

MODEL ENGINEER

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31 August - 13 September 2007

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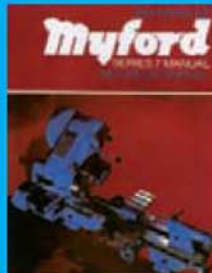


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hosted by the Llanelli club. Driving *Rough Diamond*,
the Britannia 4-6-2 built by Steve's father, he overcame
problems with the weather to emerge as the clear winner.
For a full report see page 253.

(Photograph by Michael Jones)

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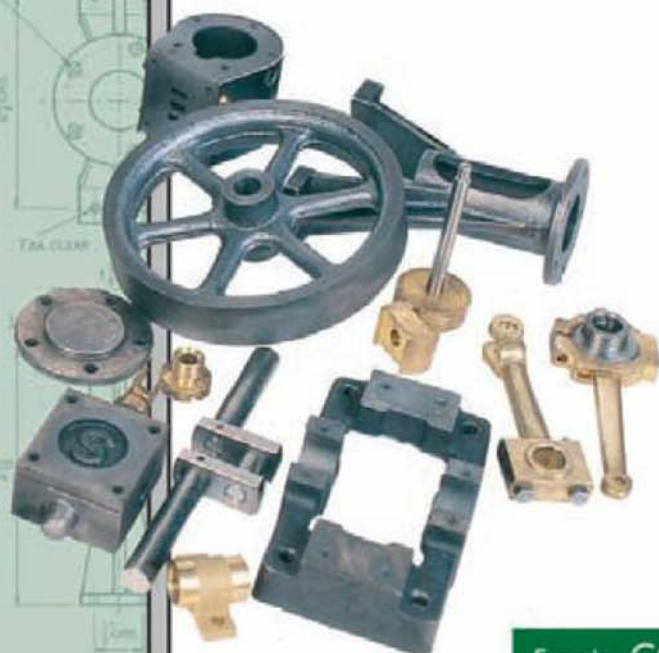
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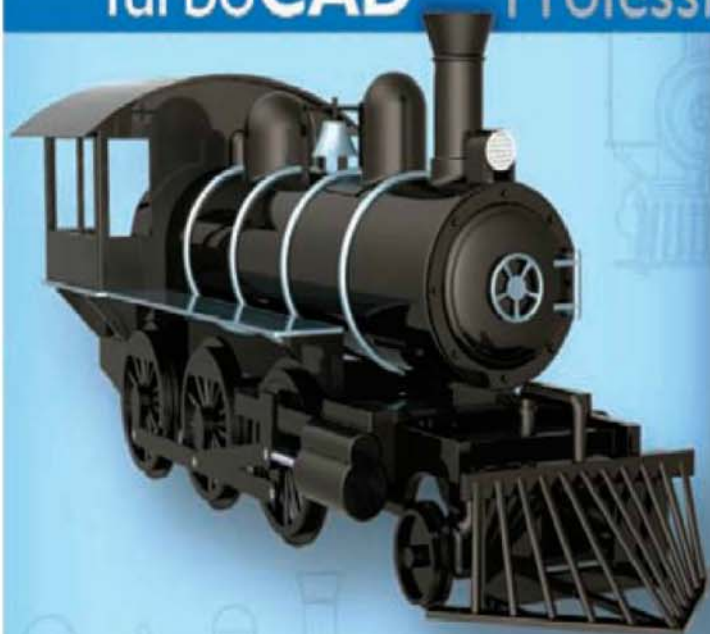
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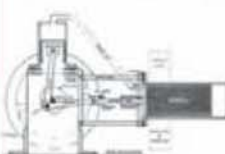
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Building the Bentley BR2 World War I Rotary Aero Engine • Blackmore • £17.90

Fourth printing of this book on building a model of one of the last and most powerful rotary engines produced - the Bentley BR2. Lew Blackmore won the Duke of Edinburgh Challenge Trophy with his model at the 1982 MODEL ENGINEER EXHIBITION, so this book gives you all the drawings, information, construction details, tips and secrets to construct a medal winner, or just a very interesting model to enjoy making. 95 A4 format pages with complete drawings, photos of parts and machining set-ups etc. PLUS a full reprint of the 1925 MoD descriptive handbook for this engine. Paperback.



The Stirling Engine Manual • Rizzo • £32.75

This is the 5th reprint for this book, parts of which first appeared in the 1980s as "Modelling Stirling and Hot Air Engines". If you want a really good outline history of hot air engines, a comprehensive and intelligible description of how they work, and drawings and construction details of models of all the major configurations of hot air engine, all of which can be built without castings, then this really is the book for you - as simple as that! Nearly 200 pages, including a 4 page colour section. Hardbound.



Building the Maltese Falcon • Shelley • £20.45

Want to build a BIG model I.C. engine? The author has a passion for big model aircraft, in his case a 15 ft wingspan Taylorcraft, and developed the Maltese Falcon to power this. The result is a 260cc Flat Four, Side Valve engine which turns a (scale) 34" x 18" propeller at 2500 rpm, and measures 8" in length and depth, and 13" in width across the heads. Essentially designed to be built from solid, certain parts, notably a magneto kit, and standard Honda pistons can be used if you want to get your Maltese Falcon running as quickly as possible - parts suppliers are listed. Whilst not a beginner's project, this engine can be built by any competent model engineer and, with modifications to the cooling arrangements you could use this engine to power model road vehicles, 7/4" gauge railway motive power, an outboard motor, a GT lawn mower and a motor bike would all seem possible for the clever amongst you. Full drawing set of 11 sheets, reduced in size to fit A3 format, and 36 A4 pages of notes, hints and tips on building the engine, plus numerous photos of parts and set-ups for making them; this isn't a construction manual in the sense of "Building the Bentley BR2...", but it is all good solid information aimed at helping the builder to make a 'model' I.C. engine which really will make people's jaws drop! Wirebound with card covers.



Falk No. 1 Locomotive • Harris • £11.70

Here are the drawings and building instructions for a delightful small 0-4-0 shunting engine, complete with its own winch; in 1 1/2" scale it is just 22" long. As described the model is gas-fired and for 7/4" gauge, so some reworking may be required by builders outside the U.S.A., but you will end up with an fascinating model. 63 pages with full drawings, photos and construction details. Paperback.

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CENTENARY EX



Well, it's just a week away now. For visitors, here are some guides about what to see, how to get there, where to stay, and so on.

What you will see

The exhibition will occupy two complete levels of the Ascot Grandstand, recently rebuilt at a cost of £185million. The ground level concourse will house mainly the trade stands, while the galleria will contain mostly model displays and club stands. The exhibition will be opened by enthusiast, Pete Waterman. Here is just some of what he, and you, will see.

SMEE

The SMEE will look back on 100 years of model engineering exhibitions and reflect on what has been achieved. Also to look forward and make plans for the future.

On the SMEE stand this year you will find many important historic models including examples by the late Bill Carter

and Terry Aspin. You will also be able to find examples of our members' current activities, which feature the inspirational work of gold medal winners such as Cherry Hill, Herbert Stumm, Ron Jarvis and Chris Vine. There will also be an operational workshop together with a series of clinics and working demonstrations. This year the SMEE will be looking for individuals or groups to participate in the 2008 task driven robot competition which will be launched at Ascot.

The SMEE will be operating the following demonstrations and clinics:

- Model engineering training.
- Machine set-ups on a small lathe.
- The art of hand scraping machine slides.
- Making gears using both mechanical and CNC machines.
- Engraving and profile cutting using CNC equipment.
- Adapting machines for CNC applications.
- Tool grinding and experimental wheel balancing equipment designed to reduce vibration and improve accuracy when working with the Quorn and similar small machines.
- CAD and the use of three-dimensional computer generated modelling for developing and communicating complex designs to improve human understanding and machine instruction.
- The construction of steam powered locomotives.
- Making and testing injectors
- Painting models for effect and durability.
- Designing and building robots for competition

SMEE lectures

The following daily talks have been arranged for all three days of the show, except where noted:

Room No 1

11.00 - 11.50 Why not build an internal combustion engine - by Malcolm Stride.
12.30 - 1.20 The design and construction of competitive robots - by Alan Wragg and Mike Kapp.
1.30 - 2.20 The history of stationary engines and the fascination of reproducing them as working models - by Anthony Mount.
2.30 - 3.20 The design and construction of *Anna* a 7 1/4 in. narrow gauge steam locomotive - by Derek Brown.

Room No 2

Friday 11.00 - 11.50
 Direct and analytical methods of setting tool grinders - by Joerg Hugel

Sat and Sun 11.00 - 11.50
 Designing models on screen using computer generated three dimensional knowledge-based components - by Chris Smith.
12.30 - 1.20 Modern industrial engineering processes which are useful for model engineering applications - by Peter Thomas

Fri & Sat 1.30 - 2.20
 Choosing and using CNC machines in the home workshop - by John Stevenson

Sunday 1.30 - 2.20
 Direct and analytical methods of setting tool grinders - by Joerg Hugel
2.30 - 3.20 Painting models - by Chris Vine



EXHIBITION PREVIEW

The collections

Cherry Hill

All of Cherry's models of the past 30 years will be on display. The models on show are Gold Medal winners, and winners or runners up for the Duke of Edinburgh award, the top accolade in model engineering. Typically it takes five or six years, and 4,000 to 7,000 hours, to research, design and make one of these exquisite models.

Ron Jarvis

Now in his mid 90s Ron has produced a wonderful collection of Gold and Silver winning models of the earliest days of steam in the early 18th century. The latest one will be on show for the first time, and it is hoped to display his entire collection.

George Thomas

All of the tooling produced by the late George Thomas will be on display. George was one of the most popular contributors of all time, and thousands of items to his designs have been made by model engineers.

Arthur Bodily

Arthur is one of the finest model engineers today. His working Austin racing car is a wonder to all who have seen it. However, all of his models are top notch and all will be displayed at Ascot.

Len Mason Tribute

Len Mason was one of the most popular contributors to *Model Engineer*. All of Len's models will be on display including his *Minnie*, which went on to become the most popular model traction engine of all, his famous *Mastiff* 4-cylinder 4-stroke I/C engine, his other models, and workshop equipment.

Ron Isted

Ron's exquisite drawings for his *Edwardian Elegance* articles are

greatly admired by readers of *Model Engineer*.

Martin Ranson

Martin's superb steam boats will be on display, including *Julie Anna*, powered by an unusual beam type engine, and which is being described in *Model Engineer*.

Tom Walshaw (Tubal Cain)

The many famous models created by Tom Walshaw will be on display. Under the *nom de plume* of Tubal Cain he was a stalwart of *Model Engineer* for many years with his numerous designs of steam engine.

Les Chenery

Les was one of the great model engineers of recent times. All of his magnificent aero engines will be displayed at Ascot.

Herbert Stumm

From Germany, Herbert is recognised as one of the great model engineers of his generation. His models of interesting and unusual prototypes, is beyond equal.

Harold Hall

Harold is a former editor of *Model Engineers' Workshop* and has introduced the necessary techniques and equipment to many newcomers to model engineering. All his tooling will be on display.

Ayesha

The locomotive that launched the hobby of model engineering to the general public. Many of these outstanding little locomotives are now being built to Tony Weale's 'words and music' in *Model Engineer*. A number will be on display, alongside the LBSC original of 'Battle of the Boilers' fame.

Dr Bradbury Winter

This model of Stephenson's famous *Rocket* was built by one of the greatest model engineers of all time. Made in silver,

Rocket took 15,000 to 20,000 hours to produce.

Bill Connor

Amazing models of motor cycle engines are the life's work of Bill Connor. Winners of numerous gold medals, these are the pinnacle of I/C engine modelling. These models are correct to the smallest detail.

Roy Darlington

The amazing collection of hot air engines designed and built by Roy Darlington will be on show, along with some others from members of the Stirling Society. No-one has done more than Roy to promote interest in these fascinating machines.

Sir Hugh Ford

One of the top engineers in the UK, Sir Hugh has been President of both the SMEE and the Institution of Mechanical Engineers. His Dean 4-4-0 locomotive is a model of arguably the most attractive to come out of Swindon, where Sir Hugh was later an apprentice.

Anthony Mount

Anthony is a regular contributor to *Model Engineer*, who has described the building of numerous stationary steam and hot air engines. All of Anthony's models will be on display, and he will be demonstrating them in action.

Nederlandse Vereniging van Modelbouwers

Full title of the exhibition is the International Model Engineer Exhibition and we are grateful for a special display of some fine models being brought to Ascot from the Netherlands by the leading organization there, the Nederlandse Vereniging van Modelbouwers.

Nemett

A special competition is being held for builders of the Nemett NE15s I/C engine, which was designed to introduce

model engineers to I/C engine building.

Peter G. Smith

Royal State coaches are no strangers at Royal Ascot, and Peter G. Smith is bringing the collection of wonderful miniatures, some of which are Gold Medal winners.

Edgar T. Westbury

The late Edgar T. Westbury was the prolific stalwart of *Model Engineer* for decades, and his designs have become classics for steam and I/C engine builders alike, as has his workshop equipment. A number of his popular designs will be on display, including the petrol engines from Eric Offen.

Track running and clubs

There will be an opportunity for some live steam over the exhibition weekend at the Ascot Locomotive Society whose track is alongside Ascot Racecourse. Finally all the major national clubs and associations will be there.

How to get there

Ascot is almost encircled by motorways M3, M4, M25, A329(M). When you get to Ascot, there are thousands of parking spaces. **There is no charge.**

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Bill Connor's motorcycle engines. Winners of numerous gold medals, these are the pinnacle of I/C engine modelling.

The Cherry Hill Collection. All of Cherry's models for the last 30 years will be on show – gold medal winners, and winners or runners up for the prestigious Duke of Edinburgh award – the top accolade in model engineering.

Ron Jarvis. A wonderful collection of Gold and Silver winning models of the earliest days of steam. The latest model will be on show for the very first time.

