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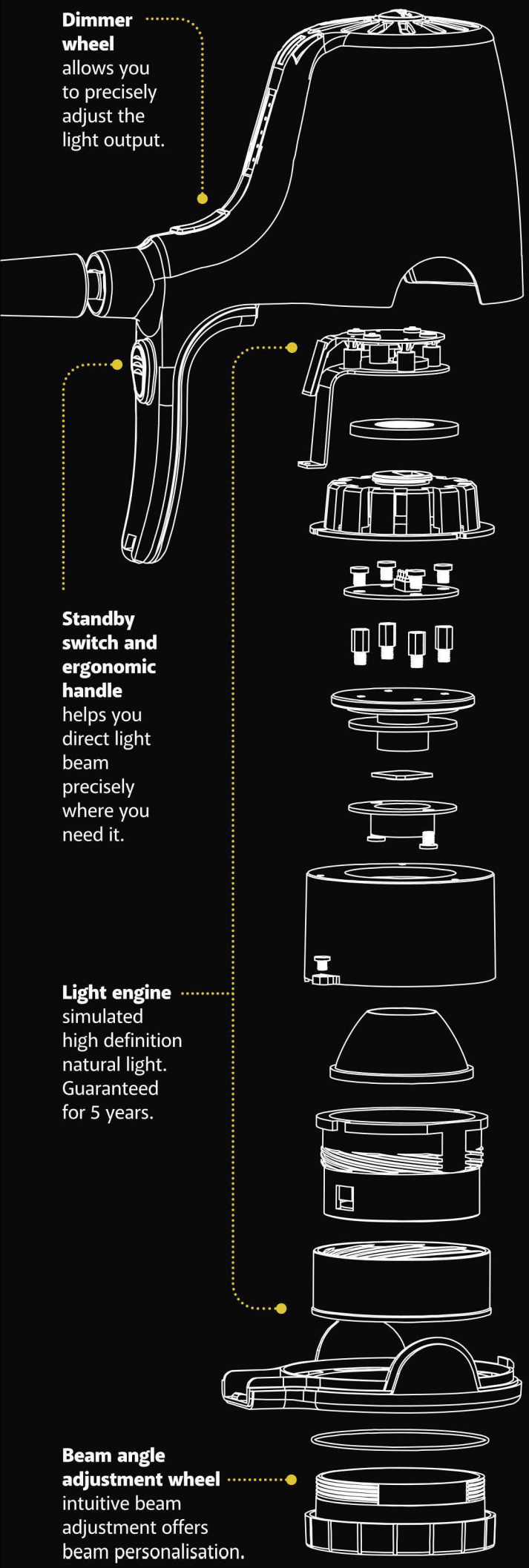

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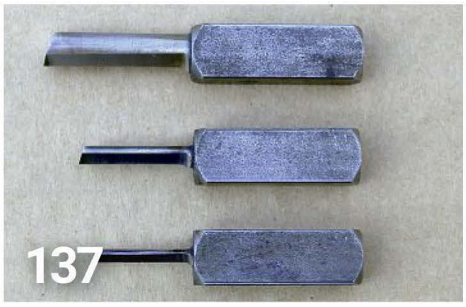

IN THIS ISSUE

Vol. 231 No. 4721 14 – 27 July 2023

SUBSCRIBE & SAVE UP TO 49%
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128 SMOKE RINGS
News, views and comment on the world of model engineering.

129 A NEW TRACK EXTENSION FOR THE MELTON MOWBRAY MES
John Arrowsmith shares in the celebrations at Whissendine.

134 FINISHING *ELLIE*, THE STEAM TRAM
Tony Bird adds a boiler and prototypical bodywork to complete his steam tram.

137 SLOTTING ON THE LATHE
Jacques Maurel selects the right tools for various slotting jobs on a small lathe.

140 ELECTRICITY GENERATORS FOR MODEL STEAM ENGINES
Bob Hayter teams up the new technology of dynamos and generators with the old technology of steam engines.

144 BEER HEIGHTS LIGHT RAILWAY SIGNALLING
Mike Hanscomb describes the signalling system at the Beer Heights Light Railway at Pecorama in Devon.

145 RADIAL VALVE GEARS AGAIN
Duncan Webster explores the subtleties of valve gear operation.

148 THE EATING OF ELEPHANTS
Steve Goodbody argues that anything is possible if you take it a bite at a time.

152 LNER B1 LOCOMOTIVE
Doug Hewson presents a true to scale 5 inch gauge model of Thompson's B1.

157 BASIC OSCILLATOR STEAM ENGINE IN CAD
Luis Trincão leads us through the creation of a 3D CAD model of an oscillating steam engine.

159 THE STATIONARY STEAM ENGINE
Ron Fitzgerald tells the story of the development of the stationary steam engine.

164 OBITUARY - IVAN LAW
Mike Law looks back over the long and productive life of his father Ivan Law.

166 A FIVE-INCH GAUGE 0-4-0 PADARN RAILWAY TENDER LOCOMOTIVE
Luker presents *Fire Queen*, a Welsh slate quarry locomotive.

172 CLUB NEWS
Geoff Theasby compiles the latest from model engineering clubs around the world.

175 CLUB DIARY
Future Events

ON THE COVER...

Chris Woolston's superb un-rebuilt Royal Scot in 7¼ inch gauge, seen at Whissendine (photo: John Arrowsmith).

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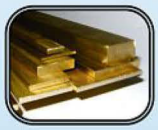

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The Model

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- Bronze cylinders with stainless steel pistons and valves
- Sprung axle boxes with needle roller bearings
- Piston valves
- Mechanical lubricator
- Outside Walschaerts valve gear
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SMOKE RINGS

MARTIN EVANS
Editor

DIANE CARNEY
Assistant Editor

Federation Rally

This year the Federation of Model Engineering Societies (FMES) rally is being held at Frimley Lodge Miniature Railway in Frimley Hampshire, on Saturday the 16th of September 2023. Set in woodland and within a country park, the railway includes a kilometre-long multi-gauge (3½, 5, 7¼ inch) ground level track and a raised track for owners of smaller locomotives (2½, 3½ and 5 inch). Over the winter the organisers, the Frimley and Ascot Locomotive Club, have invested a great deal of time and effort on the infrastructure for the rally and they are looking forward to welcoming visitors to this event. The layout of the track with technical notes can be found on the club website (www.flmr.org or use QR code).

Frimley club.

Who can attend?

The rally is open to all members of clubs affiliated to the Federation. Please visit the club website for more information on this event and its administrative requirements.

Competitions

On the day of the rally, all visitors with eligible locomotives are invited to enter the two competitions that will be held. These are the regular Australian Association of Live Steamers (AALS) trophy (FMES affiliated club members only) and the newly launched Federation Autumn Rally Competition. The rules for both competitions can be found on the FMES website (www.fmes.org.uk/project/fmes-autumn-rally-at-frimley or use QR code).

FMES rally information.

Booking your place

For the club to properly plan the resources for hosting visitors, it is requested that you complete the booking form on the club rally page as soon as possible.

Other activities

Following on from the event, there will be club running on Sunday the 17th September in which all attendees and families are invited to take part.

Departure platforms, FLMR, Frimley Lodge Park.

Model Tram Exhibition

The popular Model Tramway and Railway Exhibition returns to the National Tramway Museum, Crich Tramway Village on Saturday 19th and Sunday 20th August 2023.

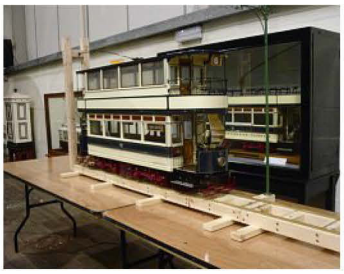
A total of eight layouts will be present at the exhibition, which will include a new 5¼ inch gauge demonstration layout, built at the museum, for the Robert Whetstone eighth scale model trams, which will be in operation for the public to view.

The National Tramway Museum is currently looking after a collection of model trams made by the late Robert Whetstone of Bromsgrove. The models are made to a very high standard (see photograph) and were often exhibited by Mr Whetstone at model engineering exhibitions.

Each model took up to three years and 3500 hours to build, and Whetstone would spend five evenings a week in his garage, producing the finely detailed replicas. He worked in the transport industry as a coachbuilder and draughtsman at the Austin/British Leyland plant in Longbridge and used to travel to work on the Birmingham trams.

Normal museum entry charges apply and opening times are 10.00am to 5.30pm (last admissions 4pm) both days. For details visit www.tramway.co.uk or telephone: 01773 854321.

Crich Museum.



Robert Whetstone one eighth scale tram.

Bradford Cup

It's my pleasure to announce that the winner of the Bradford Cup 2023, for the article or series in *Model Engineer* during 2022 voted the best by readers, is Steve Goodbody for his series on *The Eating of Elephants*. Congratulations, Steve!

Ivan Law

We very much regret to report that Ivan Law has died at the age of 95. The whole of Ivan's long and productive life was dedicated to model engineering and he was a significant figure for both the Society of Model and Experimental Engineers, where he was vice president, and also for this magazine, in his capacity as chief judge for the Model Engineer Competition for many years. We include an obituary for Ivan on page 164.

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
07710-192953
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A New Track Extension for the Melton Mowbray MES

John Arrowsmith tries out the club's newly relaid ground level track.

I was invited to the Melton Mowbray Society to enable me to cover the official opening of their new track extension. This society is tucked away in rural England, at Whissendine in Rutland, the smallest county in England and they have enjoyed a track in the grounds of the Whissendine Sports and Social club for over 40 years.

In the early days, members erected a raised track which had been donated by one of the then new members. This track served for a short while before members began the construction of the ground level 5 and 7¼ inch gauge track. This ground level track was officially opened in 1983 by Jennifer, Lady Gretton, president of the Society. Being a well organised and active club, members decided that after all this time they would really like to increase the length of their ground level track. Plans were made, the ground was examined to ensure that the necessary space could be found within their existing boundaries and costs were considered. Many other clubs have gone through this process and what at first seemed an impossible task has resulted in a fine new extension that enhances the facilities at the Society. This is exactly what has happened at Whissendine.

The route was planned to use the area around the outside of the existing track - which was the easy bit. They then had to consider how this could be incorporated into the existing station layout without a great deal of extra work. I was reminded that when the Society first acquired this site there was a diagonal fall across it of about 23 feet ... yes 23 feet!! Obviously to lay a track on such a site at all was a big task with a great deal of earth moving and filling to establish a level track bed. While a cutting had to be dug at the high end of the site, a good portion of the track was laid on the top of a concrete block wall which at the low end of the site was 5 feet high and then back filled. The work for the extension, whilst being awkward, was not going to need that amount of earthworks. One member owned a mini digger which saved a tremendous amount of hand landscaping work. The details of the amount of ground needed showed that it was possible to add an additional line parallel to and outside of the existing mainline, but how could they connect the two together to create a longer run? The answer lay in providing a new diamond crossing between the two tracks on the other side of the site from the station (**photo 1**). Dave Oliver or 'Dolly' as he was known, was a member of the main working party or 'track gang' and he volunteered to design and build this new complex crossing in addition to helping build the main track panels and points. This crossing was one of the last pieces of the new line to be installed and it gives them a run now of about 1150 feet while the raised track is about 300 feet long. When this work was completed some minor adjustments to the trackwork and points in the station area enabled the whole circuit to be joined together whilst maintaining the necessary clearances. Now, a train will leave the station in an anti-clockwise direction and continue on the inner circuit, following the original track line, going outside the steaming bays until it reaches the diamond crossing where the driver has right of way (**photo 2**). It is here that the

David Oliver's diamond crossing is a fine piece of work.

Negotiating the new diamond crossing.

The route indicator signal at the station.

Vice president Bob Moore declares the new track open for business.

Two traction engines make good use of the clubhouse terrace.

train crosses over to the new outer circuit, continues under the footbridge and over the road crossing (which now has two tracks) and continues along the outer edge of the site, around the laurels and on to the back straight until the diamond crossing is reached. Once over the crossing the train continues to the station.

Just to add a bit more interest, however, as a train approaches the station on the inner line, an electrically operated point controlled by an advance signal (**photo 3**) enables the driver to choose between stopping at the station or bypassing it and joining the inner track beyond the station, thereafter continuing the double circuit again.

It all works like a dream and members here are to be congratulated on creating this new line and thereby gaining so much more operational use from their compact site.

Very sadly, Dave Oliver passed away suddenly at the end of last year and did not witness the opening ceremony but he did see the track completed and he actually drove his locomotive on the track a couple of times. To honour all his hard work, including being secretary for a good number of years, the outstanding feature of the new track is called 'Dave's Diamond' and is commemorated with a station totem by the crossing.

Having been on the site for over forty years the opening of the new line obviously evoked memories of all the initial work and the members involved at the time. It was pleasing to see that three of the founder members were here to witness the further progress the club has made since those early days. Thirty years, almost to the day, after the original ground level track was opened, Lady Gretton, still the Society's president, was to have officially opened the new extension. Unfortunately a family commitment prevented her from attending and the opening ceremony was performed by Bob Moore who is the vice president and also one of the founder members (**photo 4**).

I could clearly see the improvements they have made in recent years because when I last visited the site for one of their Steam Gala weekends, the club had just a couple of older sectional buildings as their clubhouse and facility room. Now they have an excellent block built club building and accessible toilet block, which is nicely in keeping with the rural aspect of the site. The original Whissendine Sports and Social Club building is still on the main site and I understand this is also due for a major refurbishment which will hopefully, in turn, introduce some new members to the model engineering society. A large area in front of the clubhouse is paved and this provided a smashing operating area for a selection of traction engines to parade (**photo 5**) as well as a pleasant area for members and guests to gather for the opening ceremony. The chairman, John Wood along with vice president, Bob Moore addressed the assembled crowd; they proceeded to relate the history of the site and remembered the members who had built everything. Mention of the late Dave Oliver, who had been so instrumental in the new extension work, resulted in a degree of emotion being expressed in the speeches. The official cutting of the ribbon was performed by Sue Oliver, Dave's wife who also received a bouquet of flowers from the chairman (**photo 6**). Bob Moore then presented some framed Honorary Life Membership Certificates to two

Sue Oliver with Chairman John Wood and Vice President Bob Moore after the presentations.

Founder members David Calvert and Neville Harvey with their Honorary Membership awards.

A superb example of an un-rebuilt Royal Scot locomotive in 7¼ inch gauge owned by Chris Woolston.

Three trains wait to lead the cavalcade around the track after the official opening.

Another excellent example of an LMS Black 5 in 7¼ inch gauge, owned by Geoff and Scott Griggs.

of the founder members who were present on the day; David Calvert and Neville Harvey (**photo 7**) along with Sue Oliver who was also made an Honorary Member on behalf of her late husband, David. Having cut the ribbon a cavalcade of locomotives and passengers then proceeded to travel around the circuit.

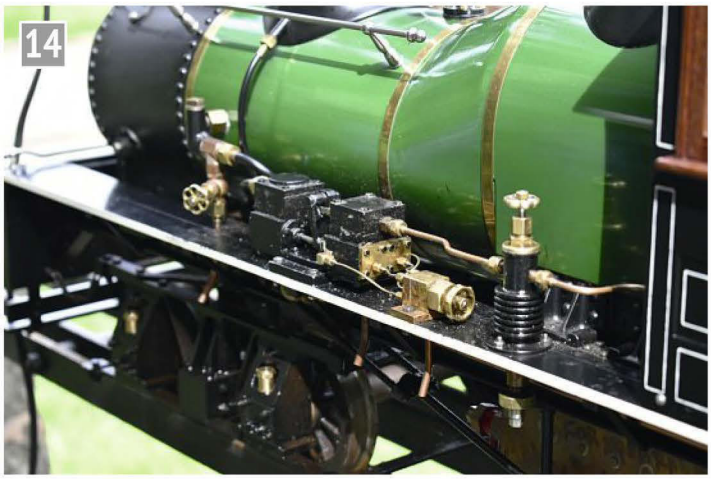
Prior to the official duties of the day I had spent some time chatting with members who were steaming their locomotives ready for the day's work and what a lot of very interesting stories emerged! The superb example of an un-rebuilt Royal Scot (**photo 8**) in 7¼ inch gauge is now owned by Chris Woolston and was found by him in an old barn, covered in all sorts of rubbish and dirt, but Chris thought it looked a good engine. Having agreed a price with the owner it was sent to a well known builder and renovator in South Wales who produced the model shown here. I can say that when it was steamed it ran absolutely beautifully all day (**photo 9**). I travelled behind it and the exhaust beat sounded spot on and the power was quite considerable. Another locomotive being prepared for the day was an LMS Black 5 in 7¼ inch gauge, now owned by Jeff and Scot Gregg which again was found in a very run down condition and in pieces at a works in London. It was brought back to Melton for a boiler test as it had never been steamed since it was built. Cleaning off the boiler revealed that its original test number was done by the Melton Mowbray club and the engine had been built locally. Coincidence or what? It was subsequently renovated by Jeff and Scott and the photos show the superb condition after this work. It too ran faultlessly all day (**photo 10**).

Standing on a ground level siding adjacent to the steaming

This 5 inch gauge 9F was a Winson kit that has been modified by Tony Measures.

Andy Briggs sets off from the station with his 7¼ inch gauge Saddle Tank locomotive.

Stewart Jackson's superb 5 inch gauge Twin Truck Class B Shay locomotive.



The miniature steam pump on the Shay.

bays was an excellent example of a BR 9F, *Evening Star*. This was originally a Winson kit but has been brought up to this standard by owner, Tony Measures (**photo 11**).

The third locomotive I must mention was the 7¼ inch gauge model of a rare prototype built and owned by Andy Briggs, which was an 0-6-0 Black Hawthorne & Co saddle tank, the original of which was built by Chapman & Furneaux at Gateshead in 1901. This engine also ran faultlessly all day,

Norman Smedley's LMS 0-4-0 Shunter and Guard's van.

happily demonstrating what a robust engine it is (**photo 12**). Over on the raised track one of the best examples of its type I have seen was being prepared. This was the 5 inch gauge Twin Truck B Class Shay locomotive, circa 1893, built by Stewart Jackson (**photo 13**) using a design by the Japanese designer, Kozo who scaled the engine from drawings in a book on the full size engines. Stewart used Kozo's book for guidance, built the engine and completed it about five years ago. Stewart explained that he had built the small steam pump mounted on the left hand running board for use as a boiler feed pump; in full size it also had other uses such as fire-fighting and washing down. It was a design from *Live Steam* magazine and Stewart scaled it down for the engine. To get it to work properly he has incorporated some drain cocks and no fewer than 16 ball valves in the small housings. He said he can run the locomotive for hours with this pump working continuously as it is very efficient. It must be very much like watch making, creating such a little pump (**photo 14**).

It was good to see a number of younger members fully involved in all the day's activities, and one young man William Davies drove me around the circuit a few times using Norman Smedley's LMS shunting engine (**photo 15**). This young man is a regular at the club and is a very competent driver. Another young member was Thomas Hutton who was driving his 0-4-0 Ruston style shunter, which he says is easy to drive and an ideal engine for trainee drivers (**photo 16**). Residing on a line by the steaming bays again was the latest locomotive being built by Dave Calvert. This is a 5 inch gauge example of a Midland Compound 4-4-0 which looks to be a fine engine in the making (**photo 17**). Also on display

Thomas Hutton leaves the station on the inner track with his 0-4-0 Ruston electric shunter.

Dave Calvert's 5 inch gauge Midland Compound still under construction.

The unfinished engine block from Norman Smedley's Foden Speed Six Steam lorry.

Alli Knott fires up his 3 inch scale Burrell traction engine to a Plastow design.

Alfie and William Knott enjoying time driving dad's 3 inch scale Burrell.

Graham Wissum with the 4 inch scale Burrell which he built.

Plenty of atmosphere as the 4½ inch scale McLaren of Chris Smith is fired up.

Ten year old Charlie Johnson driving a Wallis & Stevens Simplicity Roller built by his granddad in 1976.

The happy band of lady members who produced the amazing Buffet lunch shown in front of them.

here was the unfinished engine block from Norman Smedleys Foden Speed Six steam lorry (**photo 18**).

A small but excellent selection of traction engines were also in steam and enjoying the space available to them on the adjacent sports field as well as parading on the forecourt of the club house. Alli Knott and his two sons were steaming an as yet unpainted 3 inch scale Burrell to a Plastow design (**photo 19**) which his boys enjoyed driving (**photo 20**).

A 4½ inch scale Burrell to an original Plaistow design, and now owned by Graham Wissum, was also in steam; it was built in 1990 (**photo 21**). Making plenty of steam was the 4 inch scale McLaren owned and built by Chris Smith; again, another good example of the type (**photo 22**). In addition to these engines was a little 4½ inch scale Wallis & Steevens Simplicity Roller being driven by 10 year old Charlie Johnson whose granddad, Barry Johnson built the engine (**photo 23**).

Following the excellent buffet lunch provided by the club and with everyone well fed, the day continued well into the afternoon with the many locomotives enjoying track time and the traction engines parading around, as well as operating in the adjacent sports field. Members and guests sat and chatted and watched the track workings, marking a very special day for the club. It was a most enjoyable and relaxed event and I would like to thank everyone for their contributions on the day. I am sure that, with the enthusiasm I witnessed by members the Melton Mowbray & District Model Engineers Society, this club will continue to flourish.

I offer my personal thanks to Bob Moore, Norman Smedley and John Wood along with the ladies who worked so hard in the kitchen (**photo 24**) and all the other members I met for an excellent and most enjoyable day out.

ME

Finishing *Ellie*, the Steam Tram

PART 1

Tony Bird adds a boiler, gas tank and bodywork to complete the project.

This is a follow up article on building my version of *Ellie*, the Steam Tram. The first part of two instalments of the original article being published in *Model Engineer* on 28 January 2022. This article continues the description of the construction of the model to its first steaming and the modifications made to improve performance and ease of use.

The first article described the designing and making of a single cylinder, double acting steam engine that was fitted with a reversing system to replace the single cylinder, single acting engine with no reverse of the original version as described by Andrew Allison in his book, *Ellie the Steam Tram*.

The article ended with the model consisting of a chassis with a finished engine, a gear and chain drive to the wheels, a part-built boiler fitted with heat exchanging rods and a completed ceramic gas burner.

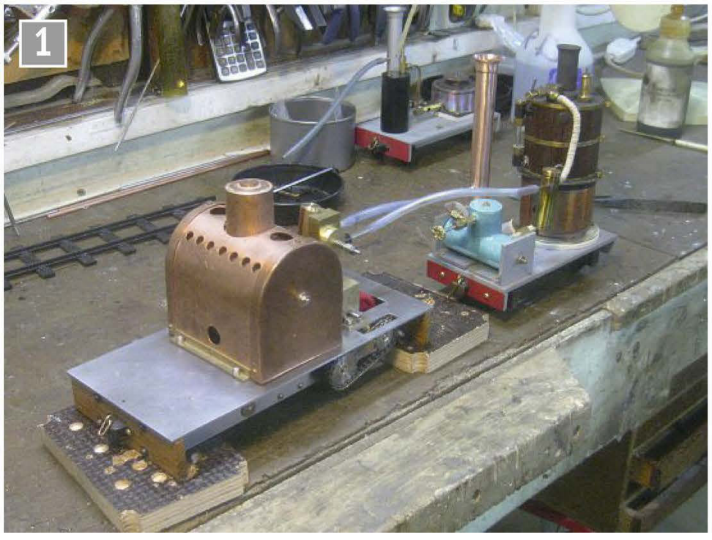
The model performed well using a test boiler fitted on a wagon (**photo 1**). A video of the engine construction and the model running on a track can be seen at: youtu.be/ZlInA09hBco (or use QR code).

Ellie *with test boiler.*

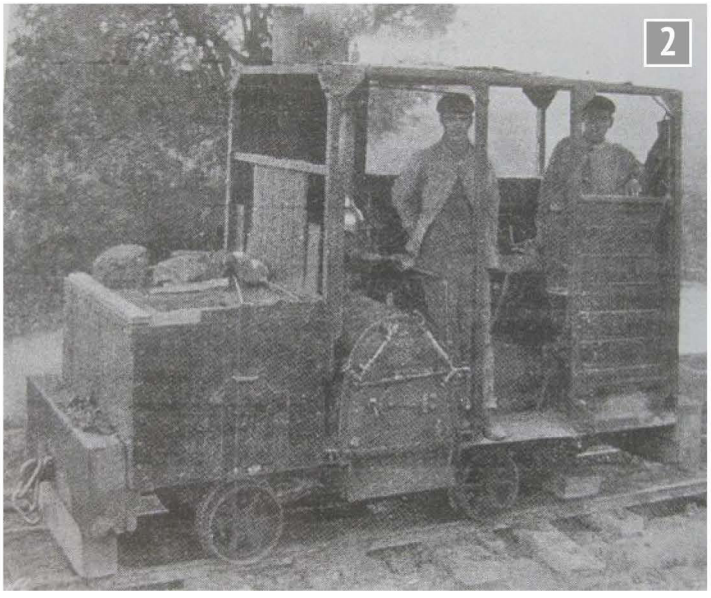
Before starting the next stage of construction, it was decided to finish the model to 7/8 inch scale, this was because a 16mm scale figure on the footplate wouldn't be able to see over the boiler, which is important as this particular model of *Ellie* could travel in both directions. To this end a 7/8 inch scale figure of a driver was ordered from Model Earth Design.

While trawling the internet some photographs of a unique locomotive were found (**photo 2**). This was obviously home built using recycled materials but these photographs provoked new ideas for a further modification to the *Ellie* design.

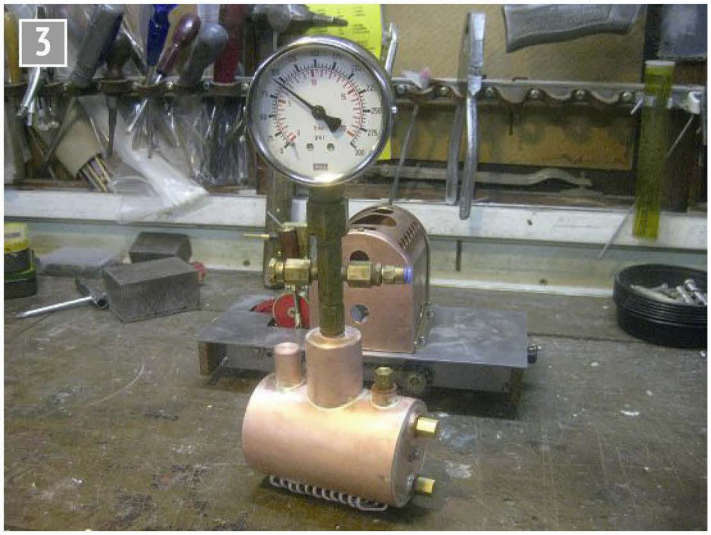
With the new ideas in mind a start was made on finishing the boiler. The boiler already had a steam dome fitted to increase the usable water capacity, the safety valve on top of it being under the chimney which in the original design was attached to the roof of the model. It was decided to copy the locomotive in the photograph and offset the chimney and why not fit a gauge glass as well? First, one of the two holes in the top of the boiler had a raised bronze plug soldered in it so that a removable chimney could be fitted. The other hole had a threaded bush for a top-up valve soldered in; for the gauge glass another threaded bush was soldered into the end of the boiler, joining the one



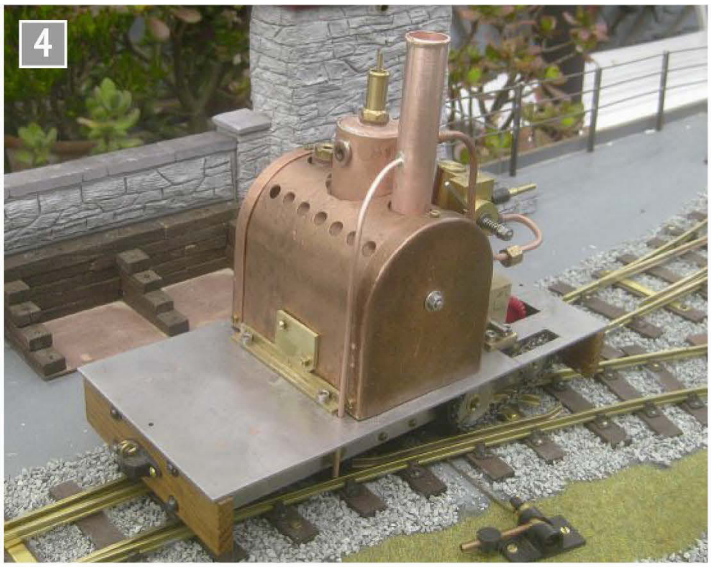
Ellie *relying on steam from a test boiler.*



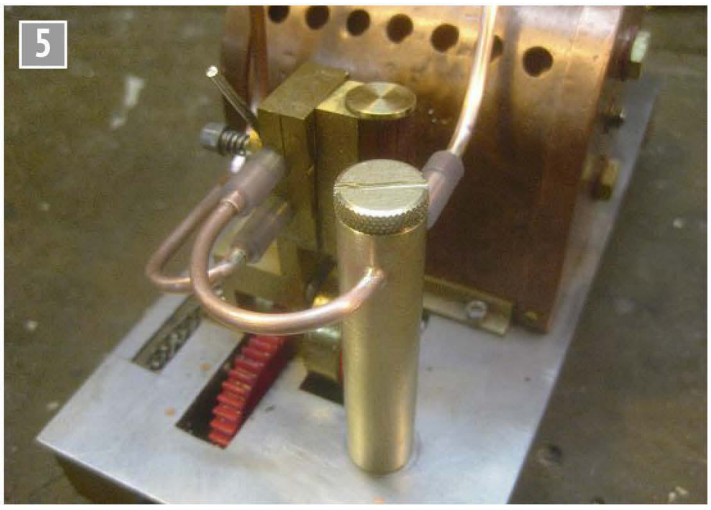
Inspiration for the styling of Ellie.



