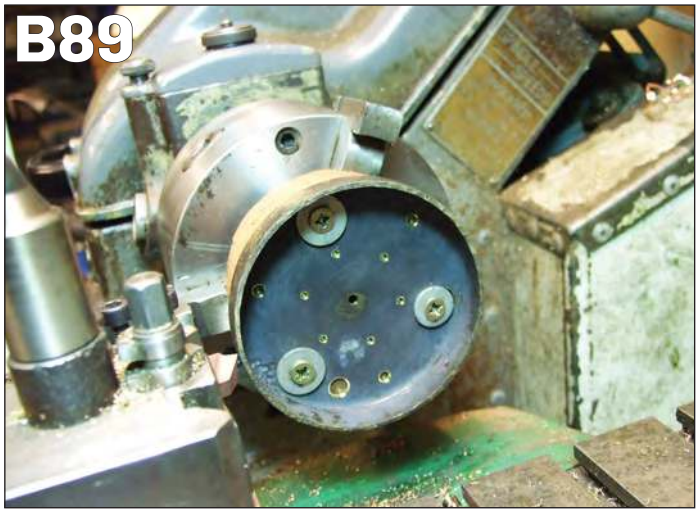
Boiler Cap Drilling STAGE ONE			
OP	RADIUS	DEGREE	ø
1	R30.5	60	ø3.5
2	〃	180	〃
3	〃	300	〃
4	R30.5	0	ø12
5	〃	120	ø10
6	〃	240	〃
7	R30.5	270	ø6.4

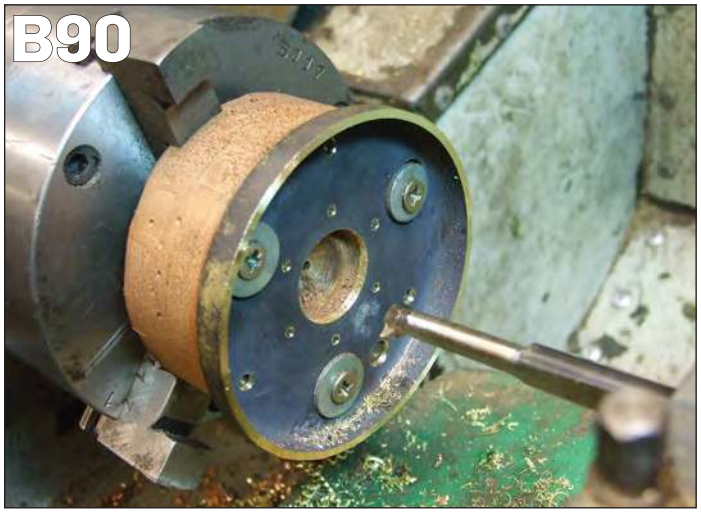


Boiler Cap Drilling STAGE TWO			
OP	RADIUS	DEGREE	ø
8	R16	0	ø2.1
9	〃	60	〃
10	〃	120	〃
11	〃	180	〃
12	〃	240	〃
13	〃	300	〃

DRAWING B24







diameter drill. Drill at OP7 **only – remove drill.**

Stage two

1) Move to 16mm on the X axis (remember to account for backlash) and clamp table.

2) Centre drill at the six positions indicated OP8 to OP13, clamping table at each position. **Remove drill**.

3) Change to a 2.1mm diameter drill. Drill at OP13 going on to OP8 back through to OP12.

4) Remove and deburr both sides of all drilled holes.

5) If at all possible rotate the table to 0° and clamp, (Photo B88), leaving the rotary table set up on the mill.

Boring chimney hole

Locate the flanged smokebox cap onto the 3mm diameter pin pushed 15mm into the central hole in the backing disc. Secure the smokebox cap to the disc with three wood screws 12mm long, passed through steel washers. Remove the 3mm pin. Hold the backing disc in a self centring chuck. (Photo B89).

PHOTO B87
A long-series centre drill is a justifiable extravagance.

PHOTO B88
Drilling of the smokebox cap completed.

PHOTO B89
The cap set up ready for final machining.

PHOTO B90
The machining completed.

PHOTO B91
A vital final job, cleaning up the edge of the cap and its radius.

Drill 6mm diameter, then drill 13mm diameter and then taking small cuts, bore out to 22mm diameter. Machine the flange length to 10mm measured from the backing disc to the flange edge (Photo B90).

Remove and deburr both sides of the bored hole and the flange. **Remember previous warnings** about sharp rag ends of swarf.

Hold the cap in a bench vice fitted with smooth/soft jaw protection and by using the **tubeplate** backing disc which will be a loose fit inside the flange, hold the cap firmly against the smooth jaw and clean up the outer edge of the flange, initially with a smooth file, followed by abrasive paper to remove any blemishes caused during the flanging process (Photo B91). EIM

NEXT MONTH...

Martin makes the chimney and solders it in place.

■ Parts 1 to 9 of this series appeared in the October 2018 to June 2019 issues of **EIM**. Digital back issues can be downloaded or printed versions ordered from www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or by telephoning 01778 392484.

Eureka revisited

Brian concludes his two-part feature describing the trials and tribulations he experienced building and using a continuous gear cutter form-relieving device.

BY **BRIAN WOOD** Part Two of Two

Part 1 of this feature in last month's **EIM** described my experience with the construction and use of 'Eureka' to make gear cutters in commercial sizes. The operational demand on the tool exceeded what the design was intended to cope with and it was not a great success. The late John Stevenson once described making Eureka as a rite of passage and I felt I had fully earned that award. But how to proceed and make my cutters, having seen the huge cost for purchase? That was still to be solved..

Remembered in a book on old lathe work, and dug out again after something of a search, was an illustration that showed a gear cutter being relieved on a lathe faceplate, secured from rotation by a finger bolted into a gap between two of the cutter teeth.

The relevant page with the illustration and accompanying text is shown here in **Figure 13**. It is taken from *Modern Shop Practice* in the classic reprint series

The cutter to be shaped is presented to the cutting tool such that one tooth is relieved at a time by virtue of the way that tooth was inclined ahead of the radial position of the relieving tool to the centreline of the faceplate. This was clearly intended to be done under power.

Could things really be as simple as that for one-off manufacture? Logic said otherwise of course since it would surely be in widespread use, but nevertheless I drew out the geometry to check it out.

That drawing proved it was not possible to avoid machining the adjacent tooth next in line as well as the intended tooth in a 12-tooth cutter at any radius from the faceplate centre, irrespective of how the blank was set up.

From this analysis, however, the germ of an idea was born. Five-tooth cutters could just be suitably aligned to clear adjacent teeth but required precision setting; the situation was better still with cutters in lower tooth counts than that. I still really wanted to use multi-tooth cutters and this ruled out a powered drive, to leave only a manual drive with the instant stop it provided.

The main drawback would come from using a faceplate. It would take the work over the gap in the lathe bed and this in itself would immediately create a further problem of inadequate support for the cutting tool, so I decided to make a suitable jig for chuck mounting.

"Could things really be as simple as that for one-off manufacture? Logic said otherwise of course since it would surely be in widespread use..."

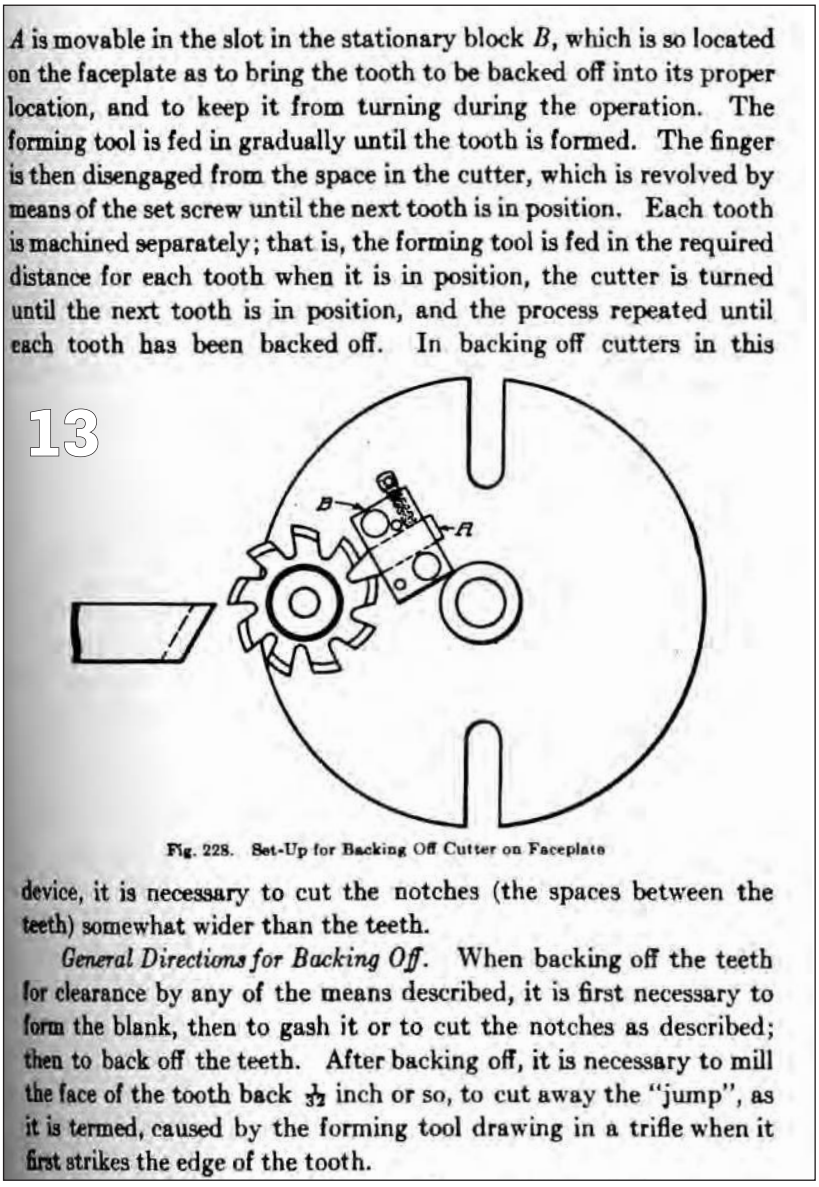
The geometry that best gave maximum access to one tooth without damaging the next tooth at the same time required a small-diameter faceplate-type jig, a little smaller in diameter than the Myford catch plate which I didn't want to modify. In any case using the catch plate would again position the work over the gap in the bed.

Alternative tool support

I then remembered seeing an article years ago in *Model Engineer* by Tubal Cain in which he described a Myford-sized tool post – he christened it the Gibraltar – that bolted directly to the cross slide and which he used to take really heavy cuts without chatter and tool deflection. Clearly something on those lines was needed here to get the tool loading right down onto the lathe bed and to eliminate the nodding I had observed.

As is so often the case in such work, the job had already expanded in the time-honoured fashion of needing a bit of tooling to help make another tool or something else before it could be used to do the job required; this was just another manifestation of the 'rule'.

On the plus side, it would give the necessary tool support to get away from the earlier and rather buttock- ▶



A is movable in the slot in the stationary block *B*, which is so located on the faceplate as to bring the tooth to be backed off into its proper location, and to keep it from turning during the operation. The forming tool is fed in gradually until the tooth is formed. The finger is then disengaged from the space in the cutter, which is revolved by means of the set screw until the next tooth is in position. Each tooth is machined separately; that is, the forming tool is fed in the required distance for each tooth when it is in position, the cutter is turned until the next tooth is in position, and the process repeated until each tooth has been backed off. In backing off cutters in this

13

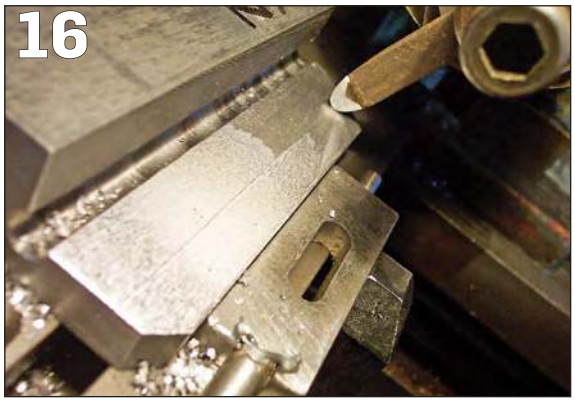
Fig. 228. Set-Up for Backing Off Cutter on Faceplate

device, it is necessary to cut the notches (the spaces between the teeth) somewhat wider than the teeth.