Ayesha – the locomotive that launched the hobby of model engineering to the general public, a number of these models will be on display alongside the LBSC original of 'Battle of the Boilers' fame.

SMEE Collection. Reflecting 100 years of association with the Model Engineer Exhibition, encompassing the historical, contemporary and future. SMEE will also be operating a ground level railway for youngsters of all ages!

**Anthony Mount • Roy Darlington • Nederlandse Vereniging Van Modelbouwers • Nemett
Peter G Smith Collection • Herbert Stumm Collection • Edgar T Westbury.**

Display of many of the designs from the great contributors to Model Engineer over the last century: **Martin Evans, John Haining, George Thomas, Tubal Cain, Don Young, Stan Bray, Dave Lammas, John Radford, Bill Hughes, Len Mason, George Gentry, etc, etc**

Many many other attractions to numerous to detail:

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For up to date information on the attractions at the centenary Model Engineer exhibition please go to our website: **www.model-engineer.co.uk**

Further details will be published in future editions of this magazine.



Ticket hotline: 0870 444 5556 www.model-engineer.co.uk

All attractions and features are correct at the time of going to press, but are subject to alteration or amendment without notice.



Southern Railway companies

SIRS, - I would like to thank Marcus Rooks for his kind comments (M.E. 4300, 25 May 2007) about the *Edwardian Elegance* articles. I agree with all he says about the London Chatham & Dover Railway, except for one minor point: the company did not cease to exist when the "South Eastern and Chatham Railway Companies Joint Management Committee" was formed in 1899. The set-up was exactly what its long-winded title suggests and was not an amalgamation, both the SER and LCDR retaining their individual identities with separate boards of directors and accounts until the 1923 grouping.

Marcus implied that the salary of the LCDR chairman, James Staats Forbes, may

have been excessive and more than the impecunious company could afford. Has he by any chance the figures to prove this? It is not widely-known that Staats Forbes was quite a famous name in the world of art connoisseurs and collectors of the late 19th century and I have often wondered how he managed to acquire several extremely expensive paintings (some of which are now in the National Gallery), while employed by one of the most poverty-stricken railway companies in the country. Obviously 'Fat Cats' are not a new phenomenon!

On a more sombre note, I would like to pay my own small tribute to Phil Hains of the Harrow and Wembley Society, whose death was announced in the same issue. When I joined the society 40 years ago, Phil was a great inspiration to me, and I'm sure

to many other beginners. He was always happy to explain in non-technical terms the most complex workshop operations, yet like so many brilliant craftsmen, he was incredibly modest about his own achievements. He once told me that the secret of a successful miniature live steam locomotive was "plenty of slop in the bits that moved"! I may say this was NOT borne out by his own work, which was in a similar league to that of the late Bill Carter and Fred Cottam. I seem to remember that Phil was a toolmaker by trade, and I believe he spent almost every evening in his workshop - it was rumoured that the only way his wife Lorna could ever guarantee to meet up with him was to volunteer to do the catering for the Society! His production rate was amazing, including a Martin Evans *Boxhill*, a Stroudley O-6-2T *Barcelona*, a German 4-4-4, an experimental locomotive of advanced design, at least one large scale traction engine and many others. They all had one thing in common: all of them had the appearance of a full-size machine that had been shrunk by some magical means, rather than a well-built and well-proportioned model, a subtle difference that is difficult to define. He will be sadly missed.

Ron Isted, by email.

Shaper parts needed

SIRS, - I have recently acquired an incomplete but otherwise good condition Adept hand shaping machine. I need an operating handle and the attaching parts which are missing. Could any reader provide details and dimensions of these parts so that I can make same?

Many thanks in anticipation.
Brian Eldred, Derbyshire.

Sawdust heaters

SIRS, - Alec Farmer's description of a sawdust heater (M.E. 4300, 25 May 2007) brought back some memories. My mother was in the WVS during World War Two, and among the items they required

Unimat lathe

SIRS, - I enjoyed reading the article by Tony Griffiths on the Unimat SL and Unimat 3 lathes.

I agree with him that they were brilliant little tools and filled a need at that time for a well-designed small lathe.

When the Unimat 3 was first introduced, my publisher at the time asked me if it would be possible to make a clock on this tool, as all my clocks had, up to then, been made on the Myford ML7. He felt that the use of a cheaper lathe might be an encouragement for beginners. Shestopal who were agents for this lathe agreed to lend me one with a modest selection of accessories, and I made a Foliot clock entirely on the Unimat 3. I was amazed at the versatility of this tool. The only difficulty I had was in dividing the wheel blanks when wheel cutting, because the divisions available on the Unimat 3 were not suitable for the high wheel counts found in clock work.

On my second clock I purchased a Chronos division plate and fitted that to the Unimat. I was then able to cut all the wheels for my Castle clock, and finally the third clock I made on the Unimat was my Scissors clock. This clock had a fusee which was machined without difficulty on this lathe.

I agree with Tony Griffiths that there was a problem with the motor burning out; however this never happened to me. I made three clocks on that lathe and the motor never gave any trouble. After completion of the Scissor clock (I actually made two together) I handed the lathe back to Shestopal who donated it to the British Horological Institute's workshop.

During the time I was using that lathe I had much feedback from users. One man came up to me at one of the Model Engineer Exhibitions to tell me that he was the Captain of a Shell oil tanker and had made the Foliot clock in his cabin at sea.

When on holiday in Portugal a local resident invited me in to his home to show me his 'workshop'. He told me he didn't have a traditional workshop in a special room because he wanted to be with his family when he was working. He took me into his living room where he had a large wardrobe. He opened the doors and inside it was all beautifully equipped with his Unimat 3 lathe, workbench, shelving for all his stock and lathe accessories etc. He was at that time making Galileo's escapement.

J. H. Wilding MBE FBHI, Sussex.



John Wilding's Scissors clock, machined entirely on a Unimat lathe.

were cooking stoves for field kitchens.

My father, a Captain in the Home Guard, and the General Manager of a coke oven plant, had a couple made up for them by the works. Each consisted of a 20-gallon steel drum with the top removed, and a central 2in. diameter hole in the bottom. A 3in. diameter wooden pole with a 2in. diameter peg on the end was placed in the hole and the space filled with packed down sawdust, which must have been dampened to keep it in place after the pole had been removed. I think sawdust was a waste product in those days, whereas today it would be used to make hardboard and MDF.

The stove was an unsophisticated device, and stood on three bricks: there was no control of the combustion air, so presumably the size of the central hole determined this. The pan rest on the top of the drum was a steel grid made from a piece of the 2 or 3in. mesh welded bar screens used for screening coke. The 'stove' was lit at the bottom of the central hole and burned for some hours on test, producing a lot of heat once well alight, but I don't remember it ever actually being used in the field in our part of the world, as the war had moved on and the need had disappeared.

Tony Finn, East Riding of Yorkshire.

Making cannon barrels

SIRS, - Recently I repaired a broken lever which in its basic form was a cylinder with two stub shafts at right angles to the main axis. At one stage I thought I might have to make the whole thing up from scratch and so started looking on the internet for a method of how to make one - I looked under cannon trunnions as this seemed the most common form of what I would need to do, but did not have much luck. The two methods suggested were to make up the trunnions separately and then attach them (weld or tapped hole) or to make them on a five-axis machining



Peter Brown's drill sharpening machine on which he is seeking information.



Drill sharpening machine

SIRS, - I attach some photographs of a drill sharpening machine which a friend was recently given. Unfortunately part of the maker's plate is missing and, as it is a rather elaborate unit, we would very much like to know more about it. Especially how to use it and whether it is complete. A copy of an instruction book/parts manual would be most helpful if any of your readers could assist, any expenses would be reimbursed.

Cast into the base is "MSE Drillmaster" and on the opposite side is a maker's plate for the motor, indicating that it is a "Brook Gryphon" made in England. The drive is totally enclosed and runs very smoothly. A 4-jaw drill type chuck will accept drills to 1/2in. diameter; the unit has an illuminated setting plate, a permanently mounted diamond for truing the wheel and a quadrant for setting the angle. For sharpening, the drill sits on a hardened steel rest and is further secured by two adjustable hardened steel blocks which prevent it from moving laterally.

In all it is an extremely well made machine and has been designed for industrial use. Tony Griffiths' articles on machine tools have been most interesting and informative and it is good that someone has recorded this information for future reference.

Peter Brown, NSW, Australia.

centre. Changing the search slightly, another suggestion was to turn up the barrel, change axis and turn up the trunnions and then use a shaper or similar to clear off the material left. Can any one tell me how cannon barrels were turned in the days before five-axis machining centres or even shapers? I have always assumed that the outside was turned, but was it left in an 'as cast' condition, with a little fettling to remove any surface casting faults? In the *Pete's Page* of *M.E.* 4296, 30 March 2007 the author speaks of a model cannon turned from solid. How were the trunnions machined onto the barrel in this model?
Michael Green, Adelaide, South Australia.

Jinties, Jockos and Ayesha's wheels

SIRS, - I would not for one moment wish to detract from Geoff Dowden's excellent model of a Midland Railway Class 3F tender engine, but please don't refer to an LMS Class 3F tank engine as a *Jinty* (*M.E.* 4292, 2 February 2007). To Midland men the *Jinty* was the Johnson

Class 0, 0-4-0 yard engine, possibly named after the Class J boiler they were fitted with.

The nickname for the 3F tank engines was *Jocko*, some having been built in Glasgow by the North British Locomotive Works. This eventually became a generic term for any shunting locomotive, for I have heard the Derby C&W Works Yard Foreman refer to a 08 Diesel Shunter as a *Jocko*.

I believe that fundamentally the fault lies with Hornby who called their 00 gauge 3F tank a *Jinty*, but they obviously did not know any better and it was perpetuated by Martin Evens with his model.

Of course the 0-4-0 yard engines were rarely seen by the general public, for they spent their time working out of sight in works yards. Derby Locomotive Works own pet was No. 41509.

On a different topic, Tony Weale, in dealing with *Ayesha's* wheels (*M.E.* 4293, 16 February 2007), says that there is no need to cone the wheels, as it is easier to turn them parallel. A locomotive will run much more freely on coned wheels, and it is well worth that little bit

of extra effort setting over the top slide to 2³/₄deg. It does not have to be spot on, provided all the wheels are turned to the same setting by zeroing both the cross and top slides, so that all the wheels are of the same diameter and they have a good root radius.

Dennis Monk, Derbyshire.

Energy saving light bulbs - a hazard?

SIRS, - I feel that readers may be concerned about the implications of the impending demise of the conventional tungsten filament light bulb. I believe we have a serious problem looming over us model engineers.

As a student and apprentice, I was taught that under no circumstances should fluorescent lamps be the sole lighting source of moving, particularly rotating, machinery. This is because of the stroboscopic effect making such moving machinery appear to be stationary at certain speeds. The new energy saving light bulbs presumably exhibit the same phenomenon.

Brian Eldred, Derbyshire.



IMLEC 2007

Neil Read and Michael Jones report on a well supported and superbly run event held in Pembrey Country Park, South Wales.

Main photo. The contestants meet up with two young ladies in traditional Welsh costume and the civic dignitaries who presented the awards.



This year the International Model Locomotive Efficiency Competition (IMLEC) was hosted by Llanelli and District Model Engineers and took place on the 7 and 8 July at their scenic track situated in Pembrey Country Park in South Wales. The organisation of the event was first class and no less than 31 entrants pitted their skills against the well-maintained track and terrain. Even the weather did its bit and stayed fine for most of the time despite the very wet conditions experienced by many parts of the UK this year.

David Kane (1)

The first competitor to take the line was David Kane of the Leyland Society with his Lancashire 2-4-2 tank. David made a clean start but approximately 8min. into the run he stopped on the rise just before the tunnel and had to back up to the start area and shed a passenger to get under way again. I understand he also had the pony truck derail adjacent to the turntable in the station area at some point in the run but, as often happens, we were on the wrong side of

the track to witness this. David continued to circulate at a steady pace and completed his run. His thermal efficiency was 0.840%.

Mike Harrison (2)

Mike Harrison of Kinver entered his GWR Grange and made a clean start with a load of 10 adults. His run was uneventful until after approximately 14min. he came to a stop just prior to the tunnel. After raising steam for 3min. or so and dropping two passengers he managed to restart and complete his run. His overall thermal efficiency was 0.715%.

Tony Vereker (3)

Tony Vereker of the Oxford

Society entered his Simplex and had a well judged, trouble free run. Indeed, he reported that his only problem was stopping the boiler pressure rising! His overall thermal efficiency was 0.555%.

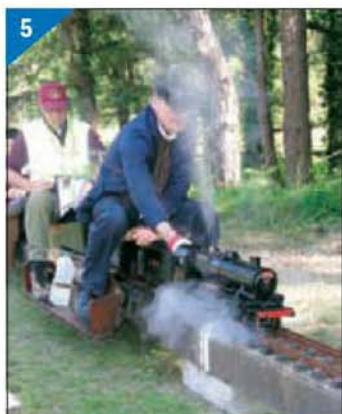
Barbara Milton (4)

IMLEC stalwart Barbara Milton of the Bristol Society was campaigning her modified Simplex and appeared to be having a trouble free run. However, after approximately 20min. had elapsed, boiler water feed problems developed that unfortunately forced her retirement.

David Tompkins (5)

Also an active supporter of





IMLEC, Dave Tompkins entered his 3 $\frac{1}{2}$ in. gauge Mogul. His total load was three adults plus a youngster. He experienced various delays and had to shed passengers as the run proceeded. His final laps were quite fast and the observer was heard reminding him of the speed limit. Dave's overall thermal efficiency was 0.302%.

Karl Midgeley (6)

Representing the Gravesend Society, Karl had entered a freelance 4-6-4 tank engine. Our notes indicate that he had a trouble free run and that the locomotive finished the event looking as clean as when it had started. Certainly the

driver seemed pleased with his efforts and reported that very little fire was left in the firebox at the end. Overall thermal efficiency was 1.177%.