The finished boiler shell undergoing a hydraulic test.



The completed boiler.



Displacement lubricator fitted to Ellie.

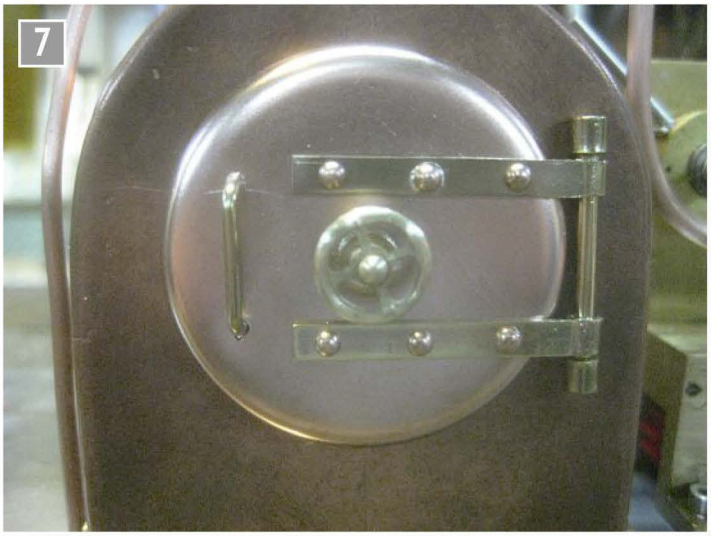
already there that would have been used for filling the boiler. With all the bushes soldered in place the holes in the boiler were plugged and the boiler tested for 10 minutes at 100 psi for a maximum working pressure for the boiler of 50 psi (**photo 3**).

A swivel cover was fitted over the hole in the boiler flame guard that would be used to light the burner. The chimney was made from a 15mm copper pipe and would be used to remove oil and water from the exhaust before it went to atmosphere. This would be achieved by blanking off the chimney tube just above the bronze plug on the boiler. Just above this blanked off portion of the chimney a pipe would be fitted to drain oil and water. The exhaust steam pipe would enter the chimney about 10mm above the drain pipe and would go almost completely across the chimney so the exhaust steam would hit the inside wall of the chimney and any oil or water would run down to the drain pipe (**photo 4**).

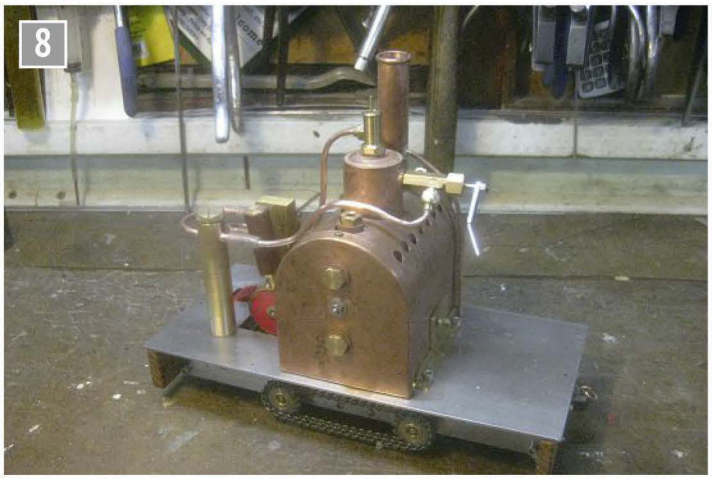
A lubricator with an offset steam pipe to allow a syringe to be used to drain it was made. At this point it might be worth mentioning some of the unions that are used on the model. They are of a type I usually use out of sight. They take up little room and are easy to take apart; the steam pipe is 1/8 inch O/D and it slides into a tube on the engine of 5/32 inch O/D which has an I/D of 1/8 inch. The steam pipe has a short section of 5/32 inch tube soldered 5mm before its end. The steam pipe is pushed into the tube on the engine until the two 5/32 inch tubes touch, then a length of silicon tube is pushed over the joint to make it steam tight. The other ends of pipes using this type of connector either have a conventional union or are soldered into something that won't move. In either case the pipe cannot come out of the connection. The copper tubes used are a K&S product available from model shops (**photo 5**).

A smokebox door was made from the top of a 28mm copper stop end (**photo 6**). The end of the threaded rod that went through a tube in the boiler to hold it in its flame guard was used to hold the smokebox door in place (**photo 7**).

Smokebox door made from a standard plumbing part.



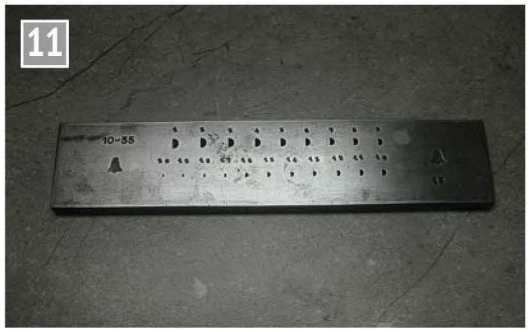
Smokebox door fitted to Ellie.



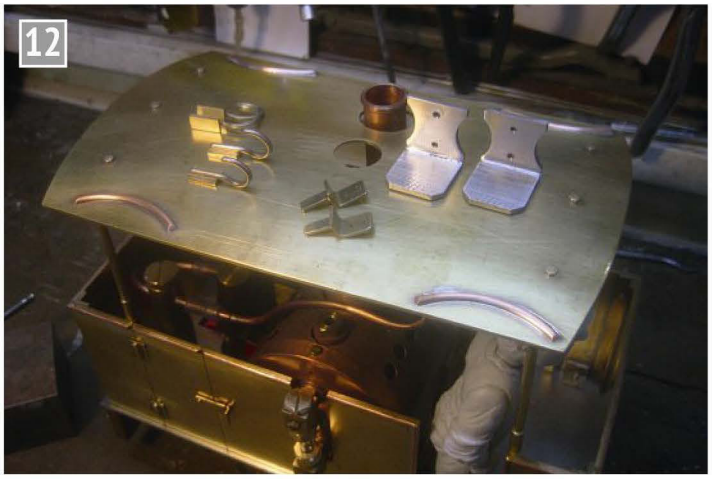
Gas regulator fitted – gas tank required.

Mocking up the bodywork.

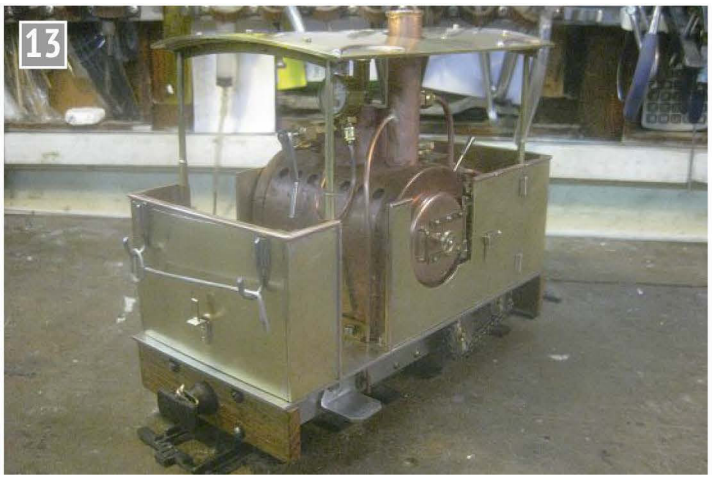
Brass bodywork under construction.



Draw plate used for making beading.



Some of Ellie's fittings.



Ellie *complete except for a gas tank.*

A regulator was made and fitted and, in this condition, had a gas tank been made the model could have been run (**photo 8**).

Next, instead of making a gas tank it was decided to make a start on the body so a number of cardboard bodies were tried and **photo 9** shows the one decided upon (**photo 9**).

The material used for the both body and its roof was from a brass plate reclaimed from the bottom of a door. (It was a bit thick at 1.5mm.) After the body sides were cut to shape, they were held together using rivetted and soft soldered brass angle which was also used to secure the body to the footplate (**photo 10**).

Like the original *Ellie*, this version has a removable roof whose stanchions go into tubes soldered to the body. This version uses square section tubes as they are not positioned in the corner of the body; because the roof is shorter, they are attached to the flat body sides. The tubes again are K&S products and accepted a 1/8 inch brass rod that was used as a stanchion which went through the footplate and was secured by a 5BA nut. The roof, being 1.5mm thick, had to be annealed before going through the rolls to be curved.

Some 2mm diameter copper wire from electric cable was made into 'D' section by using a draw plate (**photo 11**).

A video of a draw plate in use can be seen at: youtu.be/RrR9zZpi4bo (or use QR code).

Using a draw plate.

The 'D' section wire, once made, was used as beading for the body edges and for rain water deflectors on the roof. A gauge glass was made and fitted. Other fittings that were made include steps for access to the footplate along with lamp irons and hooks for firing irons (**photo 12**).

Some simulated hinges and door latches were made and soft soldered to the body which just about finished the work needed on the body (**photo 13**).

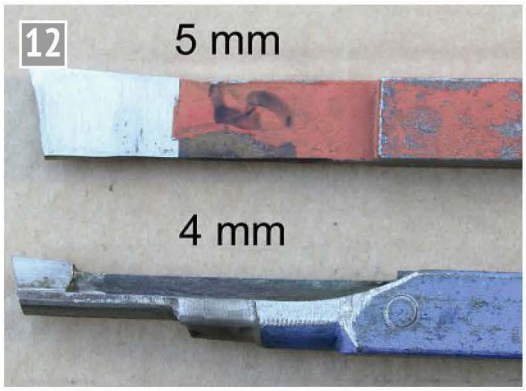
●To be continued.

PART 4

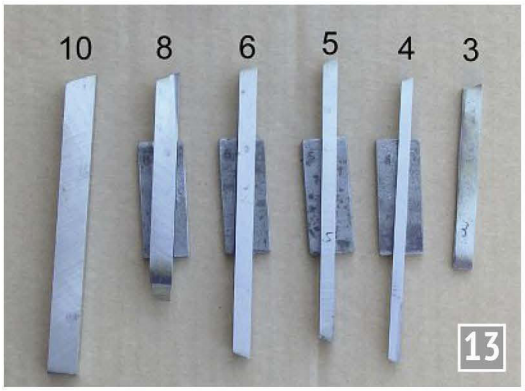
Slotting on the Lathe

Jacques Maurel makes a slotting tool for his lathe.

Continued from p.25, M.E.4719, June 16

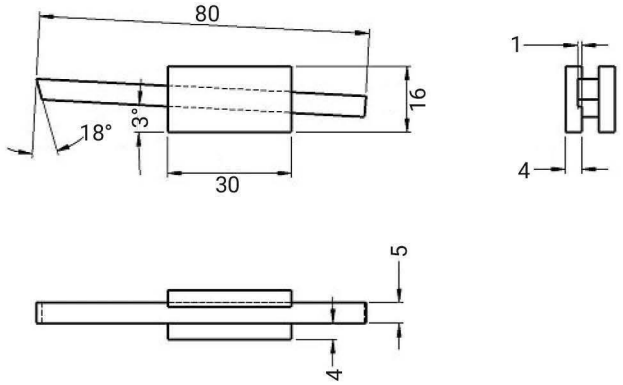


Standard tools.



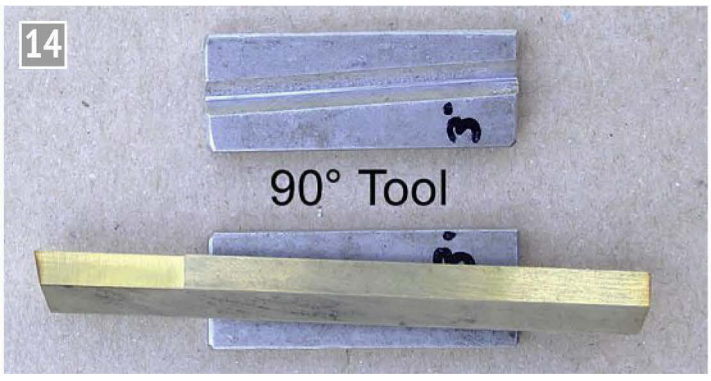
Short tools.

Fig 38



Slotting tools – standard tools

The ones in **photo 12** were obtained second hand. These tools are usually too big as the ISO standard for shaft minimum diameter relative to key dimensions is given in **table 3**.



Short tools with 90 degree bit.

Slotting tools – short tools

See **photos 13** and **14**.

As most of the keyway slotting is for a short length, I've used standard HSS square bits of the right width, set in a bit holder giving the 3 degree clearance angle. The bit protrusion is adjusted to just slightly more than the slot depth, see **fig 38**. The problem is to find the good width for the HSS bits as they are usually slightly undersize (by 0.05mm). I was fortunate enough to find some just 0.01mm undersize that could be used. The 3mm width tool was cut from a HSS wood planer blade. Even a too small tool can be used as a second cut can be done

Table 3

Key width/height	2/2	3/3	4/4	5/5	6/6	8/7	10/8
Mini shaft diameter	6	8	10	12	17	22	30

18+

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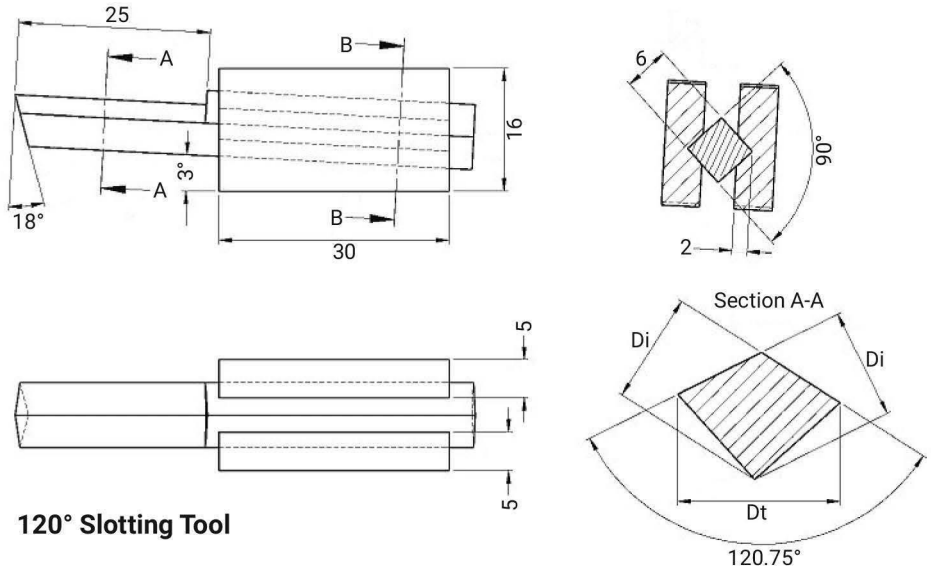
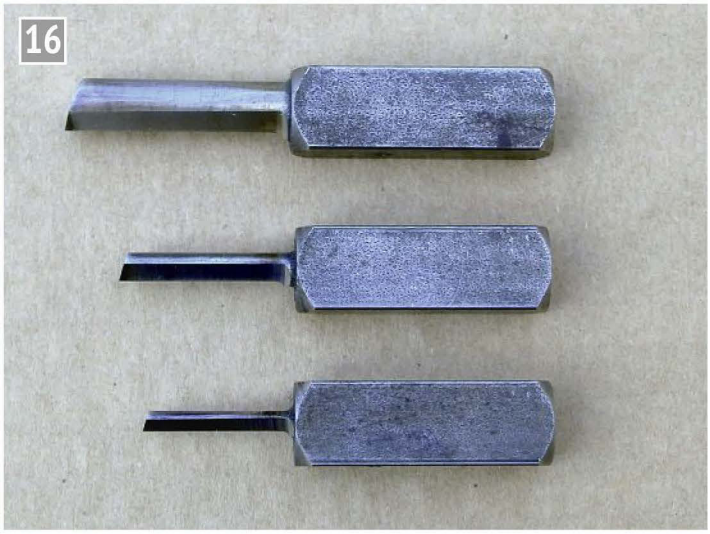
Fig 39

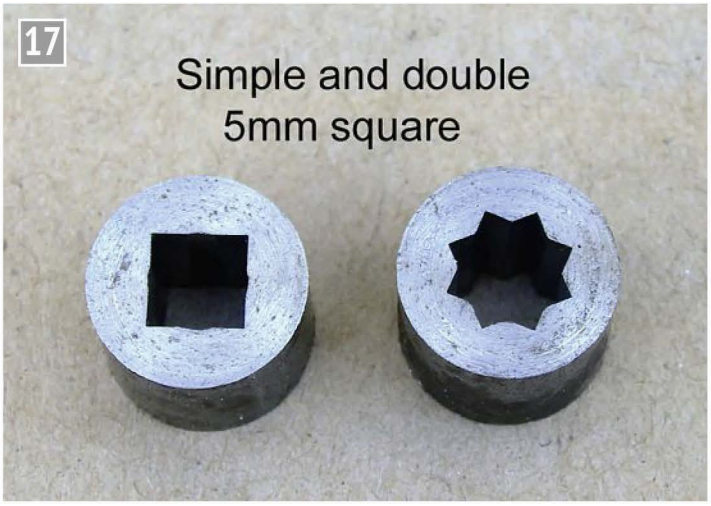


120° Slotting Tool

Tool for slotting hexagon holes.



Special tools.



Square hole made with special tool.

to widen the slot, or some file strokes can do the job, as these short tools are so easily and quickly made.

A 120 degree angle bit is used for slotting hexagon holes, see **photo 15** and **fig 39**. Note that the dihedral angle must be 120.75 degrees for machining a true 120 degree angle (for 3 degree clearance and 15 degree rake angles). For a good symmetry, the Di dimensions must be equal (be careful when sharpening) to ease the tool height adjustment (see later).

A special 90 degree bit is used for slotting square holes, see photo 14, and note that the dihedral angle must be 90.9 degrees to machine a true 90 degree angle (for 3 degree clearance and 15 degree rake angles).

For machining small square holes (4 and 5mm) I've made special tools from small round HSS bits stuck with epoxy glue on a square body before grinding. The 3 degree clearance angle is given by the 10mm short square tool guide, see **photo 16, 17** and **fig 40**, - very convenient for machining square holes in boring bars and the like.

A plain 4mm square HSS bit can be used to slot a 6mm square hole. Of course the machined square angles will be a few tenths of a degree less than 90 degrees but this won't worry us very much for an HSS tip sitting in a boring bar. It's also possible with this tool to machine smaller squares by grinding the back, as I was

Fig 40

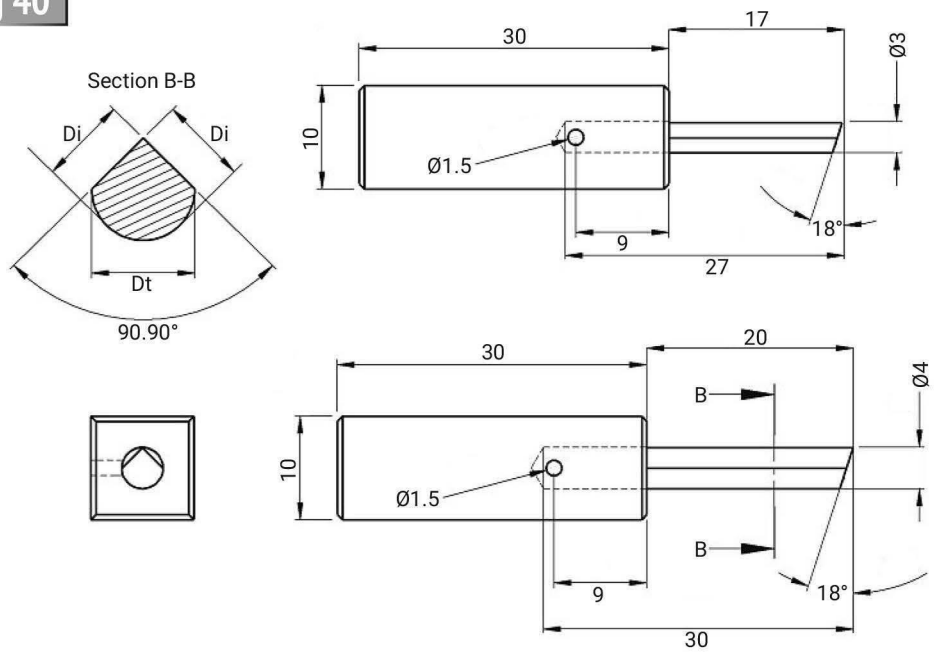


Fig 41

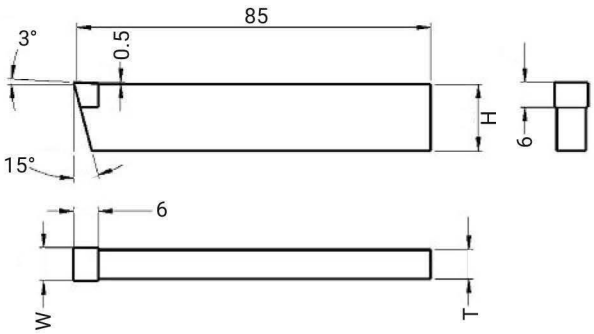


Table 4			
Slot width (mm)	H	W	T
4	9	4.05	3
5	11	5.05	4
6	15	6.05	5
8	15	8.05	7

unable to find 3mm square HSS bits.

For these machining operations, it is of course necessary to index the lathe chuck.

Slotting tools – long tools

See **photo 18** and **fig 41**.

These tools were made with a 6mm HSS square tip silver soldered on a steel body, so no problem with the tip thickness and maximum stiffness as the protrusion of the bit can be adjusted to the minimum value. **Photograph 19** shows how to hold the HSS tip on the body for silver soldering using a 'C' clamp made with a 3mm diameter iron wire.

Tools dimensions (for fig 41) are given in **table 4**.

●To be continued.

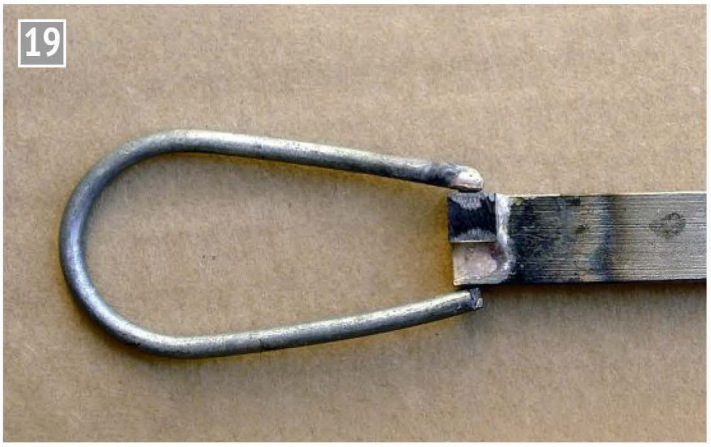
NEXT TIME

We finish off by slotting some polygonal holes.

18

Long tools.

19



Holding an HSS tip for silver soldering.

Electricity Generators for Model Steam Engines

PART 2

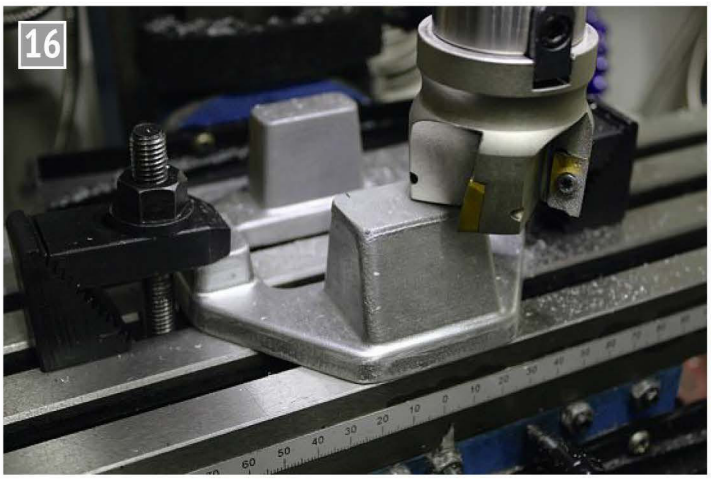
Bob Hayter examines the pairing of steam engines with electricity generators.

Continued from p.93
M.E.4720 June 30

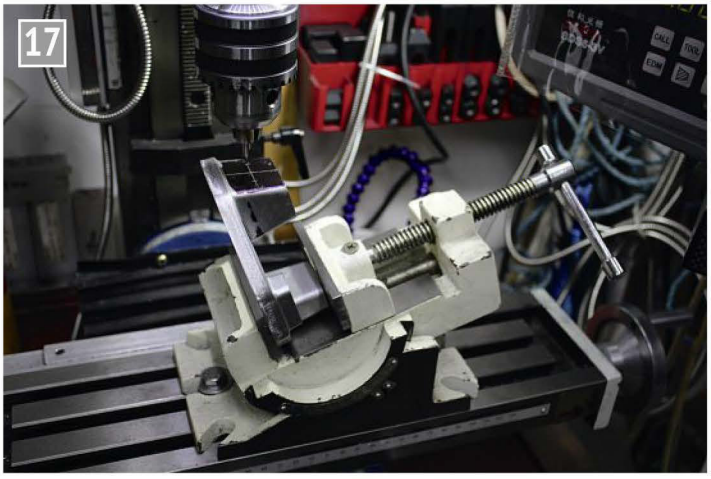
What I described in Part 1 is fine for my model turbine but what is needed is a model generator to match better the speed of a piston steam engine I had previously made, a Stuart 10H. Once again Cringle Model Engineering provided a design and castings to make such a machine (**photo 15**) - a generator with a rotating 6 pole magnet and 12 stationary pickup coils fixed around it.

These castings are also in aluminium so construction is straightforward. Starting with the base, the casting requires some cleaning up by hand filing before being mounted in the mill to level the base and mounting surfaces (**photo 16**), taking care to get the bearing mounts parallel with each other. Several changes of mounting will be required to complete all faces then drill and tap the mounting holes. A little care and some gentle work are required for the sloping front face to take the electrical output terminals (**photo 17**).

Cringle generator castings.



Levelling the mounting surfaces on the base.



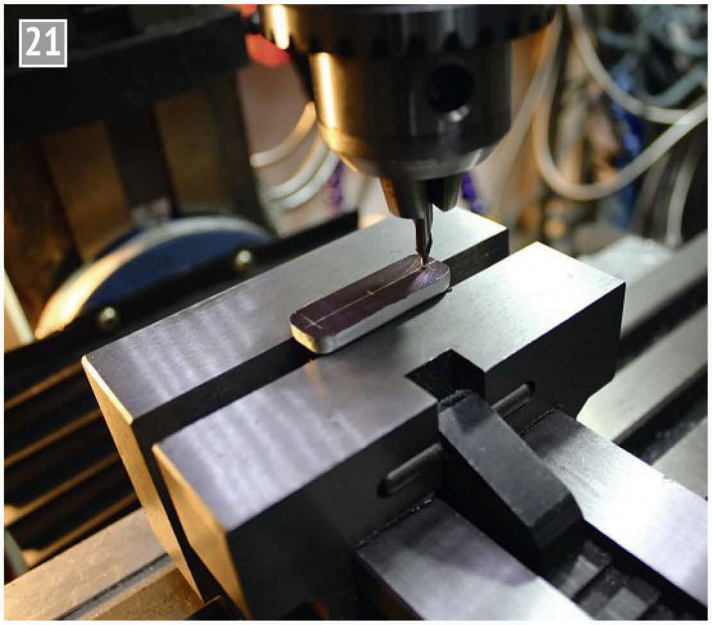
Drilling the holes for the terminals.

Once the base was complete I turned to the main housing. This needed cleaning up and facing very similarly to the two pole generator. I started by mounting it in the lathe and machined the inner bore for just over half the depth of the housing before turning it around to complete the job. I then inserted a piece of wood in the bore and marked the centre to allow measurement of the height for the mountings which were machined in the mill (**photo 18**). This dimension is critical as it centres the rotor in the housing. Whilst in the mill I drilled the mounting holes and those for the lifting eyes which also needed to be tapped. Turning the housing over gave access to face the lifting eye mounts. The housing was then placed on the base to check the centre height and any adjustments required can be made at this stage (**photo 19**).

Levelling off the mountings on the body.

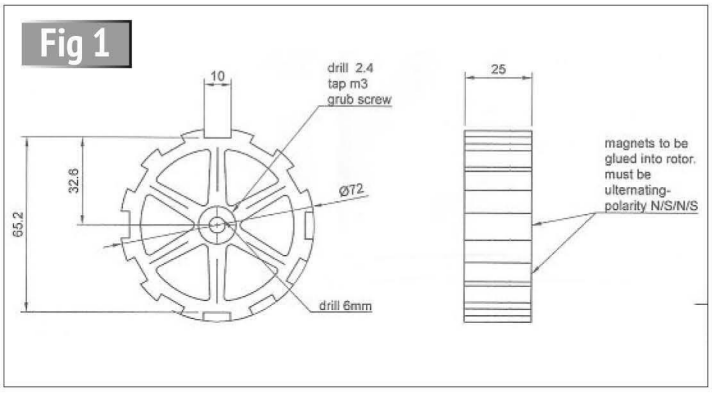
Trial assembly of the base and body.

Bearing mounting castings.



Drilling the fixing holes into the bearing mountings.

Drilling for the bearings.



The rotor.

Trial assembly of the bearing mountings.

Next, I turned to the bearing housings (**photo 20**), placing them in the mill to clean up the base and drill the mounting holes (**photo 21**). They were then transferred to the four-jaw chuck in the lathe to machine for the bearings (**photo 22**). I then made another check to ensure everything was lined up and central (**photo 23**).