General Directions for Backing Off. When backing off the teeth for clearance by any of the means described, it is first necessary to form the blank, then to gash it or to cut the notches as described; then to back off the teeth. After backing off, it is necessary to mill the face of the tooth back $\frac{1}{32}$ inch or so, to cut away the "jump", as it is termed, caused by the forming tool drawing in a trifle when it first strikes the edge of the tooth.

PHOTO 13: This page from *Modern Shop Practice*, classic reprint series, shows a gear cutter being relieved on a lathe faceplate, and gave Brian an idea...

All photos and diagrams in this feature by the author



clenching experience with Eureka with its barely controlled lumpish machining. For that alone it was worth doing!

Gathering dust under the bench I had two 8kg chunks of flame-cut 2-inch thick steel plate – these were left over after making annular blanks for traction engine wheel rims. One of these was duly cut down to make a 'Gibraltar' style tool post.

Photos 14, 15, 16 and 17 show some of the various stages involved. They include sawing off the surplus material to hack out the shape I had in mind, drilling full-length run-out features for the bandsaw blade to drop into, cleaning it all up on the shaper and finally having it ready for use.

Photo 18 is the view from below to show how it is clamped to the slots in the cross slide. I have not drawn it as the sizes needed will be dictated by the particular lathe it is made for, the concept however is easy enough to follow and adapt as necessary.

PHOTO 14: Sawing down 2-inch thick steel slab.

PHOTO 15: Long drilling on the lathe.

PHOTO 16: Cleaning up on the shaper.

PHOTO 17: Finished and ready to fit.

PHOTO 18: Underside view showing how it clamps to the X slide.

The new jig

Having made the support I could now go ahead and make the new jig for the relieving work. Briefly, it is fabricated from oddments out of the ubiquitous scrap box to include a hefty chuck-mounted support bar shown in Photo 19 that is spigotted into and bolted to the thick mounting disc as shown in Photo 20.

The chuck is not powered, it merely provides support via the lathe spindle bearings for the jig at one end.

The gear-cutter blank is carried on a close fitting 1-inch diameter boss; a shaped finger holds the tooth to be worked on in register. The blank is clamped down to the jig by a short bridging piece and straddling the whole thing is a built-out section on stepped pillars that is centred for tailstock support. Photos 21 and 22 show how these features are arranged.

Sketch 1 shows the salient dimensions of the jig for gear cutters of 2.25 inches or more in diameter.

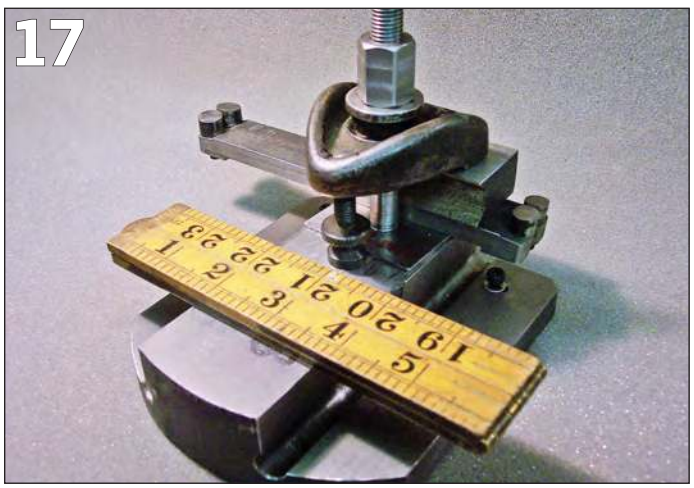
The turning force was provided by a ½-inch diameter steel bar having a turned-down section to 5/16-inch diameter that was fitted into a comfortable wooden handle about a foot long to provide the manual drive via a 5/16-inch hole in the rim of the jig.

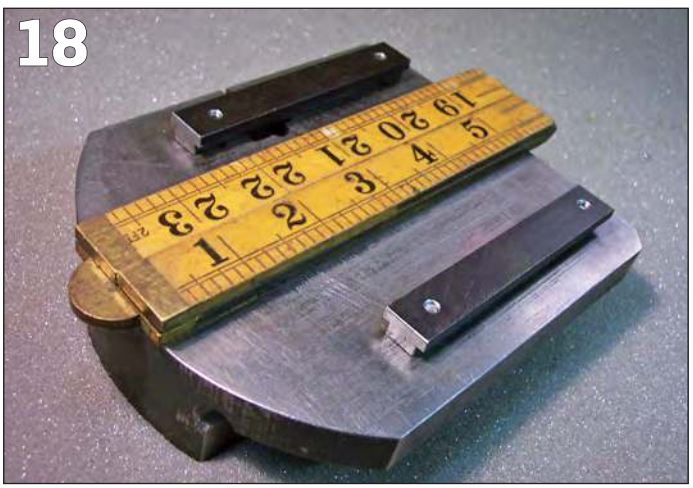
I had made the cutter blanks long before this stage, so by cutting off the intermediate teeth of one I made it into a six-tooth cutter and left the second one unmutilated with 12 teeth.

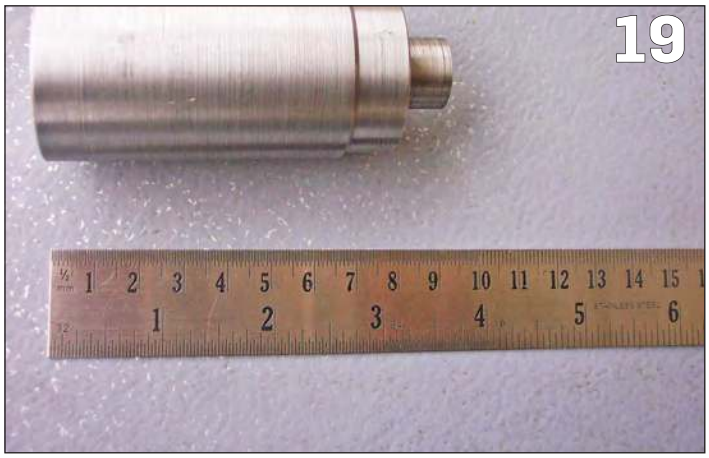
By using only manual drive I was then able to cut a selected tooth under fully controlled conditions. The load on the handle was enough to repeatedly bend the turned-down section as shown in Photo 23. I used a two-handed pull, braced against my chest, to be sure I could control the sudden release in effort as a cut completed and arrest the button tool from impacting the next tooth.

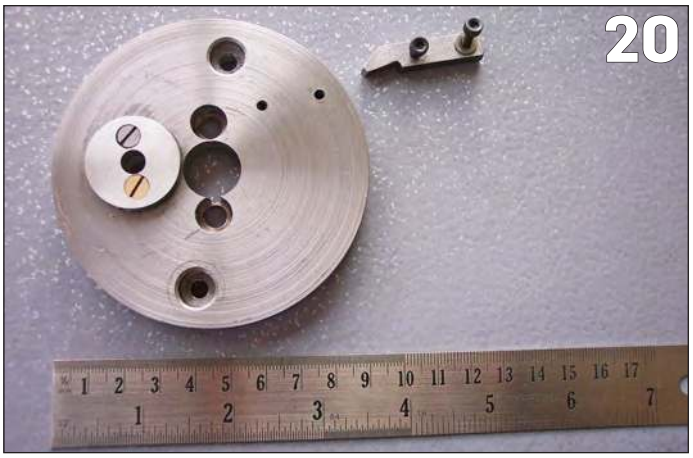
If I was making the operating handle again I would increase the bar diameter to at least 10mm for greater stiffness – the bending was a nuisance and tended to mask that point of release. About 35 pounds feet or so of torque was needed to shave off metal using the button form tools; when using the topping tool it was considerably easier work due to the narrow section involved. Photo 24 is an overview of the relieving process taking place.

With a load of that order it was really not surprising that Eureka struggled to cope. I estimate that it equates to tearing off metal from a 25mm diameter steel bar with a 6mm deep cut and powered feed. That comparison does not of course allow









for the interrupted cut that Eureka was also required to manage.

The real merit of doing the job by hand was the complete control it gave me, especially in avoiding the risk of damaging the tooth above the one being cut.

Cutting proceeded in stages with the blank indexed round one tooth at a time to complete a full circuit before adding a new increment of cut to take it round again. Described in this way it seems tediously slow, but in practice it was actually faster.

Extreme Pressure (EP) gear oil lubrication of the cutting tool and work gave a smooth surface finish and reduced somewhat the effort involved in pulling the jig over.

Care was still needed with the sudden release of load as the individual shavings were about to come off to avoid overshooting into the next tooth round. That point could of course be seen approaching as each tooth was cut.

Photo 25 shows the stamped-on Vee mark to indicate which tooth was in the correct position for relieving. It was remarkably easy to pick the wrong one before I marked it.

Aftermath

Photo 26 shows the two finished and hardened steel cutters made using the alternative jig. They went on to cut the gears I needed and I have included two views of Graham Meek's clutch in Photo 27 and 28 that I hope show the fruits of all this labour.

The two working gears of the clutch proper were cut in brass; only the outer one can be seen, the inner is hidden inside the body of the device. The two idlers were initially made in black nylon.

After some time in use the 25T rear idler deformed over its contact width with the brass gear, to suffer from tooth distortion and smearing which gave trouble in correct working.

To replace it I fabricated a gear from pieces of Tufnol which has as expected behaved much better. The front 30T idler remains unchanged in nylon at this stage. If I was making the accessory again, the idlers would both be in Tufnol, expensive as it is.

Delrin might also be a suitable material but I have no experience of its performance in machine-cut gear form. SIEG uses it all the time in moulded form for the change wheels on the firm's mini lathes so I would expect reliable behaviour.

I have yet to complete the auto shut-off feature designed for the clutch with something of my own. I was rather dubious about using a small internal ball bearing notching into machined grooves in the operating selector barrel that controls forward and reverse operation through a ▶

PHOTO 19: The support spigot for the relieving tool.

PHOTO 20: Small faceplate-type disc with spigot attached.

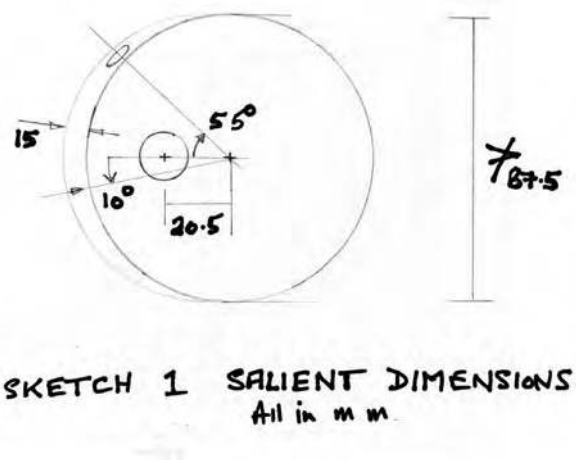
PHOTO 21: Cutter location and clamp, the indexing finger has also been fitted.

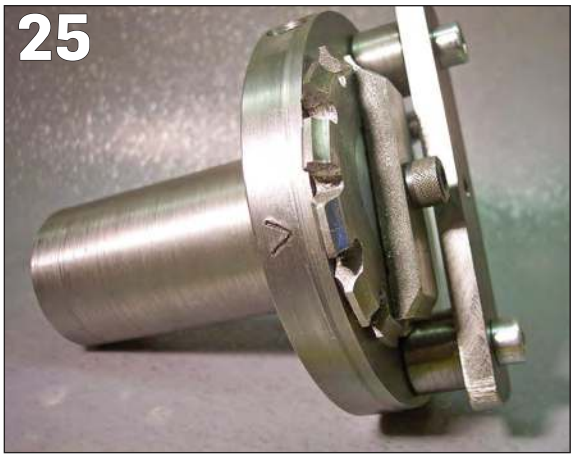
PHOTO 22: Bridging section for tailstock support.

PHOTO 23: A bent drive-handle peg.

SKETCH 1: Salient dimensions of the relieving jig.

SKETCH 1





neutral position. Neat as the concept is, the notches are necessarily very close together and the depth is critical.

Graham Meek warns constructors in his notes that this ball could potentially drop out, disappear into the guts of the clutch and then jam it if the designed limits with the operating handle are exceeded. When or if that happens the whole thing needs stripping to recover it and that seems to be its Achilles heel.

In practice I have found the clutch works very well; in plain turning for example it is a joy to use by simply flicking the control back and forth. The whole accessory will be better still when I have an auto trip built, fitted and working.

Upon reflection of the whole exercise, I imagine three tooth cutters could be made quite easily under power with a similar jig on a suitably sturdy lathe.