Michael Richardson (7)

Entered as a private entrant Michael Richardson was running his handsome 2-10-0 9F. We believe that 15min. into the run he had a short delay but otherwise it was uneventful. Indeed the driver's only comment at the finish was: "I enjoyed it", which is the main thing. Overall thermal efficiency was 0.634%.

Brian Remnant (8)

Although Brian, of Romney

Marsh Society, had a short water level related delay with his Sweet Pea his run was otherwise uneventful. He reported that he was quite pleased with his efforts, as well he might be as his overall thermal efficiency was 1.707%.

Ivor Roberts (9)

Local man Ivor Roberts must have been pleased with his trouble free run as his fellow club men told me that his GWR 61xx had been in pieces a day or two prior to the event. Overall thermal efficiency achieved by Ivor was 1.042%.

Paul Collins (10)

Paul from the Harlington Society



is another regular IMLEC contender and entered his 4-4-2 Atlantic. He lost boiler pressure on his second lap causing some delay on the climb to the tunnel but managed to restart





without rolling back to complete the run. Overall thermal efficiency was 0.471%.

David Mills (11)

Representing the Romney Marsh Society, David was campaigning his 0-6-0 Minx. Our notes suggest that it was a steady, relaxed run with no untoward moments. Despite his relaxed demeanour the driver reported he felt nervous during the run. The thermal efficiency figure achieved was 0.520%

Ben Pavier (12)

It was time for another 3½zin. gauge locomotive and Ben Pavier, representing the Southport Society, came to the

line with his 4-4-2 Atlantic. The run was reeled off in fine style and Ben's comment at the end says it all - "Good that, wasn't it!". No argument there! Overall thermal efficiency was 0.607%.

Geoffrey Symes (13)

Offering a change of tempo after the last run was Geoffrey Symes' impressive 5in. gauge 2-8-4 Dholpur. Geoffrey, representing Worthing Society, seemed to slow on the third and fourth laps but otherwise completed his run without noticeable problems. Overall thermal efficiency was 1.210%.

John Linkins (14)

Another contestant representing the Romney Marsh Society was John Linkins with his 2-6-0 BR Class 2. John's run was a joy to watch and we noticed no major problems. Carrying a total load of nine adults, the overall thermal efficiency achieved was 1.317%.

Jack Dibnah (15)

Another example of the popular Sweet Pea design was entered by Jack Dibnah, who was representing the Manx Model Engineers. Jack's run looked



like it might be delayed by a broken gauge glass but, in the event, repairs were smartly carried out and the locomotive brought to the start line in time. Although the locomotive

was seen to struggle at times, on the incline the run was completed without major problems and resulted in an overall thermal efficiency of 0.545%.



Jimmy Woods (16)

Putting the word 'International' into the International Model Locomotive Efficiency Competition was New Zealander Jimmy Woods. Representing the Manx Model Engineers and running a 5in. gauge 4-6-2 Merchant Navy, Jimmy had problems on his opening lap and had to roll back on the incline and shed passengers. However, he then found his form and finished the run in fine style. Overall thermal efficiency was 0.741%.

David Mayall (17)

Representing the Bracknell Society and running his 3½in. gauge Derby 4F was regular IMLEC entrant David Mayall. David chose to run with a

total load of two adults. According to our records, this experienced contestant had a clean run without any problems. Overall thermal efficiency was 0.501%.

Les Walters (18)

Yet another clean run was recorded by this representative of the Swansea Society. The sight of his 4-6-0 Manor circulating consistently must have gladdened the hearts of the many GWR fans present at the event. Les ran with a total load of nine adults and achieved an overall thermal efficiency figure of 1.084%.

Edgar Playfoot (19)

It was a pleasure to see this 0-8-0 LBSC Netta driven



by Edgar Playfoot of the Maidstone Society. Edgar did the great LBSC proud and had a trouble free run carrying a total load of seven adults. His overall thermal efficiency was 1.093%.



Kenneth Parker (20)

Kenneth Parker of the North Wilts. Society entered his 2-6-2 Prairie and had a largely trouble free run with a total load of eight adults. It was noticed that some effort was needed to get

Run	Drivers name	Loco. type	Wheels	Gauge in.	Society	Av. speed mph	Passengers (adults)	Run time (min)	Distance run (ft.)	Coal type	Coal used lb	Av. P
29	Steve Eaton	Britannia	4-6-2	5	Chesterfield	6.226	14	25.97	14,233	a	1.188	20
24	Paul Tompkins	S & R	2-8-0	5	Guildford	6.636	10.5	26.60	15,538	a	1.625	19
8	Brian Remnant	Sweet Pea	0-4-2	5	Romney Marsh	5.811	14	27.37	14,000	a	1.938	25
26	John Hurley	Royal Scot	4-6-0	5	Kinver	5.052	9	24.60	10,939	a	1.520	21
14	John Linkins	BR Class 2	2-6-0	5	Romney Marsh	6.582	9	26.82	15,540	a	1.563	14
27	Glyn Winsall	Metro Tank	2-4-0	5	Rugby	6.931	5.5	25.47	15,540	a	1.125	9.7
28	Andy Williams	BR 9F	2-10-0	5	Pembroke ME	6.432	12	27.45	15,543	a	2.344	20
13	Geoffrey Symes	Dholpur	2-8-4	5	Worthing	5.878	17	27.07	14,007	a	3.813	35
23	John Cottam	Merchant Navy	4-6-2	5	Chesterfield	6.658	8	26.52	15,543	a	2.000	16
6	Karl Midgeley	Freelance tank	4-6-4	5	Gravesend	6.449	9	27.37	15,538	a	1.938	15
19	Edgar Playfoot	LBSC Netta	0-8-0	5	Maldstone	7.191	7	26.97	17,072	a	2.125	14
18	Les. Walters	GWR Manor	4-6-0	5	Swansea	5.285	9	26.80	12,467	a	1.688	15
22	James Brunning	GWR 1500	0-6-0	5	Ascot	6.582	6	26.82	15,539	a	1.688	12
9	Ivor Roberts	GWR 61	2-6-2	5	Llanelli	6.283	7	25.32	14,003	a	1.844	14
20	Kenneth Parker	Prairie	2-6-2	5	North Wilts	5.701	8	24.83	12,461	a	1.563	12
1	David Kane	Lanc. tank	2-4-2	5	Leyland	3.738	6	23.55	7,749	a	1.156	13
16	Jim Woods	Merchant Navy	4-6-2	5	Manx ME	4.427	11	27.08	10,554	a	2.279	17
31	Tom Parham	Enterprise tank	2-6-2	5	Maldstone	4.190	12	26.90	9,922	a	2.625	21
2	Mike Harrison	GWR Grange	4-6-0	5	Kinver	4.302	10	20.77	7,865	a	2.969	29
7	M. Richardson	9F	2-10-0	5	Private	4.839	14	25.66	10,930	a	3.188	20
3	Tony Vereker	Simplex	0-6-0	5	Oxford	5.720	5	24.73	12,453	a	1.875	9.7
15	Jack Dibnah	Sweet Pea	0-4-0	5	Manx ME	5.133	7	27.58	12,463	a	2.375	11
11	David Mills	Minx	0-6-0	5	Romney Marsh	5.461	5	22.73	10,927	a	1.656	8.5
21	C. Weatherley	Sweet Pea	2-6-0	5	Worthing	4.375	6	25.17	9,694	a	1.938	11
10	Paul Collins	Atlantic	4-4-2	5	Harlington	4.211	6.5	26.13	9,685	a	2.625	13
4	Barbara Milton	Modified Simplex	2-6-0	5	Bristol					Retired		
25	Brian Eatock	Black Five	4-6-0	3.5	Chesterfield	6.244	3	25.48	14,005	a	1.594	9.2
12	Ben Pavler	Atlantic	4-4-2	3.5	Southport	6.957	3	25.37	15,537	a	1.680	7.2
17	David Mayall	Derby 4F	0-6-0	3.5	Bracknell	6.787	2	26.01	15,539	a	1.000	3.5
30	Marcus Peel	B2	2-6-0	3.5	Southport	5.763	3	25.72	13,049	a	0.875	3.5
5	Dave Tompkins	Mogul	2-6-0	3.5	Guildford	3.492	3	20.60	6,332	a	1.375	7.2



up the incline but, with all the clean runs previously recorded, your observers were perhaps starting to become more critical. Never the less it was an excellent run and achieved an overall thermal efficiency of 0.933%.

Charles Weatherley (21)

Last man to enter the contest on Saturday was Charles Weatherley with a 2-6-0 Sweet Pea. Yet another nice steady run was to be the order of the day with a total load of six adults. Mr. Weatherley,

representing the Worthing Society, seemed pleased with his run but mentioned that some work on the oiling system was still needed on his recently finished locomotive. Overall thermal efficiency was 0.513%.

James Brunning (22)

First man on Sunday morning was James Brunning, representing the Ascot Society, with his 0-6-0 GWR 1500. James had what appeared to be a very relaxed run even resorting to some extensive whistle blowing as he made his last lap - much to the delight of his younger passengers. His overall thermal efficiency was 1.077%.

John Cottam (23)

Handsome, powerful and fast are three adjectives that come to mind when considering John Cottam's 4-6-2 Merchant Navy locomotive. From a spectator's point of view the run went well without any noticeable problems. Representing the Chesterfield society, John's overall thermal efficiency was 1.178%.

Paul Tompkins (24)

Yet another regular entrant who has had some bad luck at previous events, Paul was again representing the Guildford society. His chosen locomotive was his 2-8-0 Somerset and Dorset and the blue paint work made a pleasant change from the usual blacks and greens. The run went well and Paul was heard to observe at the end that "he didn't think he could have done better". You cannot ask for more. Overall thermal efficiency was 1.723%.

Brian Eatock (25)

Next amongst the 3^{1/2}in. gauge entries was Brian Eatock from the Chesterfield Society. His 4-6-0 Black Five ran with a total of three adults and set a fast pace. Indeed, your reporters believe they heard the observer warning Brian once or twice that he was exceeding the speed limit. No other problems were observed and the overall thermal efficiency achieved was 0.745%.

John Hurley (26)

Representing the Kinver Society, John was running his 4-6-0 Royal Scot and made his run look very relaxed and stress free. John has had some bad luck at past events but this year the circuits of the track were reeled of in fine style and no problems were observed. The overall efficiency achieved was 1.434%.

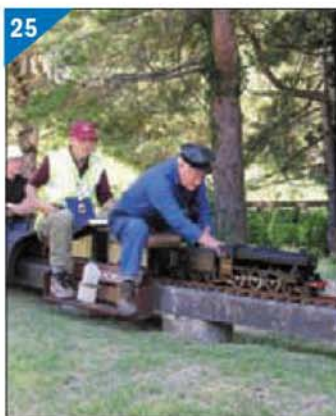
Glyn Winsall (27)

Glyn first contested IMLEC as a youngster and has continued to support the event achieving a win at Kinver in 2004. He was representing, as usual, the Rugby society and running his 2-4-0 Metro tank. His run started with five adults plus one youngster but our photos suggest that one passenger was dropped during the opening lap. Glyn set a cracking pace and afterwards said that he felt the speed restrictions had cramped his style. Overall thermal efficiency achieved was 1.237%.

Andrew Williams (28)

Andy Williams entered his handsome 2-10-0 BR 9F and was representing the Pembroke

Drawbar pull (lb)	Total work done (ft. lbf)	Av. drawbar H.P.	S.F.C (lb/DBHP.hr)	C.C.R. (lb/hr)	Thermal eff. %
540	292,346	0.341	8.050	2.745	2.259
630	305,011	0.347	10.562	3.665	1.723
740	360,360	0.399	10.647	4.248	1.707
710	237,486	0.293	12.652	3.707	1.434
430	224,242	0.253	13.822	3.497	1.317
750	151,515	0.180	14.722	2.650	1.237
1150	313,191	0.346	14.806	5.123	1.227
880	502,571	0.563	15.011	8.451	1.210
510	256,615	0.293	15.444	4.525	1.178
990	248,453	0.275	15.447	4.248	1.177
820	252,007	0.284	16.644	4.727	1.093
990	199,347	0.225	16.796	3.779	1.084
740	197,967	0.224	16.857	3.776	1.077
950	209,345	0.251	17.410	4.370	1.042
740	158,753	0.194	19.469	3.777	0.933
650	105,774	0.136	21.654	2.945	0.840
420	183,851	0.206	24.510	5.049	0.741
1190	210,247	0.237	24.705	5.855	0.735
380	231,074	0.337	25.451	8.577	0.715
1150	220,240	0.260	28.669	7.454	0.634
100	113,322	0.139	32.727	4.549	0.555
310	140,957	0.155	33.335	5.167	0.545
580	93,754	0.125	34.968	4.371	0.520
1180	108,379	0.130	35.538	4.620	0.513
910	134,718	0.156	38.641	6.028	0.471
230	129,266	0.154	24.377	3.754	0.745
150	111,090	0.133	29.872	3.973	0.607
510	54,542	0.064	36.047	2.307	0.501
510	45,802	0.054	37.796	2.041	0.481
150	45,274	0.067	59.776	4.005	0.302



ME. Running with a load of 12 adults, our records reveal no drama or untoward moments. Each lap was run at speed but without effort. Andy's overall thermal efficiency was 1.227%.

Steve Eaton (29)

Another entrant representing Chesterfield was Steve Eaton with his 4-6-2 *Britannia Rough Diamond*. Steve was unlucky in the timing of his run as it coincided with a passing shower. Not surprisingly this gave him traction problems and at one point he reversed back from the incline all the way to the bridge. He also dropped off one truck and three passengers. Never the less the run was completed and a very creditable overall thermal efficiency figure of 2.259% achieved.