I put these parts on one side and moved onto the rotor (**fig 1**), first cleaning up the casting before mounting in the lathe to bore the centre and mount on a mandrel. This gave clear access to turn the outer diameter to size. The method for cutting the slots for the magnets very much depends on the equipment you have available. I am lucky to have

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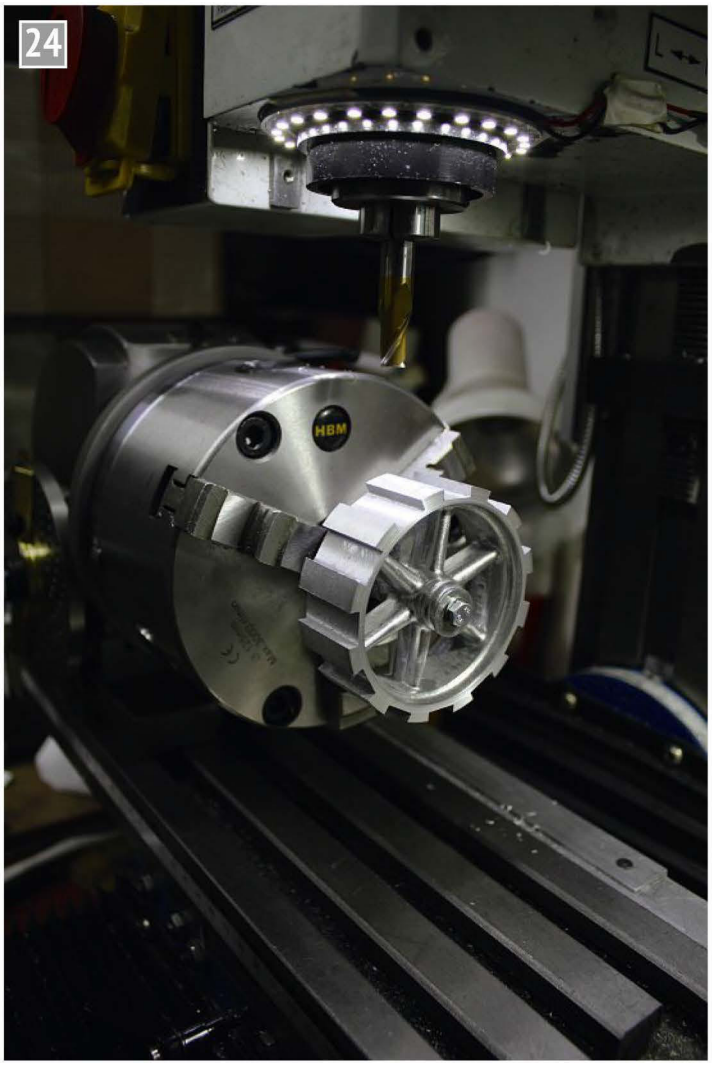
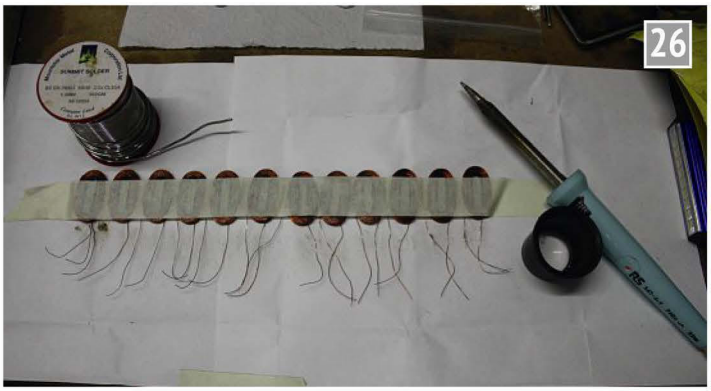


Cutting the slots in the rotor.

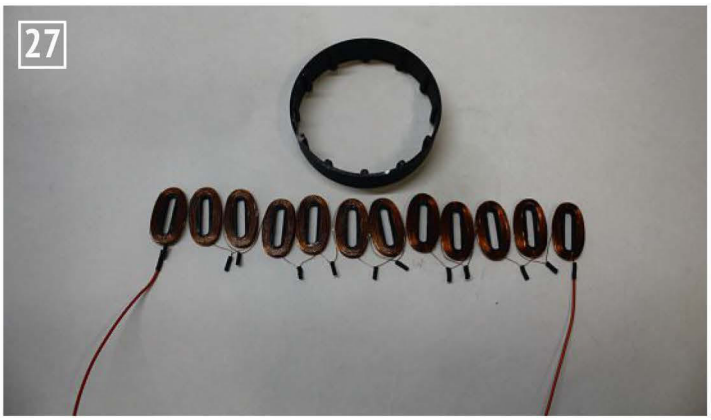
A compass was used to identify the poles on the magnets.

an indexing mount and chuck which I set up on the mill. Twelve equally spaced slots were cut to take the magnets just flush with the surface (**photo 24**).

Just a note here on handling neodymium magnets – they are quite brittle but the magnetic force is very strong. Before unpacking them ensure that the bench is clean of swarf and dust. Also keep metal tools and other metallic objects clear. It might be amusing to see a magnet slide across the bench and attach itself to the vice but you'll then have to get it off! The best method is to slide it to an edge.



Setting out the spacing of the coils.

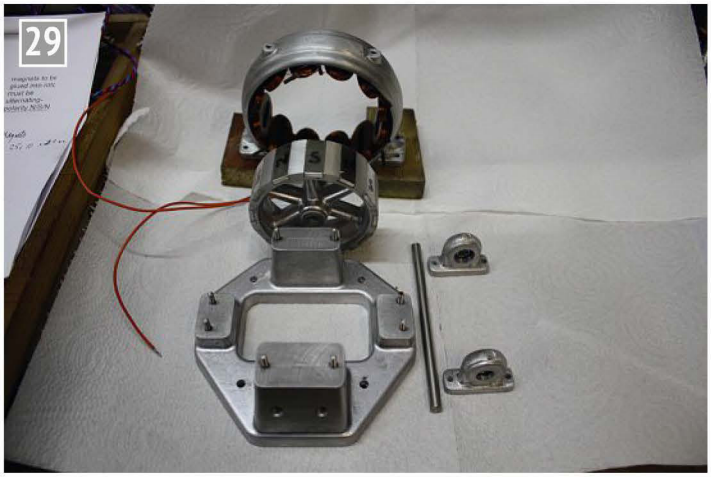


Coils soldered together in the correct sequence.

Coils mounted in the plastic housing.

The magnets are held in place with an epoxy adhesive but the orientation is very important. I got my trusty compass out and used it to identify the north and south poles on each magnet, marking them up with a felt tip pen. You will notice that the poles are on the larger side faces not on the ends as you might think from experience of bar magnets at school. The magnets are glued in with alternating orientation (**photo 25**) and the assembly put safely on one side for the adhesive to harden. I put it in a cardboard box to keep steel objects away.

I then prepared to make the coil assembly, I put a sheet of clean paper out on the bench and laid the coils out spaced to form a length about that of the inner circumference of the housing. I then held them in place with a piece of masking tape (**photo 26**). I cleaned the ends of the wire tails and soldered them together in the pattern shown on **photo 27**. A check for electrical continuity showed that I had got all the joints made properly. The coils could then be pushed into the slots in the plastic housing taking care to maintain the orientation and not damage



Generator ready for assembly.

Turning the lifting eyes.

The finished generator.

the pre-formed coils or break the connections - fiddly work but worth taking a bit of time over (**photo 28**). Next, I carefully pushed the plastic housed coil assembly into the aluminium outer housing and was ready for a full trial setup (**photo 29**). I found that it was necessary to flatten some of the coils further into the plastic to allow the rotor to turn freely. Then I could take the generator apart again for painting (**photo 30**).

Finally, there were just the lifting eyes and pulley to add and the wires to connect to complete the model. The lifting eyes are identical to the first generator though I resorted to machining operations making the profile for two at once in the lathe (**photo 31**) and screwed them in to finish the model (**photo 32**). All that remained was to mount the generator with the engine and a lamp to show it works (**photo 33**).

Acknowledgements

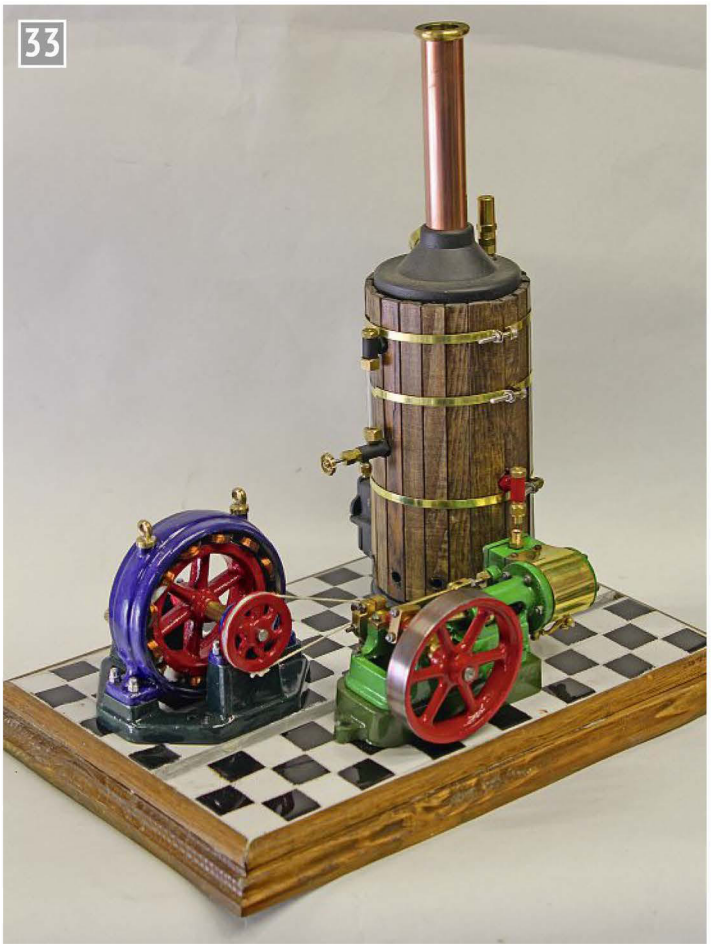
Ellenroad Steam Museum for access to take photos 1, 2 and 3 (Part 1).

Luke Cringle of Cringle Model Engineering for the design and castings.

Note: I have no personal connection with Cringle Model Engineering, though I have found their aluminium castings easy to work with.

ME

Generator is painted.



The complete generating set.

Beer Heights Light Railway Signalling

PART 6 – SOME INTERLOCKING FEATURES

The following notes should be read in conjunction with the track diagram given in Part 1 (Fig 1, M.E.4716, May 5).

Mike Hanscomb, Hon Signal Engineer, BHLR, explains the workings of the signalling system at Pecorama.

Continued from p.90, M.E.4720 June 30

SIGRs

These operate signals by either energising a solenoid for semaphores or changing aspects from red to green for colour-light signals. They require track circuits clear, points in their correct position and motor-control relays down, and no conflicting or opposing routes in use. As the signalling is all two-aspect and signals are at danger until a train has passed the previous signal, SIGRs also check that the next signal's SIGR is down.

Stick relays (xyzSRs)

A stick relay is an ordinary relay with one of its make contacts round (i.e., in parallel with) transitory controls in its pick path. A good example is a PushSR, a relay which is operated by pressing a plunger. This is a transitory action, so the plunger contact has a make contact of the PushSR round it. The PushSR in effect, stores the fact that the plunger has been pressed.

HOLDSRs

Much of the system depends for its operation on the principle of Route Locking or, as we call it on BHLR, Route Holding. The idea is that, once a signal has given a driver a proceed aspect, the route protected by that signal is held 'reserved' for the train. This is done by allocating a relay, called a HOLDSR (said as 'hold ess arr'), to that signal. HOLDSRs are normally energised. Their feed is cut when the SIGR operates, so they de-energise when their signal shows a proceed aspect. This prevents any conflicting or opposing route being used. The signal returns to danger when the train occupies the next track circuit past the signal but the HOLDSR remains down until the train proceeds out of that section. This could be proved by the train occupying a track circuit at the end of that section. That seems okay, but suppose this one track circuit is suffering an intermittent fault, perhaps due to a loose connection, and therefore going 'occupied' intermittently. If this fault appeared while a train were approaching, it would cancel the route-holding. One solution is that two adjacent track circuits must be occupied at the same time to release Route Holding. As the occupation of the track circuits is transitory, HOLDSRs are stick relays.

Semaphore signal arms are fitted with a microswitch which checks the arm is at danger. HOLDSRs cannot re-energise if the arm is not 'on'. A consequence of this is that, if the arm is moved manually away from the 'on' position, perhaps during routine maintenance, the HOLDSR for that signal will de-energise and prevent any conflicting or opposing moves being made. During the first week of operating the new system, a problem occurred which no-one could have foreseen. A blackbird tried to land on LM27 signal arm and was startled to find it wasn't a fixture! The arm dropped momentarily from the 'on' position and this cut off the feed to 27HOLDSR, preventing the conflicting signal (LM31) from operating when required. It was fortunate that the CME himself saw the offending bird; it would otherwise have been a mystery as to what caused LM31 signal to stay at danger. Subsequently, mods were carried out to ensure that each HOLDSR stick path is round the OnCRs as well as the other transitory controls.

HOLDSRs have a further function. On bi-directional lines, they select which signal needs to be cleared for the direction required. For instance, TE1 signal clears when a down train occupies BM or BN track circuit. However, these track circuits are also occupied by an up train approaching LM 37 signal, having been signalled from TE10. TE1 clears only for trains coming from LM35 signal, so LM35HOLDSR being down selects TE1. Likewise, LM37 signal clears only when a train occupies BL or BM with TE10HOLDSR down.

HOLDSRs are used also to select which signal is required at a facing junction. For instance, if the driver requests shed at LM37, LM30 disc will clear to allow the train to enter Devils Gorge. When the train occupies BE/1 with 30HOLDSR down, points 43 and 44 motor reverse and shunt signal LM25 clears. When the train occupies BB/2 with 25 HOLDSR down, 43 and 44 points motor back to normal and LM22 shunt disc clears.

FCFSRs (First-Come-First-Served Relay)

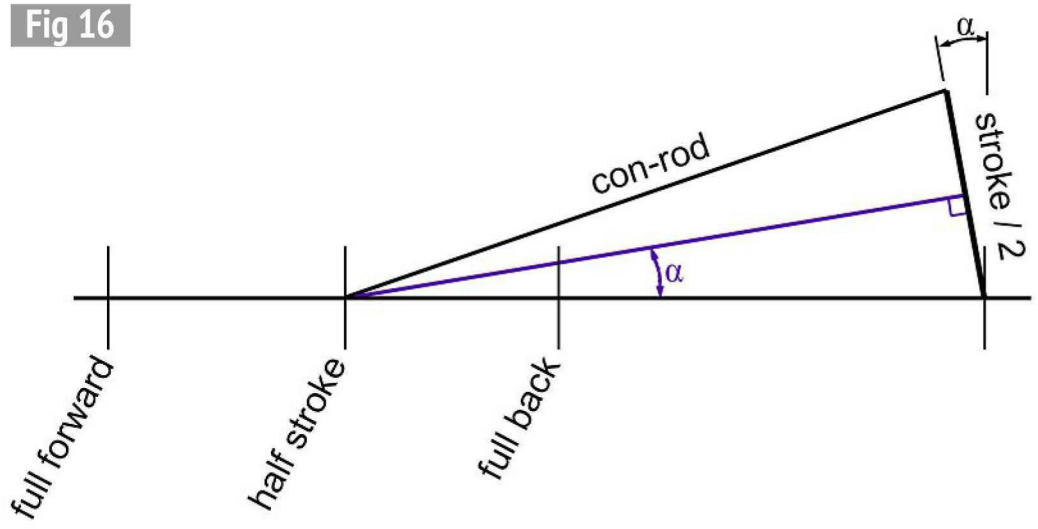
On bi-directional lines and at converging junctions, a 'first-come-first-served' system is used. Consider LM21 and LM31 signals. Each has an FCFSR relay. If a train occupies BB/1 (on the approach to LM21 signal) before an 'opposing' train occupies BK track (on the approach to LM31 signal), 21FCFSR will energise and prevent 31FCFSR from doing likewise. The train at LM21 will get a proceed aspect and enter the Devils Gorge section. This move cancels 21FCFSR which allows 31FCFSR to energise. This transfers priority to the train at LM31 signal but it will have to wait until the system has checked that the train from LM21 signal has come through the section, ie. LM21HOLDSR has re-picked (see above).

●To be continued.

Radial Valve Gears Again

PART 4 – STEPHENSON'S (3)

Fig 16

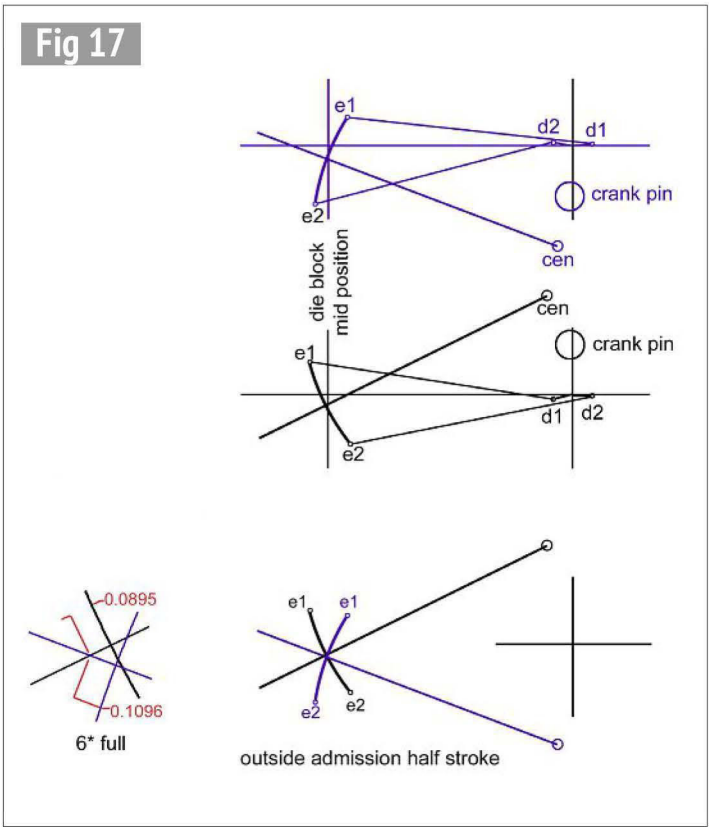


Stephenson's gear 'notched up'.

Duncan Webster sheds light on what is often seen as a complex subject.

Continued from p.111
M.E.4720 June 30

Fig 17



Correcting for connecting rod angularity.

Connecting rod angularity

The next (and last) thing to consider is the effect of connecting rod angularity on piston stroke, and hence the relation between piston stroke and valve travel. This time we will start with locomotive links, because it's easier. Again, taking Don's Design 1 dimensions we have:

stroke = 2.25 inches
conRod = 10.25 inches

I have stuck with the eccentric rod length at the same as the slot radius.

Figure 16 (exaggerated for clarity) shows the set up at half stroke.

$$\alpha = asin\left(\frac{stroke}{4 * conRod}\right)$$

In this case α works out at 3.1 degrees. If we start with the crank at 3 o'clock, the crank has rotated 93.1 degrees for 50% piston stroke. If we just ignore this, when the crank is at 12 o'clock the piston would be biased towards the back of the cylinder - 47% of the stroke from back centre. Locomotives tend to have long connecting rods compared to their stroke; relatively shorter connecting rods would have a higher discrepancy. What to do about it? If we move the point of suspension of the expansion link backwards or forwards away from half way along the slot, but still staying on the longitudinal centre line (i.e. equidistant from e1 and e2 in **fig 17**), as the expansion link rocks back and to, the depth in gear (dimension u in fig 11(a) – see Part 3, M.E.4720) will be altered. If we get this offset right, it should correct the connecting rod error, at least at half stroke.

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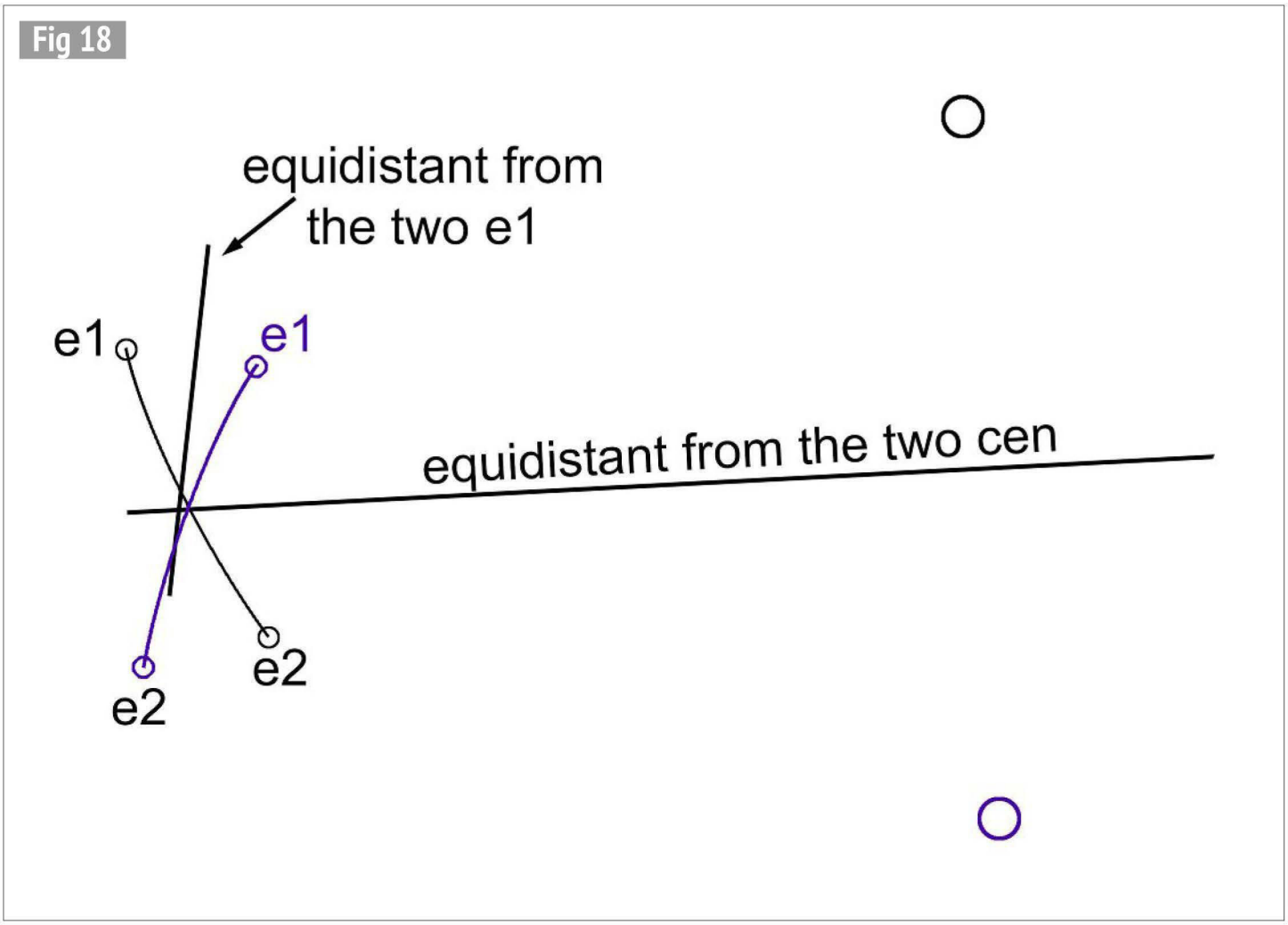
Fig 18



Finding the point of suspension.

Method 1

Don explains how to do it in detail using cardboard templates for the eccentric rods and slotted link, with drawing pins as joints. Briefly, draw the crank and eccentric centres at the two half stroke positions. Using the templates move the slotted link up and down to get the valve travel equal to the lap (ie the point of cutoff). This point is one side of the die block mid position for the crank up, the other side for crank down. At each of these points draw the slotted link centre line by copying off the template. Where these two centrelines cross is the required point of suspension. This is shown in fig 17, which is drawn for outside admission.

I went one better, using similar mathematics to the complete valve gear model. We can calculate the positions of e1 and e2 to give this condition and then using CAD draw the centre lines a lot more accurately than using cardboard cutouts. The maths could be done using a calculator, but would be very tedious, and a little program is available. How to draw the centre lines is explained in more detail in Note 1 below. What this revealed is that this method doesn't quite work. It is found that the distance from this ideal point to the slot along the centreline is not the same in both conditions. The scrap view bottom left labelled '6* full' in fig 17 shows this. I was so surprised by this that I have spent a considerable time checking the drawings and I have found no error. My pragmatic suggestion is to take the average but, if this does not appeal, you might try this next suggestion.

Method 2

If we abandon the constraint that the point of suspension should be on the longitudinal centre line then we can achieve the same distance from the curved slot, at the expense of making the events in reverse worse. Most club locomotives, and full-size express passenger locomotives, don't do a lot of reversing. Establish the positions of e1 and e2 as previously but then construct a line equidistant from the two centres of curvature (labelled 'cen' in **fig 18**) and a second line equidistant from the two e1 positions. Where these two lines cross is the new point of suspension. It may or may not be on the longitudinal centre line - with the dimensions I used it wasn't.

Launch links

Exactly the same principle applies for launch links so we don't need to labour the point. The mathematical model is slightly different as it doesn't have to work out the real eccentric proportions - it uses the equivalent eccentric but it does have to allow for the offset eccentric pins. I have not investigated the suspension offset - the Don method might or might not work.

How I would do the design

Much as I like doing sums, they can get a bit tedious. If I were to build an engine with Stephenson's, I'd use Don's overall sizing rules but ignore the eccentric rod correction. Then I'd use the full valve gear model and just experiment with the suspension offset to get best results at running position, say 30% cutoff in forward gear for a locomotive. The change in lead from full gear to mid gear will pop out of this exercise, so you can set full gear lead for acceptable lead at shorter cut off. Scale modellers will just scale down the original.

Which variety

So far, we have only covered setups where the valve is driven directly from the die block. Many locomotives had a rocker interposed so that the valves could be on top of the cylinders. This of course reverses the motion of the valve relative to the piston, so if you have that set up with outside admission valves, just design as if it were inside admission and vice versa.

Don maintains that outside admission direct drive valves are best driven by locomotive links, and direct drive inside admission by launch links. This is to minimise the suspension offset and so minimise die slip. I have not investigated this but I have no reason to doubt it. One downside of locomotive links is that the eccentric throw has to be greater, thus the diameter has to be larger, which makes the rubbing speed higher leading to greater wear. It also makes the lead change full to mid gear larger. Unless you are following a particular prototype, I'd design both and then run through a simulation program. Mine will tell you the die slip and you can then make an informed judgement. I'm not a fan of inside cylinder locomotives - my fingers are too big and having the valves between the cylinders just makes the situation ten times worse, as you can't see the ports to set the valves.

●To be continued.

Note 1

See fig 17.

a) How to draw the expansion link centre line:

draw a circle centred on e1 radius eccentric rod length, repeat on e2. These circles intersect twice, so draw a line through these two intersections. This is the slotted link centre line and the right-hand intersection is the centre of the curved slot radius, labelled 'cen'. The design programs print out the coordinates of the two cen positions, which will serve to check your drawing skills

b) How to draw a line equidistant from the two 'cen' positions:

draw a circle radius the distance between the two 'cen' positions (not critical), centred on the top 'cen' position. Repeat on the bottom one. These circles intersect twice, so draw a line through these two intersections. This line is equidistant from the two 'cen' positions

c) How to draw a line equidistant from the two e1 positions:

draw a circle radius the distance between the two e1 positions (not critical), centred on the front e1 position. Repeat on the rear one. These circles intersect twice, so draw a line through these two intersections. This line is equidistant from the two e1 positions.

NEXT ISSUE

Parklands

Brian Baker looks back at the Parklands Railway Week, which took place in Hemsby, Norfolk, at the end of May.

Schools Class

Robert Hobbs adds to his collection of 3½ inch gauge locomotives with the construction of *Winchester*, a Southern Railway 'Schools' Class locomotive.

Workshop

Peter Seymour-Howell's new workshop acquires doors and a roof.

Drive Unit

Iain Haile adds a power feed to the table of his milling machine.

William Spence

Cliff Almond discusses the rather unusual motion work on *William Spence*, the Guinness locomotive.

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ON SALE JULY 28 2023

The Eating of Elephants

PART 18 – PRESSURE, PROGENY AND PIGMENTS

Steve Goodbody finds some things are best tackled in small helpings

Continued from p.79
M.E.4720 June 30

In 1999, after twelve years of enforced idleness, *Elidir* crossed the ocean and washed up in a basement in New Jersey. Having decided that she would be finished with the same suite of tools with which she was started, her new surroundings, while having far fewer windows than before, appeared comfortably reminiscent of her previous home in the Sussex weald.

Picking up the pieces

With the lathe in place, the workbench finished and a voltage-compatible drilling machine bolted securely to the floor, work on *Elidir* finally restarted in her new subterranean home after a twelve-year hiatus and, over the course of the next few years and with the competing demands of work and domestic life to contend with, progress continued at a slow but steady pace.

Eventually the valve gear was finished, followed by the mechanical lubricator which, after yet another '*What if?*' moment, bore little similarity to the original design and took its drive from the end of a crankpin rather than the valve spindle (**photo 103**). And so, with valves set, the lubricator filled, the air compressor connected and the supply valve slowly opened - and after no less than seventeen years since work on her had begun - *Elidir*'s wheels began turning under their own power for the first time. As the occasional droplet of oil shot from the blastpipe and splattered against the ceiling above, I can assure you that I was grinning from ear to ear.