A Harrison or Colchester lathe would have the power and low-speed torque needed and with a heavier build of carriage it might not even need the Gibraltar-style tool support that a lighter lathe such as my Myford clearly required.

They could be fully relieved one tooth at a time to finish at a chosen position of tool infeed before resetting the cutter blank to the next tooth position. Three-tooth gear cutters would be an immediate improvement over single-tooth fly cutters for one-off use. There is though no reason why a single-tooth type fly cutter couldn't be made on such a jig.

With the advances in CNC machining and the modern software that supports it, all these mechanical solutions are becoming methods of the past.

It was, however, interesting to try out an old idea and use it to get results, especially as it was not capable of working as it had been portrayed in the book. EIM

PHOTO 24: A view of the relieving in progress.

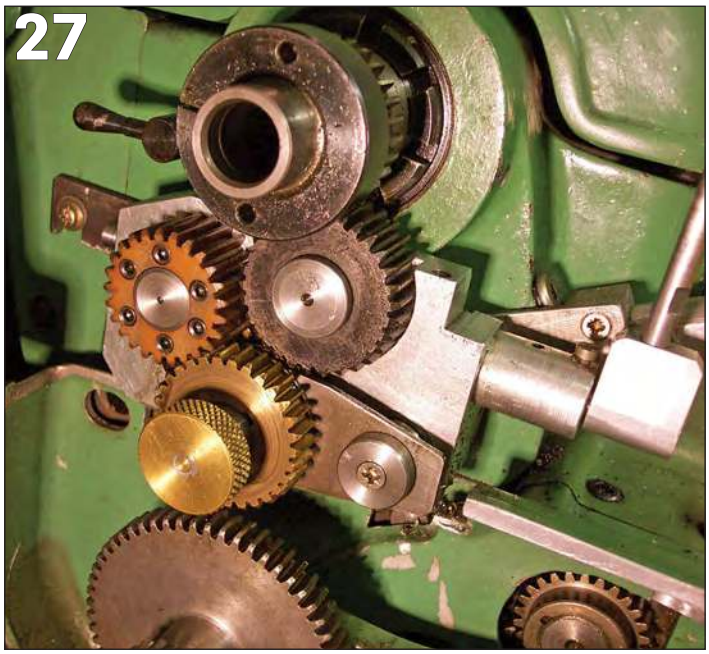
PHOTO 25: Vee mark to indicate the tooth to be worked on.

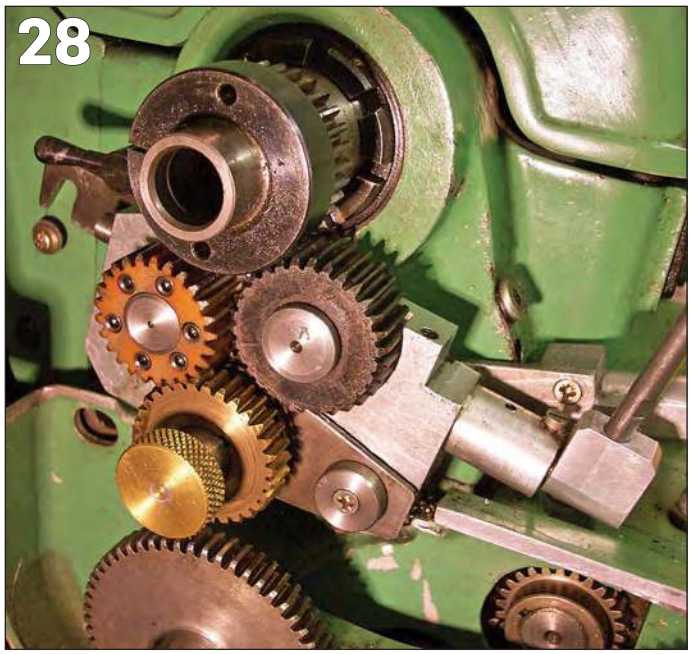
PHOTO 26: Finished steel cutters after hardening.

PHOTO 27: View of Graham Meek's clutch, in engaged position...

PHOTO 28: ...and here disengaged.

■ Part 1 of this feature appeared last month. To obtain a back issue go to www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or call 01778 392484.





The Designograph

Dave finds written inspiration to build another unique gift for his grandchildren.

BY **DAVE ROWE**

In November 1957 the magazine *Practical Mechanics* published plans by H A Wyne for 'Making a Designograph', a name which was, I presume, dreamt up by either H A Wyne or the editor. The quotation that summed up the era for me was "The British nurtured manual skills rather than technology, regarding throwing things away as a crime and had been forced by poverty to use time and ingenuity as they had nothing else to spend."

This was exemplified by the first paragraph of the article; "The appliance is capable of drawing an infinite number of designs, and can be constructed with odd scraps of material which may be found in the junk box – the materials include parts of a packing case, three motor cycle spokes, a piece of broken hinge and terminals from old electrical apparatus."

I'm sure it worked, but something much more upmarket was needed to make it a Christmas present for a grand daughter.

In the 1947 article the author thought that the end of a packing case would be perfect as a base and the 5mm thick sides of the case could be used to "make the pulleys if a double thickness was to be glued together with the grain at right angles." I was fortunate to have a good stock of mahogany with which to make the base and the pulleys but decided to have a piece of scrap 12mm ply on which to assemble all the components as adjustments might be necessary.

They were indeed necessary and the ply had many extra holes added as things were moved around. When everything was satisfactory the parts were all removed from the ply, the correct screw holes drilled right through and used to mark out the polished mahogany.

A paper issue

In the published design the large pulley served as a turntable to which a circular piece of paper had to be fixed with drawing pins. The only bulk supply of 160mm diameter white paper I could even remember seeing were filter papers in a laboratory and the texture of that paper was quite unsuitable for drawing on.

The idea of cutting out 150 paper discs with scissors didn't appeal, but a 180mm square mahogany platform screwed to the large pulley would be superior except for requiring the use of inelegant drawing pins in it and their consequent holes pockmarking the wood.

ABOVE: Dave's completed designograph – a superb present for his lucky granddaughter.

The answer was to drill 15mm holes (Forstner Bit) at each corner, insert 15mm steel plugs, the upper ends of which had been polished on the lathe, and to use small rare earth magnets to hold the paper in place. The ones I used were cylindrical, 5mm diameter and 5mm long, very powerful and their highly polished finish gave them the look of being chromium plated.

Although the drive belt was shown in the 1957 diagram no mention of it was made in the text, so I assumed that string was intended to be used. I had salvaged a 750mm long (open length) 4mm wide toothed drive belt (**A - Figure 1**) from a copier/printer and the 120mm pulley this was to drive was formed from 12mm birch ply. This could have been turned on the lathe but the chosen method was to cut the disc on the bandsaw then drill a 3mm central hole and nail it to a board clamped to the router table (**Figure 2**). Using only one clamp allowed the board to be tapped until the pulley was in contact with a straight cutter.

The pulley was rotated by hand and the board tapped close to the cutter until all the perimeter was smooth. A biscuit cutter was inserted in the router and a 4mm wide groove ▶

BELOW: The page of *Practical Mechanics* that inspired the automata project.

November, 1957 NEWNES PRACTICAL MECHANICS (JUNIOR SECTION) 99

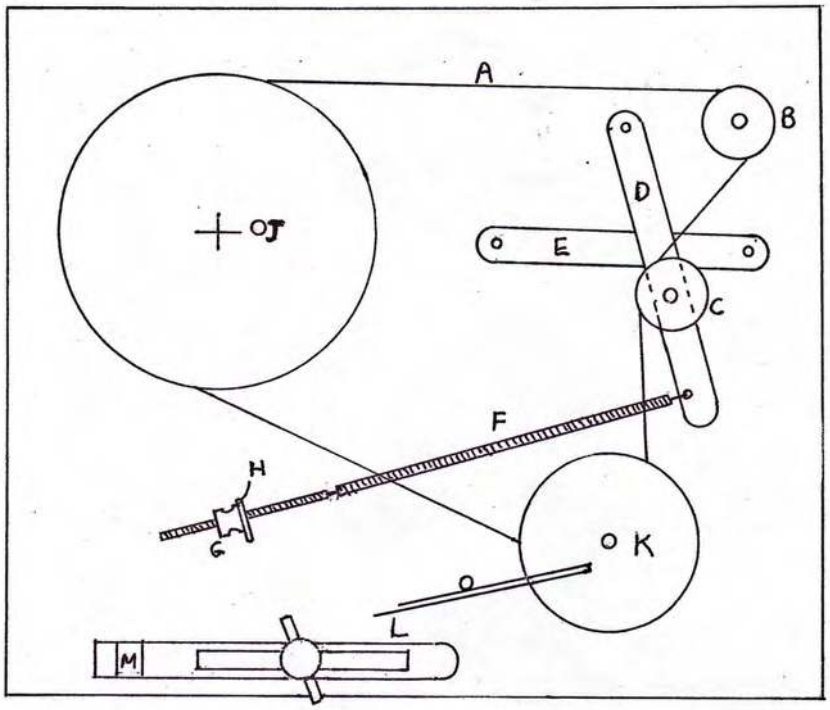
MAKING A DESIGNOGRAPH

With Which You Can Make these Weird Contemporary Designs

By H. A. WYNE

OUR SPECIAL SECTION for the JUNIOR MECHANIC

FIGURE 1



"The original article claimed an infinite number of designs so, being perverse, I trebled that infinity by having three pulleys..."

FIGURE 5

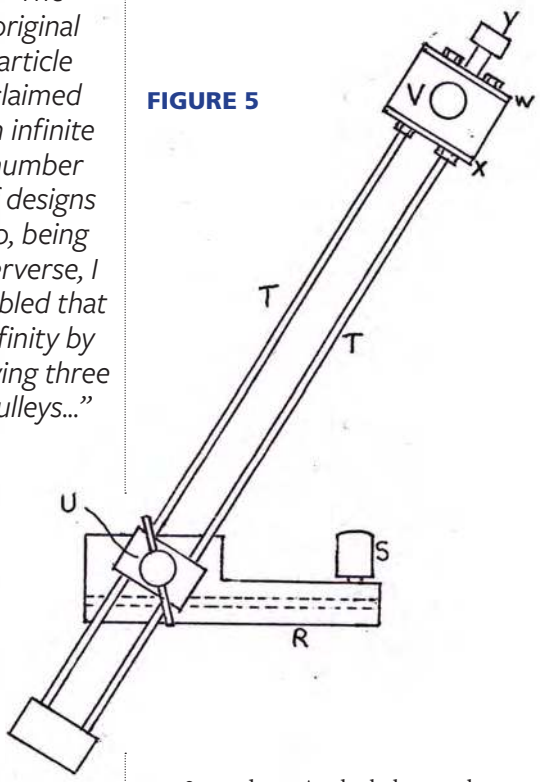
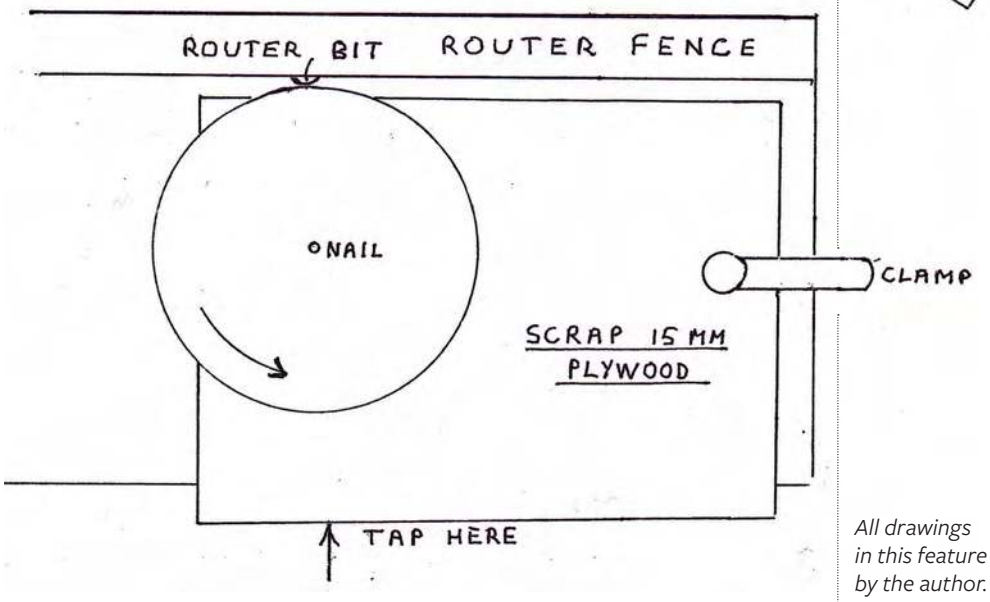


FIGURE 2



All drawings in this feature by the author. Photos by Andy York.

cut 2mm deep. As the belt was also 4mm wide, a second pass widened the groove to 5mm.