Marcus Peel (30)

Last of the 3 $\frac{1}{2}$ in. entries was Marcus Peel of the Southport Society with his 2-6-0 B2. Marcus ran with a total of three adults and was also unlucky with the weather as another passing shower anointed his run. This caused him problems

on his opening lap and one passenger and the riding car were dropped. He splashed on under this reduced load to achieve an overall thermal efficiency of 0.481%.

Tom Parham (31)

So it was time for the last contestant and Tom Parham representing the Maidstone Society with his 2-6-2 *Enterprise* tank took to the track. The locomotive had sustained accidental damage the previous day and hurried repairs had been carried out to enable the run to take place. Under the circumstances Tom's run was relatively trouble free. One stoppage was noted approximately 16min. into the run but a restart was made and the laps continued for the allotted time. The overall thermal efficiency achieved was 0.735%.

Concluding ceremonies

While the runs had been continuing the indefatigable computer operator had been tallying the results and pretty soon after the last run it was clear that the winner of IMLEC

2007 was Steve Eaton. Best amongst the 3 $\frac{1}{2}$ in. gauge entries was Brian Eatock.

The Martin Evans Challenge Trophy and other awards were presented by Llanelli Deputy Town Mayor and Mayoress Mr. and Mrs. Nigel Bevan and the Vice Chairman Councillor

Hugh Richards. We extend our congratulations to the winners and our thanks to the civic dignitaries for their attendance. We also thank Llanelli and District ME for organising such a memorable event.

Look out for details of IMLEC 2008 in due course. **ME**





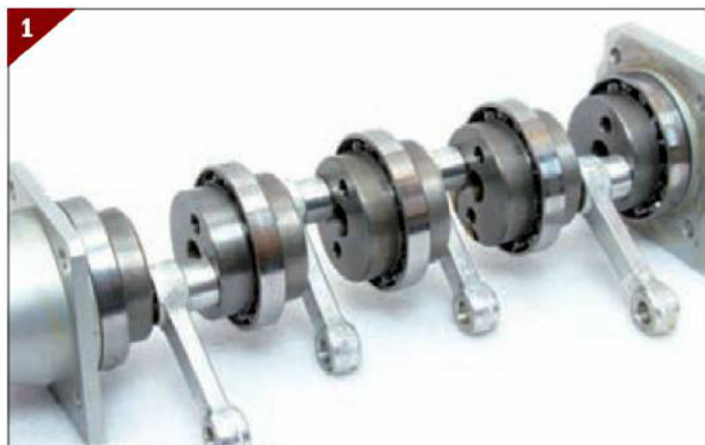
Nemett

For those wishing to contact me via email, I now have a direct email address – **Nemett@vodafoneemail.co.uk** which can be used for all Nemett related items. It should not be used for *Model Engineer* related contacts which should all be made via the editor at **david.carpenter@magicalia.com**. The other consequence of my changing internet providers is that the I/C Engine Builders website is likely to disappear for a while until I can get a new site set up. In the meantime anyone wishing to contact or find out about the group should use the email address above.

In this part of the discussion on engine balance I will look at multi-cylinder engines and will start with a 4-cylinder in-line engine. This may seem strange after the single, but the 4-cylinder engine is much simpler than the in-line twin which, as mentioned last time, comes with its own unique set of problems. I do not intend to try to go into complex calculations (I shall only confuse myself!) but rather to try to illustrate the key points relating to the various engine layouts.

With multi-cylinder engines another dimension is added to the balance equation, that of the firing order and how regular (evenly spaced) the power strokes are. Engines with unevenly spaced power strokes will seem rough, even if the mechanical balance is good. Firing order also has an effect on any rocking motion imparted to engine by the power strokes, it is best to alternate firing strokes either side of the centre of the engine as in the firing order 1, 3, 4, 2.

One way of seeing clearly what is happening with multi-cylinder engines is to use linear diagrams to represent the power, exhaust, inlet, compression cycle of each cylinder. The basic diagram for a single cylinder engine is shown in **fig 1**. Moving up from the bottom, we have the power



stroke commencing at the 0deg. top dead centre, exhaust commencing at 180deg. bottom dead centre, inlet commencing at 360deg. top dead centre and compression commencing at 540deg. bottom dead centre.

The diagram does not show any variations on the valve events from this basic situation. For our present purposes it does not need to because all the cylinders are identical. The segments are all of equal length and represent one stroke or 180deg. of crankshaft rotation. We will use this basic diagram to look at some firing sequences available for different engine configurations.

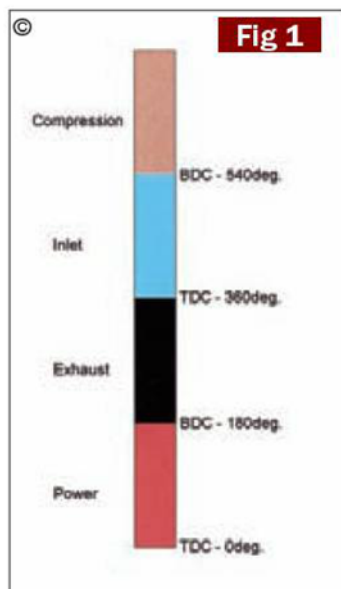
If we start with a typical 4-cylinder engine crankshaft layout (**fig 2**), we can see that the crankshaft as a whole is, in part, balanced against the forces introduced by the pistons reversing direction because when cylinder one is

at TDC, cylinder two is at BDC, thus cancelling out the forces. This is also the situation with cylinders three and four.

However, this is not the whole story because, although a pair of identical piston/connecting rod assemblies is acting in opposite directions, the pistons are not directly opposite each other (they can't be) so the forces create a bending motion at the crankshaft, shown by the lower paired arrows in **fig 2**. These forces will cause problems if the crankshaft is not stiff enough.

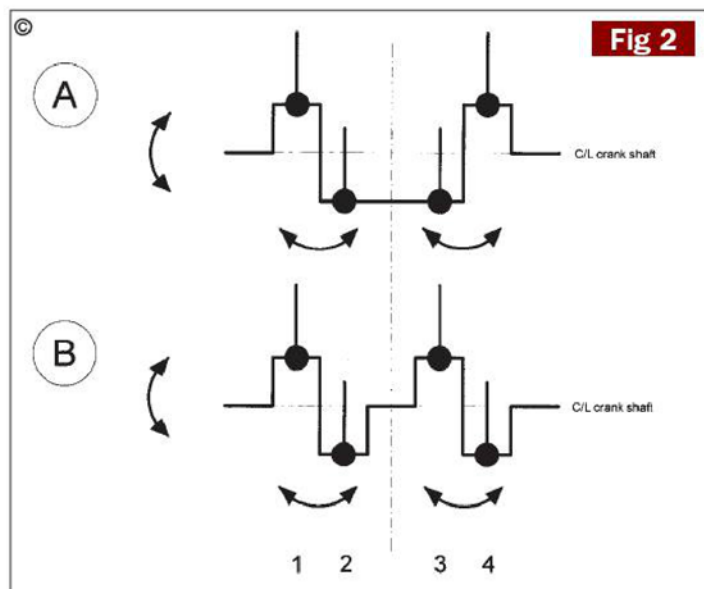
Older engines often only had main bearings at each end of the crankshaft, but later engines had 'three bearing' shafts with a centre bearing between cylinders two and three and most modern full-size engines have five bearing crankshafts with a bearing between each pair of cylinders.

The 40cc Schillings engine crankshaft (**photo 1**) is an



1. An example of a very rigid five bearing crankshaft set-up for a 4-cylinder 4-stroke engine.
Fig 1. The basic 4-stroke cycle in diagrammatic form.

Fig 2. Two crankshaft layouts for 4-cylinder in line engines.



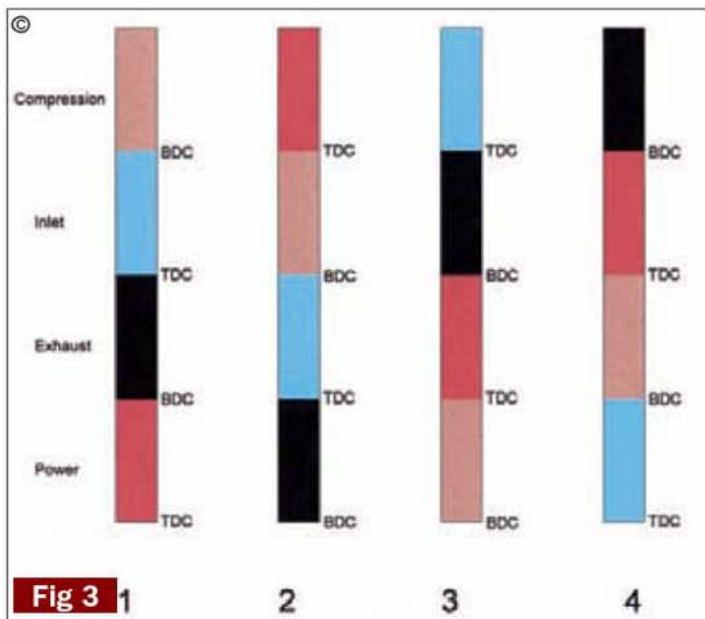


Fig 3. The schematic diagram showing the operating sequence for a 4-cylinder engine layout based on fig 2.

Fig 4. An alternative firing sequence for a 4-cylinder engine.

Fig 5. Two crankshaft layouts for flat, four-cylinder engines.

Fig 6. An operating sequence for a flat, four-cylinder engine.

excellent example of this with five ball race main bearings.

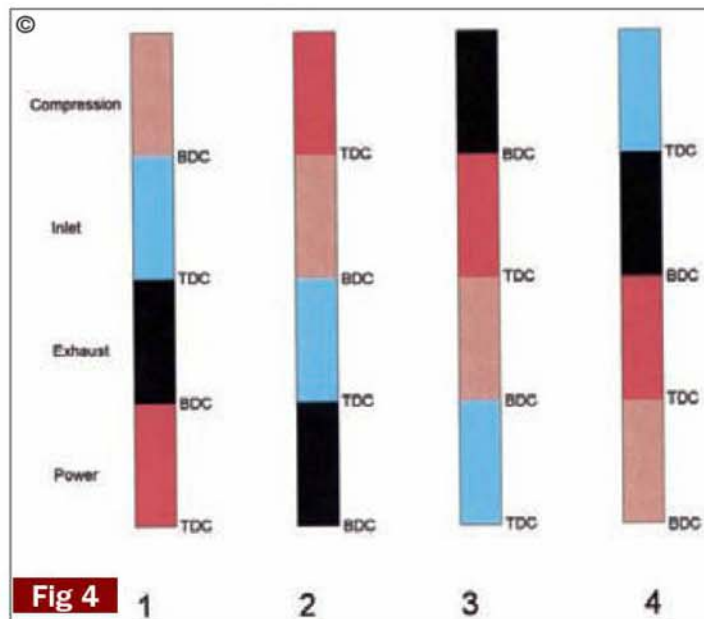
Engines with no intermediate main bearings will benefit from having longer crankshaft ends supported by extra bearings to provide greater rigidity. The sideways forces behave in a similar way, so many engine designs do not have balance

weights on the shaft (Edgar Westbury's Seal for example) but are still very smooth running.

For those wanting the ultimate in smoothness, balancing each cylinder as for a single-cylinder engine may give some benefits.

If we look at **fig 3**, showing the cycles for each of the four cylinders (applicable to fig 2a), it can be seen that I have placed the diagrams for each cylinder to match up with the cylinder positions (TDC or BDC), but with each cylinder at a different point in the cycle.

If we move up from the bottom of the diagram (equivalent to rotating the crankshaft through two revolutions, or 720deg.)



cylinder one fires first, followed by cylinder three, cylinder four and finally cylinder two, or a firing order of 1, 3, 4, 2.

It will also be seen that the sequence is evenly spaced over the two crankshaft revolutions making the engine very smooth.

The firing order of in-line four cylinder 4-stroke engines is dependent on which crankshaft layout is used and the cam relationship.

Therefore, fig 2a can have firing orders of 1, 3, 4, 2 or 1, 2, 4, 3. Figure 2b can have 1, 4, 3, 2 (preferable) or 1, 2, 3, 4.

Firing order also has an effect on the smoothness of the engine because the power impulses generate a rocking

motion in the whole engine, shown by the left-hand side arrows in fig 2.

In this respect, the firing order options for fig 2a are identical, whilst fig 2b is best with the order 1, 4, 3, 2. Using these diagrams, the firing order can be changed by swapping any two sequences on the same crankpin.

Four cylinder 2-stroke engines with the same crankshaft layouts will have the cylinders firing in pairs as in fig 2(a), giving the smoothest running because no rocking motion is generated.