Following another 'what if' moment, the lubricator and its drive mechanism bear little similarity to Elidir's *original design.*

And, having achieved this major milestone, thoughts turned towards that other major component, the boiler.

Kettles and confusion

Now, while *Elidir*'s drawings detailed a boiler made from copper, tentative research had quickly shown that the cost of those materials, let alone the cost of a finished copper boiler, would be prohibitively expensive. Therefore, having concluded that the boiler must be made from steel and not being a welder myself, I would need someone to build it for me and, unfortunately, I did not know of any boilermakers in America. Fortunately however, having recently joined the New Jersey Live Steamers, my local model engineering club, I had met Reg, another Englishman, and, after explaining the situation to him, he handed me the telephone number of a boiler maker he thought might be suitable. And so, early the following week, I picked up the phone and, noting the unfamiliar area code, dialled the number.

"Valerie here; how can I help?", enquired the lady on the other end of line in an accent which, from what I could make out, hailed directly from either Lancashire or Yorkshire.

"Um, hello and sorry to bother you, but I'm trying to reach Steam Age. Do I have the right number?" I replied, assuming I'd misdialled.

"Aye, that's us, let me grab Ray and put him on the line."

After a short pause and a clunk as the phone was handed over, a man's voice emerged from the line speaking, once again, in the same red-or-white-rose brogue. "Steam Age here, Ray Pennell speaking, what can I do for you?"

"Hello Ray", I began, confused and uncertain how to continue without sounding like an idiot. "Look, I'm sorry to bother you, but I'm building an *Elidir* and need to have a boiler built. The trouble is, I'm based in New Jersey, in the United States and was given your number by an English chap at our club and I suspect that I might have dialled the wrong continent."

"*Ah well, so much for not sounding like an idiot*" I thought, as laughter erupted from the handset.

"Aye lad, you've got the right number. We're in Texas - I'm surprised you couldn't tell by our accents!". In the background, I could hear Valerie laughing. "Alright", he continued, "tell us again what you need and let's see what we can do".

With the ice broken after a good chat - and with the appropriate drawing subsequently dispatched to Texas for Ray's review and having received a reasonable quotation shortly afterwards - and with a few questions and answers in between, *Elidir*'s boiler was placed on order at the end of the following week, the beginning of December 2001.

Progress and delays

Now, while I'd like to report that in 2002, with her chassis running on air and her boiler about to be constructed, *Elidir*'s

The steel-faced wooden former used to flange the smokebox end plates.

Once assembled, evidence of sustained sledgehammer abuse becomes clear.

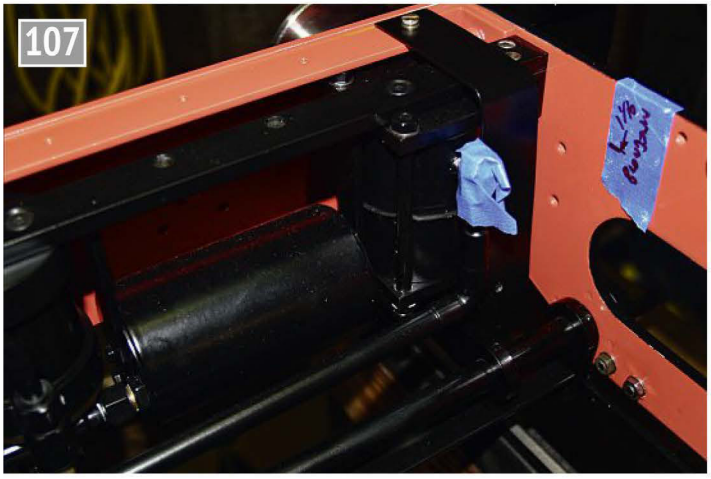
The finished smokebox mounted on the chassis. Despite benign appearances, the brutal effort needed to cold flange that eighth-inch steel plate is not easily forgotten.

completion was well within sight, the truth of the matter was, as you've by now come to expect, somewhat different.

Hence, another four years having swiftly passed in the meantime, it was not until the end of 2005, with the heavy boiler drilled and tapped and prepared for all of its fittings and the eighth-inch thick plates of her flanged-steel smokebox brutally battered into submission with the aid of a steel-faced wooden former, a hefty sledgehammer and torrents of sweat (**photos 104**, **105** and **106**), that her boiler and smokebox were finally mated using the cast-gunmetal ring which had been laboriously filed to size because, as spotted when first studying *Elidir*'s drawings some twenty years prior, it was the one part of the engine that was simply too big to machine with the available equipment.

Then, with the boiler and smokebox temporarily hoisted atop the chassis to establish their exact position, a multitude of steam and vacuum braking components had been designed, built and shoehorned into the vacant space behind the firebox, the result of the first '*What If?*' which I had pondered while filing the frames many years before, if you remember (**photos 107** and **108**).

Whilst agreeing that progress had indeed been made during that four-year period, you, will perhaps have concluded, with a derisive sniff, that it had not been rapid.



From left to right, the vertical steam brake cylinder, horizontal vacuum reservoir and vertical vacuum brake cylinder, together with their attendant piping and brake-shaft, are sandwiched into the space between the rear buffer beam and the boiler backhead.

In this close-up of the brake piping and steam brake cylinder, the right-hand edge of the upper masking tape indicates where the boiler backhead will lie.

But please don't be too hasty in your condemnation, critical Reader, because I have a good excuse this time. Have you noticed that there's always an excuse? You see, Jenny and I, having concluded that our humble abode was a bit too humble for our future needs, had undertaken a major housing expansion during those several years and while this had curtailed *Elidir*'s progress once again, the news wasn't all bad because - and please don't tell Jenny this - although the upper-two stories of the extension, comprising a spacious bedroom above and a cosy sitting room beneath, were certainly nice accessories, it was the bottom floor, an extension to the basement, that provided the real benefits as far as I was concerned. For the lowest space, taking advantage of the natural slope outside the house and having plenty of windows for natural light, also incorporated a large double door leading directly from the basement to the wider world beyond.

If you, like me, had been wondering how I'd ever get *Elidir* out of the basement when she was finished, then here was the answer, for this new, well-lit, 15-foot square basement room with ready outdoor access was destined to become my new workshop.

And, just like that, we've reached 2010.

"What?" I hear you cry in anguish as you re-read the last few paragraphs to check you haven't missed something and conclude, quite correctly, that I'm pulling a fast one. "One

≫

minute we're at the end of 2005, the next you're telling me it's 2010. That's another four-year delay! How on earth did that happen?"

Ah, you've caught me, attentive Reader and please accept my apology as I really should not have tried to slip that past you - *mea culpa* and all that. Suffice to say, during that further four-year period, our busy lives became even busier thanks to the arrival of two bouncing bundles of joy spaced two years apart; first a daughter and then a son … and hopefully that's all the explanation you need for yet another interruption in *Elidir*'s progress for as I, like many before me, soon discovered, the demands of children inevitably outweighed the luxury of hobbies (**photo 109**).

Eventually however, with sleeping patterns re-established and a degree of normalcy returned, I was able to return to the workshop, still in the old part of the basement, remove the dust covers from tools and locomotive and prepare to resume where I had left off four years before. And that, if I remembered correctly, meant painting.

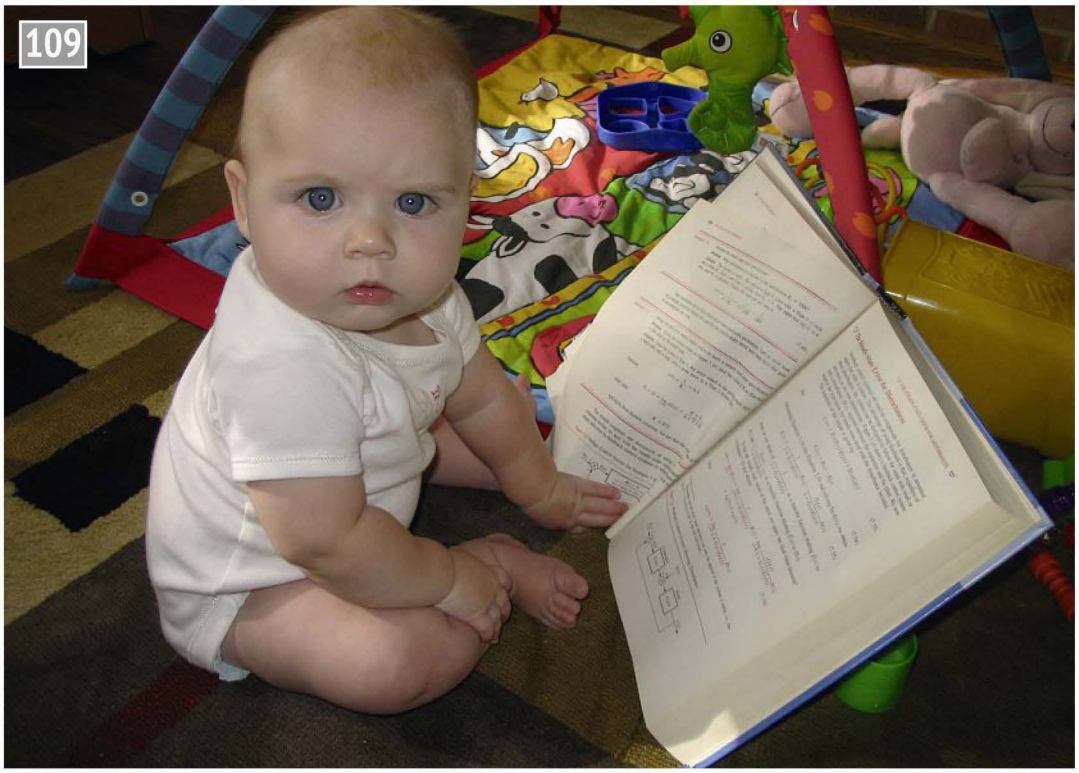
Painting: round 1

Now, having had several years to mentally plan this trepidation-filled job and being determined not to make the same mistakes with *Elidir* that I had with *Rob Roy* and having learned the benefits of patience and proper research along the way, I had by then read everything I could find on the subject online. And then, realising that everything on the internet was either confusing, contradictory, impractical or a combination of them all, I did what I should have done from the very start and bought Christopher Vine's book which had been recommended by more than one source along the way. And that, to put it mildly, was a very good move.

How (Not) to Paint a Locomotive. It sounds like the opposite of something you should read if you are about to paint, say, a locomotive, doesn't it? But let me tell you and with the caveat and disclaimer that I have no connection with this work-of-genius other than as a satisfied customer, if you're going to do some painting and you haven't already read it then you really should. For, as I devoured the content of that book for the third time and began committing to memory the pitfalls and recommendations and explanations contained within, I realised that I had found the model painter's holy grail.

Feeling if not confident then at least well-armed and with a multitude of shower curtains, extraction fans and lights, I began turning my still-vacant future workshop into a well-lit, well-ventilated painting booth and set about acquiring the necessary tools for the job, all based largely upon Mr. Vine's well documented experience.

Eventually, with *Elidir*'s chassis stripped down to its component parts and her boiler cleading and smokebox dismantled and made ready, and with twenty-five years of protective lubricants wiped, stripped, dissolved and banished during the month-long cleaning and degreasing process - and after a week of practice and experimentation on various test pieces to get the hang of the paints, the spray gun and the many adjustable parameters for each, the first day of painting finally arrived.



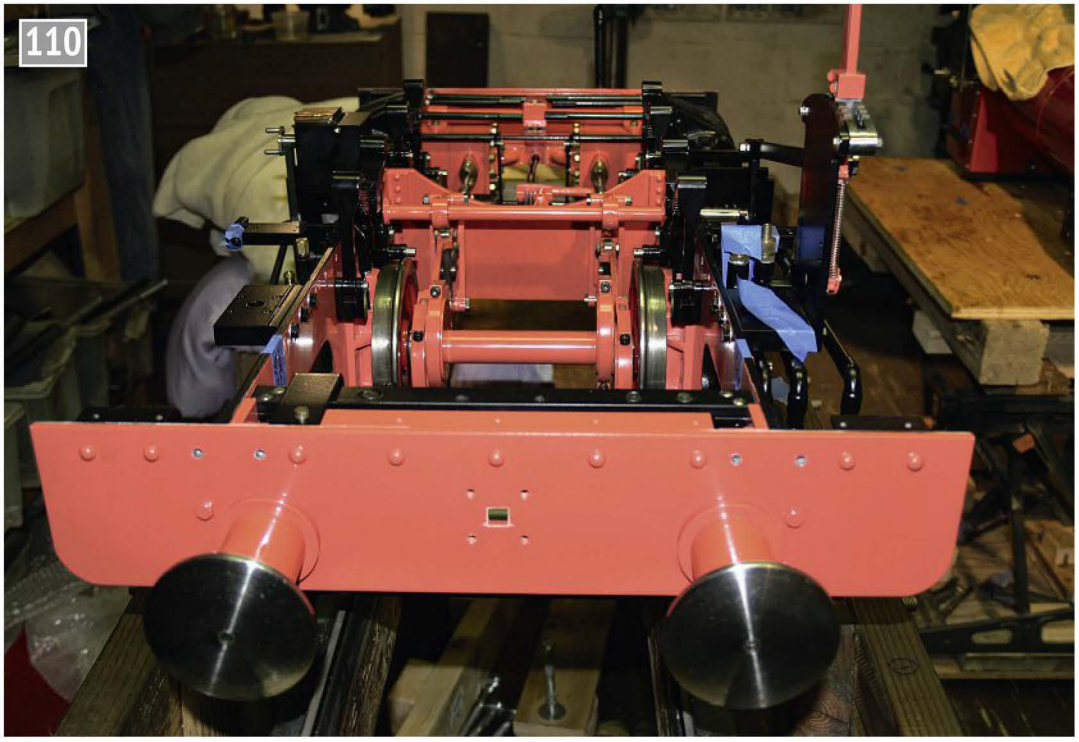
The demands of children outweigh the luxury of hobbies. Here, the author's daughter, a precocious child, demands tutoring in control systems theory, the cheeky thing.

And just as Mr. Vine predicted and despite being forewarned and as careful as I could to avoid them along the way, during the course of 2010 I proceeded to quite literally make every mistake in the book. Runs? Frequently. Dust? Absolutely. Dropped parts? Occasionally. Wet paint smudged with coverall sleeve? Inevitably. Yes, I suffered them all, often repeatedly.

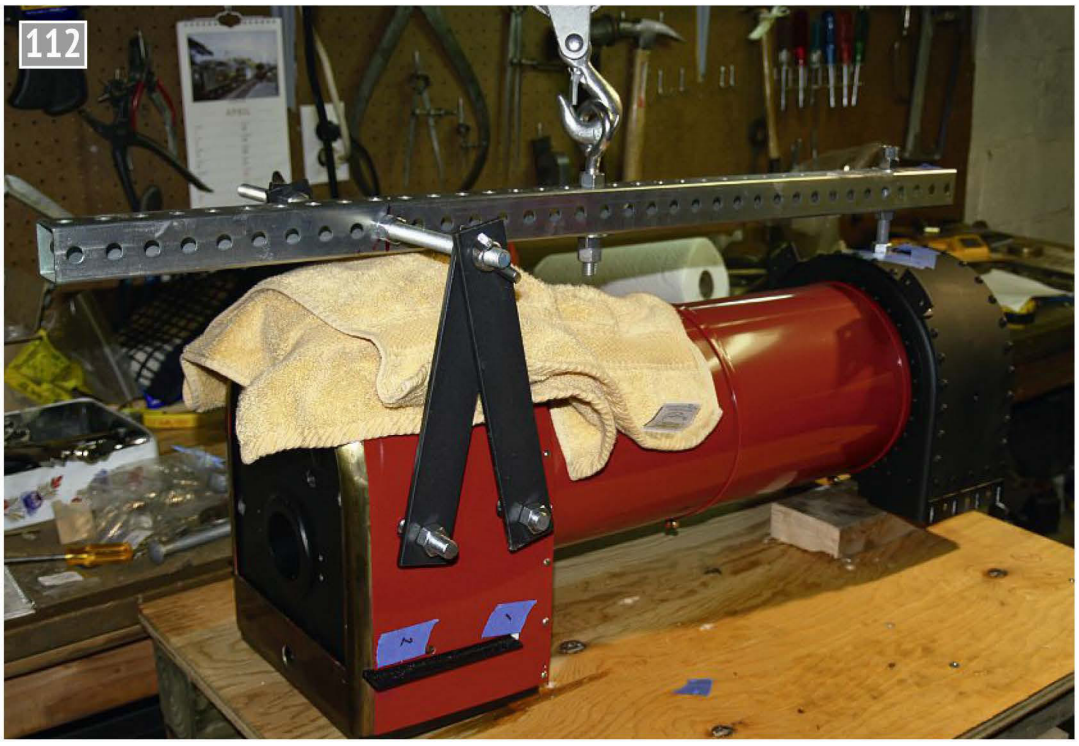
However, in addition to the prescribed mistakes and being the creative sort, I managed to invent several blunders of my very own besides. Nowhere, for example, does Mr. Vine mention that, should you have installed dust filters beneath your ceiling-mounted extraction fans and should those filters be situated directly over thirty freshly-painted, immaculately-glistening, but otherwise unprotected items on the bench and should one of the tie-wraps holding one of those filters suddenly break, then a monsoon of dried paint dandruff will suddenly shower upon your work without warning, scaring you half to death and utterly ruining your last two hours of labour. No; I am proud to say I invented that cockup all by myself. Aren't you impressed?

Anyway, despite the setbacks the paintwork progressed well and each component was carefully sprayed with two coats of etching primer, two coats of enamel primer and two, sometimes three, enamel top-coats. Except for the etching primer and the final top-coat, each coat was allowed to dry for at least twenty-four hours, often longer and carefully rubbed down. Over the course of a solid ten-month period, for it really did take that long, the number of boxes filled with finished and carefully wrapped parts steadily increased and the collection of unfinished items correspondingly diminished until, one happy day at the beginning of November 2010, there was nothing left to paint.

After allowing a further two months for the parts to fully



At the beginning of 2011, the painted and reassembled chassis is ready for its boiler



After experimentation, the lifting eye is positioned at the hole closest to the centre of balance. The lift went to plan, but my goodness was it a nerve-racking experience!

dry and with the painting booth and its contents carefully disassembled and packed away for the future, as 2010 rolled into 2011 *Elidir*'s chassis and boiler were ready to be reassembled (**photos 110**, **111** and **112**).

At long last, it seemed *Elidir* and I were on the home straight.

Postscript to Part 18

Now one of the things about the USA is that it's a very big place. And, while that seems like an obvious platitude, I've noticed that we British islanders sometimes fail to fully grasp the true difference in scale. To help put things into context, let's say that you live in the bustling town of Crowborough in East Sussex, to randomly pick an example, and need a boiler for your locomotive. Flicking through the various suppliers and naming no names, you might narrow the options down to a manufacturer in Gloucestershire, or perhaps Somerset, or maybe Wales, these being the nearest to

The boiler and smokebox are ready to be winched into the chassis

home as far as you can tell. "Bother", you perhaps say, concluding that the closest of these is at least two hundred miles away and the logistics will surely be a nuisance.

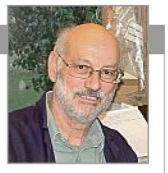
Now, in comparison, let me explain that Steam Age USA, located in Cypress, Texas and the origin of *Elidir*'s boiler, was located nearly one thousand, seven hundred miles from our New Jersey home. Hence, using Crowborough as the baseline once again, the closest manufacturer at that time was somewhat further away than Gloucestershire or Somerset or Wales. In fact, and to conclude the analogy, if *Elidir*'s chassis were still housed in Crowborough, then her boiler was built on the far side of Bucharest, somewhere near the shores of the Black Sea. And I was grateful to find someone that close!

On a different subject, it may appear that I have a certain fixation with windows in this series of articles, so let me state for the record that I indeed do. Having experienced both cases, I can assure you that there is nothing better than a workshop filled with natural light and little worse than practising the hobby in a cave. Hence, if you're planning your new workshop, please take plenty of time to consider the number and placement of its windows; I promise you it won't be wasted effort.

●To be continued.

LNER B1 Locomotive

PART 24 – LUBRICATOR AND ATOMISERS



Doug Hewson presents an authentic 5 inch gauge version of Thompson's B1 locomotive.

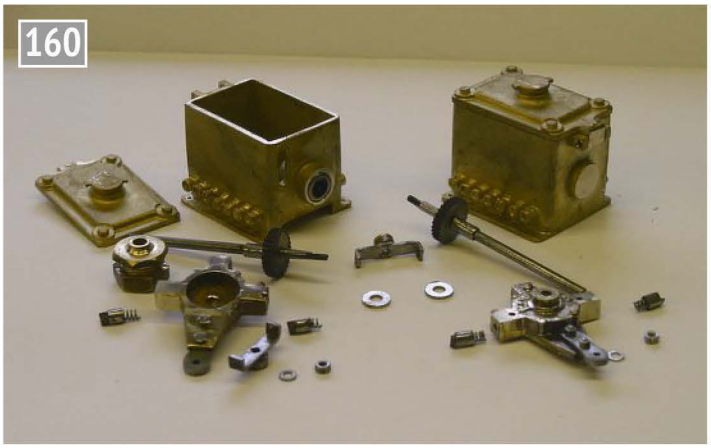
Continued from p.104, M.E.4720, June 30

Atomiser on the author's 4MT locomotive.

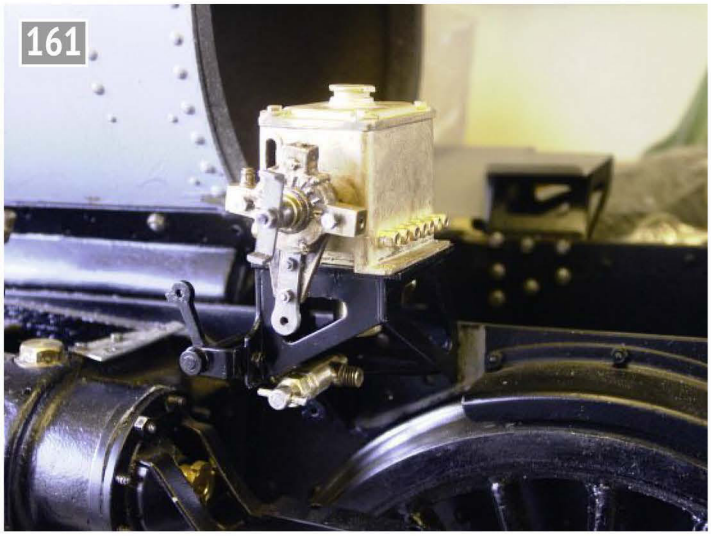
I realised that this may create a little controversy in the camp, but I decided to fit my 4MT with atomisers and in commissioning my engine under the auspices of Eddie Gibbons he seemed to think they were quite amazing. You can of course bypass the atomisers by just making them as dummies. Whatever you do, they need to be on the engine as they are quite a distinctive item around the front of the engine. (So why don't you make them work!)

What the atomisers do is to feed the oil into the cylinders under live steam. Having discussed them with Eddie he seemed to be most impressed with them. I don't know whether I would have fitted them on my 4MT but I saw a BR Class 2 on a stand at an exhibition built by David Hudson of the Bromsgrove Society and I noticed a gadget just above the side platform level. I asked him what the gadget was and he was delighted to tell me what it was, and I was quite amazed when he said "Ah, these are my atomisers". I told him that the BR 4MT also has atomisers on it, in fact, all of the BR Standard engines have them on and so do the B1s. I decided that I needed to quiz him on his atomisers. I asked him "what is inside it?", fully expecting him to say, oh there are steam nozzles and other such things in there. However, what he did say was "Nothing" so I thought, that will do for me! I was just at the stage where I needed to concentrate on the lubrication so I thought that I will have to fit an atomiser on my engine, even if it didn't work. I covered most of mine with the side platforms but I know it is there, and one can see most of the pipes coming from it! Mine is far more complicated than the one on the B1 as it has four more pipes coming from it – "phew", I hear you say!

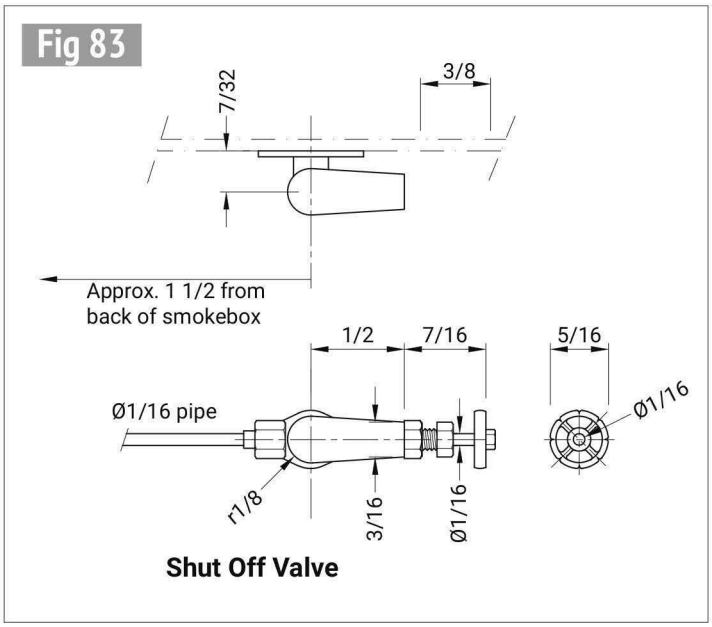
Now, I think I have rambled on for long enough so we will get on with some building. First of all, one of my club colleagues, Ballan Baker, solved the problem of the lack of capacity in his lubricator tanks by introducing a cunning plan. He fitted the two lubricators on his lovely K1 by feeding the first lubricator into the second one and from there to his cylinders. Both of them were filled with superheated steam oil of course. One thing that my 4MT has are two lubricators of similar design to the B1 so I have used some of my photographs to illustrate this article. **Photograph 159** shows my atomiser on the 4MT which has pipes of .054 diameter for the piston and valve rod glands alternating with 1/16 pipes over the cylinder tappings so that they deposit the oil above the valve bobbins. **Photograph 160** shows my two lubricators for the 4MT, the only difference being that the priming handles on the B1 are dished 4 spoked



Lubricators for the author's 4MT locomotive.



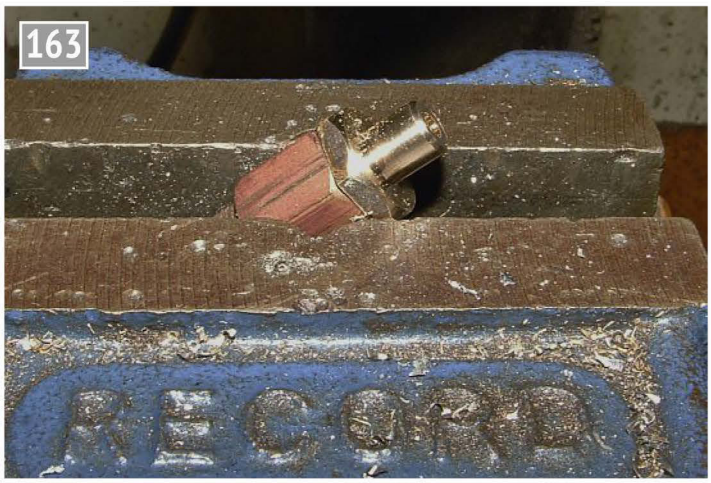
Lubricator mounted on the locomotive with 'spare valve' below.



Shut-off valve.

Lubricator internals.

Measuring up for the pump body.



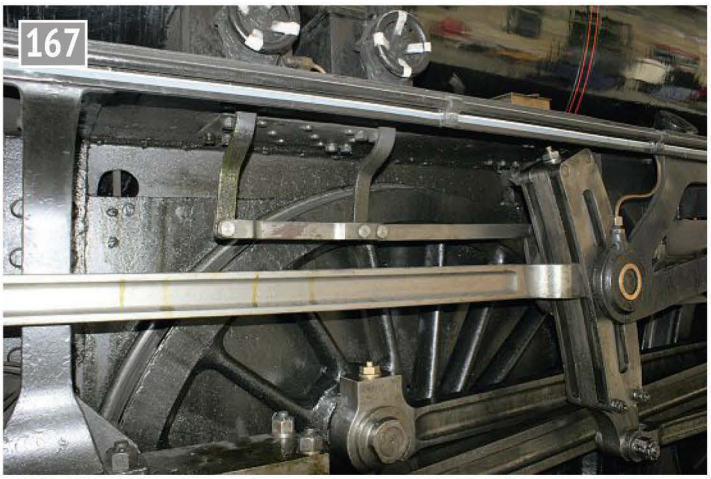
Drilling the oil ports.

handwheels. One other thing which I decided to do on my lubricator was to fit two pawls inside the ratchet housings dead opposite one another. This means that with the standard 47 toothed ratchet wheel and the scale linkage I used it means that when it rocks it will move half a tooth at a time, hence halving the oil consumption. Eddie emailed me to say that the only oil left is a hint of oil left around the blast pipe, which to me is the perfect amount. This means there is no oil all over the cleading and neither is there any all over my glasses! Did you know that on an 8F, each oil pump is set to deliver 1oz per 100 miles! I think that a lot of model engineers must use that after an afternoon's steaming!