Drive pulley B (Figure 1) and jockey pulled C were both 28mm diameter and turned from 15mm thick mahogany. To prevent scratching of the mahogany case the jockey arm, D, rested on a brass strip, E, while the tension of spring F was adjusted via screw G and bracket H. The 120mm disc bearing J was offset 15mm to impart an eccentric movement to the paper.

The need for a jockey arm provided an additional benefit as it gave latitude as to the positioning of pulleys B and K, while spring F was given a spraying of Plasti-Kote brilliant metallic gold paint to enhance its appearance.

The 1957 drawing showed pulley K having a series of holes in its upper

FIGURE 3

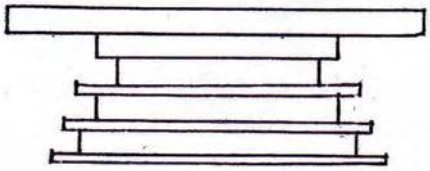


FIGURE 4

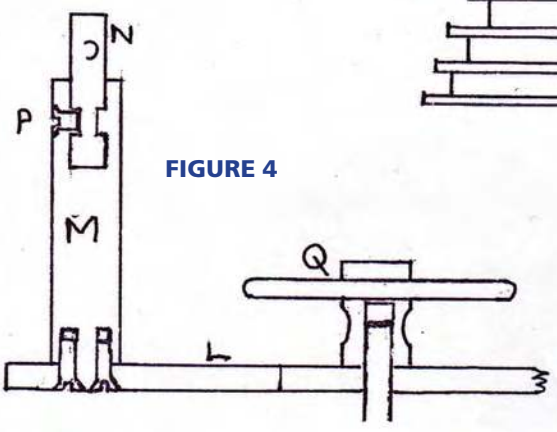
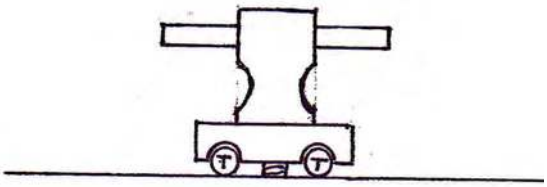


FIGURE 6



surface. Figure 3 shows what was substituted for a packing case pulley – a brass disc with eight available holes to take the end of rod O, each hole being countersunk to allow easier location of the rod's pointed end.

More than infinity

The original article claimed an infinite number of designs so, being perverse, I trebled that infinity by having three pulleys here. To prevent the belt dislodging the three had to be very close together so three 5mm thick discs were turned from mahogany and three 1½mm birch ply discs formed. The whole sandwich was glued together and the birch discs were stained with a matching mahogany wood dye.

Figure 4 shows how the slotted 3mm thick brass strip, L, had upright M screwed to it and how the swivelling support, N for rod O was retained by a screw, P. This assembly was held in the required position by key, Q.

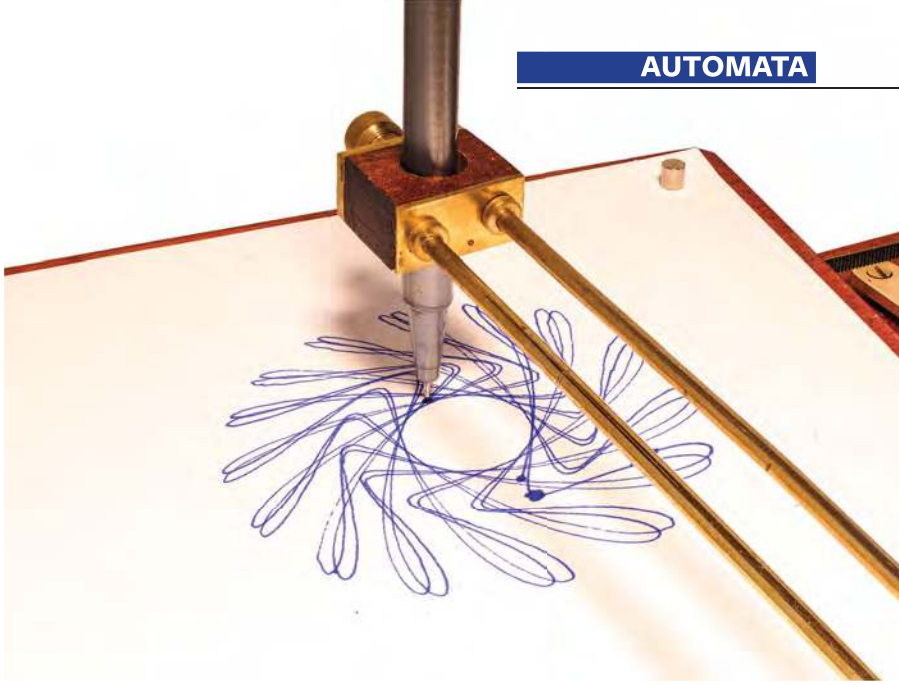
On the pen-carrying assembly, Figure 5, a 3.3mm hole was drilled through R to accept the 3.2mm brazing rod, O, Figure 4, and this brass block had a knob, S, to lock O in position. Two 3.2mm brazing rods, T, 240mm long extended to the pen holder, the position of this assembly being adjusted via key, U. The mahogany block, V, was drilled to 11mm to accept a pen and held between brass plates W and X, with screw Y retaining the pen. Figure 6 explains how key U held the two rods in place against R.

The photo of the completed designograph shows that a draw was fitted underneath to hold a supply of paper squares and ten coloured pens. When the grandchildren were younger, the automata I made were brightly painted but now my grand daughter was 13 and I thought the bright colours of childhood could give way to polished brass and mahogany which has given it the look of a piece of Victorian scientific equipment.

Being almost entirely built from recycled materials the only expenditure was for pens and paper, with perhaps £2 for brass knobs, keys and rods. EIM

■ For obtaining the 5x5mm cylindrical magnets, Dave recommends 'Krazyshoppinghere' on eBay stores, or Magnet Store Ltd in Manchester, phone 0844 844 2757, email info@magnetstore.co.uk

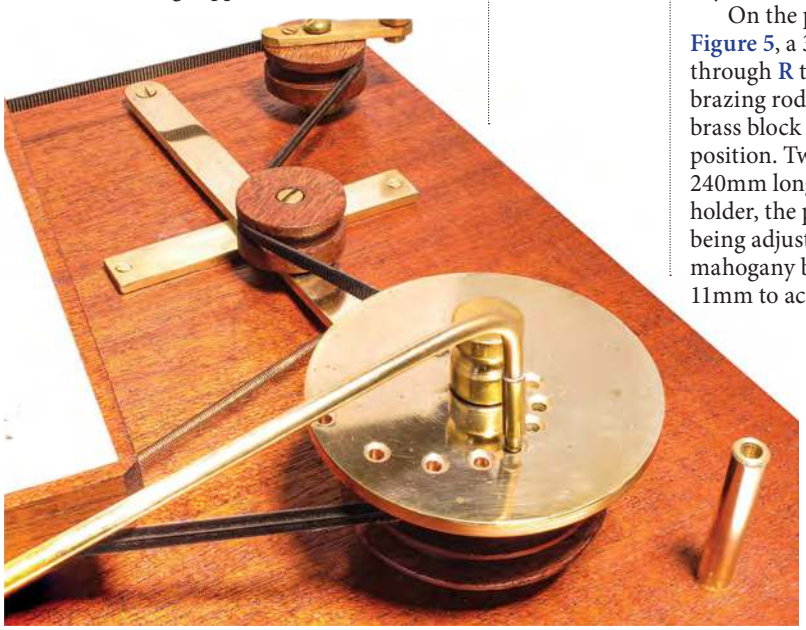
Previous automata articles by Dave appeared in the February, April, June and November 2018 issues of EIM.



RIGHT: The completed device will draw intricate patterns that delight the young users.

BELOW: Close-up of the mahogany three-puller arrangement – 'infinity trebled' according to Dave.

BOTTOM: This is a fine piece of clever engineering.



A riveting performance

Harry takes a good look at these simple but highly useful means of joining components.

BY **HARRY BILLMORE**

Riveting is both a very useful way of joining two pieces of material together without heating them up and as a decorative feature. But there are several other reasons for using riveting as a joining method, among which are the low cost of installation, the lower requirements for hole preparation (no thread cutting required), high reliability, the light and strong joint made due to the low weight, and resistance to fatigue due to high elasticity and durability.

There are many different types of riveting, ranging from hot riveting using a pneumatic hammer or hydraulic press, to pop riveting using aluminium rivets and a pop-rivet gun. They all achieve a tight joint in much the same way at the most basic level.

A rivet is a smooth cylindrical shaft, with a larger, usually domed, head on one end. Holes very slightly larger than the shaft are drilled in the two work pieces to be joined, the rivet placed in the holes, then expanded with the ends squashed outward to hold the work pieces together.

In this article we are looking at the main methods of riveting model engineers will come across, mainly cold riveting of copper or aluminium rivets and hot riveting with steel rivets. While it is perfectly possible to carry out both of these operations with a hydraulic press, as such equipment is found in very few home workshops we will focus on the traditional use of a hammer to form

PHOTO 1: The shape of a typical rivet is clearly evident in this view. Yes this is a large one, being heated up for installation on a locomotive of the Welshpool & Llanfair Light Railway, but the techniques are the same for the tiniest rivets on models.

PHOTO 2: Two types of finished rivet – The one above is finished flush in a countersunk hole, the one below has a domed finish.

PHOTO 3: The domed finish to a rivet is most common, seen here on copper and steel types.

the rivet head and to swell the stem of the rivet. As has already been alluded to, a reasonable amount of the holding strength of the rivet is actually provided by the swelling of the stem rather than purely in the forming of the head. Anyone who has tried to remove a properly formed rivet from a properly sized hole will know that this is a difficult process even after the head has been removed.

An often-asked question is what-sized rivet should be used for structural joints – setting aside aesthetics, the visual appearance of the riveted surface, for the moment.

The diameter of the rivet shank, D, shall be at least one quarter of the thickness of all plates to be riveted, the clamping length, S.

The length of the rivet shank, L, must be calculated based on the thickness of all plates to be riveted, – the rivet shank must be longer than the thickness of all the plates by the measure of the 'head allowance', Z.

The formula is $L = S + Z$.

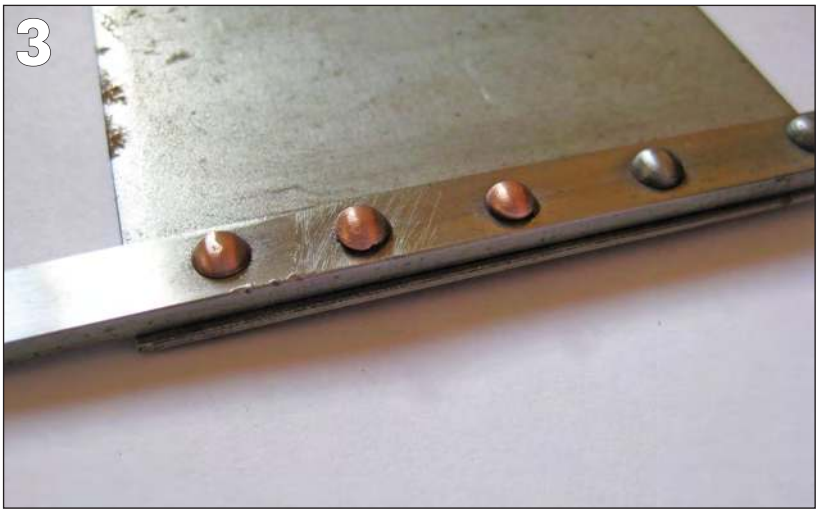
The head allowance depends on the kind of rivet and the field of application. With a steel button-head rivet with a shank of up to 20mm;

$$Z = 1.5 \times D$$

For rivets with shanks of more than 20 mm;

$$Z = 1.6 \times D$$

Should your work require fitting a



countersunk-head rivet, then its head must be measured as well for the calculations to be correct.

To quickly obtain a rivet of the correct length, I have shimmed two pieces of plate to the same thickness as the total length of the rivet shank and then drilled a close-fitting hole through to allow the shank of the rivet to pass through, followed by nipping the end off with a chisel if the rivet is copper, or careful application of an angle grinder for steel rivets. The easiest way of course is to buy the correct length to start with!