A better shaft layout for 2-strokes may be with the big ends spaced at 90deg. on the

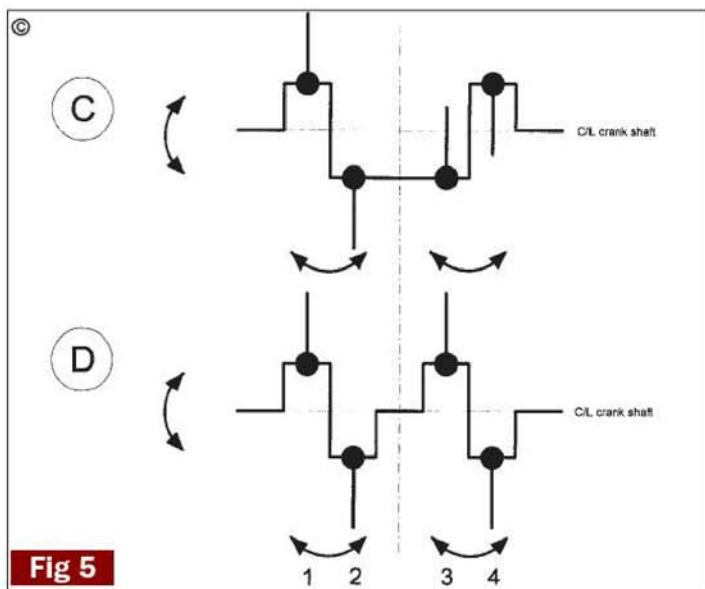


Fig 5

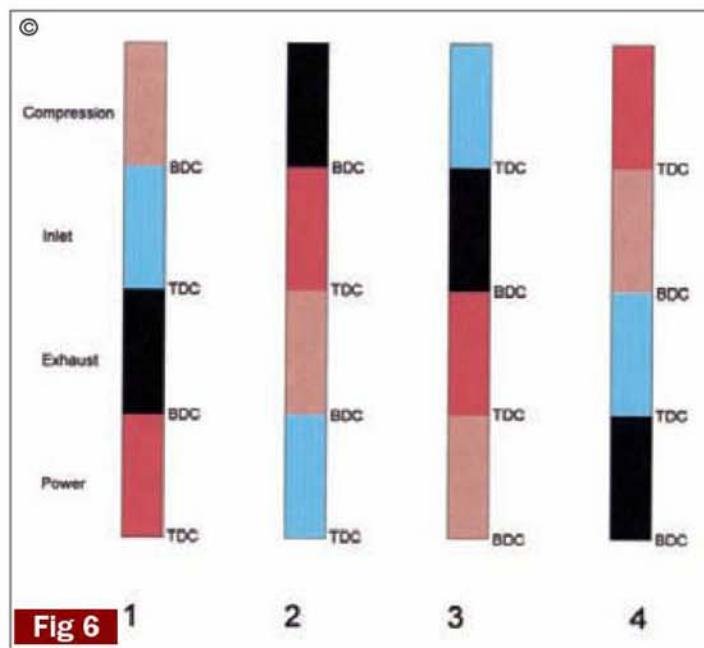
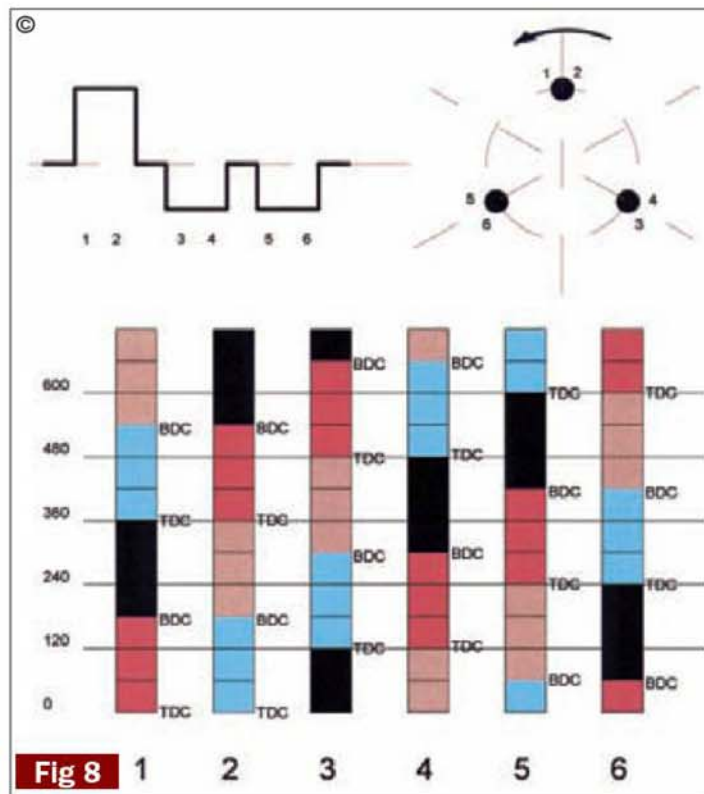
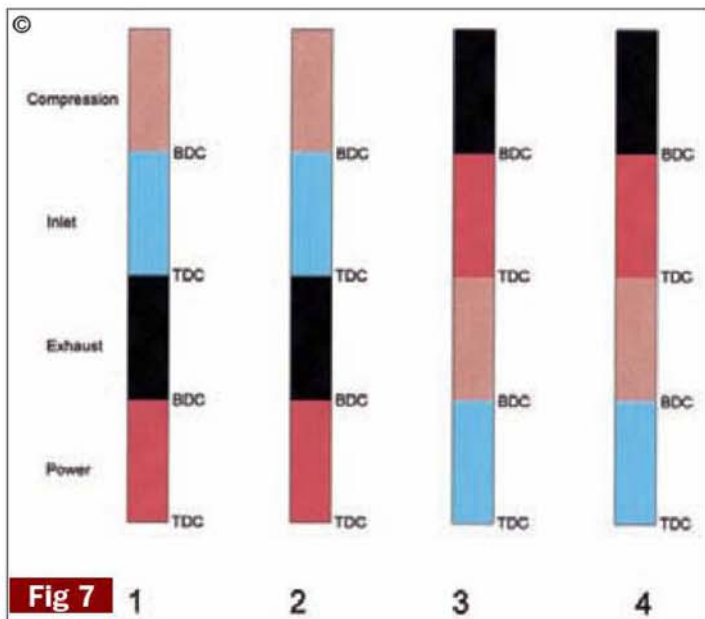


Fig 6



shaft so that the firing order can then be made the same (but twice as often) as the 4-stroke engine.

I don't believe that it is a good thing to have the cylinders firing 1, 2, 3, 4. I think it will 'wind up' the crankshaft but if anyone has greater knowledge of this aspect, I will be pleased to hear from you. The rocking motion will also tend to be slower and more pronounced.

The other thing that introduces itself with multi-cylinder engines is the question of evenly spaced power impulses. In the two examples shown, the firing strokes are evenly spaced and therefore do not introduce any additional unevenness into the engine.

Both the examples in figures 3 and 4 are examples of 'flat plane' layouts with all the crankpins lying in one plane.

This type of crankshaft (photo 2) can be machined from a piece of flat bar and can be used in other multi-cylinder engine layouts, but the results may not be perfect in terms of even running.

An example is certain American V8 engines with flat plane cranks which had a characteristic 'lumpy' sound. V8 engines with the crankpins arranged to give even firing intervals are more difficult to make but result in a smoother running engine.

If we now look at a flat-four engine arrangement (fig 5) we

can see that the situation is much better.

The same crankshaft layouts can be used but the cylinders are now arranged in opposing pairs. The mechanical balance in both cases is good. **Figure 5c** is typical and gives possible firing orders of 1, 3, 2, 4 or 1, 4, 2, 3 (fig 6).

The big advantage with flat four engines (and flat twins) is that if the sets of opposing cylinders are timed to fire together in pairs (1+2, 3+4), the engine becomes very smooth because the power impulses cancel each other out and the rocking motion disappears completely. The engine will also generate more torque. The firing sequence in **fig 7** illustrates this situation.

Firing order diagrams can be drawn for any number of cylinders. If done correctly

to scale, they work for crankshafts with the cranks spaced round the crank as for 6-cylinder engines.

In this case, the bottom of the diagram for each cylinder will not always be on TDC or BDC; it will be raised in proportion to the relative angle

of the crankpins. **Figure 8** shows the crankshaft layout and sequence diagram for a straight six engine with the crankpins spaced 120deg. apart.

With six cylinders firing over the full two revolutions of the crankshaft, the interval between them is 120deg.

The crankshaft layout is shown in diagrammatic form at the top of fig 8. Note that the crankpins are lined up in pairs. I used three common crankpins 120deg. apart, but other arrangements can be used if desired.

In the bottom half of the figure, the sequence for each cylinder is positioned to reflect the point at which it fires during the two rotations of the shaft. This is easy to do because each coloured block on the sequence represents

180deg. so 120deg. is $\frac{2}{3}$ of a block. The firing order shown can be changed

Fig 7. Alternative operating sequence for a flat four engine.

Fig 8. A full set of diagrams for an in-line 6-cylinder 4-stroke engine.

2. A part-machined flat plane crankshaft for a 4-cylinder engine.

by swapping any two cylinders on the same crankpin.

If you fancy making a 6-cylinder 4-stroke engine with crank spacing of 60deg., you will find that it is impossible to obtain even firing intervals.

Use of these types of diagrams helps ensure that the cam relationships are set correctly to give the correct firing order.

Even the master (Edgar Westbury) got it wrong occasionally; my Seal construction notes contain a correction to the firing order from that defined on the drawings.

Next time I will use these techniques to look at twin-cylinder engines in various guises.

ME

PART 5

Continued from page 156
(M.E. 4305, 3 August 2007)

James G. Rizzo describes the second stage in the assembly of this fascinating Stirling engine.

THE DAVIDE Mk.II STIRLING ENGINE

This stage of assembly involved the power cylinders, power pistons, sealing discs and plugs. The process is rather fiddling and needs deft fingers and a modicum of patience! Reference is made to **fig 20** and **photo 17**.

Step 1. The power piston rods were inserted into the scotch yoke with a smear of Loctite Screwlock.

Step 2. The internal plugs of both cylinders were placed on the piston rods. The rods were in turn inserted into the piston crowns with the Loctite Screwlock.

Step 3. The pistons were inserted into the power cylinders, which in turn were bolted to the crankcase. The internal plugs were inserted in the cylinders and fixed with Loctite.

Step 4. The power cylinders were bolted to the crankcase.

Step 5. The sealing discs were bolted to the cylinders, the left-hand one with a thin gasket.

Sub-assembly of the displacer unit

The displacer unit, which consists of the displacer

cylinder, the displacer, displacer rod and the displacer plug were assembled together before the unit was inserted into the top of the crankcase. Reference is made to **fig 21**. The following steps were taken:

Step 1. The displacer rod was taken out of the crankcase (with the clevis removed) and screwed into the displacer with epoxy adhesive.

Step 2. The displacer was inserted into the displacer cylinder.

Step 3. The displacer plug was temporarily fitted into the cylinder and the latter drilled to allow an 8mm brass pipe to pass into the hole previously prepared in the plug (see **fig 10**, M.E. 4303, 6 July 2007).

Step 4. The displacer plug was inserted into the cylinder with adhesive.

Step 5. A length of 8mm, thin walled brass pipe was inserted with epoxy adhesive into the plug with approximately $\frac{3}{16}$ in. or 5mm protruding into the crankcase (the other pipe from the side of the cylinder was left until later.)

Step 6. The clevis was screwed on the displacer rod.

Step 7. The displacer unit, together with a 2mm O-ring, was screwed into the crankcase top.

Step 8. The clevis was once more attached to the displacer con-rod.

Step 9. The crankshaft was turned a few times to check that the mechanism was working correctly.

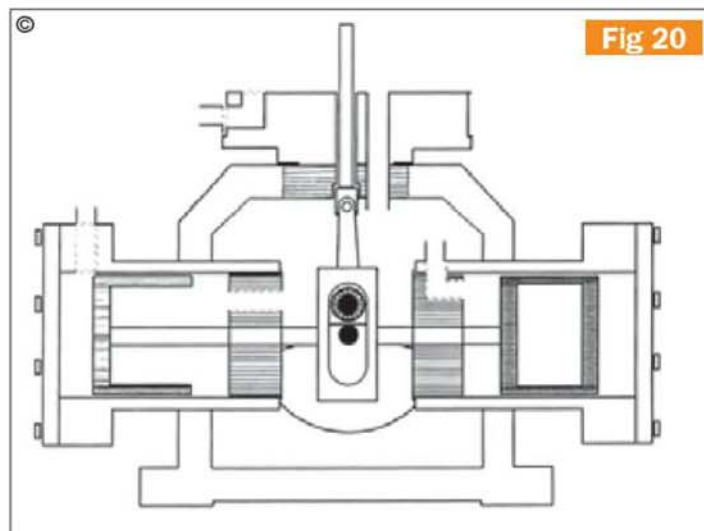
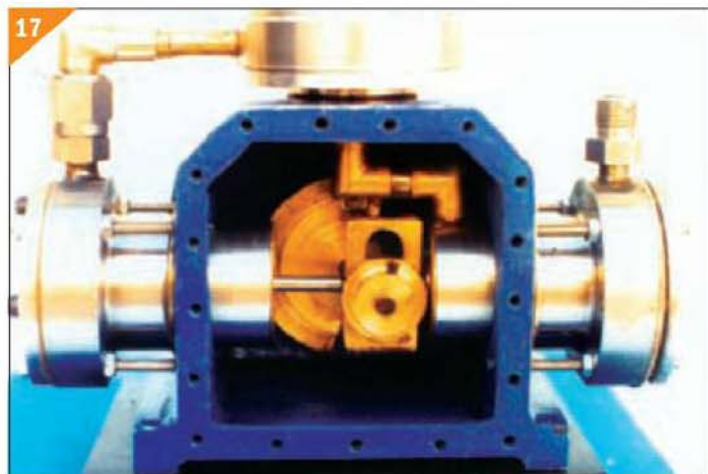
Pressure pipe fitting

The fitting of the pressure pipe connection to the right-hand power cylinder inside the crankcase appears visually rather complex but is, in fact, quite straightforward.

Two 90deg. bends and two short pieces of pipe connecting the bends with the displacer plug were prepared beforehand so that once the displacer unit was inserted into the crankcase, fitting of the parts would be relatively easy to handle. The bends mentioned above are those used in small bore plumbing or with gas pipes. Reference is made to **fig 22a**, shown here, and **photo 15** which appeared in M.E. 4305, 3 August 2007.

17. The fully assembled pressure pipe connections from the displacer cylinder to the power cylinders.

Fig 20. A drawing of the sub-assembly when at stage 2.