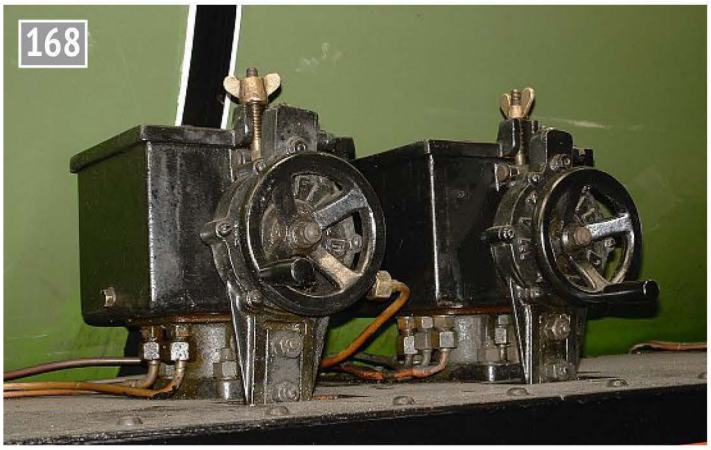
You will see that I put an additional valve in the steam line to my lubricators to shut the oil off completely but that was a precaution and I can now tell you that it just is not necessary. The steam needs to be on all the time. My spare valve is pictured in **photo 161**. I must also use some of my Y4 photographs to show how I made the pump for the Y4 as the photos for 4MT did not turn out to be any good. **Photograph 162** is the pump for the Y4 and as you will see I have done away with the Scotch crank and all that goes with it and hidden at the back of the box is the ratchet which leaves more room for the oil.

Photograph 163 shows the drillings for the oil ports, and they need to be oriented to emerge just inside the top of the oil chamber. I just drilled these holes by eye. **Photograph 164** shows me measuring the depth of the hole to the bottom of the piston before I made the body to screw onto the pump.

The position of the ball is critical.



Lubricator operating linkage.

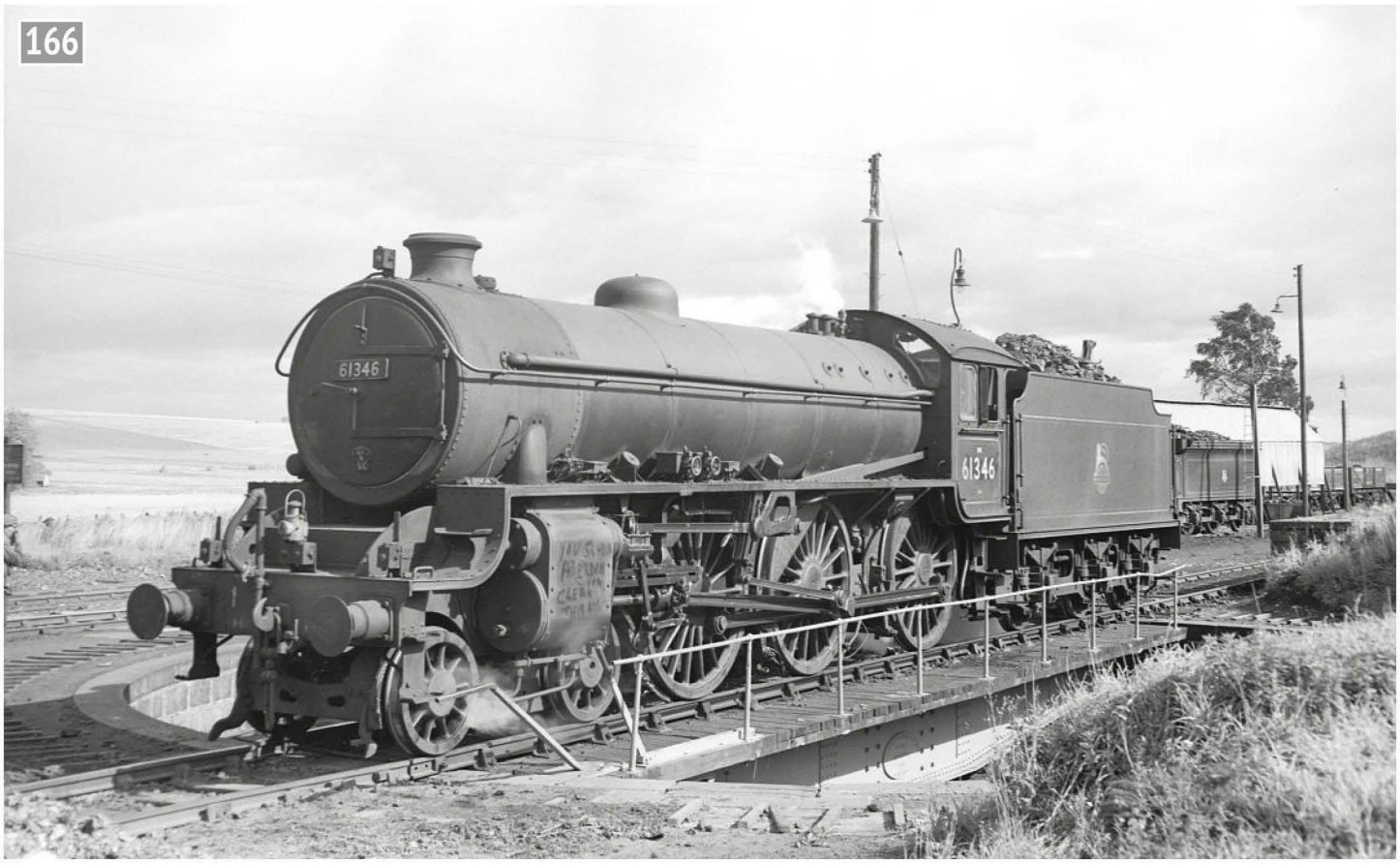


A pair of lubricators on B1 61306 (photo by John Thompson).

Photograph 165 shows the ball in the hole and this must be made so that it just protrudes far enough to push the ball off its seat. One mistake I made when building my original Y4 was that I made the outside of the body half a thread too deep so the pump just leaked oil past the half a thread and so it always ran a bit dry. What a difference that made once I had diagnosed the problem and made a new body for my pump. It took ages to solve this problem.

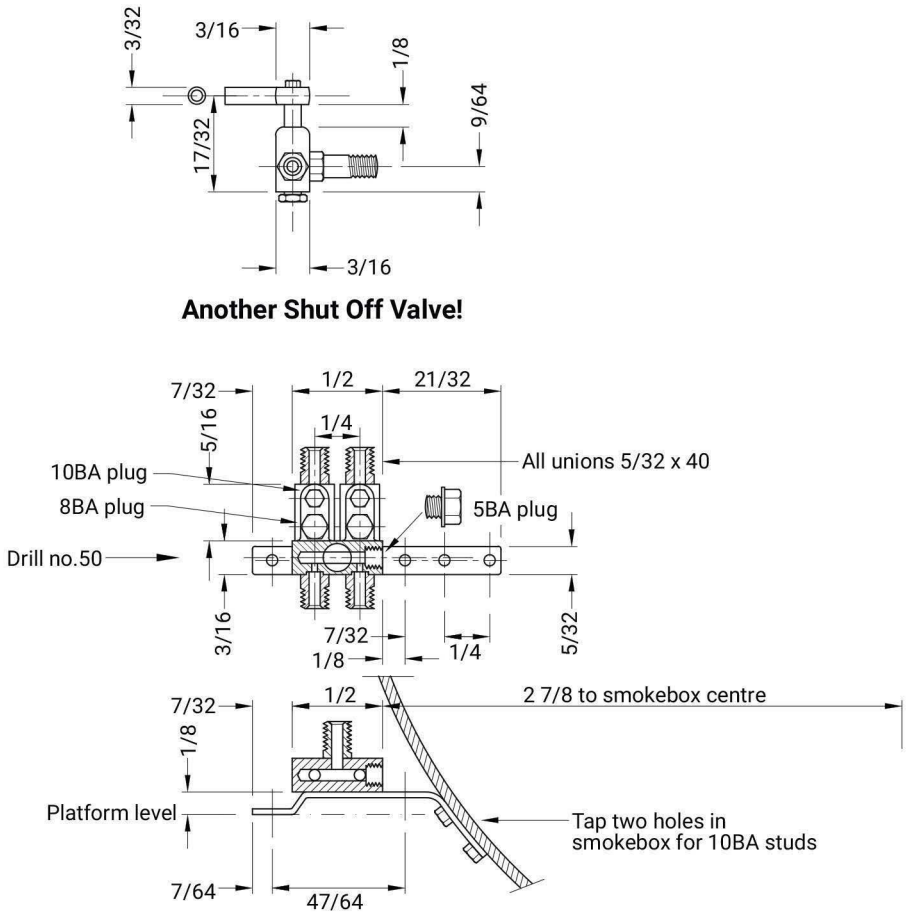
Photograph 166 shows 61346 with the two lubricators on the left hand side platform and the paint on the spokes is to assist the driver in seeing whether or not the hand wheels are revolving. (I always try to include at least one full size B1 and this is it).

Photograph 167 shows the underside of the lubricators and the reinforcing plate to



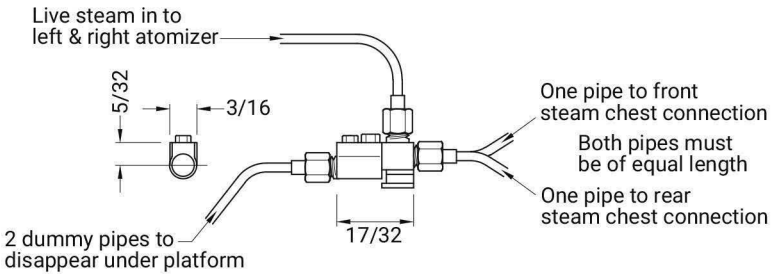
B1 61346 at Keith September 18th 1955 (photo by The Transport Treasury).

Fig 84



Another shut-off valve.

Fig 85

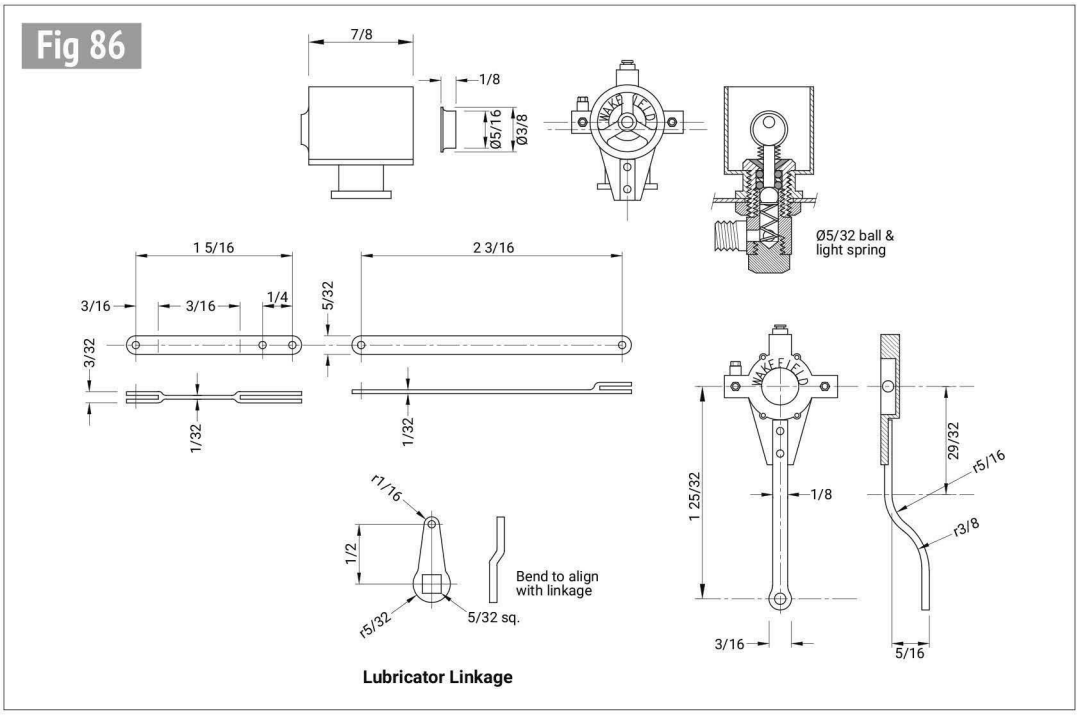


Atomiser.

stiffen up the local area. The idea was to show the linkage connecting the two lubricators and the separate link to the arm on the back of the expansion link. Also the photograph shows the cranks in the links where they join on to the main drive link. I am pretty sure that all these links will be hardened, Well, I would do that as a matter of course anyway.

Photograph 168 shows the the two lubricators together on 61306.

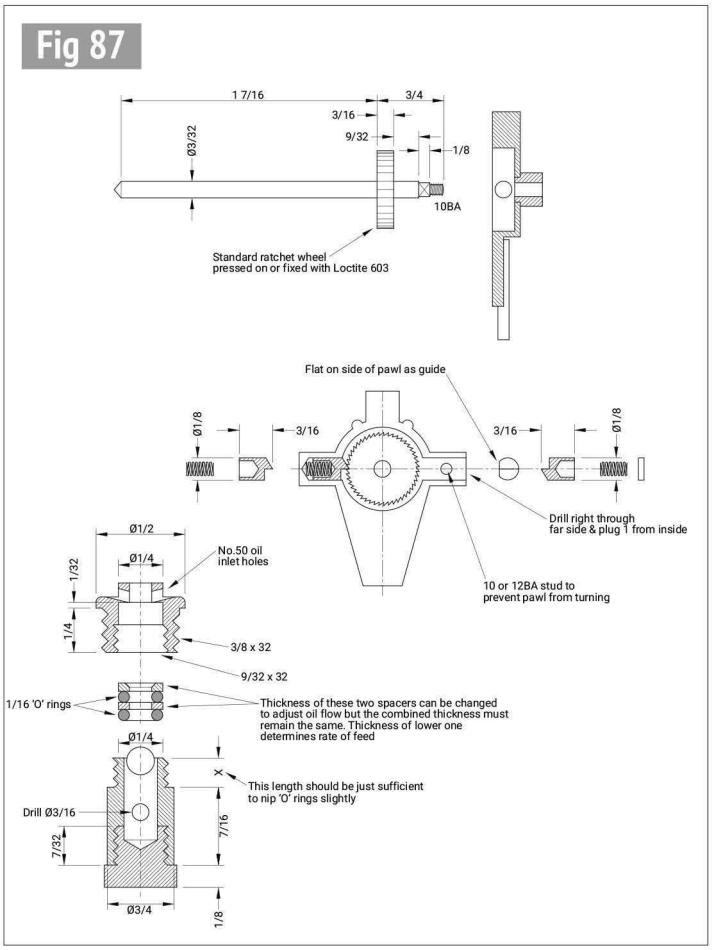
The atomisers also seem to have found favour with the NELPEG group as they have just fitted one their Q6 and they look just like mine! This was reported in the North Yorks Moors Railway magazine last year. One thing you must not do is the leave the engine



Wakefield lubricator (1).

Atomisers on a B1.

Swab box on B1 61264.



Wakefield lubricator (2).

A general view of the atomisers and swab box.

Wakefield lubricator castings from Adam Cro.

unattended with the drain coaks shut, otherwise it may wander off.

This should complete all of the lubrication. **Photograph 169** shows the atomisers on the right hand side of the B1 which I have tried to draw. **Photograph 170** is one of the swab boxes and on the left hand side of the B1 61264 and **photo 171** shows the general area around the atomisers. A friend of mine who is building the 7¼ inch B1 has just bought a couple of lubricators from Adam Cro and I have to say that they are absolutly exquisite. They are made in both 5 and 7¼ inch gauge and are the correct type No. 7 Wakefield lubricarors. I am not saying that they are cheap but they are just like the real thing. I have recently heard from another friend if mine who is building a 5 inch gauge J39, and he too has bought two for his locomotive, pictured in **photo 172**.

●To be continued.

NEXT TIME

We make the coupling rods.

Basic Oscillator Steam Engine in CAD PART 6

QR 13 www.youtube.com/watch?v=9mDWXLWHuUw

Luis Trincão takes us through the CAD process step by step.

Continued from p.100
M.E.4720 June 30

Exploded views

Now you have completed the engine assembly, let's see how to create an Exploded View. It often helps understanding the drawing, hence its importance. As an introduction, I recommend watching the video you will access by scanning **QR Code 13** or searching the Internet for 'onshape exploded view'.

Everything will be as if there were no Mate Connectors, but don't worry because when we close the Exploded View screen, everything goes back to normal.

Step E1 - Start from the Assembly and open the Exploded views window (**fig 79**).

Step E2 –Drag (left mouse button) the cylinder and cover. Click on the cylinder and the Triade Manipulator appears. Drag the cylinder in the desired direction. Release the cylinder and select the cover, which will follow the cylinder. Confirm the Explode Step.

Step E3 – Drag the cover to separate it from the cylinder and confirm. During the construction of your Exploded View, you can edit previous steps by right-clicking on the desired step as you can see in **fig 80**. If you do not want Explode Lines, uncheck the option.

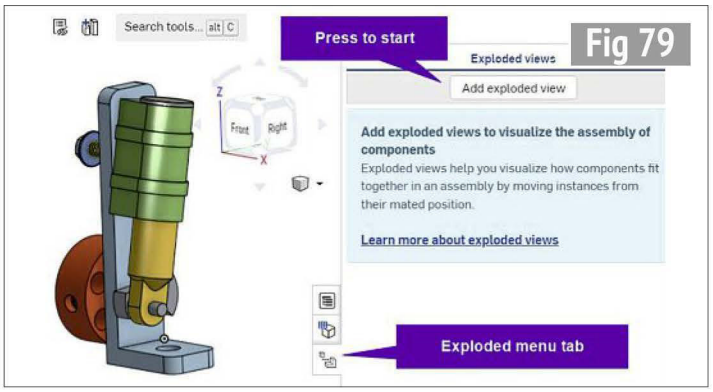
Step E4 – Drag nut and washer in a similar way.

Step E5 – Drag pin.

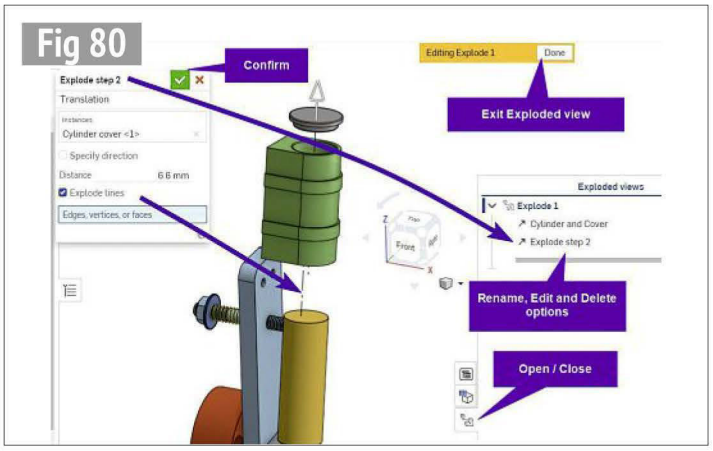
Step E6– Drag the spring and the other washer. To make it easier, you can hide the pin, move the spring and then unhide the pin.

To explode the remaining parts, proceed in a similar way.

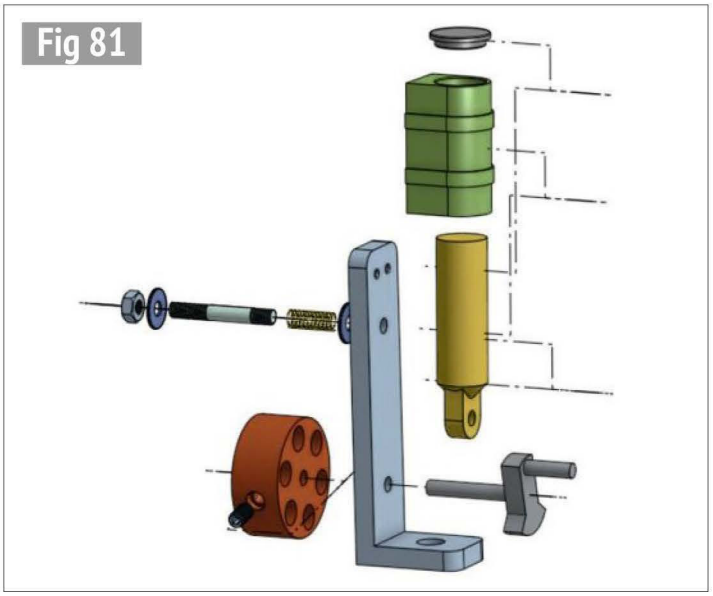
Eventually you will get a view like **fig 81**. As Assemblies and Parts, Exploded Views can be moved around to find the best perspective.



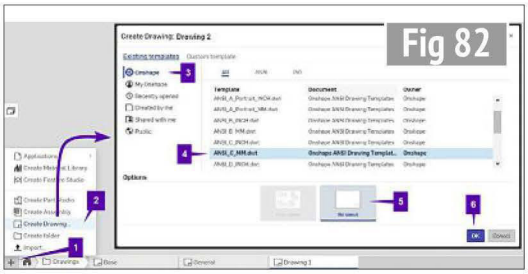
Exploded menu.



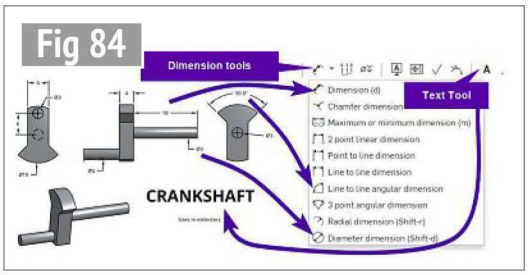
Exploded cylinder.



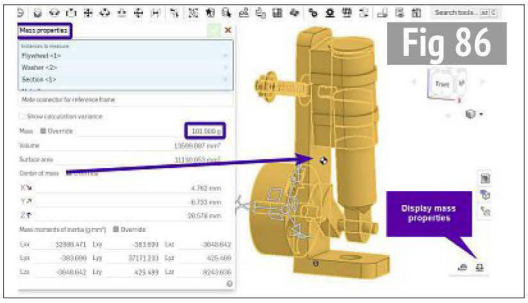
Exploded final.



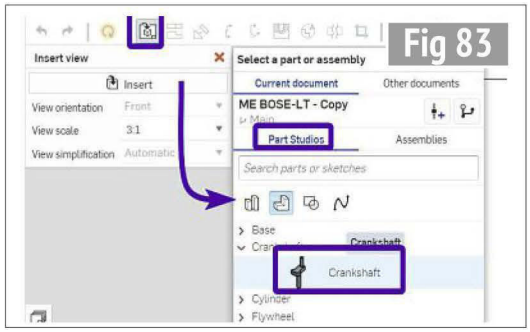
Create drawing.



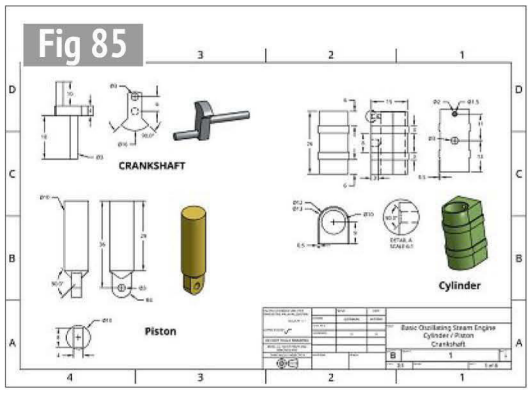
Crankshaft drawing.



Mass properties.



Insert part.



Drawing.

Drawings

We are almost done with this introduction to CAD. Let's talk about drawings.

I think that for most model engineers, it doesn't make much sense to talk about professional drawing with all the rules that it implies. As far as I'm concerned, I only do simple drawings that allow me to build my models. I suggest viewing the video accessible through **QR Code 14** or an Internet search for 'Onshape Drawings'. I leave it to the reader's curiosity to further explore the topic.

QR 14 www.youtube.com/watch?v=P5eDH3KxM_0

I will briefly exemplify how the Crankshaft drawing can be generated.

Step D1 – Create a drawing. Proceed as shown in **fig 82**. You now have a blank drawing sheet.

Step D2 – Select the part you want to insert in your drawing – crankshaft - **fig 83**.

Step D3 – On the next screen, choose and place the views you want on the blank sheet. You can choose the scale now, but you can also change it later.

Step D4 – Choose which dimensions you want to show, using the dedicated tools (**fig 84**). In this case, only three Dimension tools were used. All dimensions come from the crankshaft Part Studio. If a change in any dimension in the Part Studio is made, a refresh must be done in the drawing sheet and all dimensions will be automatically updated. Other changes on the Part Studio will also be updated when a drawing refresh is done. Be aware that parts of the drawing may become incoherent and require changes.

Step D5 – Insert the information in the Title Block – bottom right corner.

Step D6 - Right-click on each of the parts and choose 'Show shaded view' to see the drawing with the colour defined in Part Studio. Sometimes it is better to avoid this option for cleaner reading of the drawing.

Step D7 – Right-click on the tab of your drawing and select Export to generate a file in pdf format, which you can save or print. There is an example in **fig 85**.

Some details that might interest you:

- If you right click on one of the drawing views, you can edit some properties. Very useful to change the scale. We can start with a certain scale and at any moment change it without having to do it all over again.

- A drawing can have several sheets. You can copy/paste drawings between sheets.

- It is possible to make drawings with Exploded Views as shown in fig 2 of the first part of this series. If you are interested, the tutorial accessible through QR Code 13 is recommended.

- You can select details to be seen in greater detail, as is the case of the steam port in the Cylinder drawing in fig 85. It is possible to change the scale in the details without changing the scale of the remaining views.

Final notes

There are many unexplored features in this series, as it was only intended to be an introduction to CAD. I highlight two:

- Weight and centre of gravity of parts and assemblies. For this we must assign the material to all parts. See the example in **fig 86**. You can see the centre of mass represented in the drawing and its coordinates on the table, the weight of the assembly and other data. When this option is selected, there is a warning if any of the parts do not have material assigned. As expected, if you move the flywheel, the centre of mass also changes position. Although I haven't tested it, I see the possibility of correcting the balance of a crankshaft by the trial-and-error method.

- Another interesting possibility is to create a sheet metal part and obtain a flat pattern of it. It can then be exported to a drawing. A possible use might be in boiler cladding.

My use of Onshape is not only intended to support my hobby of model engineering, but also to design specific parts and 3D print them for use at home. Some time ago, I needed a small drain plug stopper. According to the hardware store, that size has not been manufactured for over 15 years. It was available on the Internet for the exorbitant price of €25. I made a CAD part, printed it in 3D *et voilà* for less than €1. Now I have the 3D file and when I need it, I just have to print it.

I hope I have managed to introduce CAD drawing to readers who have not yet experienced any adventures in this domain. If you are afraid to start using CAD software, my encouraging words are: two years ago, I had never used CAD software. I'm not yet an expert, but what I know serves my needs.

For those who already use CAD software, I hope I wasn't too boring.

ME

The Stationary Steam Engine

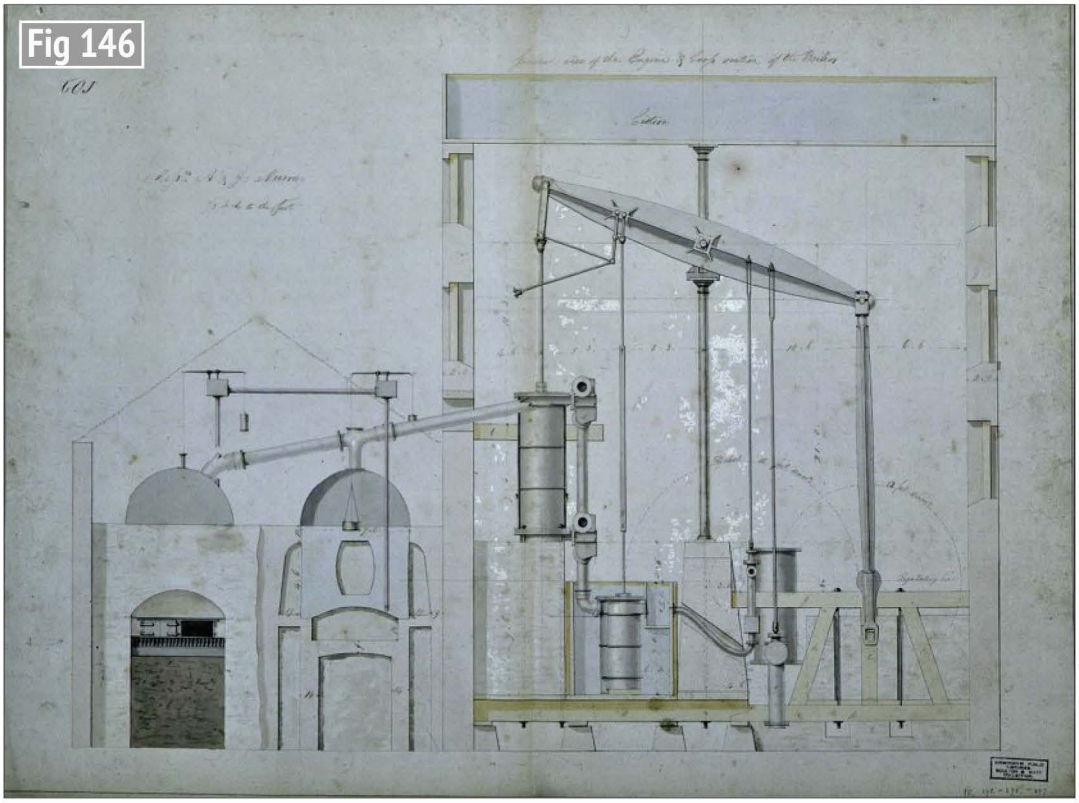
PART 48 – The First Maturity of the Beam Engine

Ron Fitzgerald takes a look at the history and development of the stationary steam engine.