Correct hole preparation is essential to effective riveting. After selecting the rivet size and placing the sheets together, the holes must be marked for drilling. The hole marks should be punched with a centre punch but only just deep enough to start the drill. If the punch is too hard, the mark made will be too large and particularly with smaller sizes, the metal will distort visibly around the rivet. The diameter of the drill used depends on the type of rivet being put in the hole, but a good rule of thumb is to use a drill around three thousandths of an inch (0.0762mm) larger than the rivet shank.

Now that we have rivets of the right size, and a hole of the right diameter, we need to determine what sort of finish we want the hammered end of the rivet to have. If the rivet will be on view, generally a button head finish is chosen, which requires a support, a setter and a header to be made. If one side of the rivet will not be on view, then generally a hammered flat head is acceptable. If a flush finish is required in a countersunk hole, then careful attention must be given to hammering the shank to swell the rivet before filling in the countersunk hole.

Most of the above techniques will require the making of at least a support, a dolly, for the rivet head to sit in while the other end is hammered or pressed. There are a few methods of making these. A hemisphere can be machined into the end of a piece of bar using a lathe. A die grinder can be employed to grind in the hemisphere or, if you are using steel rivets, the material that will be used as the support can be heated up to a bright orange then held in a vice and a rivet used as a punch to form the hemisphere. This last option is usually the quickest and easiest and gives a very nice support which is easily reformed if it distorts with use.

The method of compressing the rivet being used will determine if the support will need attachments for fitting it to a press or if holding it in a vice will be enough.

The same methods described above can be used to make the header that will shape the rivet end into a dome, and the hollow formed in both header and support will need to be slightly less than a perfect hemisphere so that they do not make contact with and mark the pieces being joined. Finally the setter is a hollow punch, with the hole down the middle a sliding fit over the rivet shank.

The process

A rivet is placed in the hole through the work pieces to be joined, its head resting in the support with the shank facing upward. The setter is then used to sharply tap the work pieces together onto the rivet head.

A hammer is then applied directly on the end of the rivet shank, aiming straight down the length of the shank. This will upset (swell) the rivet inside the hole, and usually a couple of blows are enough to fill the bore completely.

If you are aiming for a domed head, then a series of blows are made around the diameter of the shank to start forming the dome and the header is then used to create the shape of the rivet head, moving the header around to produce the final form.

The amount of work needed ▶

PHOTO 4: Rivet tools – from left the setter, header and support.

PHOTO 5: The support held secure for accurate work.

PHOTO 6: Using a bearing to check the hollow in the support is not quite a full hemisphere to avoid marking the work.

PHOTO 7: Harry using a header and a support to join two plates with rivets. Note the long rivet placed through an adjacent hole to aid accurate lining up of the components.

Photos in this feature by Harry and Dave Billmore, Andrew Charman and Simon Mayor

depends on the size of the work being tackled. If you are putting 2mm copper rivets into a tank side, a tap on the end to upset the rivet then finishing with the header will work fine. Larger sizes, however, require a little more work to form the head as neatly and accurately as possible.

To form a flat head or a countersink, the hammer blows are continued along the axis of the rivet in a similar way to the upsetting blows, being careful to keep the forming head central on the rivet shank. If it starts to form off-centre, change your hammer blow angle to bring it back to the centre.

Heat advantage

Most model engineering will use rivets of less than 8mm diameter, and rivets of this size in any material can all be formed cold if access to heat is not available. However a tighter joint will be made if the rivet is heated, while the forming of the head will be much easier.

There are a few other types of rivets that come in very handy, the most ubiquitous being the pop rivet. This is an aluminium item that uses a steel pin to pull a ball through the hollow aluminium rivet by means of a special gun. These are particularly useful if you cannot access the back of a rivet for hammering. They do have their limitations however, limited load carrying and their appearance being two of the main drawbacks.

The other extremely useful type of rivet is a rivnut – as the name implies this is a rivet that turns into a nut. It is a threaded aluminium tube with a compressible section that forms the rivet head. They are great for holding lightweight items to thin sheet, such as nameplates or handrails on a loco.

One final useful tool I have discovered for use in all sorts of riveting work is the Cleco clip. Used extensively in aircraft manufacture, these are small removable clips that fit into rivet-sized holes and hold the work pieces together for trial assembly or for final riveting. Being able to drill all the holes while the clips hold everything in the correct position makes riveting far faster. EIM

PHOTO 8: The pop-rivet gun, widely used for rapid riveting, especially where rear access is difficult.

PHOTO 9: A pop-rivet and its finished appearance – this is not popular with typical model engineers!

PHOTO 10: The rear, usually unseen finish of a pop-rivet.

PHOTO 11: The rivnut is a useful combination item.

PHOTO 12: Cleco clips hold pieces together for trial assembly or final riveting.

PHOTO 13-14: Back to the big stuff – forming a rivet head with an air-powered press, with the rivet held in place from below.

Screw-down regulators

Mike describes his methods for controlling the progress of a locomotive

BY **MIKE WHEELWRIGHT**

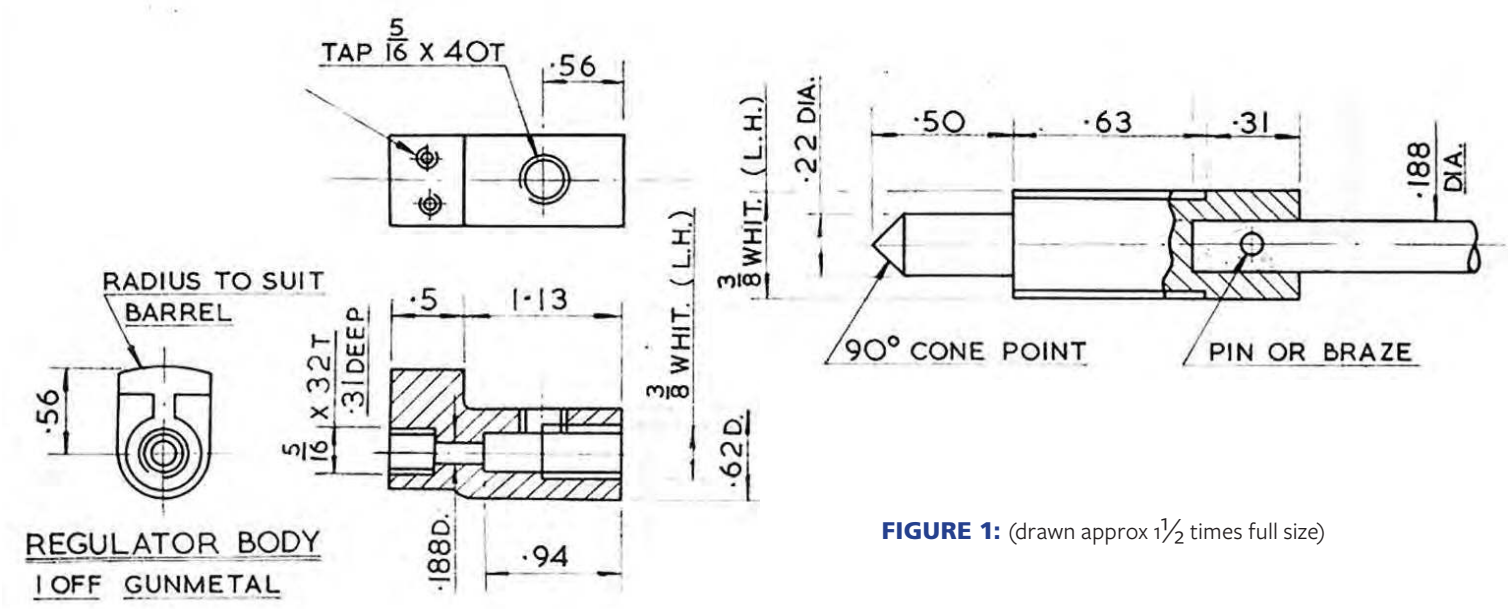


FIGURE 1: (drawn approx 1½ times full size)

In the June issue of EIM our young contributor Andrew Strongitharm related the trials and tribulations he suffered making and modifying a screw-down regulator for his model of the Barclay 0-4-0T 'Dougal'. Given that the engine is a relatively simple design for a beginner everything should have worked out well and as I have made and run three engines with this type of regulator that give every satisfaction I felt it might be worthwhile describing the methods I have used.

The original regulator design shown for Dougal is virtually the same as has been specified for many smallish 3½-inch gauge engines over the years and it is well proven as providing smooth control and closing tightly when shut: I have no doubt that if our builder had stuck to the original drawings he would have had nothing to worry about.

First impressions

In my account of designing LNWR No. 650 'Lord Rathmore' (EIM June-October 2018) in 5-inch gauge I referred to my preference for a big screw-down regulator as a result of the excellent performance of this type in my first engine, a Don Young 'Derby 4F', followed by less-satisfying experiences with Stroudley-type disk regulators in the next two 5-inch gauge models (poor sealing when shut, less smooth opening). The regulator specified for Dougal is virtually the same as for the 4F as can be seen by comparison with the Don Young Derby drawing (Figure 1).

"My preference for a big screw-down regulator comes as a result of the excellent performance of this type in my first engine..."

FIGURE 1: Mike's drawing for a regulator on a 3½-inch gauge LMS 4F loco (drawn approx 1½ times full size).

FIGURE 2: The regulator opening on the same loco.

All drawings in this feature by the author

Looking at the 4F regulator the seat is a 3/16-inch diameter hole closed by a 7/32-inch diameter plug with 90-degree cone advanced by a 3/8-inch BSW thread (16tpi). Driving experience showed that steam delivery maximised at about a quarter of a turn of the regulator. From Figure 2 it can be seen that in this position the cone is drawn back 0.016-inch (one quarter of the 1/16-inch pitch) and the annular opening at the edge of the seat is 0.016 / √2 or 0.011-inch.

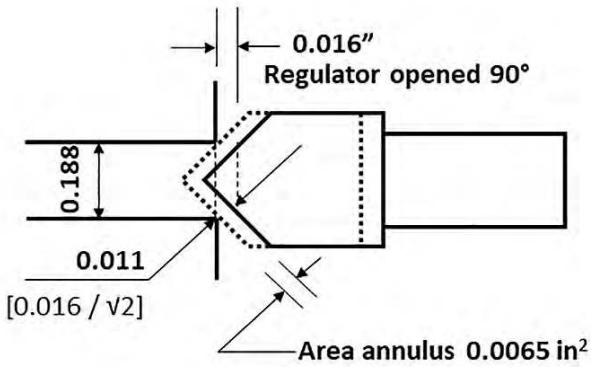
This leaves an area of 0.0065-inch^2 for steam to pass, a bit difficult to visualise but easier to think of as a round hole of equivalent area, 0.091-inch diameter, about 3/32-inch. This gave me an insight into the area I would need for feeding steam to the four 1⅜ x 2⅛-inch cylinders of the Claughton. On the basis of a simple, but unfounded, assumption that to feed the fourfold swept volume I would have to provide about four times the opening area I estimated an equivalent hole of 3/16-inch diameter would do.

Control improved

Finding it difficult to believe a big 4-6-0 would pull anything worthwhile with such a small opening to steam I resorted to temporarily replacing the regulator disk on a 5-inch narrow gauge engine I used for heavy work (two 5/16-inch holes) by another with two holes of 3/16 -inch diameter run into each other. My doubts were dispelled and control of the engine was much improved, I duly marked the position of the handle when pulling hard up a 1 in 100 gradient.