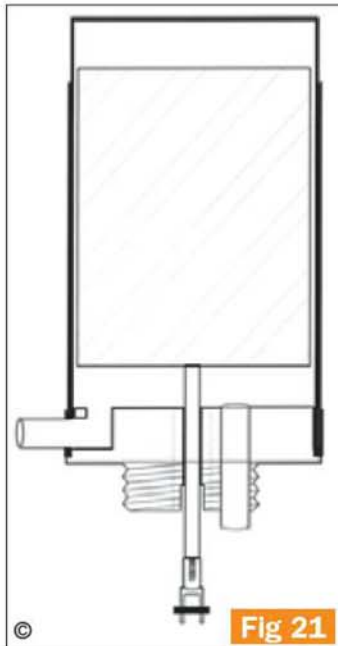


Fig 21

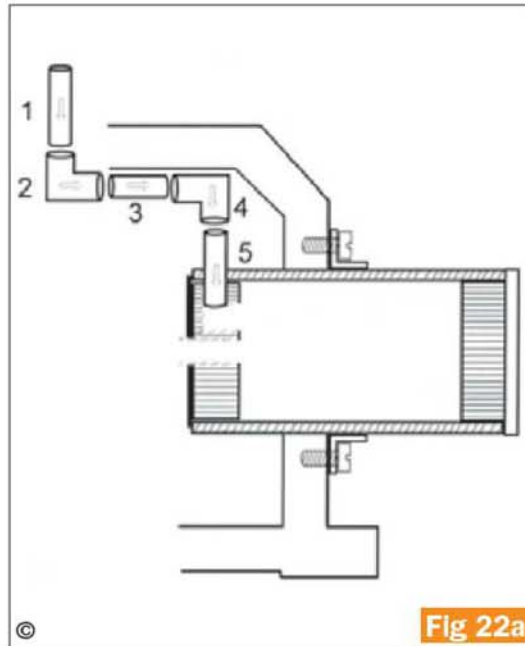


Fig 22a

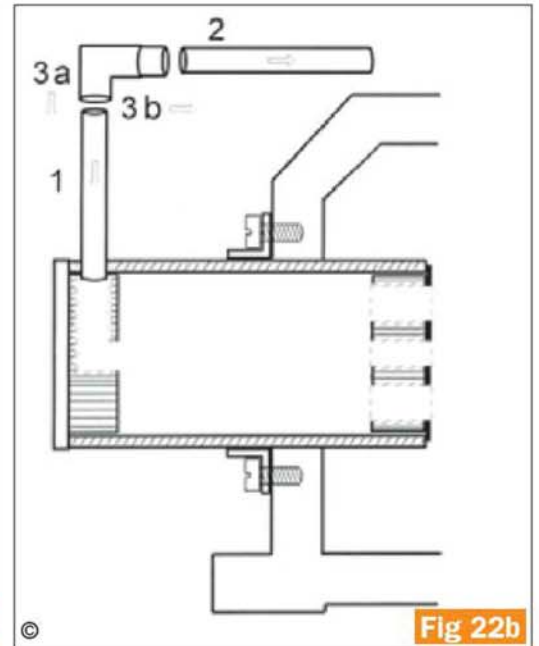


Fig 22b

The four pieces (Nos. 2, 3, 4 and 5 shown in fig 22a) were smeared with epoxy adhesive and in quick succession mounted into each other, then into the protruding pipe from the displacer unit, and finally into the power cylinder.

Long nose pliers were necessary for the final step, that of dragging the last piece of pipe (No. 5) into the power cylinder plug.

Fitting the connection between the displacer cylinder and the left-hand power cylinder was easier since this is completely external, requiring only one bend and two fairly long pieces of brass pipe, **fig 22b** and photo 16 (M.E. 4305, 3 August 2007).

The only minor difficulty was the bend, which needed the horizontal pipe to be slightly longer than the inserted length at each end. Thus, if the pipe length required was 2in. or 51mm, a longer piece - $2\frac{7}{32}$ in. or 56mm was cut first, providing enough to have a 4mm insertion at each end, .

This was inserted into the bend as far as it could go, then with the vertical parts in place, the horizontal pipe was dragged into the displacer cylinder and fixed with epoxy adhesive. There could be other ways of managing these connections, and therefore the reader may wish to experiment further.

Two other points:

1. In order that the appearance of the engine gives an æsthetical balance, a 'false' pressure pipe connection was made on the right-hand power cylinder; it did not connect to the displacer cylinder.

2. The reader may prefer a shorter connection between the displacer cylinder and the left-hand power cylinder. This could be done by inserting a bent copper pipe (O/D 8mm, I/D 7mm) between the two components, using either a pipe bender or a long wire spring which can be extracted when the bending is finished.

Flywheel

The flywheel used on *Davide Mk II* is a bronze casting off a cast iron flywheel purchased at one of the engineering exhibitions. It was made for an I/C or steam engine is $3\frac{17}{32}$ in. or 90mm O/D with a rim thickness $\frac{25}{32}$ in. or 20mm (**fig 23**). It is fairly heavy and of just the right type for this engine with a total of 32cc and with twin pistons acting in tandem.

Testing the power cylinders

Apart from tests that were made when each power cylinder was assembled with its respective pressure pipe outlet, another test was made when the pressure pipe connections with the displacer cylinder had been completed.

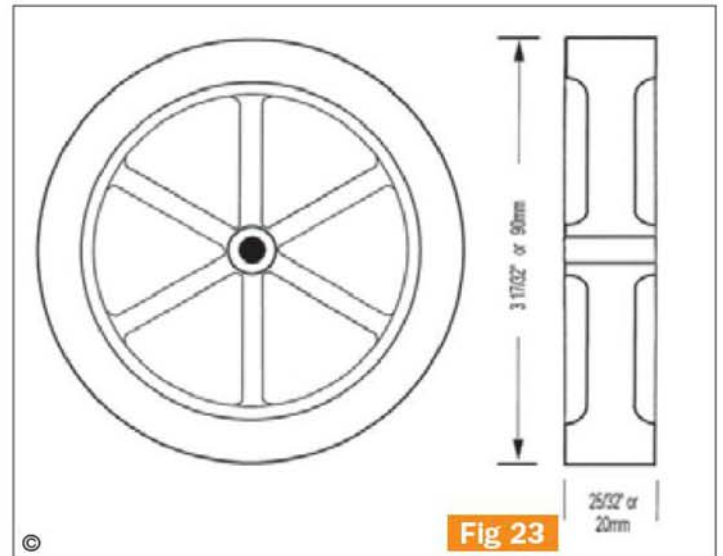


Fig 23

With the flywheel in place, the crank was turned in a clockwise direction while first blocking the two left-hand cylinder plug holes (inside the crankcase) and then blocking the right-hand cylinder external plug hole. In each case there was stiff resistance to the flywheel motion.

Engine assembly - final stages

With the main components constructed and assembled and the parts thoroughly checked, it was the turn of the peripheral equipment to be constructed and installed. Contrary to good engineering practice a test run was made with a blowlamp and a water-soaked rag round the lower end of the displacer cylinder, a run which only took

Fig 21. The assembled displacer unit.

Fig 22a. Details of the assembly of the pressure pipe fittings to the right-hand power cylinder.

Fig 22b. Details of the assembly of the pressure pipe fittings to the left-hand power cylinder.

Fig 23. The flywheel.

seconds but proved that the engine could run easily and without problems.

Figure 24 shows how a *Davide Mk II* with different power cylinders would look like on a fabricated crankcase.

Water cooling jacket

The water cooling jacket made for this engine was constructed ➤

STIRLING ENGINE

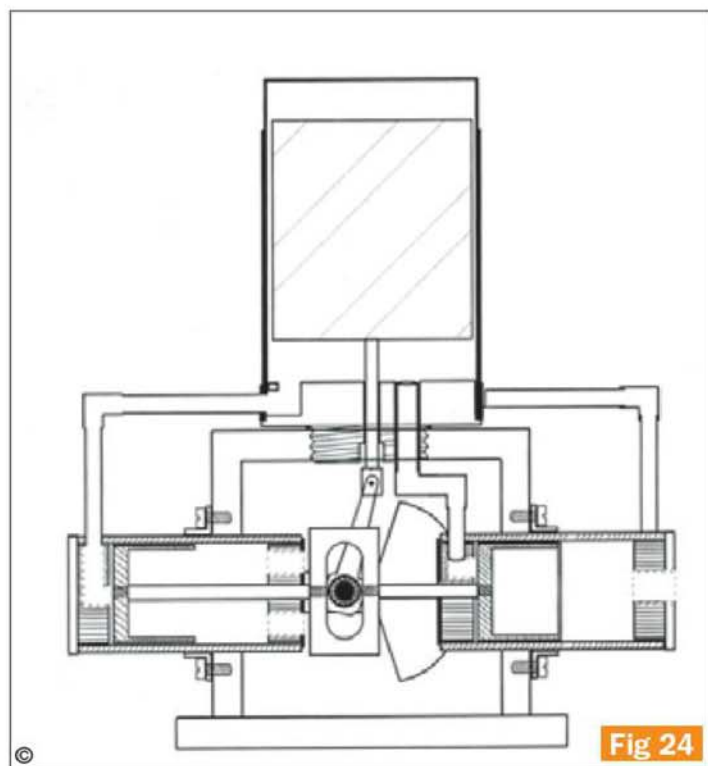


Fig 24

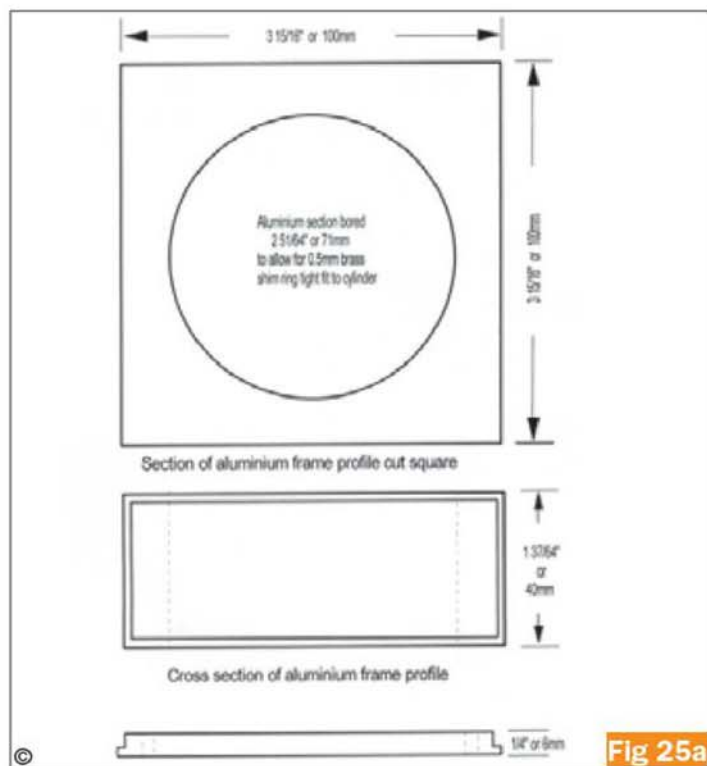


Fig 25a



Fig 24. The engine on a fabricated crankcase.

Fig 25a. Details of the cooling jacket.

Fig 25b. Schematic of the cooling jacket.

18. The finished water jacket.

centring 4-jaw chuck and bored $2\frac{3}{4}$ in. or 70mm to fit tightly on the displacer cylinder. Two end-plates were cut from $\frac{1}{4}$ in. (6mm actual) plate, 100mm x 40mm, milled around the edges to fit exactly into the profile. The plates were then drilled to take two steel studs, **figs 25a and 25b, photo 18.**

Before fitting the aluminium box-like structure on to the displacer cylinder a layer of Super Steel epoxy adhesive (by Plastic Padding) was smeared near the bottom, wider end of the displacer where the diameter increased to $2\frac{27}{32}$ in. (72mm). This step provided a location for the cooling jacket and helped seal it at the bottom.

from an aluminium door section 100mm square and a 2mm wall thickness. It proved to be a relatively easy cooling gadget to make and quite efficient. The material came from the scrap bin of a manufacturer of doors and windows at no cost to myself.

A piece of the profile, which was $1\frac{37}{64}$ in. (40mm) deep, was cut, placed in a self-

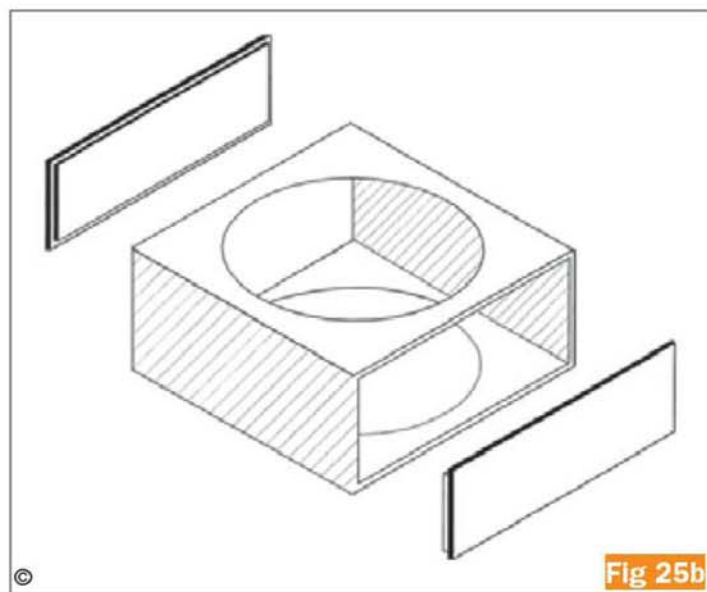


Fig 25b

The next step was a little more complex as another layer of this epoxy had to be smeared pretty quickly (it has a short curing time after the catalyst has been mixed) on the displacer cylinder inside the box. This was done by smearing the adhesive round the inside top of the box and the cylinder using a narrow, Wflat screwdriver.

The box was turned round while doing this to ensure an even layer and the parts kept upside down so that both layers of the adhesive would penetrate the junctions between the

displacer cylinder and the aluminium profile. It was not as complicated as it sounds on reading this, and the result was just perfect.

Before sealing the water jacket the end plates were drilled on opposite sides and at different levels to take 8mm brass pipe and bends for connecting to the water tank.