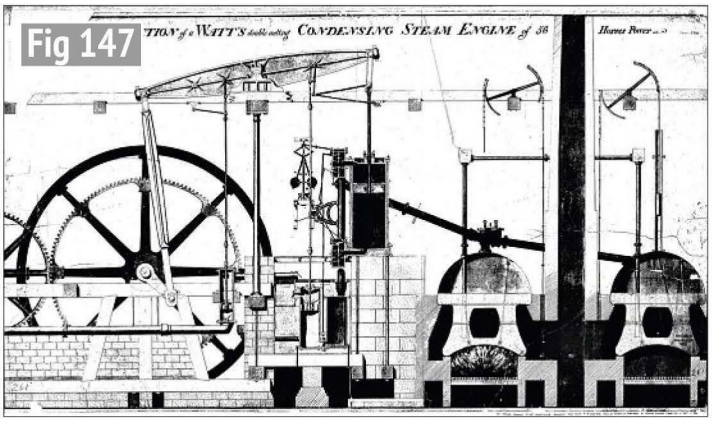
Continued from p.37, M.E. 4719, June 16

It would be perverse to argue that the stationary steam engine in the form that it had taken by 1800 was anything other than the creation of James Watt. By transposing the steam condensing function from the main power cylinder to a separate condensing vessel Watt had alleviated the gross fuel inefficiency that characterised the Newcomen beam pumping engine. The separate condenser allowed piston speed to increase independently of the rate of vacuum formation and made possible out-and-return power strokes in the same cylinder, the double-acting engine. A corollary of the double-acting engine was rotative motion which, with the use of the flywheel to iron-out cyclical variations in cylinder output, made the engine viable as a power source for driving machines, hugely extending its sphere of application. Although a development largely independent of Watt himself, supplanting timber by iron as the main medium of construction, gave the machine sufficient strength to withstand the stresses imposed by ever-increasing power output.

The Boulton and Watt 40 hp engine completed in 1801 for the Manchester cotton spinners A. & G. Murray (**fig 146**) shows the steam mill engine as it entered its first age of modernity. Apart from the isolated and unsuccessful 100 hp leviathan built for G. A. Lee, this engine is an example of the largest mill engine built by Boulton and Watt at this period. The cylinder, 31½ inches in diameter for a seven-foot stroke, (a 45 hp cylinder, 331/3 inches diameter with the same stroke, was supplied to Mitchel & Holt's Mill at Holtstown near Manchester in the same year but this was an isolated instance) is mounted on an ashlar foundation plinth and the valves are of the older



Engine for A. & G. Murray, Dekker Mill, Ancoats, drawing dated 4th September 1801. (B & W Archive 3147/5/95).



No 1 Sectional elevation of Watt double-acting condensing steam engine of 56 horse power (built by William Whitmore of Birmingham for Portsmouth Dockyard Copper Mill in 1805). Simon Goodrich Collection, Science Museum Library.

rack-and-sector operated plug valve type. The masonry bob wall that had been used to support the beam bearing in earlier large mill engines has been reduced to an ashlar stub wall that now supports the pair of hollow cylindrical cast iron columns underpinning the entablature upon which the main beam bearing is carried. The main beam is an elliptical plate casting with a central longitudinal rib but no edge flanges. The links for the parallel motion are wrought-iron forgings. Two further, short columns rising above the entablature provide support for a cast iron roof tank which holds the condenser injection water supply. The condenser and the air pump, to which it is connected, are enclosed in a wooden, water-filled, cistern which became known as the cold well. At one side of the cold well cistern there is a smaller cistern, the hot well, which receives the hot water discharged from the air pump. The hot well supplies feed water for the boiler by way of a pump, also operated from the main beam. A third, larger pump lifts water from a well and delivers it to the roof tank.

The connecting rod is a cruciform-section cast-iron column, identical in form to the vertical columns used in contemporary iron-framed mill structures. Cast-iron is also used for the crankshaft and the crank sweep which has supplanted the sun-and-planet gear. The crank and the flywheel are carried on two separate shafts geared together, the flywheel shaft being effectively the first motion shaft. The crankshaft has a twelve-foot diameter gear wheel at the opposite end to the crank that drives a pinion on the flywheel shaft whilst the flywheel itself is fifteen feet in diameter. Iron has supplanted timber for all of the working components of the engine; the only substantial remaining timber construction is the trestle framework that carries the crankshaft and a continuous timber bressummer that forms the anchor plate for the vertical holding down bolts.

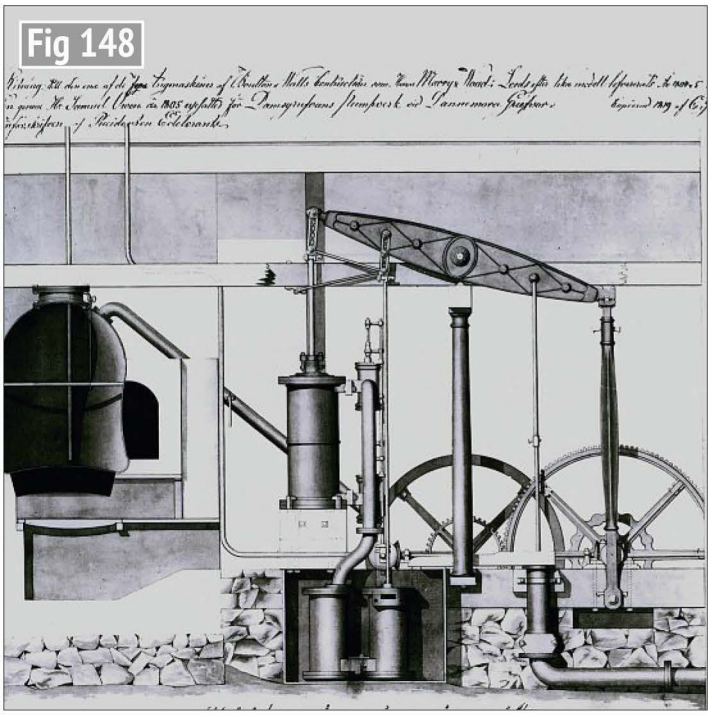
An adjacent building contains a pair of waggon boilers to a design developed by Watt. Set in a brick casing, the boilers are externally fired by a furnace placed on a grate below the boiler shell. Hot gases, after first heating the underside of the boiler, ascend in a riser chamber at the opposite end to the firing hole and thence return through the length of the boiler by way of an internal flue. At the firing end of the boiler setting the flue gases, as they emerge from the internal flue, divide right and left across the face of the boiler shell and then re-pass down the boiler sides in brick chambers which terminate at the chimney. Each boiler is fitted with a water float which controls the admission of water, maintaining a constant level.

Drawings of many similar Soho-built engines are contained in the Boulton and Watt collection in Birmingham but, outside this, little is known of the immediate diffusion of the Watt type engine following the end of his patents. Surviving illustrations of machines built by the earliest rival engine builders are rare, for which reason particular interest attaches to the drawings of steam engines in the collection of Simon Goodrich held by the Science Museum Library. From December 1796 Goodrich was an engineer and draughtsman under Sir Samuel Bentham, Inspector General of Naval Works. He was based in Portsmouth and was largely responsible for the reconstruction program at this and other naval dockyards. Deeply interested in engineering throughout his career, Goodrich toured the country to keep abreast of developments. His surviving diaries and drawings are an invaluable source of information.

In 1803 Goodrich began to formulate plans for a copper mill for Portsmouth. The main part of the contract, the rolling machinery, shears and stamps, with the steam engine, was awarded to William Whitmore. Whitmore was in business with Richard Ford and John Brunton in 1776 at 27 Charles Street, Birmingham, where they were involved in making clock and watch maker's tools including ...*Engine, Oval and Common Lathes*... along with weighing machines ranging from scales to wagon weighing platforms (**ref 245**). By 1780 Whitmore had established himself independently in nearby Newhall Street, continuing to produce the heavier engineering products of the former partnership, more especially metal rolling machinery and weighing machines. Three years later Goodrich was shown around the works which he describes in his diary as being water powered with boring machines and lathes, one of which was capable of cutting large screw threads. Although he does not mention a foundry, Whitmore would certainly have had one at the time of the visit and a later report of 1808 confirms its existence.

There is nothing in the Whitmore trade literature to show when steam engine building commenced but he was asked to quote for an engine to power Bentham's proposed steam dredger in June 1800. The dockyard rolling mill contract which he secured three years later included a 56 horsepower Watt type engine which was complete by September 1805. A drawing said to be this engine survives (**fig 147**) although E. A. Forward in his Newcomen Society article on Goodrich (**ref 246**) says that the engine in question had a blowing cylinder 30 inches in diameter and 3 feet 8 inches stroke between the crank and the centre pillars whereas the drawing shows only a water pump supplying the cold well cistern in this position.

The steam cylinder, 36 inches in diameter and seven-foot stroke, was fitted with nozzles and valve gear worked by tappets mounted on the air pump plug rod, identical to Soho practice. The arrangement of the condensing gear also follows Soho but the cold well tank is cast-iron. The beam is superior to the Ancoats engine in that it has flanges attached to the top and bottom edges although Boulton and Watt had also used a beam of this pattern for the Fazeley Street engine in 1803. The connecting rod is cruciform-section. The most substantial difference between the two engines is to be found in the arrangement of the crankshaft and flywheel which in the Whitmore engine use the same shaft. Attached to the flywheel arms a gear wheel engages with a gear on a separate first motion shaft. Both shafts are supported by a timber trestle and timber is used for the entablature beam below the beam bearing with a timber spring beam sandwiched between the entablature and the bearing pillow block. Timber is also used for tie beams in the foundations. Goodrich later had cause to



The Fenton Murray and Wood engine supplied to the Swedish Elfvik textile mill in 1804, later located at the Dannemora iron mine.

criticise this engine as the cylinder was excessively long compared to the piston stroke giving rise to steam wastage. He was also dissatisfied with the quality of the rolling mill machinery supplied by Whitmore (**ref 247**).

Part 44 of this series, *The First Iron Beams* (M.E.4713, March 24), featured the drawing of a 'mystery' engine found in the Leeds Archives Department. Although no definitive date can be attached to the drawing it would seem to be a contemporary of the Manchester and Portsmouth engines. In the previous discussion, interest was concentrated upon its open-web iron beam but reference to the illustration reproduced will show that it strongly resembles the two engines described above. The cylinder and valves follow the Soho pattern although whether the valves are of the concentric spindle type as opposed to the Watt rack-and-sector arrangement is not clear. The arrangement of the condensing gear and cold well follow Soho practice but the Leeds engine is closer to the Whitmore machine as the crank and the flywheel are mounted on the same shaft. There is no indication of how power was taken off the crankshaft to the first motion shaft in the Leeds engine. The cylinder plinth is built up of ashlar but the flywheel shaft is carried on a timber trestle which differs only marginally from that of the other two engines.

The Whitmore and the Leeds engines have a common identity that is directly derived from Boulton and Watt's practice, even to the extent of repeating the anachronistic timber framing that supported the working shafts. These engines seem to show that the surest way of entering the steam engine building business after Watt's patents lapsed was to slavishly copy the Soho Foundry product. The Leeds engine may have been built by Matthew Murray but with the exception of the beam it cannot be distinguished from Boulton and Watt's current products.

The continuing Soho influence upon Murray into the first years of the nineteenth-century is apparent from the engine that he supplied to the aspiring Leeds cotton spinner Ard Walker in 1801. In November 1800 and February 1802, Walker, a Leeds wine merchant, inherited two adjacent pieces of land in Hunslet. On the first stood a water-powered fulling mill dating from 1780 which he intended to convert to cotton spinning and, to this end, in 1801, a Fenton, Murray and Wood steam engine was installed. Valuing the engine fifteen years later Murray described it as a *...Patent Steam Engine of 30 horses power...,* the term *patent* engine referring not to his own patents but to what had become a generic description of the Watt engine. The extent of the debt the engine owed to Boulton and Watt is further apparent from the subsequent descriptions prepared for the valuation (**ref 248**). Built by Murray over twelve months after Watt's patents ceased to be valid, this engine had all of the characteristics of an eighteenth-century Soho product, not only in terms of the timber beam but also to the extent of retaining the dubious sun-and-planet gear rather than the simpler and more reliable crank.

It may be that the retrograde elements in Ard Walker's engine reflected the customer's wishes, a not infrequent cause of conservative practice. In contrast, the earliest known authenticated representation of a Murray engine shows a machine that represents a more self-confident assertion of individuality. The engine is dated to 1804/5 although the wash drawing was not made until 1819. It was one of a consignment of four engines for Sweden, three of which were made by the Round Foundry. The order was placed by the Baron Edelcrantz who had a commission from the Swedish King Gustav IV to tour Europe and to report on industrial and technological progress. Two of the Murray engines were installed in government-owned distilleries in Stockholm but the third went to Lars Fresk's textile mill at Elfvik (**fig 148**). It was working by December 1804 but, proving underpowered, it was transferred to the famous Dannemora Iron Mines to be used for pumping and haulage.

The drawing is believed to show the engine as it was at the Elfvik mill. In general, the layout of the cylinder, valve boxes, condenser and air pump follow Boulton and Watt but the Swedish engine's valve gear is more advanced in that the motion is via a layshaft driven by bevel gears off the crankshaft. It is not clear whether a cam or an eccentric is used to raise and lower the valve spindles but the spindles are of Murray's concentric pattern. The main beam has become a single casting of I-section with edge flanges and decorative detailing has been applied to the plate surfaces, a characteristic of Murray's beams thereafter. The column supporting the entablature is of a much more substantial section compared to the A. & G. Murray and Whitmore engines but this may be single rather than the double columns used by Soho. The connecting rod is of the now customary cruciform-section. A large diameter gearwheel is attached to the opposite end of the shaft which carries the crank and this gear meshes with a pinion on the separate flywheel shaft to give a velocity ratio of 1:2.78. Although the use of the timber trestle frame to support the crankshaft has been replaced by a rubble stone foundation, a timber baulk is retained to form a bed for the crankshaft and the well water pump. Timber is also used under the bottom plate of the main column which supports the entablature, also of timber and the spring beam is timber.

Virtually contemporary with Murray's Swedish engines was the pumping engine delivered by the Round Foundry to Willington Colliery. Willington was first sunk by William Brown in partnership with Matthew Bell in 1775 and extended to 840 feet under Watson between 1800 and 1806, making it one of the deepest in the coalfield. This new generation of very deep pits marked a turning point in the pumping technology of the north-eastern coalfield. Up to this point, the Watt-style engine had made limited progress in coal mining as the cheaper and simpler common

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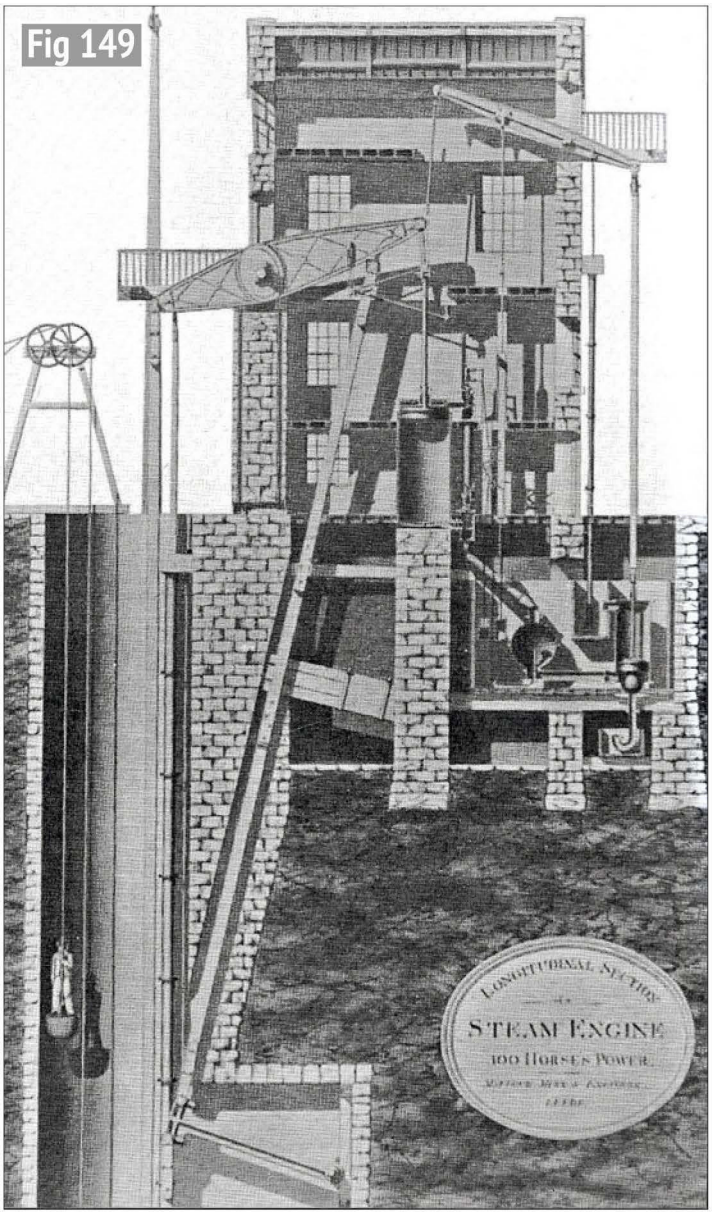


The Willington Colliery 100 horsepower pumping engine of 1804.

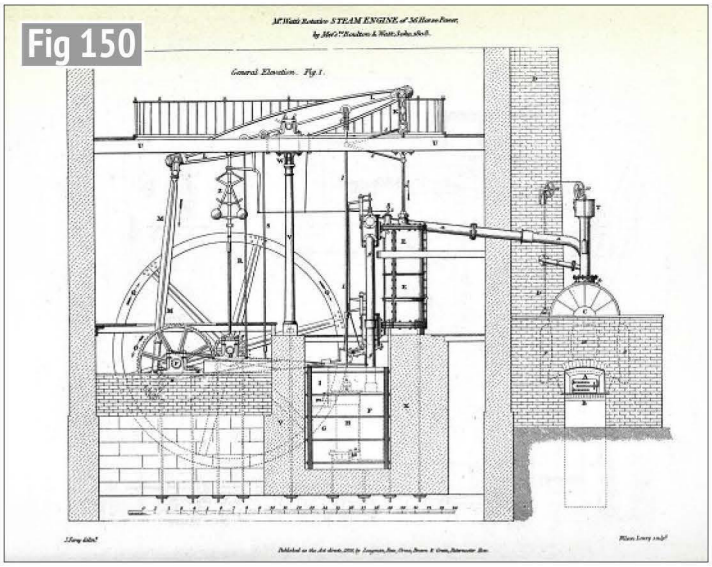
engine sufficed for moderate depths but, as Smeaton had found in the south-west, the use of unassisted atmospheric pressure as the working agent meant that in larger engines the cylinder size became unwieldy and thermal events unmanageable. Despite its fame, Smeaton's famously massive Chacewater engine was overwhelmed and quickly replaced by a Boulton and Watt machine.

Willington was part of the trend away from the atmospheric engine in north-eastern mine pumping but this retreat of the atmospheric engine in the face of the condensing engine owed little to the Soho Foundry. After 1800 Boulton and Watt built only a handful of colliery pumping engines and the firm was excluded entirely from the north-east. Here, initially at least, the ascendant figure was undoubtedly Matthew Murray. Murray must have felt some smug satisfaction in securing the highly prestigious order for the Willington engine in 1804, a 100 horsepower machine that was not only the most powerful engine in the Newcastle area but probably in the country.

Boulton and Watt's mine pumping engines had largely adhered to single-acting cylinders working on what was to become known as the Cornish cycle but an attempt had been made to apply the double-acting principle. For Hebburn Colliery in 1797, Soho Foundry built a double-acting 63 inch, 8½ feet stroke machine, believed to have been their only instance of a mine pumping engine of this type with the possible exception of the 60 inch by 9ft stroke unit supplied in 1803 to John Hope's Trustees' Edinburgh Colliery. Murray must have been aware of the Hebburn machine as the Willington engine adopted all of its main features (**fig 149**). To achieve water delivery on both the up and down strokes of the piston, a second spear rod was attached to the engine beam at the piston side of the beam fulcrum. This ran diagonally through a slant shaft in the engine house foundations, descending to a rocking bob lever in an inset which transformed the motion into vertical movement down to the pit bottom pumps. As the connection between this diagonal rod and the beam obstructed the conventional position for the condensing equipment the latter was relocated outside the engine house on the opposite side to the shaft and a smaller slave beam was attached to the piston end of the main beam. Whilst the pump spear rods remained timber which was more resilient and easily repaired in the event of an accidental over-stroke of the pumps, the main structural parts of the engine were now entirely made of iron. The condenser chamber is of spherical form and the valves are plug valves operated by a tappet rod which works the valve gear that in turn drives concentric valve spindles. With the exception of the valves Murray's engine was quite simply an all-iron version of the Hebburn machine built eight years previously.

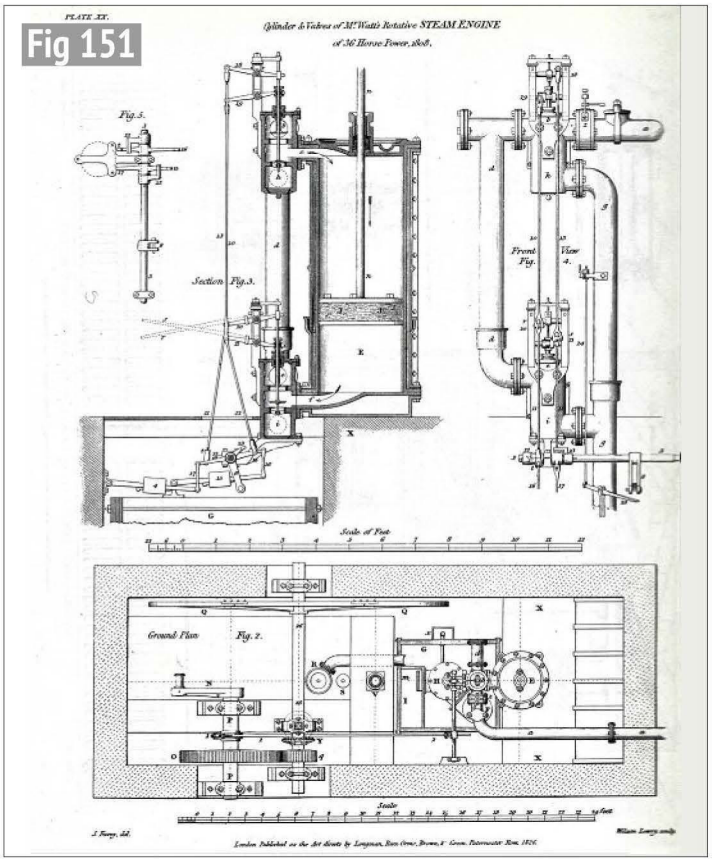
The concentric valve spindles used in the Stockholm and Willington engines had been central to the *scire facias* action directed at Murray's patent 2531 of 1801. Boulton and Watt's claim to have invented this valve arrangement was established only by default and both firms continued to make extensive use of the device. The well-known Farey drawing of the Boulton and Watt, 36 horsepower, rotative engine, dated 1808 (**figs 150** and **151**), but supplied in the previous year to the Stockport cotton spinner Mr. Howard, made use of concentric valve spindles.

This engine exemplifies Boulton and Watt's mature design as it had evolved through the first decade of the nineteenth-century but it also represents the familiar form of the beam engine for the next hundred years. Indeed, by 1810, there was no longer anything in the pioneering firm's engines to distinguish them from the rising generation



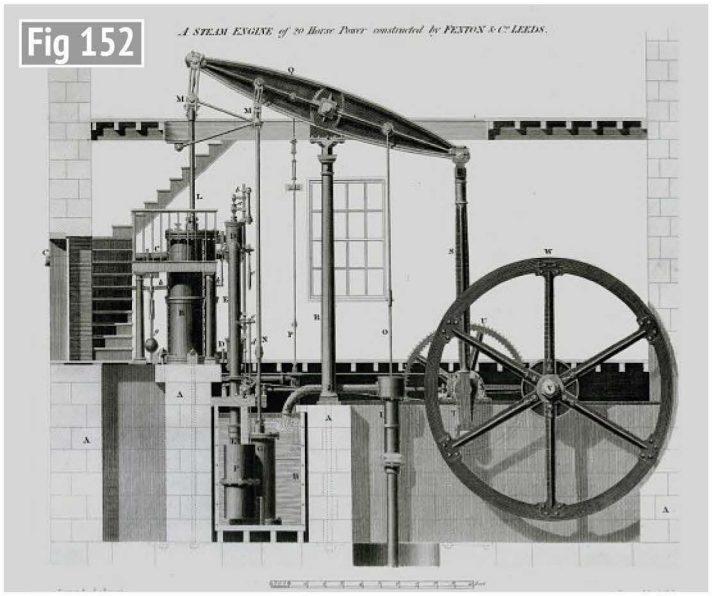
John Farey's engraving of a 36 horsepower rotative Boulton and Watt engine of 1807/8. A Treatise on the Steam Engine … *(1827) John Farey.*

Fig 151



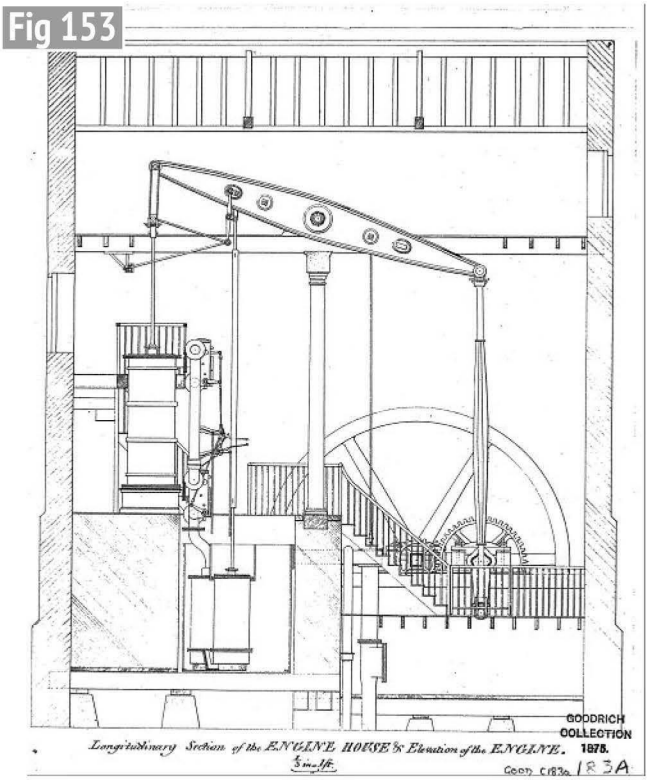
John Farey's engraving of a 36 horsepower rotative Boulton and Watt engine of 1807/8. Details of the valve gear with concentric valve spindles. A Treatise on the Steam Engine ... *(1827) John Farey.*

Fig 152



Joseph Clement's superb drawing of a Fenton, Murray and Wood 20 horsepower engine with eccentric drive from the crankshaft and concentric valve spindles.

Fig 153



Engine House and Engine for a Steam Corn Mill. Mr. Rastrick c. 1812. Simon Goodrich Collection, Science Museum Library.

of competitors, led by Murray's Round Foundry. Murray's engines were usually cheaper than Boulton and Watt's - Goodrich quotes in 1804 £1,083 for a 20 hp Boulton and Watt engine and £600 for a Murray engine and £1,418 compared to £830 for a 30 hp machine, a disparity that was not achieved at the expense of quality for Murray was recognised nationally and internationally as the most accomplished steam engine builder of the period (**fig 152**).

The fact that an industry standard had emerged by this time is further illustrated by the design that John Rastrick prepared for Goodrich in 1812 to power the Portsmouth corn mill (**fig 153**). Rastrick is better remembered today for his association with Trevithick which will be discussed more fully in a subsequent part of this series. His association with John Hazledine in the Bridgnorth Foundry is thought to have commenced in 1807 when he became the firm's mechanical and civil engineer but he did not become a partner until after John Hazledine's death in 1810 when the family connection was through Robert, John's brother. As Hazledine, Rastrick & Co., Rastrick became the managing engineer and to him undoubtedly the Goodrich corn mill engine design is owed. It differs in detail only from contemporary Boulton and Watt products and still uses the old plug rod tappets to work the valves in contrast to the 1807 Boulton and Watt and Murray designs which had moved on to rotative drives from the crankshaft.

●To be continued.

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245. Trade Catalogue of Ford, Whitmore and Brunton c.1775.

246. *Simon Goodrich and his Work as an Engineer.* A. E. Forward. T.N.S. Vol. III, 1922-3. P.1.

247. Letter from Goodrich to the Navy Board reproduced in *Matthew Murray 1765-1726 and the Firm of Fenton Murray & Co.* P. M. Thompson 2015. P.153.

248. Letter of January 25th 1816 from Matthew Murray to Ard Walker. West Yorkshire Archives WYL 160/23 and WYL160/63 Agreement 2nd November 1843.

NEXT TIME

We look at smaller and non-beam engines.

OBITUARY

IVAN LAW 1927-2023

If Ivan were to have a headstone it would read 'Ivan Law - Lifelong Model Engineer'.

Being a Lifelong Model Engineer by definition means starting at an early age. Ivan's father, Fred, although not a founder member, was a very early member of the Sheffield Society of Model Engineers and he used to take young Ivan along to the meetings. However, the event that really inspired Ivan was a memorable visit to a member's workshop where he was surrounded by machinery.

Ivan missed a lot of school when he was younger as he suffered from chronic asthma and was very poorly at times. When I was clearing out his house I came across Ivan's school reports which made interesting reading. It was obvious from these early reports that Ivan had a natural flair for mathematics, science and practical subjects and showed indifference to other subjects. This peeved me a bit as Ivan often berated me for obtaining similar school reports!