On removing the dome it could be ▶

FIGURE 2: (not to scale)



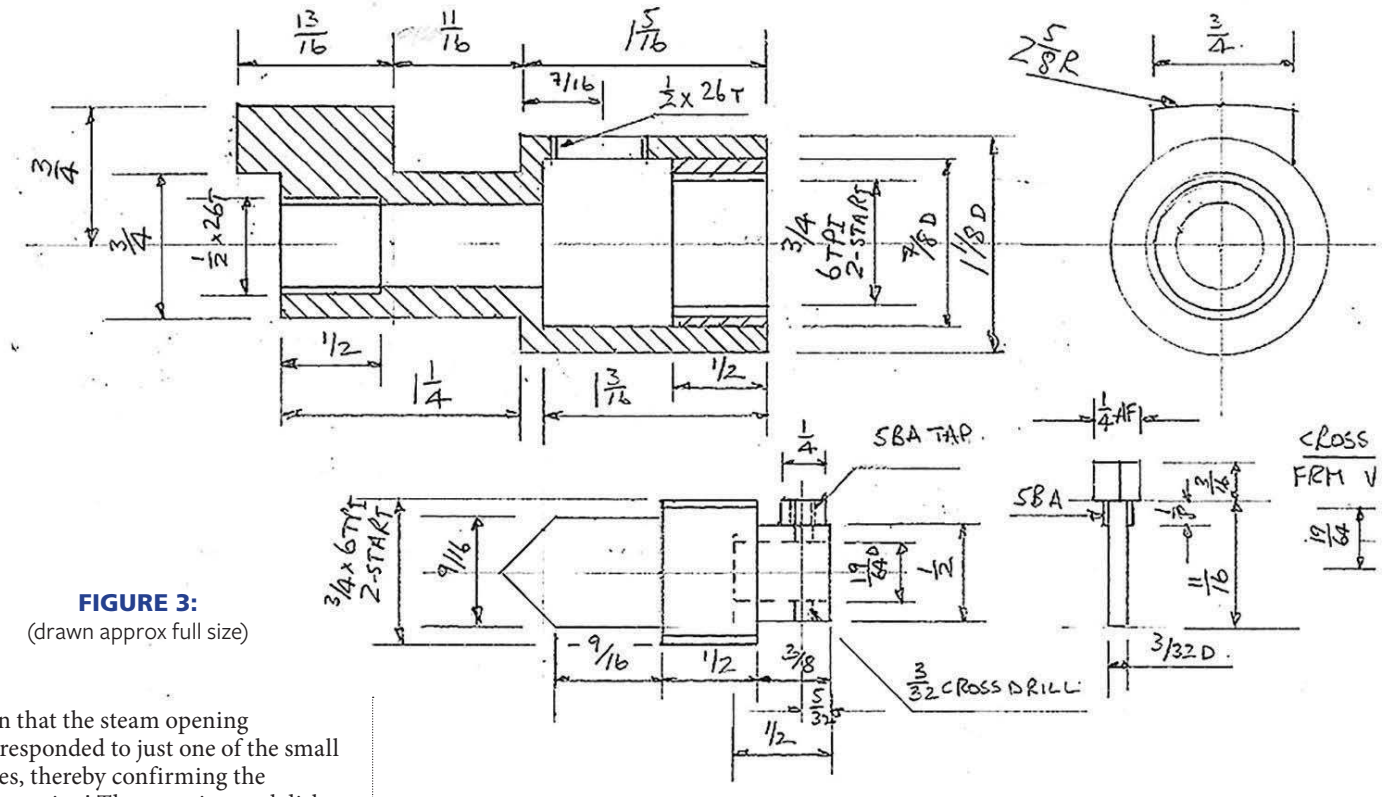


FIGURE 3:
(drawn approx full size)

seen that the steam opening corresponded to just one of the small holes, thereby confirming the assumption! The experimental disk on the narrow gauge tank engine became permanent and I proceeded to design a screw-down regulator for the Claughton giving an equivalent opening.

As can be seen from the drawing (Figure 3) the design is not easy as I wanted the regulator quadrant on the doorplate (LMS-speak for modellers' backhead) to look correct so the maximum swing angle available was only 60 degrees, one sixth of a turn. To get the big opening it needed a seat diameter of 0.465-inch and a ¾-inch diameter 6 tpi two-start thread that retracted the cone by 0.028-inch.

Naturally I had to cut both the external and internal threads on my Myford and as I normally do very little thread cutting my skill is pretty limited but in cutting a thread that requires almost no mechanical strength I could get away with a very sloppy fit. In fact this assists with free operation, useful with expansion of dissimilar metals, as well as allowing the cone to align into the seating to seal tightly. The outcome was an engine that has run for several years and a regulator that is a joy to use.

FIGURE 3:
The regulator of Mike's 5-inch gauge Claughton, serialised in EIM in 2018.

FIGURE 4:
This design is for a LNWR Whitworth loco, again in 5-inch gauge.

Compound choice

A screw-down regulator was definitely out of the question for my next engine, a Midland Railway Compound which has a special regulator for starting in 'simple' based on the Deeley pattern of the original, but the 5-inch gauge LNWR 2-4-0 'Whitworth' that followed was an ideal candidate.

Being of such a small prototype it is not a great deal larger than some 3½-inch gauge models so I reckoned that a regulator something about twice the size of the 4F's would do. No experimentation this time as it lay in size between two successful engines so the opening area was made equivalent to a ⅛-inch diameter hole (0.0123-inch^2). Studying Figure 4 it can be seen that the seat is $^{11}/_{32}$-inch diameter and the thread is 13 x 2.5mm pitch giving the required area with the handle swinging through 60 degrees, again following the prototype's regulator.

The thread may seem strange but I was hoping to find something standard about ½-inch x 10 TPI so as to avoid more thread cutting but for

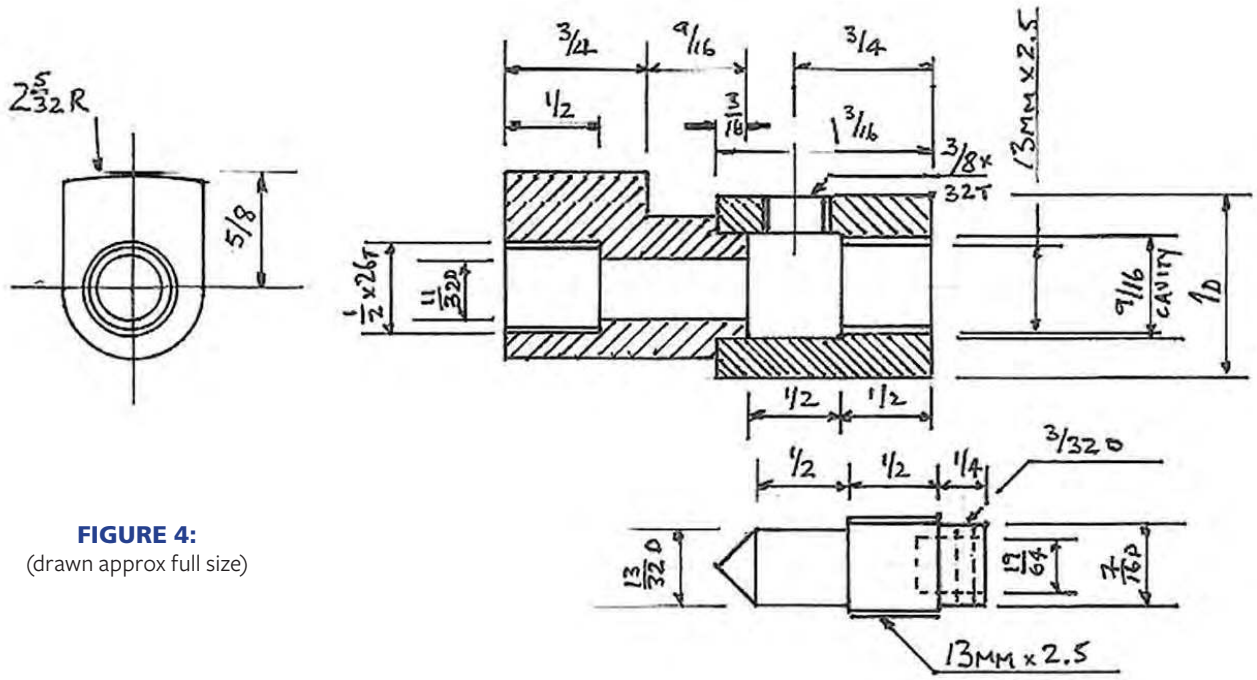


FIGURE 4:
(drawn approx full size)

such a coarse thread the BSW diameter is ¾-inch. I was lucky enough to notice that one of our tap and die suppliers was listing this metric size thereby simplifying manufacture, however there is a lesson to be learned.

With my botched thread on the Claughton everything worked well from the start but not so with the proper fit obtained by tap and die: I had to ease the male thread to obtain free rotation on assembly but after a few runs things began to seize. I had the entertaining job of removing the plug from the regulator working through the dome opening and then I eased the thread until it was a bit floppy, this did the trick and the seal when closed is very good, like on the other engines. I believe I qualify for a diploma in keyhole surgery!

Reaching for the rod

Finally what about the regulator rod? Of course I have a standardised way of dealing with this, again based on practical experience, designs usually show the rotating part of the regulator silver soldered or pinned to a 3/16-inch diameter operating rod but the Whitworth was not the first case where I have had to take out part of a regulator so I make them with a provision for withdrawing the rod.

We must also consider how to seal the rod where it passes out through the gland on the doorplate. For many years I used soft graphited yarn in the gland, compressed by nuts on studs passing through the ears, but it never seemed to seal for long and I found unpicking the yarn to be a rather annoying process.

Regulator rods are now 5mm diameter with a short length of 19/64-inch diameter attached at the front end, Figures 3 and 4 show recesses in the back of the regulator plug to accept the drive from the rod that is held by a 3/32-inch diameter phosphor bronze cross pin with a long head and a threaded portion. If the orientation of the cross hole is made nearly vertical (with the regulator almost shut) the thread can be used to jack the pin out when the regulator needs to be taken apart. The rod can then be withdrawn a bit allowing for the plug to be unscrewed and removed.

Figure 5 shows the arrangement for sealing the rod in the door plate bush which is 10mm internal diameter with an 8mm hole at the bottom, big enough for the drive end of the rod to pass. After inserting the rod a neck ring 8mm outside diameter (OD), 5mm internal diameter is put on followed by a Viton O-ring, 10mm OD x 2.5mm to be very lightly compressed by the gland – this does not leak but a new O-ring is recommended after every disassembly, which is not too great an expense!

I have used this method for several years and retro-fitted some earlier engines that were built to the designs of others, I find that it works well and taking things apart is relatively simple.

This concludes my account of using various sizes of screw-down Regulators, I have found them to be easy to use and reliable, my sizing is based only on my experience and I have not attempted to apply any theoretical analysis. EIM

■ Andrew Strongitharm's Dougal constructional series takes a brief break this month – Andrew will be back next month describing the making of various backhead fittings.

FIGURE 5:
(drawn approx full size)

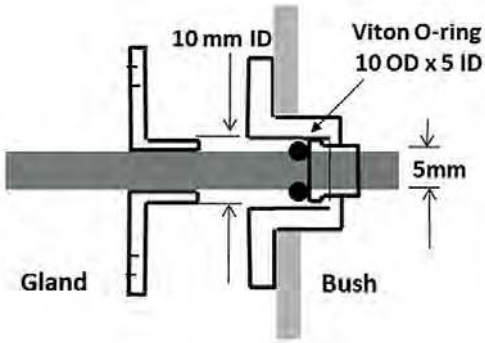
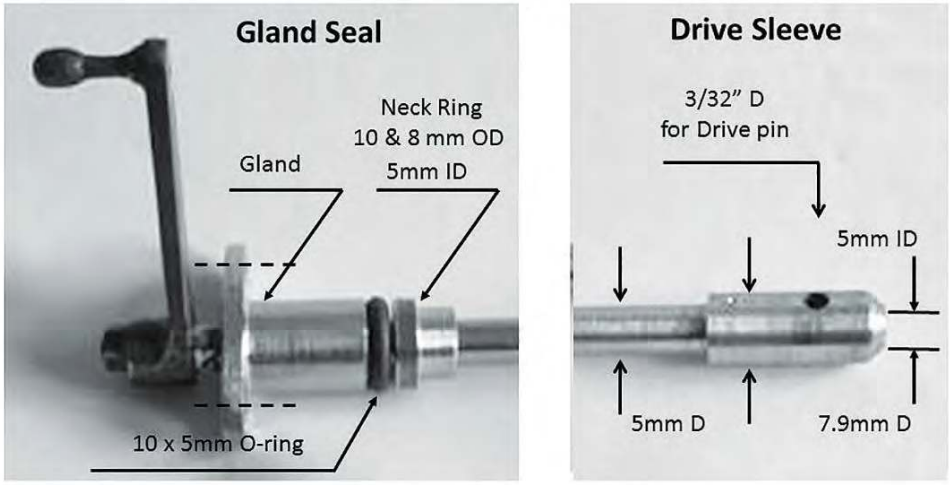


FIGURE 5: Regulation sealing in the bush – for a full description see the text.

FIGURE 6: Two pictures showing the regulator rod setup on the Whitworth.

BOTTOM: The proof of the text – Mike's 5-inch Claughton in action with its builder on the regulator.

FIGURE 6:



PNP plugs the vacuum

Latest in the series of essential accessories for model locomotives produced by PNP Railways are vacuum brake hoses. They are injection moulded in a high-quality thermoplastic elastomer, and each includes a moulded-in spring.