The advantage of such a cooler is that water actually surrounds the displacer cylinder and the cooling effect is much greater than with a slip-on container or fins.

● To be continued.



AYESHA II

PART 8

Continued from page 148
(M.E. 4305, 3 August 2007)

Tony Weale
finishes the chassis
and describes the
smokebox and
chimney.

Moving to the grate and ashpan layout at the rear of the chassis, this is an awkward area on a wide firebox Atlantic. Space is restricted, and LBSC's own *Ayesha* had a slightly impractical fixed grate and ashpan. The 1930 design suggested a dropping centre section to the grate, which would be fiddly to make in 2½in. gauge, and would not drop very far with a shallow ashpan above the trailing axle.

The *Ayesha II* design is not ideal, but is easy to make (See issue 4305 for drawings). It allows complete removal of the grate and ashpan after a run. The ashpan can be also be dropped separately, with the grate left in place.

The first parts required are the two ash deflectors, which cover the trailing wheels. These are very simply made from 20swg, steel or brass, cut to the shape illustrated in the drawings published in M.E. 4305, and folded in the bench vice. They should be rigid enough without any jointing, but the sloping edges can be silver-soldered if preferred. Note the 6BA clearance hole at the lower rear corner to accept the ashpan support.

Attach each deflector to the trailing frame with two or three small screws or rivets, so that the top of the flange on the deflector is flush with the top edge of the frame. The screw heads will be hidden by the footplate valance.

The deflectors are bridged by the rear grate support, which is just a length of ¼in. square bar, drilled and countersunk for a 5BA fixing screw at each end. Directly below this is the ashpan support. On our prototype this is a length of ¼in. rod, threaded at each end for a pair of clamping nuts which attach it to the deflector.

With hindsight, a 6BA screw about ½in. long, put through the clearance hole in each deflector from the outside, with a retaining nut, would support the ashpan equally well and improve access to the rear of the ashpan for raking-out.

The grate bars are made from ¼ by ⅛ in. mild steel. Black steel is more durable than bright material in this application, and an exhibition finish is quite unnecessary! Cut nine pieces, 2⅞in. long, mark out and drill the ⅛in. clearance holes in one piece, then use this as a jig to drill all the others. Cut and file the two front supports from ¼in. square mild steel, and cut the tie bars from ⅛in. rod.

You can, if you like, turn and drill 14 little bushes to act as spacers for the grate bars, but it is easier to use ordinary steel hexagonal nuts of a suitable size.

With the grate assembled, offer it up to the chassis and determine the best position in the frames for the cross pin holes. These must be at least

⅜in. below the top edge of the frames to clear the running plate valance, and are drilled ⅛in. clearance. It does not matter if the grate slopes gently forwards.

The ashpan is another simple piece of folded sheet steel or brass, slotted at the rear to hook over the rear retaining rod, and drilled at the front for a ⅛in. cross pin. Both grate and ashpan should be made to fit loosely in the space available, otherwise when hot and choked with ash they will become very tight and difficult to remove,

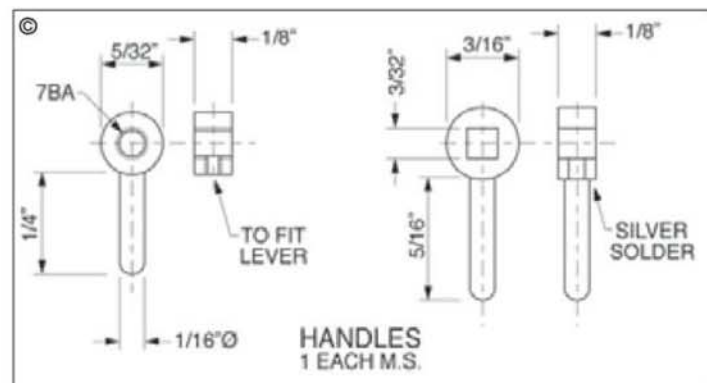
Smokebox

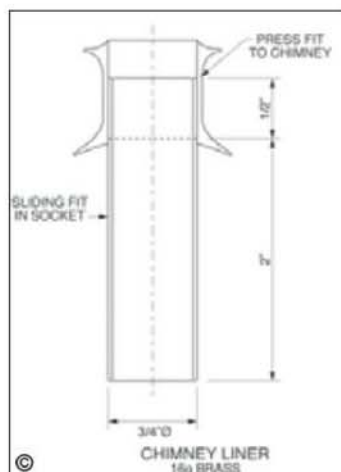
The chassis is now complete, and we can move on to the smokebox and saddle. The smokebox barrel is a piece of 3¼in. dia. 16 gauge brass or copper tube. Steel could be used, but will not last as long.

Start by squaring-up the ends of the tube in the lathe, using the 3-jaw chuck to the finished length: 1⅜in. for *Ayesha II* herself and 1⅞in. for the variations. A piece of tube like this can be a slippery customer in the lathe, and it is highly advisable to turn a wooden plug, say ¾in. thick, which can be driven into each end of the tube to support the external chuck jaws. Also place soft packing between the jaws and the tube to protect the surface.

While the tube is in the lathe, mark off a top and bottom centre-line, 180deg. apart, and locate the chimney, blast pipe and steam pipe centres. Remove from the lathe and open these holes out to size.

The smokebox requires a joint ring to match it to the boiler barrel diameter. This can ➤





be produced from an off-cut of the smokebox tube itself, or from a $\frac{1}{2}$ in. wide strip of 16 gauge brass, bent and silver-soldered to form a $3\frac{1}{8}$ in. dia. ring to be a push-fit inside the smokebox tube and over the boiler barrel.

Leave about $\frac{1}{4}$ in. of the ring projecting at the rear of the smokebox to form the seating for the boiler cladding,

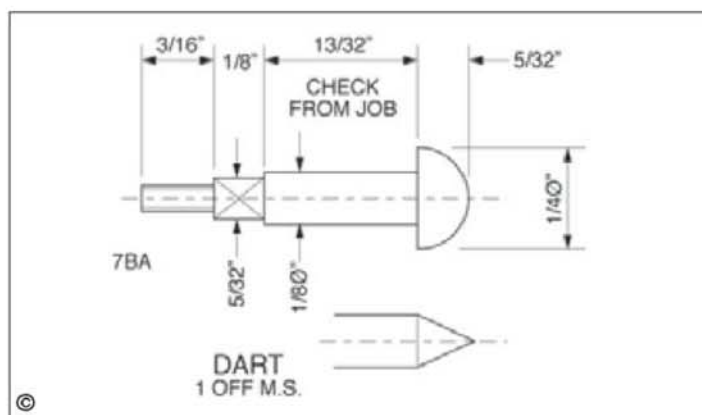
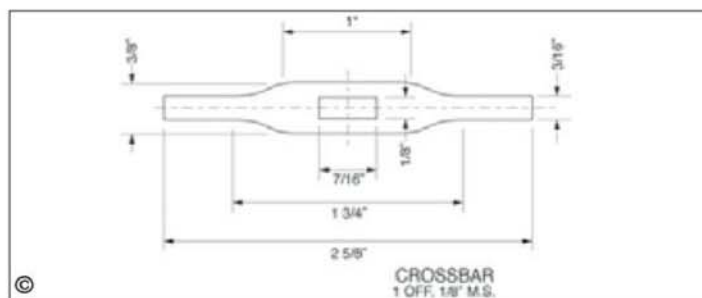
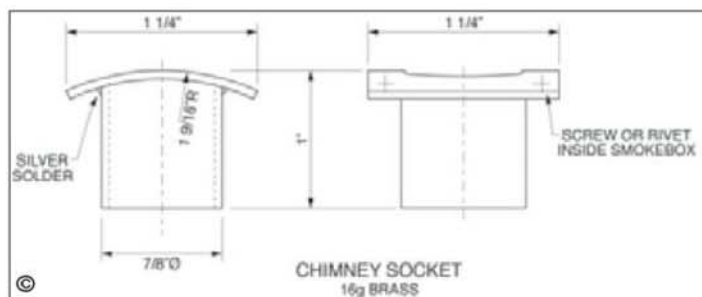
Smokebox door and ring

The smokebox door and ring will be available as aluminium castings, although they can be made from solid brass if preferred. To machine the cast door ring, chuck it as truly as possible by the outside diameter, standing proud of the jaws so that the front can be faced. Then bore the centre hole to $2\frac{1}{4}$ in. diameter.

Re-chuck the opposite way round, with the jaws gripping on the centre hole, and face the back of the ring, finishing $\frac{5}{16}$ in. thick. Turn the outside diameter to a smooth finish and a tight hand-push fit in the smokebox tube. The inside of the door ring can now be cleaned up if necessary.

The smokebox door casting will have a chucking spigot on the outside. Hold the door by its rim in the 3-jaw chuck, setting it back against the steps of the jaws, or a packing piece, and turn the spigot parallel. Next, chuck the door casting by the spigot, turn to $2\frac{1}{4}$ in. dia., and face the mating surface, finishing the door $\frac{5}{32}$ in. thick.

Now centre-drill for the dart hole opening this up to $\frac{1}{8}$ in.,



and cut off the spigot flush with the door. If the casting is reasonably smooth, the outside of the door can be left as it is.

If not, turn up a brass spigot, say $\frac{1}{2}$ in. dia., and an inch or so long with a $\frac{1}{8}$ in. dia. pip to fit into the hole in the door, and solder it to the inside of the door. Chuck the door by this new spigot, check that it runs reasonably true, and smooth off the outside of the casting with files and abrasive paper. Finally melt off the spigot.

The door-securing dart and hinges are some of the smallest components of the locomotive, but are very satisfying when they work properly. Make the hinge lugs first.

Chuck a length of $\frac{5}{32}$ in. square mild steel in the 4-jaw, set to run truly, reduce $\frac{5}{32}$ in. length to 0.087in. dia. and thread 8BA. Part off at $\frac{5}{16}$ in., advance the material in the

chuck and repeat. Drill one lug for the hinge pin, and use as a jig for drilling the second one, then file to shape.

Offer up the smokebox door to the door ring, centralize it, and decide on the best position for the lugs, then drill and tap the ring 8BA and screw the lugs in, aligning them with the hinge pin, which is just a piece of $\frac{1}{16}$ in. mild steel rod,

Now cut the hinge straps from $\frac{1}{16} \times \frac{1}{4}$ in. mild steel, rounding off one end of each. Leave them over length, so that they can be bent round the hinge pin. Offer them up to the door, and bend them so that they will lie flat on the casting, yet remain parallel. Clamp them in position, then drill and attach with countersunk rivets or very small screws.

Note that the outer fixings will emerge on the mating face of the door and must be filed flush.

Now bend the outer ends of the straps around the hinge pin,

and cut off the excess length. If the hinge pin is reasonably tight in the lugs it will probably stay put, but if necessary the top end can be threaded for a 12BA nut. You should now have a pair of workable hinges.

Ivatt and Brighton builders may like to vary the design here, and adapt the hinge dimensions to the style of their chosen prototype.

The door dart starts life as a piece of $\frac{1}{4}$ in. mild steel rod. Chuck in the 3-jaw with about 1in. projecting. Decide the overall length required for the stem of the dart, and turn this down to $\frac{1}{8}$ in. diameter. The exact length will depend on the thickness of the door, crossbar and smokebox front ring.

If in doubt, it is better to have it slightly too long, and it can be adjusted with a washer behind the handles. Reduce a $\frac{3}{16}$ in. length of the outer end to 0.098in. and thread 7BA. File the next $\frac{1}{8}$ in. length to a $\frac{3}{32}$ in. square. This can be done accurately enough with reference to one of the chuck jaws.

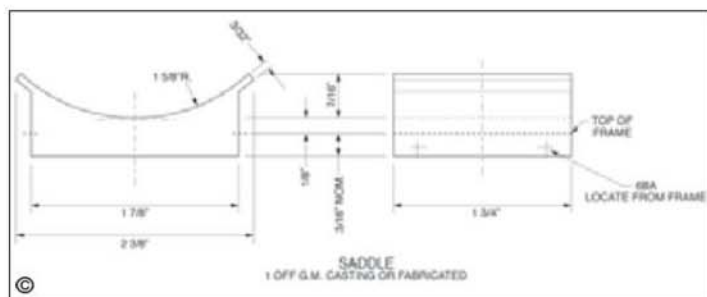
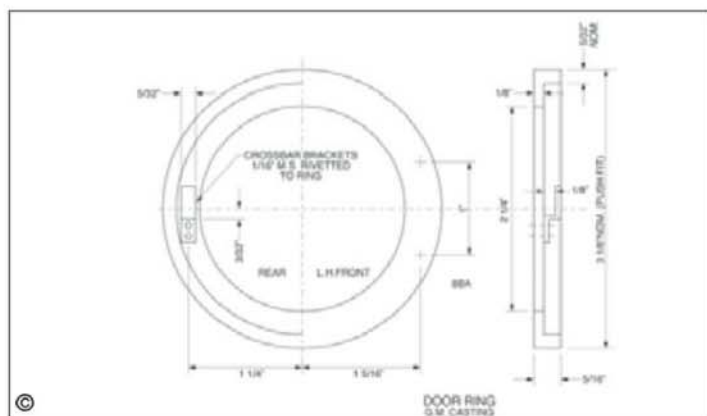
Now reverse the component in the chuck, finish the large end to $\frac{5}{32}$ in. thickness, and file this to shape to form the pointed head of the dart.

The two handles are basically similar, each consisting of a turned cylindrical bush with a $\frac{1}{16}$ in. steel wire handle silver-soldered into a hole drilled in one side. The outer handle is tapped 7BA, while the inner one requires a $\frac{3}{32}$ in. square hole to match the dart. This is a job for a small needle file.

By comparison, the crossbar is easy to make, being basically a piece of mild steel, $\frac{1}{8} \times \frac{3}{8}$ in., with a slot in the middle to accept the dart. The external profile in the drawing is copied from LBSC's own locomotive, and should not need any further explanation.