On finishing school Ivan studied engineering at a Technical College in the centre of Sheffield and started an apprenticeship at an engineering firm specialising in producing mining equipment. After his apprenticeship he applied for a job at Rolls Royce where he was successful in obtaining a place. He had to attend a lengthy course at the Rolls Royce training college in Leeds and he was then appointed as a draughtsman in a Rolls Royce drawing Office on Marsden Street in Chesterfield. He worked here throughout the 60's and eventually ended up heading his own section working on nozzle guide vanes on Rolls Royce aero engines.

Running parallel to his career was his keen interest in engineering as a hobby. He lived at Gleadless in Sheffield and had constructed, with his father, a workshop at the end of the back garden. By today's standards this was a primitive building made out of corrugated steel sheet with a single brick front with tiny windows, no heating and only filament bulbs for illumination. The machinery was basic but Ivan managed to build his first steam locomotive in here at the age of 14, a 3½ inch 'Rainhill'. This workshop remained virtually unchanged from 1940 to the 60's apart from a new Myford ML7 arriving in the late 40's. I can remember spending time in there and it was dark, damp and full of spiders. Ivan eventually installed a paraffin heater for the winter and although it raised the temperature the warm damp air condensed on the corrugated steel roof and then rained down on the machines, his work and Ivan. Ivan was however oblivious to all this hardship as he concentrated on his work night after night. My mum, Jean, often had trouble getting him out of the workshop even at meal times. The power to the workshop was provided by a three-core rubber cable which ran down the length of the garden and was plugged into the cooker point in the kitchen by a round pin plug. When dinner was ready the method of attracting the engineer to the dining table was for Mum to unplug the cable and plug it back in again. The success of this operation was dependant on how interesting the work being undertaken was versus how hungry he was. On more than one occasion Ivan came through the door chuntering about how he was on a finishing cut when the lights went out, the machine stopped and then all came back on again ruining the precise surface finish he was up until that point achieving. Under these harsh conditions Ivan built many engines, all increasing in complexity. It was in this workshop and under these conditions that Ivan built, as he later said, the most challenging model of his career, a twin cylinder petrol engined '1831' locomotive. The design of this locomotive was published in *Model Engineer* magazine by Edgar Westbury and many of these models were started but only a handful of working examples were ever completed. Ivan's ran perfectly but he was never bothered to try it on a track. This was because once a project was completed he instantly lost interest in at as he was already focussing on his next project. At this time most models built by model engineers were of modest 3½ or 4¾ inch gauge but Ivan decided to build a larger scale 7¼ inch model. He was a member of the Sheffield Model and Experimental Engineers and this was the first larger scale model to be built in the club at that time. Sunday mornings were without fail always spent at the Sheffield Model Engineering Club and in the sixties and early seventies Ivan seemed to be perpetually the chairman of the club. Ivan remained a member of the Sheffield Society of Model Engineers for the rest of his life, being an active committee member and eventually being honoured with the club presidency.

In 1966 we moved house from Sheffield to Ollerton in Nottinghamshire. I think the motivation for this was partly that Jean fell in love with the new house but I guess Ivan's real motivation behind the move was that the new house was going to be built with a purpose-built workshop on the side of the house which was modern and accessible without going outside - no more unplugging machines to attract attention. The new workshop proved a great success - warm,

lots of natural light and a comfortable place to work. Machinery was improved with a Super 7 with gearbox and production of model making increased. We still attended Sheffield every Sunday morning despite the increased travelling.

On February 4th 1971 something happened which would alter the course of Ivan's life for the better. Rolls Royce went bust! The RB211 jet engine that Ivan had been working on caused massive problems for the company. Ivan got wind of this before it happened and so it came as no surprise to him. Ivan did not have to take compulsory redundancy but the drawing office in Chesterfield was shut down and he had to move to the Derby office.

At the same time and by fortuitous coincidence Ivan's friend and president of the Sheffield Model Engineers, Arnold Throp, decided to retire. Arnold had built up his own company called Dore Engineering producing kits for a small vertical milling machine. This machine was the Dore Westbury which Arnold and Professor Chaddock had improved from Westbury's original design. Ivan and another Rolls Royce employee who worked at the same drawing office, Peter Southworth, took the bold step of taking voluntary redundancy and by combining their redundancy packages set up a company called 'Model Engineering Services'. Even before Royce's announcement Ivan and Peter had often discussed the lack of small accessories available for the home workshop and had started designing a range of rotary tables. From then on Model Engineering Services was launched producing the Dore Westbury milling machine and rotary tables with many more small tools to be added later including an abrasive band machine, surface grinder, dividing head, Quorn tool and cutter grinder, Kennet tool and cutter grinder, lathe steady, adjustable angle plate, low profile machine vice, boring

and facing tool and then they developed the Dore Westbury into the Mk2 with stiffer column and head support and longer quill travel.

This change of career direction also necessitated larger premises and much to Ivan's delight a large fully equipped machine shop was needed. This meant the Law family moving back to Sheffield to an old farm where Ivan and Peter converted the cow shed to a workshop and all the stables to material stores. All M.E.S. products were dispatched from here but Ivan encouraged customers to call in person so he could meet and chat with them. Those of you who collected items from here may remember the obligatory cup of tea at Pipworth Farm.

Model Engineering Services was a great success from the 70's through to the 90's. In order to promote the business Ivan attended the Model Engineer Exhibition and was asked to join the team of demonstrators on the SMEE workshop stand at the shows. Ivan was very proud to be a member of SMEE and the highlight of his year was to spend time on their stand at the show demonstrating milling processes like milling crankshafts, camshafts and gear cutting. Other notable figures to be found on the stand at this time were Professor Chaddock and George Thomas. For Ivan, it was his annual fortnight holiday, being amongst friends and talking to hundreds of model engineers. SMEE asked him to become a judge for the machine tools section of the Model Engineer Competition held at the exhibition. Due to his wide range of knowledge of all matters relating to model engineering he was eventually asked to become Chief Judge, a position he held until the demise of the competition due to COVID. He made several trips down to Marshall House, the SMEE headquarters in London, to deliver talks and take part in the judging of their annual in-house competition. He was very proud to be appointed as vice-president of SMEE.

In 1985 through his contacts at SMEE and the exhibitions he was asked by Argus Books to write a book for the Workshop Practice series on the subject of Measuring and Marking Metals and this was followed three years later by his Gear and Gear Cutting book. Both of these books were written from the perspective of a home workshop provision, something Ivan had been familiar with all his life.

He was also involved in various independent engineering projects, one notable example being the replica 'bombe' project at Bletchley Park. This was an electro mechanical device used by British cryptologists at Bletchley Park to help decipher German Enigma-machine-encrypted secret messages during WW2. Ivan made the bevel gears for this working example, which were unavailable from any other source.

By 2010 and by now in his 80's the demand for M.E.S. products was declining, partly due to affordable far Eastern tooling becoming widely available at low cost and also, as Ivan put it, 'the replacement of model engineers with cheque-book model engineers who preferred to buy models to play trains with rather than make anything'. It was therefore decided to wind down M.E.S. and concentrate on building new projects.

Thus, a new era had now begun for Ivan. I had now retired and we decided to build projects together, working both in Ivan's workshop and also making bits independently in our own workshops. This partnership was very successful and in the following 12 years five engines were completed. After a lifetime of observing him at work Ivan still surprised me with his problem-solving skills in producing complicated machined parts. He refused to buy anything in and would much rather make everything. The only bits he bought were gauge glasses and pressure gauges - even the latter he had built at one time. Ivan loved machining and was renowned for saying "I'll go and get a cut on" meaning he was going to machine a bit of material into shape. The more involved and complicated the machining process the better, so he went ahead doing what he loved and I did the mundane jobs of boiler building, fittings, plate-work and painting. I was still the apprentice to the master.

In March 2022 and at the age of 94 he was still in the workshop most days but becoming unsteady on his feet. Unfortunately, he fell in the workshop hitting his head on the concrete floor. The ambulance team that attended him were appalled that he was in such a dangerous place at that age but Ivan just replied saying "You won't understand, you aren't model engineers!"

From there he went into a care home as he lost the ability to live independently, I knew he would be unhappy being away from his workshop and I knew the chances of finding a care home with a workshop attached were pretty slim. The last year of his life was a frustrating one - for the first time in his life he had to sit all day with nothing to occupy his mind. He went downhill both physically and mentally, eventually dying on the 20th June.

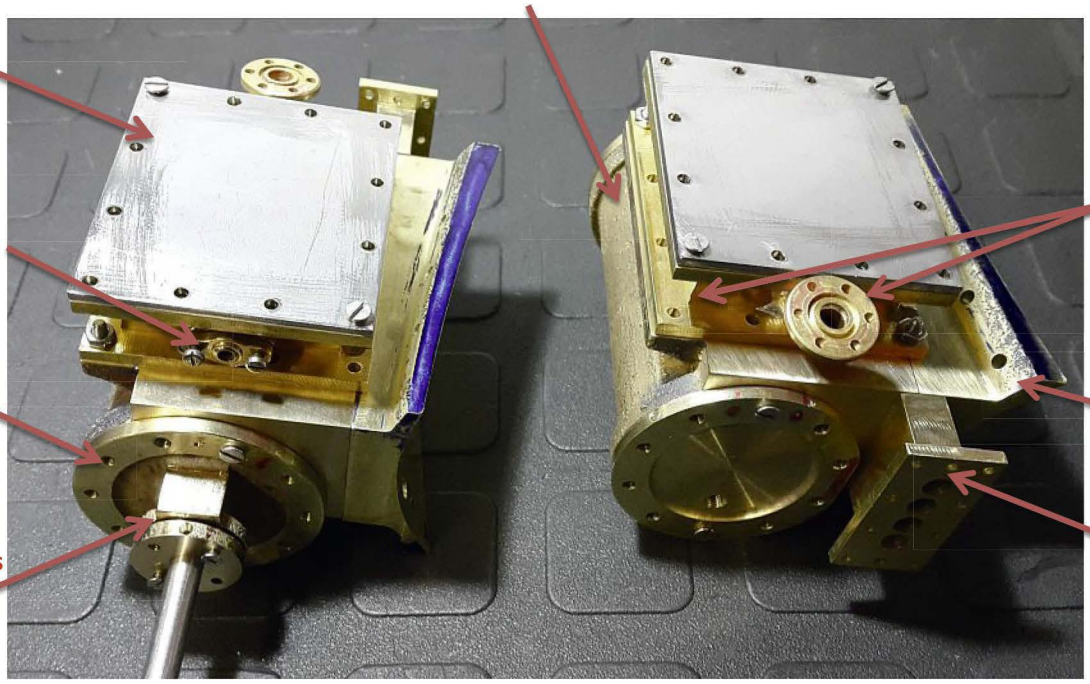
He has left a legacy of many models and machine tools - too many to list - that he designed and built and also the two books which are still selling and helping newcomers to the hobby.

I have no doubt that wherever he is he now he will have 'a cut on'.

Mike Law

A Five-Inch Gauge 0-4-0 Padarn Railway Tender Locomotive PART 7

Fig 10



Materials used for the composite cylinder assemblies.

Luker builds a five inch gauge model of a Welsh slate quarry locomotive.

Continued from p.87
M.E.4720 June 30

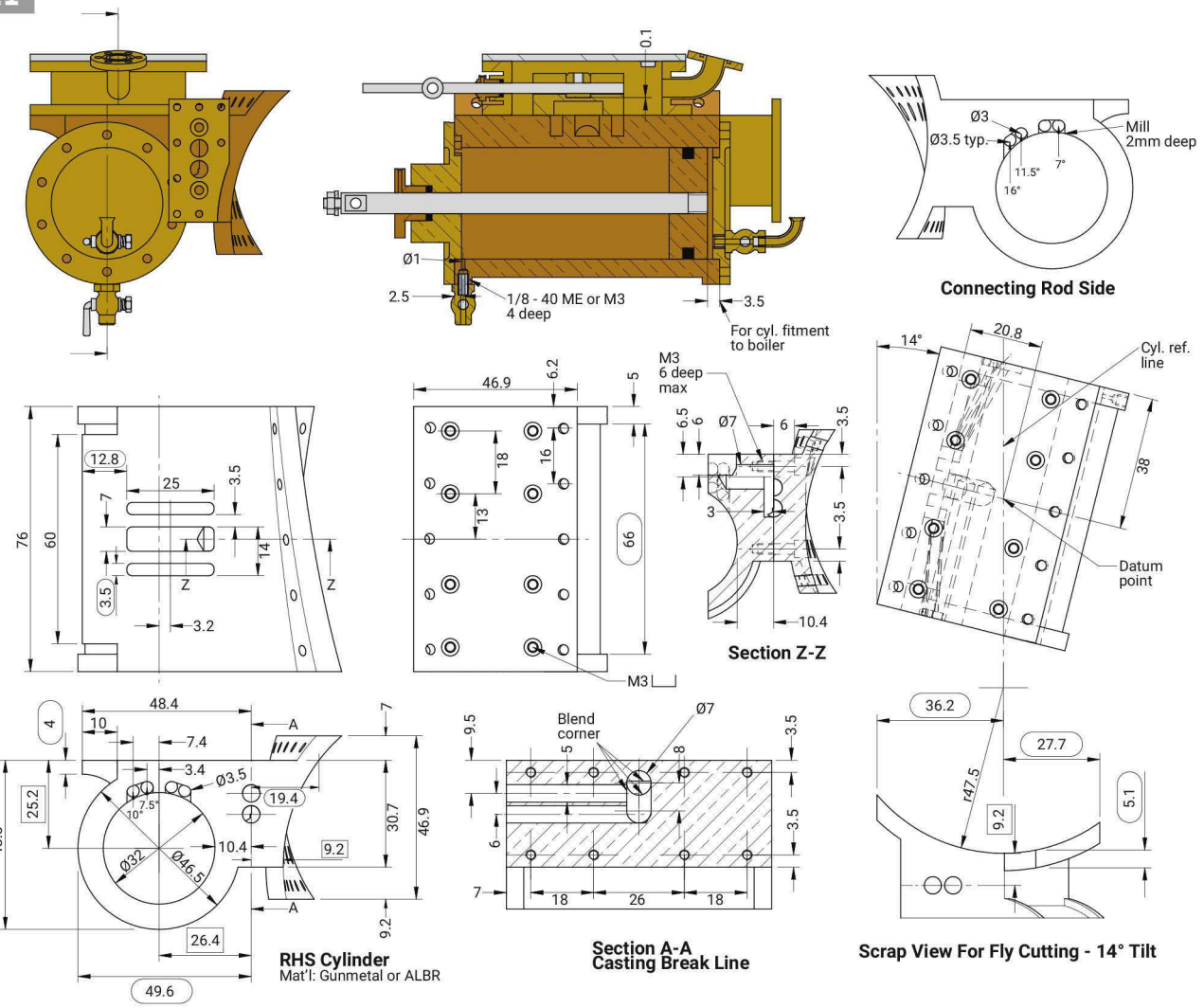
The cylinder assembly

My AlBr mix, mentioned in the previous part, is an incredibly hard-wearing bearing material so it was used for the cylinders and all of the glands. Items like the piston side cylinder end cap gland were silver soldered to the cylinder cap to get the prototypical recess and take advantage of the new bearing material. This AlBr has a much higher tensile strength than gunmetal allowing areas that are drilled and tapped to be thinner, thus closer to scale. This is particularly noticeable on the piston rod gland studs. The cylinder pad was made from malleable brass and all the other less critical components were machined from standard brass, making the cylinder assembly composite, taking advantage of the various material strengths (**fig 10**).

The cylinders

The cylinders (**fig 11**) look very complicated and they are, if done as one piece. Setting up a single casting with limited reference sides, especially where the job needs to be moved between machines, is just looking for misalignment, which will make mounting to the boiler a nightmare. If the cylinders are broken into two pieces a number of advantages become clear. For one, the cylinder can be a common casting (only one pattern) with just the left-hand and right-hand boiler pads requiring smaller unique patterns. The cylinder and pads can be made from dissimilar materials aiding in manufacture and fitment. For my cylinders the pads were made from a high copper brass (red brass as it's commonly called), which is slightly more

Fig 11

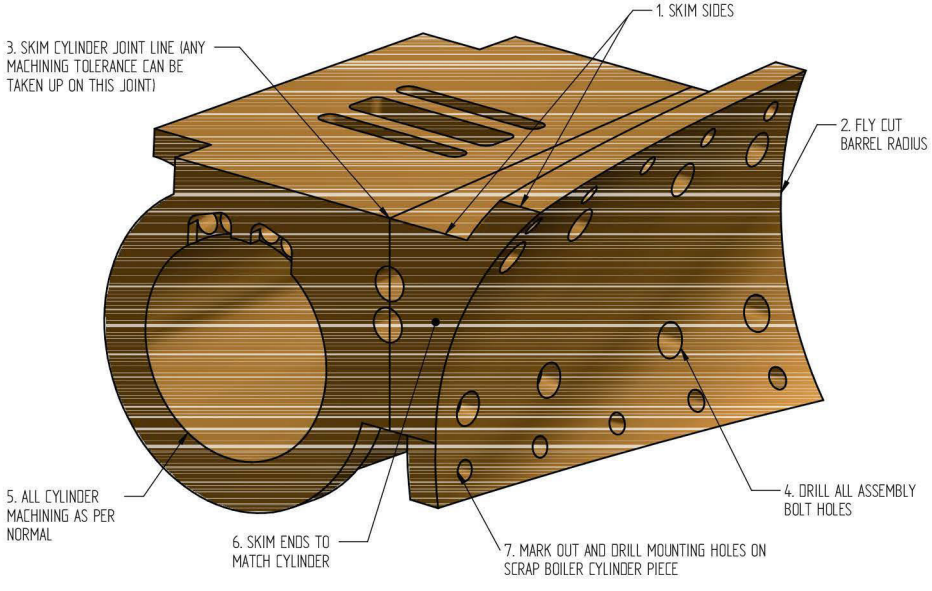


Cylinders.

ductile, and the cylinders AlBr which has exceptional wear and friction characteristics. Another advantage is, if you make a mistake that results in the casting being scrapped, the amount of re-work is limited to just the scrapped part and not the whole (single) cast cylinder.

The sequence of machining the cylinder assembly resulted in substantial consternation (**fig 12**). I was particularly aware of the possibility of tolerance stack-up with the 14 degree swept cut that needed to match the boiler, as well as the final position of the valve chest relative to the rocker. In the end I machined it in such a way that all the tolerance drift could be corrected on a single surface, which, incidentally, was the theoretical parting line, allowing an accurate

Fig 12



Machining sequence for cylinders.

Using a depth gauge to check the width of the cylinder boiler pad.

Lining up the boiler pad casting for fly cutting on the horizontal mill at 14degrees. The centres were used to align the datum point used multiple times during the machining.

Fly cutting the boiler pad and using the tool to scribe the centreline of the boiler.

Aligning the cylinder boiler pad to the scribed centreline. This gives two points of measurement to the round bar to check machining.

assembly even with a number of machining operations. Following the machining plan I started with the pad...

The boiler pads

The top and bottom of the pads are simple milling operations and should be kept as close to drawing as possible but any minor drift will not be a train smash. I like to have a piece of flat plate under castings like these to make measurements with my home-made depth gauge easier (**photo 64**). Once the top and bottom have been machined, a 2mm reference hole should be through drilled at the reference point given in the drawings and should be as close as possible to the midpoint lengthwise but spot on relative to the machined edge.

I used my trusty horizontal milling machine but this could just as easily be done using a lathe or vertical mill with a little packing and jigging. Two pointers, one in the spindle and one in the reference hole just drilled, will give the correct centreline if the casting is held at a 14 degree angle relative to the spindle (**photo 65**). Using a simple fly cutting operation the casting is skimmed until the bolting area matches the drawing at the thinnest point. If the other corners are slightly thicker this will have no effect on the final position of the cylinder. Before removing the part a line should be scribed using the tool aligned with the centre reference hole. This is the reference centreline for the cylinder pad (**photo 66**).

The final flat that mates with the main cylinder can be skimmed in the mill, resting on a piece of round bar, with the round bar aligned to the scribed centreline. The thickness of the pad can be checked in two positions from this machined surface to the round bar, correcting any previous machining misalignment (**photo 67**).

Back to the drilling table, the mounting holes are drilled and counter bored, all relative to the reference hole in the middle and the fixed vice jaw. Here it makes sense to drill the counter bore deep enough so that only one size screw is needed for the whole assembly.

Drilling the pad mounting holes

One of the oddities in doing a locomotive like this is the orientation of all the mounting holes in the boiler. These of course need to go through the centreline to prevent the head of the bolt shearing off, and studs won't work. The simplest way to achieve this is to drill everything on a scrap piece of boiler tube mounted in the vice and set up to the centreline of the tube (**photo 68**).

Drilling the boiler mounting holes on the boiler centreline.

Machining the cylinder bodies

Whenever I get to the cylinders of any build, I take out my trusty test bar and check my lathe bed alignment to make sure no twist has crept in due to seasonal changes. When I've skimmed the bar and checked both sides with a micrometer I'm good to go. There is nothing worse than a bore that isn't parallel, resulting in the piston binding on one end.

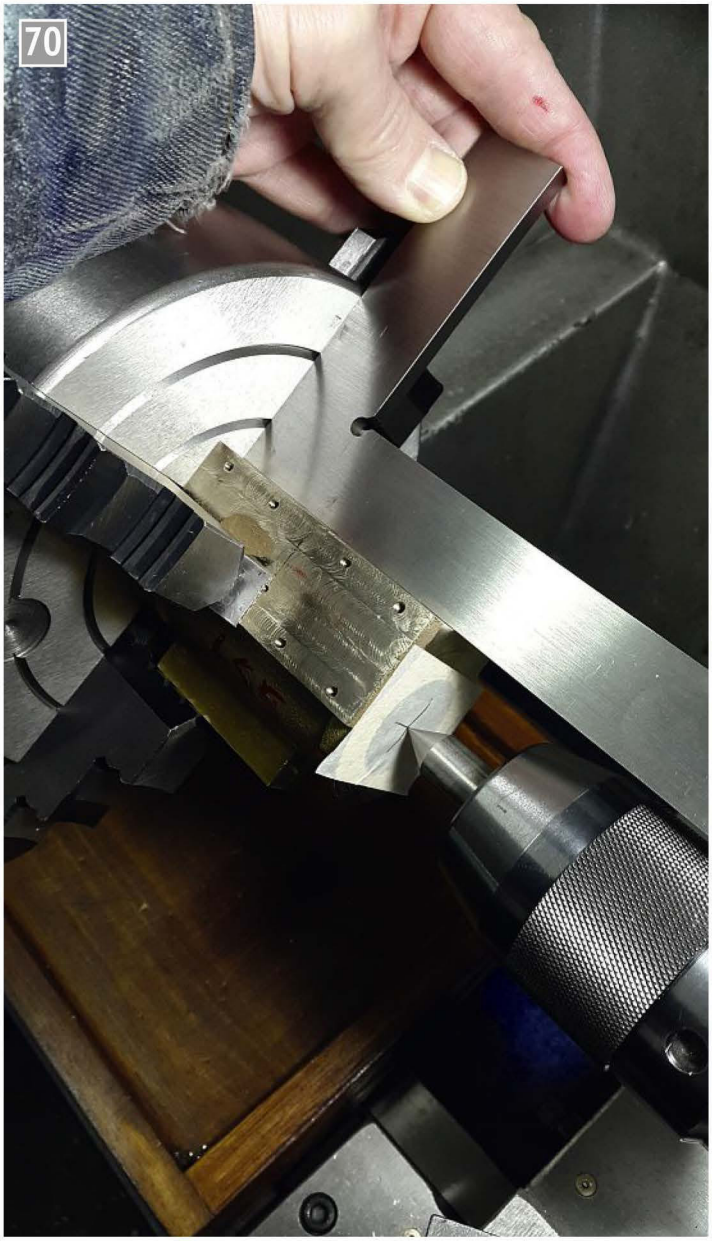
For these cylinders the valve surface, and the reference

surface that mates with the boiler pad, were machined to size using an end mill, ground for smooth milling (i.e. corners slightly chamfered) using convenient as-cast surfaces as reference. If the milling vice is in good nick and set up properly these reference surfaces will be pretty square and will keep all subsequent operations close to drawing. The valve surface of the main cylinder and the pad should be aligned to check all relevant dimensions for machining the cylinders. If all is good the cylinders can be machined.

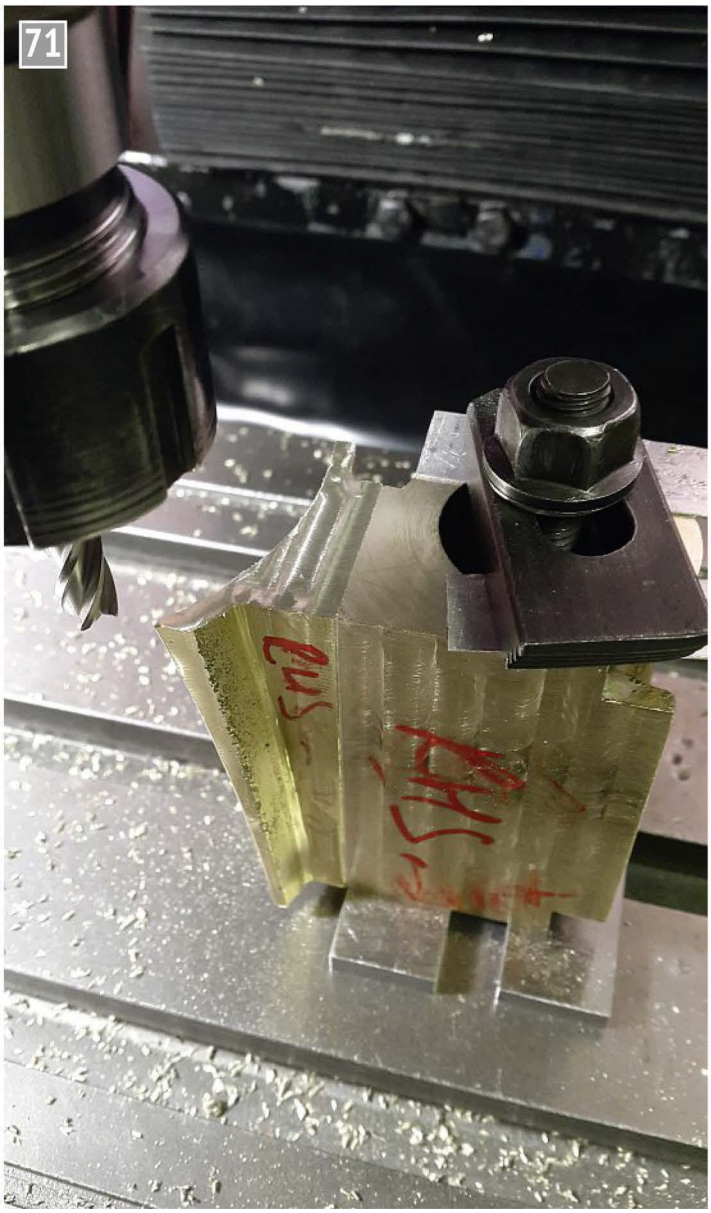
To find the centre of the bore I normally just stick some masking tape over the hole and, using the two reference planes, the correct position of the bore centre can be pencilled on the masking tape (**photo 69**). The cylinder is then taken back to the fourjaw chuck on the lathe and the valve surface lined up with the chuck and the centre of the bore you've just drawn up (**photo 70**). One advantage of the masking tape is you'll notice very quickly if you're squeezing the casting too hard by the tape bulging. If the tape bulges, the cylinders have given in and the bore won't be round. The front face is then skimmed; this will be the piston rod side, and the bore is machined to size keeping an eye on the reference dimensions for the end cap bosses. One pattern can be used for both cylinders but they are not interchangeable after the first facing operation. The bore needs to be perfectly square with the one face to get easy piston movement along the entire stroke. I make a point of keeping a marker handy, writing notes on the part as I go, then finally marking the cylinders right at the end. I even write down the measured dimensions on the part.

The cylinders and the pads can be joined if all the dimensions match the drawings by spotting the cylinder through the pad. If the cylinder bore position is slightly out the interface between the two parts can be shimmed or skimmed as required to get the assembly close to nominal. With all the holes drilled and tapped the ends of the pads can be skimmed to match the cylinders (**photo 71**).

Checking centre mark is true; the smaller the dot the closer the cross hairs are on centre.



Checking the casting is square for boring.



Skimming the ends of the pads to match the cylinder casting.