Two types are available. The 5-inch gauge version, made to a scale of 1 1/16th to 1ft, fits a 7/32-inch pipe, measuring 69.5mm long, with an internal diameter for pipe connections of 5mm and an outside diameter of 7mm. Each pipe costs £9.00 and PNP says they are suitable for standard gauge locomotives in 5-inch gauge or narrow gauge stock in other gauges.

The larger version is designed for 7¼-inch standard gauge stock or again narrow gauge in other sizes. It is scaled at 1.54-inch to 1ft, is 104mm long with an internal diameter of 6mm to fit a ¼-inch pipe and an outside diameter of 10.5mm. Cost is £6.50 each.

PNP Railways. Tel: 01453 833388 Web: www.pnp-railways.co.uk

No Warco at 2019 Midlands show

In a move that will shock many readers, machine tool supplier Warco has told us that it will not be attending the Midlands Model Engineering Exhibition this year.

The company says that the decision has been taken "after long and serious consideration," and has been made based on costs and major disruption in preparing the counters and machines for presentation at the exhibition, setting up and attendance over the exhibition days and re-stocking the stores and showroom after the event.

"This combined effort, involving many staff in multiple departments, is at least five weeks out of an already stretched work schedule," Warco stated.

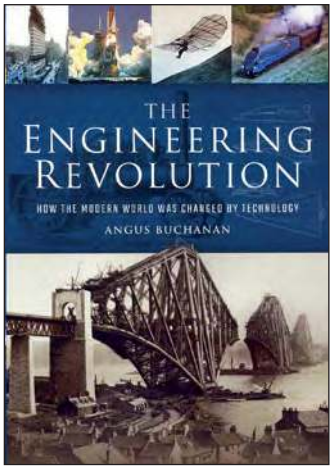
The firm will certainly be missed – it has been attending the Midlands show since its inception in Birmingham 30 years ago, and has followed the event to new venues of the Royal Showground, Donington Park race circuit and to the current Warwickshire Event Centre where it always has a significant stand.

"Warco would like express their thanks and apologies to their many regular visitors and loyal friends," the company stated, adding that to compensate for not attending, it will have some very special offers to coincide with the week of the show.

Rest assured we still expect the Midlands show, held between 17th and 20th October, to be one of the most major exhibitions of the year for the model engineer with plenty to see – we will be carrying our usual full preview and reports on the event and of course we will be there too!

The Engineering Revolution

Edited by Angus Buchanan



One of those titles that tries to encompass a vast subject – this is subtitled 'How the Modern World was changed by Technology' and is produced by the History of Technology research unit at the University of Bath. Angus Buchanan draws together 12 chapters each written by a specialist and covering production of food, power for industry and society, buildings and civil engineering, transport by land sea and air, communications, medicine, technology and society, warfare, future prospects and heritage. "The history of technology is the history of the species," the jacket proclaims.

The power and two of the three transport chapters will be of most interest to EIM readers, the first of the latter providing a brief history of shipping and the second showing how steam produced a revolution on both land and sea. There are some interesting points made, illustrated with a compact selection of both period and modern illustrations.

This book paints a picture without going into too much detail, though parts of it can be quite thought provoking. While of limited interest to the model engineer, it provides a mildly distracting read.

Published by Pen & Sword
Email: enquiries@pen-and-sword.co.uk
Web: www.pen-and-sword.co.uk
ISBN 978-1-473899-08-7
List Price £25.00

Power, Poles & Platelaying

George Hobbs

This is a rather different book on the Isle of Man's Manx Electric Tramway, which dates right back to Victorian times, and the subject matter covered will likely particularly appeal to readers of EIM.

The book is subtitled 'Keeping the MER on Track' and in intricate detail it focuses on the engineering, both mechanical and civil, that goes into ensuring the 3ft gauge line operates, despite the age of its equipment and the worst that the weather can throw at its North Atlantic coast location.

The sheer volume of detail is impressive – track forms, overhead pole designs, maintenance rail vehicles, individual analysis of structures, it's all here, running across both the MER and the Snaefell Mountain Railway. The latter offers its own bespoke challenges such as the central Fell rail used for braking and the complicated points that have to be maintained as a result.

Not so long ago there was an impressive 5-inch gauge model of a Manx tramcar appearing at shows – anyone wanting to follow suit with models of this type will find a lot to assist in the book.

Published by Loaghtan Books
Tel: 01624 818292
Email: info@loaghtanbooks.com
Web: www.loaghtanbooks.com
ISBN 978-1-908060-23-5
List Price £19.95

New engines to the fore

Busy times at the clubs with interesting hardware making its debut...

COMPILED BY **ANDREW CHARMAN**

Not quite as many club magazines and newsletters have arrived in the editorial inbox since last month's edition of these pages, but there is quite a lot of interest to be found in those we have received, clearly demonstrating that the 2019 club open season is well up and running, and very healthy too.

Particularly noticeable during an enjoyable afternoon perusing the latest arrivals (a great way to lose half a day – it's work, honest!) are some impressive new builds making their debut, and we were immediately drawn to the latest newsletter from the **Worthing SME**. The front-page picture, reproduced here, shows Worthing chairman Kevan Ayling with the first traction engine he has built – a 4-inch scale Foster (Kevan clearly doesn't do things by halves).

Now almost complete, the engine has taken four and a half years so far to build, from a set of drawings on which Kevan found more than 70 errors in the dimensions... In the picture it is on its very first outing from the workshop, Kevan standing nervously by as Worthing boiler tester Brian Hunt watches the safety valves lift for the first time.

A fine effort from Kevan and Worthing newsletter editor Dereck Langridge reports that at least three more club members are currently building traction engines, a very healthy sign for the hobby.

Elsewhere in the newsletter Kevan reports that the Worthing committee has unanimously agreed to offer the post of club president to Andrew Breese, one of the three enthusiasts who started the club in 1974. Many congratulations to Andrew.

New-build mania

Lots of new attractions at the **Grimsby & Cleethorpes ME**, the latest edition of the club's *Blower* newsletter highlighting the fact that in recent weeks the track has seen the debut of two brand-new locomotives and another with an 80-year-plus history that has been fully refurbished.

The latter is an American-style 4-6-2 Pacific built to the design of renowned miniature locomotive engineer Henry Greenly, in 1933. It apparently ran first on a private railway near London, then the Wonderland Miniature Railway at Cleethorpes and then further north in Cumbria. Returned to Lincolnshire in 2012 and now owned by Steve Foxton, it has been fully overhauled by Grimsby member Ray Crome.

"Built from a set of drawings on which Kevan found more than 70 errors in the dimensions.."

ABOVE RIGHT: Boiler tester Brian Hunt seems happy kneeling by the brand-new 4-inch scale foster, the first traction engine built by Worthing chairman Kevan Hunt, standing alongside. *Photo: Dereck Langridge*

The second picture shows the latest debutant at Grimsby, Graham Dumbleton's 7¼-inch 'Britannia' 4-6-2 having its steam test with its proud owner standing alongside.

Elsewhere in *The Blower* there is a report compiled by member Barry Green on the Grimsby club's part in the recent National Model Engineering Show at Doncaster (which we report in this issue). Barry goes into great detail and with good reason – the club made a decision to abandon its traditional display stand in favour of a new design – and promptly won the trophy for the best club display at the show! "I know I was not alone in having serious doubts and ▶

RIGHT: New on the track at Grimsby, but a very old loco – Ray Crome tries out the 1933 Greenly Pacific he has just finished overhauling for its owner. *Photo: Greg Marsden*

misgivings about the idea of dumping the structure that has served us so well for many years in favour of what would surely be nothing more than a table display – how wrong can you be?" Barry admits.

He adds that the design, with vertical banner flags bearing photographs and graphics at each end of the stand, railway totem-style club nameplates and some 60 models, was far more professional a display than the club has ever previously managed.

Britannias were to the fore at the **Ryedale SME** on 13th April. One of the most pleasing aspects of club membership is the opportunity to visit other clubs and to run on different tracks, and on this particular day Ryedale welcomed members from the **Urmston & Warrington** club.

The visiting locomotive count included a trio of Britannias, No. 70004 'William Shakespeare', 70030 'William Wordsworth' and 70045 'Lord Rowallan' as well as Duchess class No. 46234 'Duchess of Abercorn' in British Railways green, a Class 01 GNR 2-8-0 a Polly 2-6-0 and a pair of Class 20 diesels in London Transport livery. And to cap it all the Ryedale club debuted its new loco, a class 20 in 7¼-inch gauge.

All were kept busy hauling passenger and freight workings and despite a "biting easterly wind" great fun was clearly had by all, though apparently Ryedale's complex point and signalling arrangements required much focus by the visitors!

Small scale popular

At the **Bournemouth SME**, the 16mm garden railway is now in the process of being extended, having become increasingly popular. So much so in fact that the garden line is no longer subject to only being able to be used on the first and third Sundays of the month – members can run their 16mm locos whenever they wish, so long as they follow the society rules.

On the subject of 16mm scale progress on the Bournemouth club's Project Ellie, featured in these pages in May 2018 and aiming to produce a simple steam loco that can be built by novice model engineers, has slowed, not helped by project leader Dick Ganderton injuring his foot and having it encased in plaster! As well as preventing him driving Dick reports that the plaster cast does not make it very easy to silver solder gas tanks or boilers. We send best wishes for a swift recovery.

A club that always seems to be very busy (judging by the number of photos they send us, which is why the

"Ryedale's complex point and signalling required much focus by the visitors..."

ABOVE LEFT: Happy times at Grimsby as club member Graham Dumbleton debuts his 'Britannia'. *Photo: Greg Marsden*

LEFT: The decision to produce a new display for the Doncaster show proved a good one for Grimsby, as they won the award for best stand. *Photo: John Arrowsmith*

club features so much in these pages, hint, hint...) is the **Rugby ME**, and recent weeks have been no different. As well as busy public running sessions, expansion of the facilities has continued apace, notably at the new station where no less than five new loco watering points have been installed and commissioned.

Meanwhile work has started on the new raised track, and a visit from a digger with an auger certainly increased the pace with all the pillar planting holes dug in one day. Work has started on the planting of the pillars, seven concreted into position on 18th May. Eventually this will accommodate both 5-inch and 3½-inch gauge locomotives and Rugby secretary Howard Brewer reports that the speed of progress will depend on how many loco owners can be persuaded to lend a hand...

The Rugby club enjoyed a varied selection of visitors to its first major open weekend on 25th-26th May. This coming month sees one of the more popular gatherings, the Narrow Gauge Rally on 13th-14th July which has previously attracted a goodly selection of larger (as in physically) locos to the track in Onley Lane.

ABOVE: The arrival of a digger with the right implement greatly aided digging of post holes for the Rugby club's new track, but more help is sought with the concreting.

BELOW: Rugby saw an interesting selection of visiting locos at its first open day of the year on 25th-26th May

Photos: Howard Brewer

Joining forces

Perhaps the most significant news in the newsletter of the **Southampton ME** is off the track, the club having merged with the Winchester society. "We welcome to the Society their members most of whom were already well known to us," says editor Peter Cleare. The Winchester members have traditionally operated a portable track at various events and the booked programme for this year will continue, while the Southampton committee also believes that operating the portable track alongside Winchester members will help the club reach a wider audience.

Winchester held its final get-together on Friday 5th April and on the following day took the track to the Southampton 'Members Playday' so that everyone could get to know each other and Southampton members learn how the track operates. Apparently it proved a very successful day and we wish both Southampton and Winchester members success in their new venture.

Another very full, 44-page edition of the **SMEE** *Journal* arrived just as we were writing these pages and one comment immediately had this editor nodding in agreement; "Drawings, figures and photographs are the most common cause of problems for editors...." Oh how right is he...

Congratulations are due to Alan Wragg, who writes his first column as SMEE chairman having taken over from Allen Berman, while elsewhere in the issue is a telling column from Gareth Hughes on the lack of engineering education in schools. He tells how his friend, a metalwork teacher, found himself redesignated as a 'Design & Technology' teacher and the machine tools falling into disuse as health & safety concerns forbade their use. Eventually he resigned because he was fed up with teaching pupils how to make clocks from nothing more than perspex.

Gareth also laments how so many people 'making things' have lost the ability to use simple hand tools. "A drawing of a simple part is often accompanied by the instruction to 'have it laser cut'...."

It's sad but true – your editor will be forever grateful for being pointed at the metalwork room in his first week of 'big school' and learning how to use all the equipment that was such a mystery when he walked in. Today's youngsters are not getting that experience, with perhaps the only purveyors and teachers of such skills being the heritage movement. My daughter would never have imagined learning to braze and weld but she did, on our heritage railway...