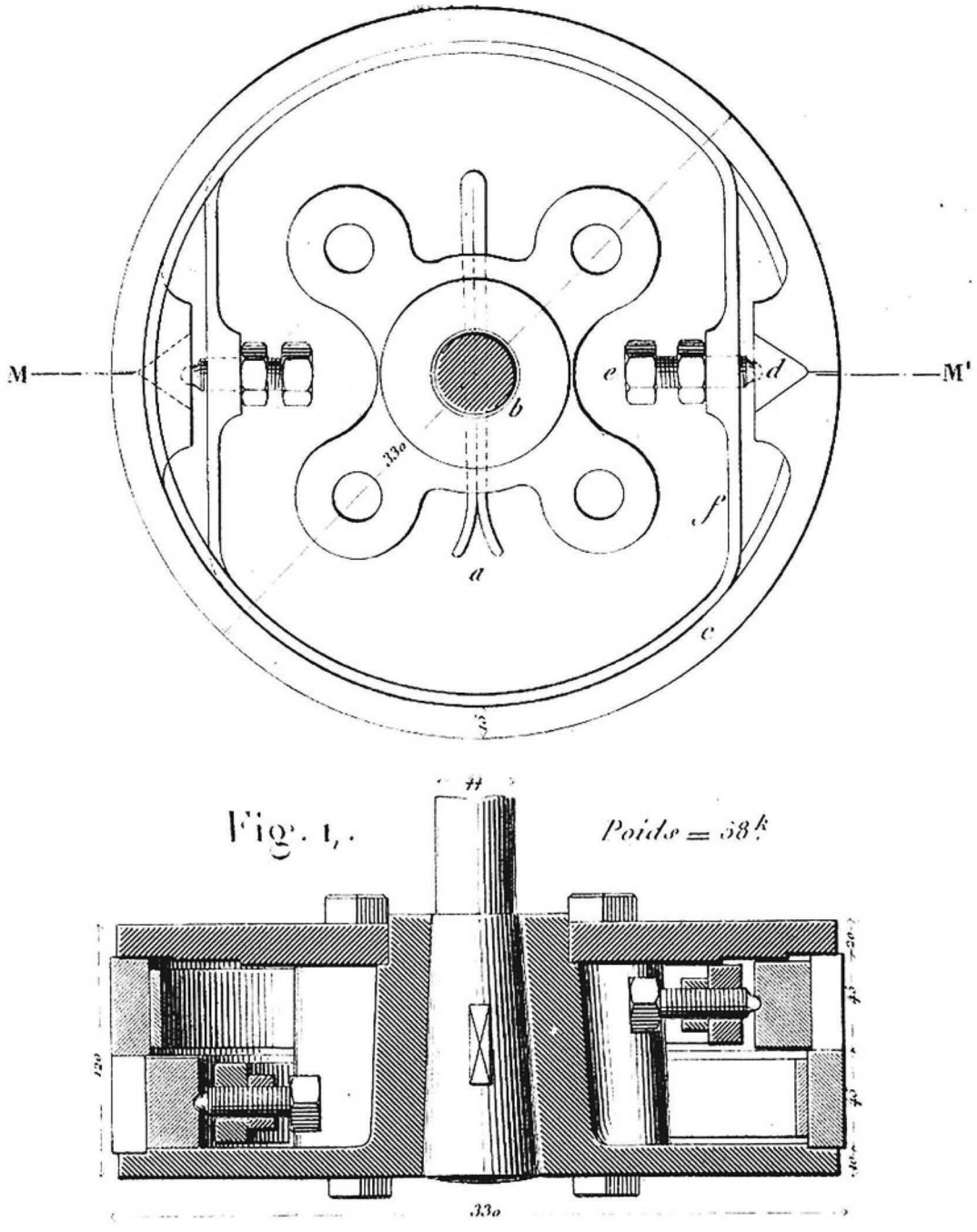
The steam ports

Keeping to the drawings when machining the ports is one of the trickier things for any builder. I always mark out the ports using either permanent marker (or marking blue) and a scriber and although I rely on the dial gauges these scribed lines are a good guide to see if I'm drifting. The ports are not on the centreline of the bore and should be measured from the as-cast boss (the valve chest will be lined up with this surface later), but a check to the centreline is worthwhile to make sure the drilled holes will not miss the mark later on.

If you're planning on making a few steam engines then it is well worthwhile adding stops to the X and Y axis, for port/slot milling. After the first cut the stops get locked and the rest of the cutting is done without using too much grey matter. Starting with the exhaust port, using a 3mm end mill, slot mill the port at least 0.5mm undersize on the gap dimension. The width dimension can be machined (eyeballed) to the scribed line and is not that critical. With the vernier, work out how much material needs to be skimmed from the sides of the port by measuring to the ends of the cylinder and the gap width. Take no more than 0.2mm on one pass and gradually open the slot up to drawing.

When the exhaust port has been completed the two inlet ports can be machined. Bring the milling cutter to the midpoint of the side port and machine the slot to depth. Using a vernier, measure the land between the exhaust port and inlet port, and the gap. First, skim the land distance to size and then open up the port to drawing. In this way, the critical dimensions are machined one after the other and tolerance issues won't stack up. This is repeated for the remaining port.

Fig 13



A drawing of a similar Sharp – Roberts piston circa 1839 (figure courtesy E. Lander).

The left-hand piston in the cylinder with the cover plate removed. The two sets of cast iron rings and adjustors as well as the brass (photo courtesy E. Lander).

It's a good idea to make the pistons and the end caps before drilling the valve port holes. Machining in this order eliminates the issues with trying to get a good fit behind the burrs and metal deformation from the steam port drilling. It also makes practical checking of the '*mechanical loose but steam tight*' fit easier.

A little side note: the pistons used in the real old girl

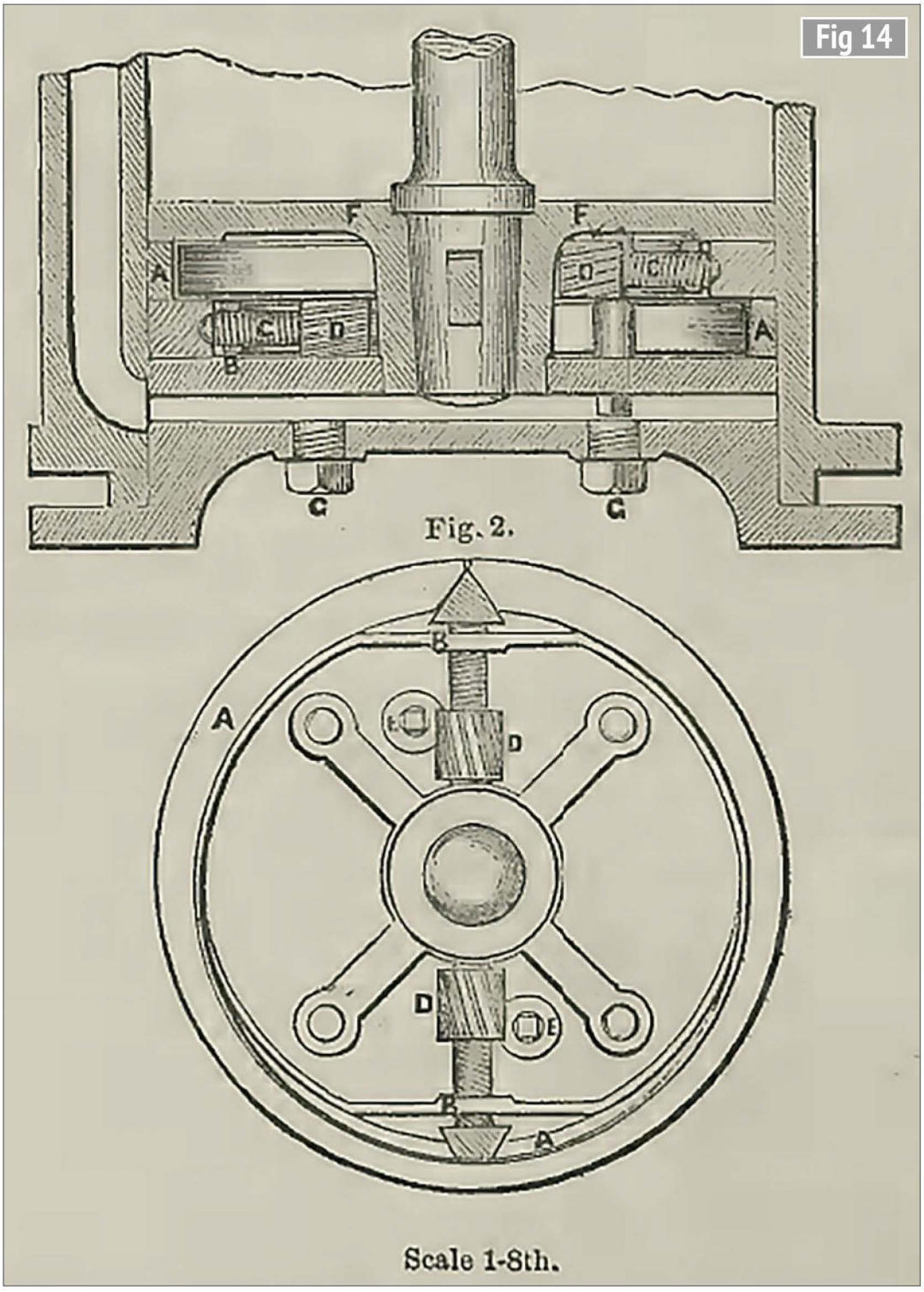
The pistons fitted to *Fire Queen* were of particular interest to me, from a 'historic evolution of design' point of view. The piston was a bronze casting forming the centre hub and webbed bolt holes, and this was covered with a plate. Sandwiched between the casting and the plate were the two sets of cast iron piston rings, each adjusted with a thinner inner ring by means of bolts and wedges. The piston rod is fitted to the piston assembly with a split wedge and the ends opened to keep it in place (**fig 13** and **photo 72**). When Eric Lander and the team from Penrhyn Castle opened the cylinder they found the gap between the rings and cylinder was in the order of 5/16 inch, not quite steam tight! The inner adjusting ring was slightly modified with the end opposite the wedge split and opened up slightly by riveting a plate to the inside. It's a good guess that these pistons were either used in another engine or came from the spares shelf and were modified to fit *Fire Queen*.

The piston would have required periodic adjustment; in the absence of a maintenance schedule it is likely these adjustment intervals were in line with the engineman's annoyance of blow-by and poor performance. Judging by the size of the gap the team found on the locomotive it is likely the tolerance was rather high. I can't imagine adjusting these pistons was easy, and I later found a short piece in *Practical Mechanics* describing a method of improving the adjustment of these pistons (**fig 14**, **ref 1**). The integrity of the adjustment mechanism aside, I would imagine setting these pistons blind would be an interesting exercise. Needless to say, the model's piston is considerably simplified!

●To be continued.

REFERENCES

Ref 1. *Barrans Improved Piston*, J. Barrans, The Practical Mechanics Journal, Vol 2 (Pg 246), April 1849-March 1850



A modification to the piston for easy adjustment by J. Barrans circa 1849.

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CLUB NEWS

Geoff Theasby reports on the latest news from the clubs.

I've bought a locomotive! Well, a part of one... It's a Ruston 48, standard gauge, serial no. 393303, which is now being restored at the North Norfolk Railway. It's not often a chance like this comes along so I cast my engineer's mite for good or ill. See Lawries Mechanical Marvels, on YouTube.

Right! Having burned the midday oil, I shall now proceed to turn my misspelled gibberish into the mellifluous prose you see before you.

In this issue: faking it, a beam engine, a mine with a doppelganger, be gentle with them..., a disappearing Titanic, surgery on a switch, a traction engine driving day and a 6th plinth.

The North York Moors railway celebrated its 50th Anniversary on 1 May. A great line, which has dealt with huge odds against it and succeeded so well. In the interests of truth and honesty, I am a small shareholder in this enterprise.
W. www.nymr.co.uk

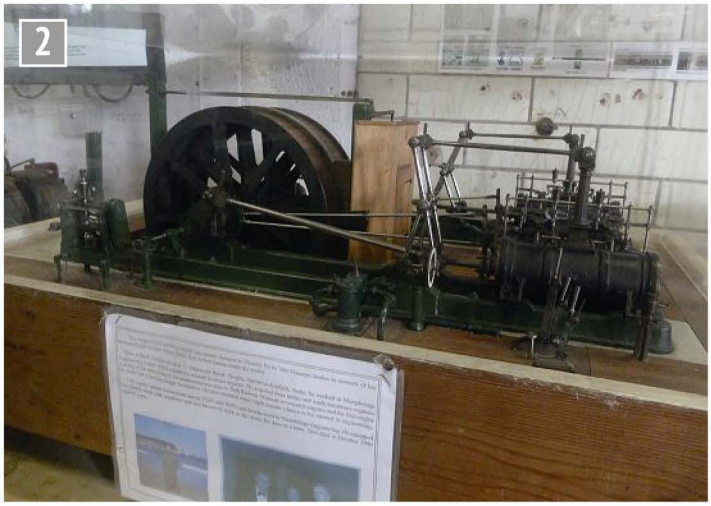
The Link, Jan-Apr, from **Ottawa Valley Live Steamers and Model Engineers**, is exercised over the growth of a virtual existence, artificial intelligence, or AI. Not only a media presence but fake news, even down to not stating the dates when a particular film clip, for instance, was taken. Often such information is deliberately falsified. The rapid expansion of 'chat bots' within the last year is another example. Of course, in 'preservation', we are keeping items made before such facilities were available to us. We should therefore bear in mind the Real World, and how tactile it was. The wonder of a three-dimensional steam model, aeroplane etc. can never be usurped by a heavy helping of CGI and many youngsters now growing up have difficulty in differentiating between the two. Bradley Hanson, who died last year, was making a Simplex, also named *Bradley,* to a Martin Evans *Major*'s design, and Graham is helping to restore and upgrade it.
W. www.ovlsme.com

Stamford Model Engineering Society reports on the Bits and Pieces meeting. Richard's beam engine begins the collection. He said that he always wanted to build a *Model Engineer* beam engine and had the raw materials under his bench. Finally, confident that it wasn't too much for him, he exhumed it only to find that some of the castings were poor, with misaligned mould halves, sand inclusions and a chilled, very hard, flywheel with blow holes etc. For various reasons, he deviated considerably from the published plans. Intending to fabricate a flywheel, he accepted an offer from Keith Holderness who found one under his bench, as you do. John had some 1950s Japanese toys, two pyrometers and a 'Nivellator' (an inclinometer, M'Lud) followed by updated information on the maintenance of *Tornado* at Darlington.

On my semi-conscious slumbering sojourn through YouTubed 'shorts' I chanced upon this, a Harley-Davidson articulated wagon, in miniature (comparatively!) with a H-D trike as prime mover. YouTube also found this, which I have entitled 'Who needs the AA?', a case of roadside repairs involving manual labour, a portable forge and a complete lack of H&S!
W. www.youtube.com/watch?v=0kog0iuGxOc&t=15s

We visited Pleasley Pit mining museum near Nottingham, as it was their Open Day, and they have two preserved steam winding engines which would be running, although the mineshafts have been capped. There is a good, if basic, cafe and plenty of outdoor tables where unenthusiastic partners, children and dogs can wait whilst their family engineering enthusiasts can gasp in awe at the great winding engines (**photo 1**). There is also a recreation of the pit head (bank), the lamp room, safety fittings etc. that go with a

Pleasley winding gear controls.



Winding engine models.

Pleasley Pit stables.

SLSLS Arthur Hurst and 3503 (picture courtesy of Arthur Hurst).

working mine. The photo shows the control centre for the south shaft winding engine. Note the illuminated display, mid-right, showing the locations of the lift cars. As one may imagine, I was overjoyed to find a few model steam winding engines on show, all built by miners (**photo 2**) and also the stables (**photo 3**). Some years ago I visited the National Mining Museum at Caphouse colliery, near Wakefield. IMHO, Pleasley is better. We dined at the Carnarvon (*sic*) in Sutton in Ashfield, Notts, which was a good meal eminently suitable for a growing lad but we didn't have one with us. The journey there and back produced no notable events or picture opportunities. That's the way motoring should be, quiet and uneventful, but then I claim it gives me nothing to write about or my name's not Smith-Llewellyn-Hardcastle
W. www.pleasleypittrust.org.uk

The Whistle, May-June, from the **British Columbia Society of Model Engineers**, celebrates its 30th Anniversary at Confederation Park, in Burnaby, Vancouver. Editor Paul Ohannesian describes how he made a blower, without access to a lathe. A locomotive was recently derailed and, rescued from the scene was a suspension spring bolt, severely bent. Chuck Laws, engineering workshop director, asks fellow drivers to be more gentle with their charges.
W. www.bcsme.org

St Albans & District Model Engineering Society *Newsletter*, May, has, in pride of place, a picture of a Lego model of the Titanic which is said to be in the New Inn, Marsden, near Huddersfield. This sort of thing does not cut any ice with me and, curiously, it is not mentioned on their website. The Society has teamed up with others in supporting a disabled and house-bound resident who is keen on steam. Secretary Guy Keen discuses centre drills and spot drills. Why does he prefer the latter? Because (he says) centre drills are very fragile and he has yet to break a spot drill.... Speaking of drills, the Mystery Object in this issue appears to be a ratchet drill. I guess it is for drilling steam boilers, rescuing sunken submariners etc., where there is no power source available.
W. www.stalbansmes.com

Ryedale Society of Model Engineers, *Newsletter,* April, reveals the international aspect to our hobby. In April, a pair of Dutchmen came to see Gilling. They were members of a party which had called some years ago and came back to visit again. A visitor from Oz took lots of pictures and scampered off home to Queensland to show his club. At a later meeting, Bob was discovered enjoying the sunshine but, although he had absolutely everything with him to perform a steam test, he had forgotten his club house key...
W. www.rsme.org.uk

Sydney Live Steam Locomotive Society May *Newsletter* states that a former member was asked why he did not volunteer. He said, "I don't cut my grass at home, why should I do it here?" Sadly, the perfect reply was not immediately forthcoming: "Because you belong to SLSLS." (*l'esprit de l'escalier*). Arthur Hurst records the 10-year refurbishment of NSW 3503, in store for 15 years. A fine looking locomotive, slightly unusual to my eyes (**photo 4**). Simon Collier makes a Westinghouse pump for 5 inch gauge and, in another item, he makes an oiler for his Myford, whilst Chris Denton continues with his traction engine regulator, different on these because it has to incorporate a governor. All the events pictured therein show lots and lots of happy people riding the trains. It is good to see.
W. www.slsls.asn.au

Chichester Model Engineers, formed in 1948, are celebrating their 75th Anniversary. They have about 50 members and have a four-gauge track, up to 10¼ inch. Editor Dave Smith comments that it can be difficult, when a club officer dies, to recover his records regarding the club activities during his period of office. This has already happened once and may do so again. Accordingly, a Google Drive has been set up which should become the fount of all relevant knowledge in due course. An excerpt from the 50th Anniversary newsletter included a timeline for that period.
W. www.cdsme.co.uk

Not much of interest to the mechanical world is moving through the Sheffield auctions currently, save for a unicycle (beat the congestion!), a hand-made model gypsy caravan and a Queensland digeridoo. Is there any other sort? The caravan does not

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7¼ inch gauge Fairlie at SSMEE (picture courtesy of Mick Savage).

seem to conform to the six types of 'Vardo', so it may be a freelance, scratch-built model.

Worthing & District Society of Model Engineers *Newsletter,* summer, posts a picture of a nubile chairperson reclining on a hydraulic lifting table. All that is missing are violet creams or a can of Tellus 32 to give his rippling muscles a sheen. On holiday, Denis Holman's wife spotted a garden shed up a tree! Very strange. Hardly a 'man cave' but it should satisfy any *stylites* in the area. Clive Patten and Geoff Bashall are both working on, respectively, their Peppercorn A1 Pacific and Merchant Navy boilers.
W. www.worthingmodelengineers.co.uk

City of Oxford Model Engineering Society sends a flyer for their famed Dreaming Spires rally on 21/22 July. Located in Cutteslowe Park, Oxford, the club offers three gauges of track, paved roadway for road vehicles, secure overnight storage for locomotives etc, and caravan/camping facilities.

Sheffield & District Society of Model and Experimental Engineers had a GTG for the 7¼ gauge society, which went extremely well. The visitors were highly complimentary and a letter of thanks remembered to thank the signallers, track gang, carriage maintainers, gardeners and general dogsbodies who labour out of sight at these events. A video of the event is on YouTube, see youtu.be/E4rgsKGYQyA. It is well produced and my only criticism is that it is too short! The society newsletter, *Steam Whistle,* May, has pictures of this event, including Peter Beever's double Fairlie, from Kent. Named *A G W Garraway*, it is conventionally boilered, enabling the driver to sit in the cab, unlike the real locomotives (**photo 5**). The story of Colin Edmonson's 'Scamp' is related, now extant in numbers, spread across the world including one at SSMEE. Mick Savage reviews a book by local man, John Curr, who claimed to have introduced rails to mines in 1775, which is before Ben Outram did in 1793 at Butterley. James Ardin reports on the 5 inch gauge Mainline Rally at Ryedale Society of Model Engineers, to which people travel hundreds of miles.
W. www.sheffieldmodelengineers.com

Raising Steam, spring, from the **Steam Apprentice Club** of the National Traction Engine Trust, has an honest picture of a Ruston Proctor 5 nhp portable engine. This was the reality of steam, often neglected and uncared for. For the apprentices themselves, a report from the Weeting Driving Day, taken from the Weeting website. 27 prospective drivers arrived for their first lesson - unsheeting the engine, cleaning the ashpan and smokebox and clearing the flues. Then, firing up and raising steam together with lots of polishing before ceasing for the day at 4pm. Each day a different machine was introduced, so providing a varied experience. The weekend ended with a slow 'race' and a whistle concert. Grateful thanks to the owners who loaned their precious machines for the event. See www.weetingrally.co.uk. Naomi Cornish, NTET Gen Sec, writes *The History of Scale models & Model Engineering*, which dates back to the 1760s. A video on Vintage Steam Road Making at Whatley Quarry Open Day is on YouTube. An item on running adjustments, in particular, on a Garrett 4CD, concerned a knocking noise on tickover. As it is a compound, there are two sets of components to check. Suspicion fell on the crosshead in the trunk guide, which was found to have 18 'thou' of play, twice what it should have been. Introducing a shim of a suitable size to reduce the play cured the problem. Back on the road! Another 'Hands On' event at the Steam Plough Club will be on 9/10 September at Hadlow in Kent. The SPC and NTET have subsidised six places for SAC members, reducing the cost from £250 to £25. 'Then and Now' has a 'before' picture of a derelict Burrell, 1895 6nhp *Duke of Windsor*, in a scrapyard looking very sorry for itself. Now restored to working order, it is also photographed at the Great Dorset Steam Fair in 2018. Also included was a rally list published by NTET.
W. www.ntet.co.uk

Unlike Trafalgar Square, I had no doubts about what to place in the 6th photo place - the very clean engine shed at **Manx Steam and Model Engineering Club** (**photo 6**).

And finally, there is a time for laughing, and a time for not laughing, and this is not it.

Now for the best part: The End.

ME

The Orchid line engine shed.

Club Diary 14 July – 3 September 2023

July

14-16 Brandon and District SME
Weeting rally, Weeting track. See www.brandonanddistrictsme.com

16 Bradford MES
Public running day, Northcliffe, 13:30. Contact: Russ Coppin, 07815 048999

16 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

16 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

16 Taunton Model Engineers
Public running, Vivary Park, 14:00-17:00. See www.tauntonme.org.uk

16 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

19 Bristol SMEE
Film: The Opening of the Ashton Court Railway, Begbrook Social Club BS16 1HY, 19:30. Contact : secretary@bristolmodelengineers.co.uk

21 Rochdale SMEE
Models running night, Springfield Park, 19:00. See www.facebook.com/RochdaleModelEngineers

21-23 City of Oxford SME
'Dreaming Spires' rally at Cutteslowe Park. Contact: Denis Mulford at denis.mulford@btinternet.com

23 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

23 Guildford MES
Open day, 14:00-17:00. See www.gmes.org.uk

23 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

23 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

27 Newton Abbot and District MES
Track evening at club site. See nadmes.org.uk

27 Sutton MEC
Afternoon run from 12 noon. Contact: Paul Harding, 0208 254 9749

30 Bristol SMEE
Public running at the Ashton Court Railway BS8 3PX, noon-17:00. Contact : secretary@bristolmodelengineers.co.uk

30 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

30 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

30 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

August

1 Taunton Model Engineers
Meeting, West Buckland, barbecue night, 18:00-23:00. See www.tauntonme.org.uk

2 Bradford MES
Evening running and social, Northcliffe, 19:30-22:00. Contact: Russ Coppin, 07815 048999

3 Sutton MEC
Bits and Pieces evening 20:00. Contact: Paul Harding, 0208 254 9749

4 Rochdale SMEE
General meeting, Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

4-6 Gloucestershire Vintage and Country Extravaganza
South Cerney Airfield, Cirencester. See www.glosvintageextravaganza.co.uk

5 Tiverton and District MES
Running day at Rackenford track. Contact: Chris Catley, 01884 798370

5 Wakefield Model Engineers
Annual open day. Contact: Blackgates at 01924 466000 or Dennis Halstead at 01924 457690

6 Bristol SMEE
Public running at the Ashton Court Railway BS8 3PX, noon-17:00. Contact : secretary@bristolmodelengineers.co.uk

6 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

6 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

6 Small Model Steam Engine Group
Open meeting. 14:00-17:00. See www.gmes.org.uk

6 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

8 Taunton Model Engineers
Club evening, Vivary Park, 18:00-21:00. See www.tauntonme.org.uk

10 Guildford MES
Open day, 10:00-13:00. See www.gmes.org.uk

13 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

13 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

13 Sutton MEC
Track Day from noon – 16:00. Contact: Paul Harding, 0208 254 9749

13 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

16 Bristol SMEE
'Anything Goes' meeting, Begbrook Social Club BS16 1HY, 19:30. Contact : secretary@bristolmodelengineers.co.uk

18 Rochdale SMEE
Quiz night, Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers

19/20 National Tramway Museum, Crich
Model Tramway and Railway Exhibition, 10:00-17:00. See www.tramway.co.uk

20 Bradford MES
Public running day, Northcliffe, 13:30. Contact: Russ Coppin, 07815 048999

20 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

20 Guildford MES
Open day, 14:00-17:00. See www.gmes.org.uk

20 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

20 Taunton Model Engineers
Public running, Vivary Park, 14:00-17:00. See www.tauntonme.org.uk

20 Tiverton and District MES
Running day at Rackenford track. Contact: Chris Catley, 01884 798370

20 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

24 Newton Abbot and District MES
Track evening at club site. See nadmes.org.uk

24 Sutton MEC
Afternoon run from 12 noon. Contact: Paul Harding, 0208 254 9749

26 Brandon and District SME
Running/family day, Weeting track. See www.brandonanddistrictsme.com

27 Canterbury MES
Public running. Contact: ginapearson@btopenworld.com

27 Warrington and District MES
Running day at the club track. See www.wdmes.org.uk/events

27/28 Bristol SMEE
Public running at the Ashton Court Railway BS8 3PX, noon-17:00. Contact : secretary@bristolmodelengineers.co.uk

27/28 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

31 Guildford MES
Open day, 10:00-13:00. See www.gmes.org.uk

September

2 Bromsgrove SME
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2 Tiverton and District MES
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2/3 Canterbury MES
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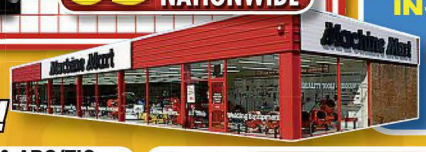

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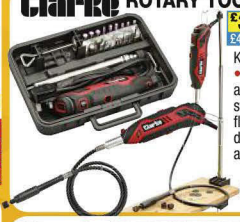

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Harrison M250 lathe 5" x 20" 240 VOLTS FROM NEW £5450

Colchester Bantam 2000 lathe (long bed) metric leadscrew, Dickson post £4950

Stanier precision vice 55mm jaw New / New Zealand £195

Jet JWL 1442, 14" swing wood lathe x 42"centres, 240 volts £1000

3 1/2" Britannia class 4-6-2 rolling chassis and castings + completed tender and part built cab, modelled on 70054 Dornoch Firth (LSBC) check out our website for more pictures £1150

Startrite 24 V 10 + welder bandsaw, nice £1750

X-Y 12" x 6" table £525

Myford Super 7B Gearbox, power cross feed £3450

Harrison L5, M250, M300 / Colchester Student 1200 / 1800 lathe change wheels + A&S 1ES milling machine table gears

Wadkin wood lathe 6" centre height x 32" centres + 14" rear face plate on the rear end + 6 3/4" 3-jaw chuck £1150

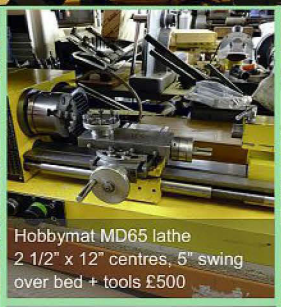
Toggle presses from £145

Transwave 4HP & 5.5HP Rotary converter £750 / £850

Just arrived! Colchester Bantam 1600 lathe £1500

Elliot table 12" x 4 1/4" high £500

Meddings L1 MK.V drilling machine £2250


Hobbymat MD65 lathe 2 1/2" x 12" centres, 5" swing over bed + tools £500

Creuson Morrisflex 240V 8" polisher buffers £825 each

Harrison Graduate wood lathe £1450

Clarke 917 vacuum former £495

Myford 3/4HP 240V resilient mount motor configurated to match a Dewhurst reversing switch already wired + instructions £226

Trugrip collets metric £35 Imperial £30, Marlco 2820 £15 each

Chester Cub 630 6" x 30" centres chucks, steadies hardly used £2950

DP / MOD gear cutters £20 each please enquire Hundreds in stock!

Boxford ME10A lathe + Tesla Inverter, very nice example £3950

RJH Bison 10" pedestal grinder complete with light £450

HME Hearth just arrived from education 3PH / mains gas £500

Tripus 240v switch £90

Myford bridge & rifle felts £6.75

Norton Deep throat No.6DB fly-press 12" throat x 9" height £950
FLYPRESS PUNCHES AVAILABLE

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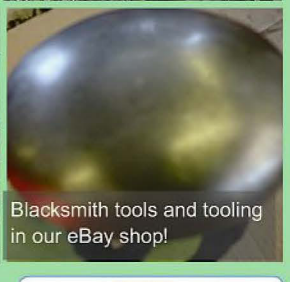
Granite 5ft x 3ft surface table £1425

Smart and Brown Sabel lathe £950

ANGLE PLATES, BOX CUBES, VICES, LATHE ACCESSORIES!

Myford gearbox unused £1000

Harrison M300 lathe £3950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