Space runs out once again – keep the reports coming in and remember, if you send in some news with a picture included it's virtually certain to make these pages... **EIM**

If it's engineering, size doesn't matter...

Small scale is fine in EIM

I have a question to ask on the lower limit for scales in EIM. Like many fellow model engineers I am facing increasing age and restrictions in space at home. I like building locomotives and don't want to give up doing so, but something in 3½ or 5-inch scale will now be beyond me I fear.

So I want to downsize, to 16mm scale – I have seen some excellent models in this scale, coal fired with all the right bits working – it is a scale that seems to cover a vast range of applications, from very crude steam locos to miniature masterpieces.

So my question is, are such locos too small for EIM? I find it hard to picture the garden railway magazines carrying an in-depth constructional series of the type that appears in these pages, but I admit to having also heard one or two of my colleagues mutter that such small scales "Are not proper model engineering." Please advise

Mike Metcalfe

Model engineering query to have answered or point to make? Email or write to the address on page 3.

The Editor replies: Mike, whoever told you that 16mm is not proper model engineering certainly wasn't told that by this office! The first magazine I edited when I came into this arena professionally was the in-house journal of the Association of 16mm Narrow Gauge Modellers (www.16mm.org.uk) and I saw some very fine model locomotives in the scale, that had been totally scratchbuilt and which used exactly the same techniques employed in the larger gauges.

Rest assured that if a quality series on the building of a smaller-scale locomotive comes in and it features proper model engineering techniques, we will gladly publish it – in fact back in its very earliest days, starting in the December 1981 issue, EIM did publish a series on building a 16mm version of the Welsh Highland Railway's 'Russell.'

Apologies to Ashlynn

I have just had a look at the article in EIM (June) written by the young Matthew Kenington about our Search Engine research centre at the National Railway Museum, and I was just about to pass it to a colleague when I noticed a small error.

While it was a very fine article, I'm afraid he must have mixed up while trying to place the correct names to the various interactions he had. At the top of page 35 he has accidentally called me 'his' and 'he'! While I know the article is already now published and that this is a relatively small point of correction, as a young woman, I would still really appreciate it if this could be corrected to 'she' and 'her'. Many thanks.

Ashlynn Welburn
Search Engine Assistant National Railway Museum

The Editor replies: Oh dear, please accept our apologies Ashlynn. Having used Search Engine myself I know how wonderful a resource it is and clearly Matthew was carried away by it all!

JULY 2019 DIARY

EVERY SATURDAY
(Weather permitting)

South Lakeland MES public running, Lightburn Pk, Ulverston, pm

Sussex MLS public running, Beech Hurst, Haywards Heath, 2-5pm

EVERY SUNDAY
(Weather permitting)

Bournemouth SME public running, Littledown Pk, BH7 7DX, 11am-3.30pm

Canterbury SME (NZ) Public running from 1pm at Halswell Domain

Fylde SME Public running at Thornton Cleveleys from 1pm.

Grimsby & Cleethorpes MES public rides, Waltham Mill, DN37 0JZ, 12-4pm

Harrow & Wembley SME public rides, Roxbourne Park, Eastcote, 2.30-5pm

Kings Lynn & District SME, Lynnsport Miniature Railway, 11am-4pm

Kinver MES public running, Marsh Playing flds, High St, Kinver DY7 6ER.

Lancaster Morecambe ME public running, Cinderbarrow Railway, Tarn Ln, nr Yealand Redmayne, from 10am

Maidstone MES public running, Mote Pk, ME15 7SU, 2.30-5pm

North Wilts MES public rides, Coate Water Railway, Coate Water Country Park, Swindon, 11am-5pm

Norwich SME public running, Eaton Pk, 1-5pm, NR4 7AU

Portsmouth MES public running, Bransbury Pk, PO4 9JY, 2-5pm

Rochdale SME public running, Springfield Park, Bolton Road (A58), Rochdale, pm

Southampton MES public running, Riverside Pk, SO18 1PQ, 1-4pm

Southport MES Public running at Victoria Park 11.30am – 4.30pm

Sussex MLS public running, Beech Hurst, Haywards Heath, 2-5pm

Urmston MES Public running in Abbotsfield Pk 11am – 3.30pm

Vale of Aylesbury MES Public rides, Quainton Rly Centre, from 12 noon.

West Huntspill MES public running, Memorial playing fields, 2-4.30pm

Wigan MES public rides, Haigh Woodland Pk, School Ln, Haigh, Wigan, PM

Wirral MES Public running, Royden Pk, Frankby, 1-3.30pm.

EVERY TUESDAY
(Weather permitting)

Bromsgrove SME public running, Avoncroft Museum of Historic Buildings, B60 4JR 11.30-3pm

Romney Marsh MES Track meeting, Rolfe Ln, New Romney from 11am

EVERY WEDNESDAY
(Weather permitting)

Bournemouth SME public running, Littledown Pk, BH7 7DX, 11am-3.30pm

Harrow & Wembley SME members meeting, Roxbourne Park, Eastcote, 2.30-10pm

Kings Lynn & District SME, Lynnsport Miniature Railway, 11am-4pm

1 Lancaster Morecambe ME members evening running, Cinderbarrow Railway, Tarn Ln, nr Yealand Redmayne, from 5pm

4 South Lakeland MES meet, Pavilion, Lightburn Pk, Ulverston, 7.30pm

5 Portsmouth MES BBQ, Bransbury Pk, Portsmouth PO4 9JY, 6.30pm

5 Rochdale SME annual model running night, Springfield Park, Bolton Road (A58), Rochdale, 7pm

6 Ickenham SME public rides, Coach & Horses pub, Ickenham, UB10 8LJ, noon-5.30pm

6 Isle of Wight ME open afternoon, Broadfields, Park Rd, Cowes, 2pm

6 Lancaster Morecambe ME Open Day, Cinderbarrow Railway, Tarn Ln, nr Yealand Redmayne, from 10am

6 North Wilts MES public rides, Coate Water Railway, Coate Water Country Park, Swindon, 11am-5pm

6 South Lakeland MES Open Day, Lightburn Pk, Ulverston

6 SMEE Talk, Jim Crebbin & his experimental locos, Roger Backhouse, Marshall Hse, London, 2.30pm

6 Southampton MES Members' Playday, Riverside Pk, SO18 1PQ

6 Tiverton MES Running day, Rackenford, contact Chris Catley, 01884 798370

6 Guildford MES Stoke Park Railway
7 Gala Weekend, Stoke Park, Guildford GU1 1TU, 10am-5pm

JULY 2019 DIARY (continued)

6 North Wilts MES Charity
7 Weekend, Coate Water Railway, Coate Water Country Park, Swindon, 11am-5pm

7 Bedford MES public running, Summerfields' Rly, High Rd. Haynes MK45 3BH, 10.30am-3.45pm

7 Northampton SME Public Running, Delapre Pk, Northampton, NN4 8AJ, 2-5pm

7 Plymouth MS public running, Goodwin Pk, PL6 6RE, 2-4.30pm

7 Southampton MES Charity Day, Riverside Pk, SO18 1PQ

7 Wimborne DSME public running, Wimborne, Dorset, BH21 3DA, 11am-4pm

7 Worthing SME public running, Field Place, BN13 1NP, 2-5pm

11 TIME meeting, Pipers Inn, 70 Bath Road (A39), Ashcott, Somerset TA7 9QL, 7pm

11 Worthing SME meeting, The Air Ambulance, Field Place, BN13 1NP, 7.30pm

12 Tiverton MES meeting, Old Heathcoat comm ctr, contact Chris Catley, 01884 798370. 7.30pm

13 Cardiff MES Steam Up & Family Day, Heath Park, 1pm-5pm

13 Northampton SME Club run, Delapre Pk, Northampton, NN4 8AJ, from noon

13 North Wilts MES AME Owners Day, Coate Water Railway, Coate Water Country Park, Swindon, 11am-5pm

13 York ME Summer Meeting, North Lane, Dringhouses YO24 2JE, 7pm

13 Rugby MES Narrow Gauge Rally,
14 Onley Ln, CV22 5QD, 10am-5pm

14 Bracknell RS public running, Jocks Ln, Binfield Road, RG12 2BH, 2-6.30pm

14 Bristol SMEE public running, Ashton Court Railway, Bristol, BS8 3PX 7.30pm

14 Canterbury MES public running, Brett Quarry, Fordwich, 2-4pm

14 Cambridge MES Public Running, Fulbrooke Rd, CB3 9EE, from 1,30pm

14 Harlington Loco Society public running, High St, Harlington UB3 5ET, 2-5pm

14 Welling MES public running, electricity station, close to Falconwood rail station, Kent 2-5pm

16 Grimsby & Cleethorpes ME meeting, Shifting a power station, Waltham Windmill, DN37 0JZ, 7.30pm

16 Model Steam Road Veh Soc Meet, Gloucs & Warks Railways by Michael Bunn, Longford Vill Hall, Longford Lane, Gloucester, GL2 9EL, 8pm

17 Bournemouth SME AGM, Bridge Community Centre, Littledown Centre, 7.30pm

19 Rochdale SME general meeting, Castleton Comm Cntr, Rochdale OL11 3AF, 7pm

19 Frimley & Ascot ME Open Running
20 Days, Frimley Lodge Min Rly, Ascot Racecourse, from 11am

20 Leyland SME LMS theme day, Worden Pk, Worden Lane PR25 1DJ

20 Romney Marsh MES Track meeting, Rolfe Ln, New Romney from 12 noon

20 SMEE rummage/disposal sale, Marshall Hse, London, 2.30pm

20 Rugby MES Open Wknd, Onley
21 Lane, CV22 5QD,

21 Bedford MES public running, Summerfields' Railways, High Rd. Haynes MK45 3BH, 10.30am-3.45pm

21 Bristol SMEE public running, Ashton Court Railway, Bristol, BS8 3PX 7.30pm

21 Cardiff MES Open Day, Heath Park, 1pm-5pm

21 Plymouth MS public running, Goodwin Pk, PL6 6RE, 2-4.30pm

21 Tiverton MES Running day, Rackenford, contact Chris Catley, 01884 798370

21 Wimborne DSME public running, Wimborne, Dorset, BH21 3DA, 11am-4pm

21 Worthing SME public running, Field Place, BN13 1NP, 2-5pm

21 York ME Open Day, North Lane, Dringhouses YO24 2JE, 7pm

22 Worthing SME meeting, Loco testing by Mike Wheelwright, Field Place, BN13 1NP, 7.30pm

24 Bedford MES public running, Summerfields' Railways, High Rd. Haynes MK45 3BH, 10.30am-3.45pm

24 Leeds SME Summer evening steam-up, Eggborough Pwr Stn, DN14 0UZ, 12.30pm-late

27 Pimlico Light Railway club day, Pimlico, Brackley, NN13 5TN

27 27 Romney Marsh MES running for New Romney Country Fayre, Rolfe Ln, New Romney from 12 noon

27 York ME Club maintenance day, North Lane, Dringhouses YO24 2JE,

28 Bristol SMEE Club Day, Ashton Court Railway, BS8 3PX 7.30pm
28 Harlington Loco Society public running, High St, Harlington UB3 5ET, 2-5pm

28 Guildford MES Stoke Park Railway open day, Stoke Park, Guildford GU1 1TU, 2-5pm

28 Pimlico Light Railway public running, Pimlico, Brackley, NN13 5TN

28 Welling MES public running, electricity station, close to Falconwood rail station, Kent 2-5pm

28 Wigan MES Open Day, Haigh Woodland Pk

30 Wigan MES meeting, Ince Methodist Church, Manchester Road, Ince, Wigan, WN1 3HB 7pm

31 Bedford MES public running, Summerfields' Railways, High Road, Haynes MK45 3BH, 10.30am-3.45pm

31 Sussex MLS public running, Beech Hurst, Haywards Heath, 2-5pm

Details for inclusion in this diary must be received at the editorial office (see page 3)at least EIGHT weeks prior to publication. Please ensure that full information is given, including the full address of every event being held. Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions

Vintage Steam Rallies

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Ploughing Engines • Stationary Engines
Live Demonstration Working Area • Steam Ploughing
Scale Steam Engines • Passenger Carrying Scale Steam Railway

Old Time Fun Fair

Veteran & Vintage Cars and Motorcycles • Tractors & Horticultural
Historic Commercial and Military Vehicles

Beer Tent • Food Stalls • Side Shows and Stalls

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Centec mill on site; To Clear


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