When complete, assemble the dart, handles and crossbar to the smokebox and determine the best positions for the crossbar brackets. These are bent from sheet steel or brass and riveted to the inside of the door ring.

The rivets must be countersunk and filed flush on



the outside of the ring, since this has to form an airtight seal against the door. Alternatively, small screws could be used, inserted from inside into tapped holes in the door ring.

The crossbar should drop easily into the brackets and should not be longer than necessary or it may be difficult to remove and refit through the door aperture.

Chimney and blast pipe

The chimney and blast pipe layout is unconventional, but very practical and efficient.

It owes nothing to LBSC, but is the work of National 2½" Gauge Association member, Peter Gardner, and complements his redesign of the boiler.

The chimney has a long liner, which is a sliding fit in a socket mounted inside the smokebox. The blast pipe is very short, virtually a nozzle mounted on the floor of the smokebox. The chimney can thus be removed easily, leaving the smokebox completely clear for access to the tubes and pipework. Our prototype, with the

dimensions shown, steamed extremely well first time out, and no adjustments have been necessary.

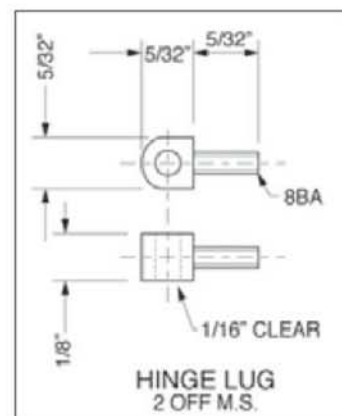
Tackle the chimney socket first. Make the flange from a 1 $\frac{1}{4}$ in. square of 16swg brass or copper, bent to fit against the internal curve of the smokebox. Centre it on the chimney hole and cut a matching hole in it.

Obtain a piece of brass or copper tube 1in. long and $\frac{3}{4}$ in internal diameter to slide over the chimney liner. Square-up one end, file the other to fit against the flange, then silver-solder the two parts together. Secure the assembly inside the smokebox with a countersunk screw or rivet near each corner.

A casting will be available for the chimney. Alternatively it can be turned from solid, or from a fabrication comprising a tube with a generous-sized ring silver-soldered to each end. In any case the sequence of operations is similar.

First, hold the job in the 3-jaw chuck as truly as possible. Face the top of the chimney, and bore the internal diameter to just under $\frac{3}{4}$ in. to be a press-fit on the chimney liner. Now make a mandrel, chucking any suitable piece of round or square section brass or steel and turning $\frac{3}{4}$ in. of the length down so that the chimney will push tightly over it, with the top towards the chuck.

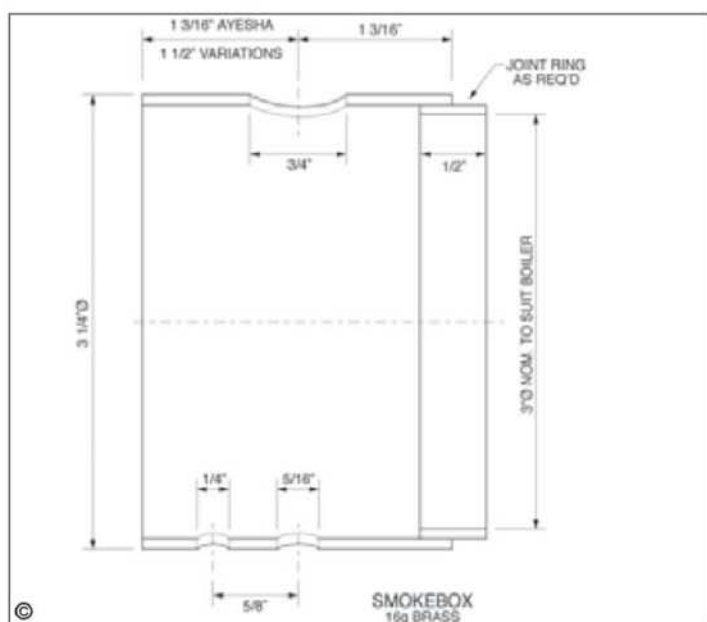
Use a round-nosed tool to profile the exterior of the chimney cap clean up the



outside diameter of the shank, and rough-turn the flared base. Study the shape required here, before removing too much metal.

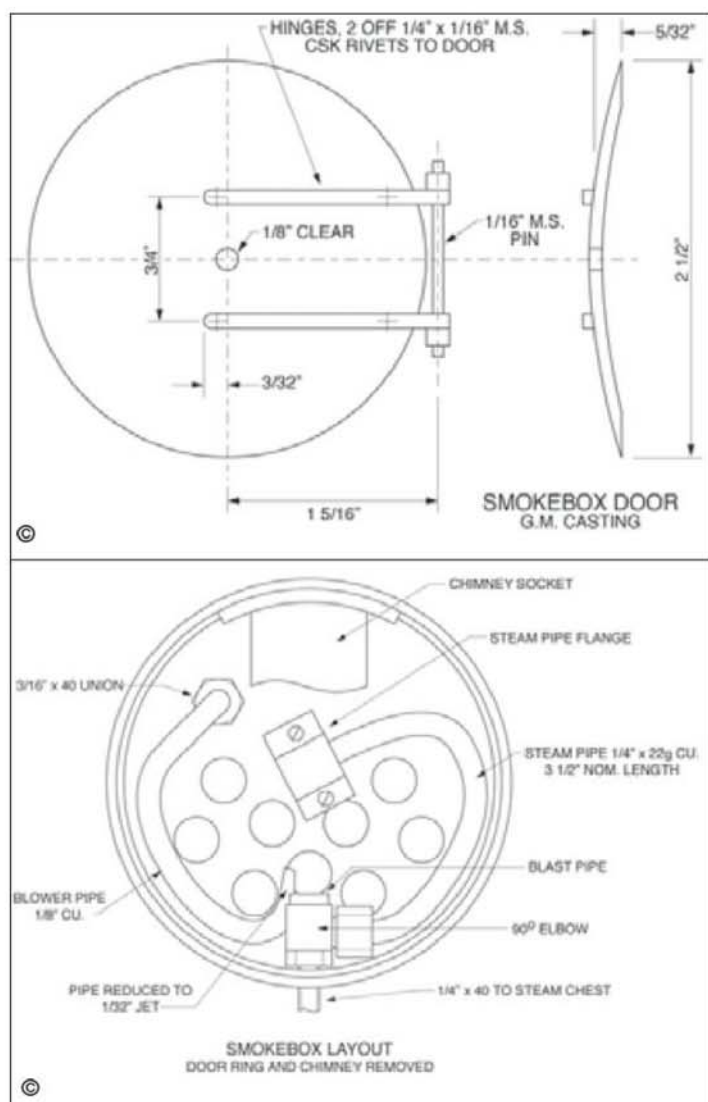
The upper part of the flared base can be finished to the profile visible on the side elevation of the locomotive, but the profile of the lower sides - the end elevation - cannot be finalised until the base has been radiused to fit the smokebox. This can either be done by fly cutting or, with a small chimney like this, by careful hand filing. Nothing looks worse on a locomotive than a crooked chimney, so whichever method is chosen make sure that it sits absolutely straight on the smokebox.

To fly-cut the base, mount the chimney horizontally with



Inside the smokebox

CLASSIC LOCOMOTIVE



a mandrel in the vertical slide, clamp it in the toolpost or directly to the top-slide. Adjust so that the axis of the chimney is at centre height, and at right angles to the lathe axis.

Various types of fly cutter are available, and will either be mounted in the chuck or on the faceplate, or on a mandrel between centres.

Adjust the cutting bit to 1 5/8 inch. radius. Run the lathe fairly fast, and apply light cuts and a slow feed with the cross and top slides. Have the smokebox to hand, to check the result.

There will now be a ridge remaining on either side of the chimney base, which cannot be removed by plain turning methods, so this stage will require some careful work with round and half-round files.

Finally, remove the chimney from the mandrel and press-fit the liner, which is just a

piece of 3/4 inch. diameter, 16 gauge copper or brass tube 2 1/2 inch. long and squared at both ends.

Smokebox saddle

The smokebox saddle can either be a casting or a fabrication. If a clean casting is available it should not need much more than smoothing over with files, though if necessary the fly cutter can be used again to produce the radius.

If preferred, the saddle can easily be fabricated from 16 or 18swg brass, cut and filed to size to form the sides and ends, topped with a rectangular plate curved to fit around the smokebox, and silver-soldered together. The top plate will require a large clearance hole or slot to admit the steam and exhaust pipes.

The saddle fits between the frames and is secured to them

by four 6BA countersunk screws. The exact height of the saddle will depend on the position of the top of the steam chest, and some adjustment may also be required to get the boiler and smokebox level, so final assembly of the saddle is best left until the boiler is fitted.

The smokebox is retained on the saddle by a running nut on the blast pipe, which in turn screws into the top of the steam chest.

Smokebox fittings

The blast pipe is a length of 1/4 inch. diameter copper tube of at least 18 gauge, threaded 40tpi all the way along. Alternatively it could be turned from brass or bronze rod, and bored 5/32 inch.

The overall length of the tube is about 1 1/8 inch. but this may need to be adjusted on assembly to achieve the 5/8 inch. distance from the face of the blast nozzle to the base of the chimney liner.

The blast nozzle is turned from 3/8 inch. hexagonal brass. Chuck the material, centre-drill and open to 1/8 inch., about 1/4 inch. deep, then enlarge this to 7/32 inch. for 5/32 inch. depth and tap 1/4 x 40. Finally, part off at 3/16 inch. overall length. The retaining nut is similar, but tapped right through, and radiused on one side with a file so that it will seat in the 5/16 inch. hole in the base of the smokebox.

Continuing with the smokebox fittings, the steam connection to the steam chest is another externally-

Drawings are available from:

PO Box 87, Leominster,
Herefordshire, HR6 6AJ

Details of castings are available from:

Box 2500, Model Engineer,
Berwick House, 8-10 Knoll Rise,
Orpington, Kent, BR6 0EL

Membership details of the National 2 1/2" Gauge Association:

Peter De Salis-Johnston,
7 Tudor Court, Fulford,
Stoke-on-Trent, ST11 9RX

threaded 1/4 inch. diameter tube, similar to the blast pipe, but approximately 5/8 inch. longer. It does not require a retaining nut inside the smokebox and can either be connected directly to the main steam pipe with a straight union, or by a 90deg. elbow as shown in the drawing. This is the neater method and maximises access to the smokebox.

To make the elbow, chuck a length of 1/2 inch. or 3/8 inch. square brass or bronze bar in the 3-jaw with about 3/4 inch. projecting. Face the end and turn 1/4 inch. down to 3/8 inch. diameter. Then thread this 3/8 x 32 from the tailstock. Centre-drill, then drill 5/32 inch. dia., 1/2 inch. deep. Part off at 5/8 inch., then centre-pop in the middle of one of the flat sides. Drill a pilot hole at this point, breaking through into the previous 5/32 inch. drilling, enlarge the pilot hole to 7/32 inch. and tap 1/4 x 40 to accept the steam chest connection.

●To be continued.

AYESHA II DRAWING AMENDMENTS

PUMP STAY

The dimension from the centre of the hole to the top of the stay should be 1/2 inch. rather than 7/16 inch.

VALVE ECCENTRIC AND STOP COLLAR

The width of the stop collar should be 1/4 inch. not 5/16 inch. and the distance from the centre of the hole to the flat should be 3/32 inch. not 1/8 inch.

GRATE

The distance from the centre lines of the spacers to the outside edge is decreased from 1/2 inch. to 3/8 inch.

SUPERHEATING

- is it really helpful?

D. A. G. Brown applies his professional knowledge of thermodynamics to assess the value of superheating for model steam locomotives.

Since the first half of the 20th century there has been a definite fashion to incorporate superheaters into our miniature locomotives. My professional background in thermodynamics has led my idle curiosity to investigate just how much benefit accrues from this added complication to model engineering. After all, superheaters do cost money to build; they can be vulnerable to decay by corrosion and leakages in them can be frustrating to mend. I am assuming that the boiler pressure at which we are running is of the order of 80 to 100psi gauge (psig), rather far removed from mid-20th century practice on main line railways.

Just take a step back to understand where the great locomotive designers were coming from. Originally it must have been guesswork and lucky inspiration, because the first complete set of scientific data to be available was Callendar's steam tables in 1900. Over the years these have been refined and developed, to the extent that my own set of tables (in SI units) runs to over 120 pages of tightly packed information - riveting reading some might say!

For those who prefer pictures, the data has been put into graphical form by Mollier. His chart provides an excellent quick reference for looking at how an engine might perform.

In the past I have used it for scheming out just what effect modified turbine blades might have in a generating set; also looking at boiler conditions, including the influence of superheating. The chart is an

excellent tool for rough sighting work, but the tables are needed for accurate detailed calculations.

Let us look at a section of the Mollier chart, reproduced in **fig 1**. The complete original is about A2 size and represents the whole gamut of steam conditions, right into the supercritical range. Photocopying the useful area for our purposes still requires a size reduction, but it retains the flavour of our argument, although it is not good enough for accurate interrogation.

On the chart the y-axis represents the level of heat (H), or total energy in the steam, otherwise called enthalpy. Along the bottom, the scale is entropy (S), which represents the level of disorder of the system. This is a difficult concept to get hold of, but suffice it to say that all processes used in this world are less than 100% efficient and lead to an increase in entropy.

The ideal process is 'isentropic' and would lead to no increase in entropy, but a reduction of enthalpy. It can therefore be represented by a vertical line on the chart. That reduction in enthalpy represents useful work taken out of the steam via an engine.

On the other hand, a process in which no use is made of an energy drop is said to be 'isenthalpic' (or at constant enthalpy) and is represented by a horizontal line on the chart. No useful energy is taken out of the steam and such an example is the passing of steam through a reducing valve.

Just stop and look at a real engine. At each stroke of the piston, the steam does not

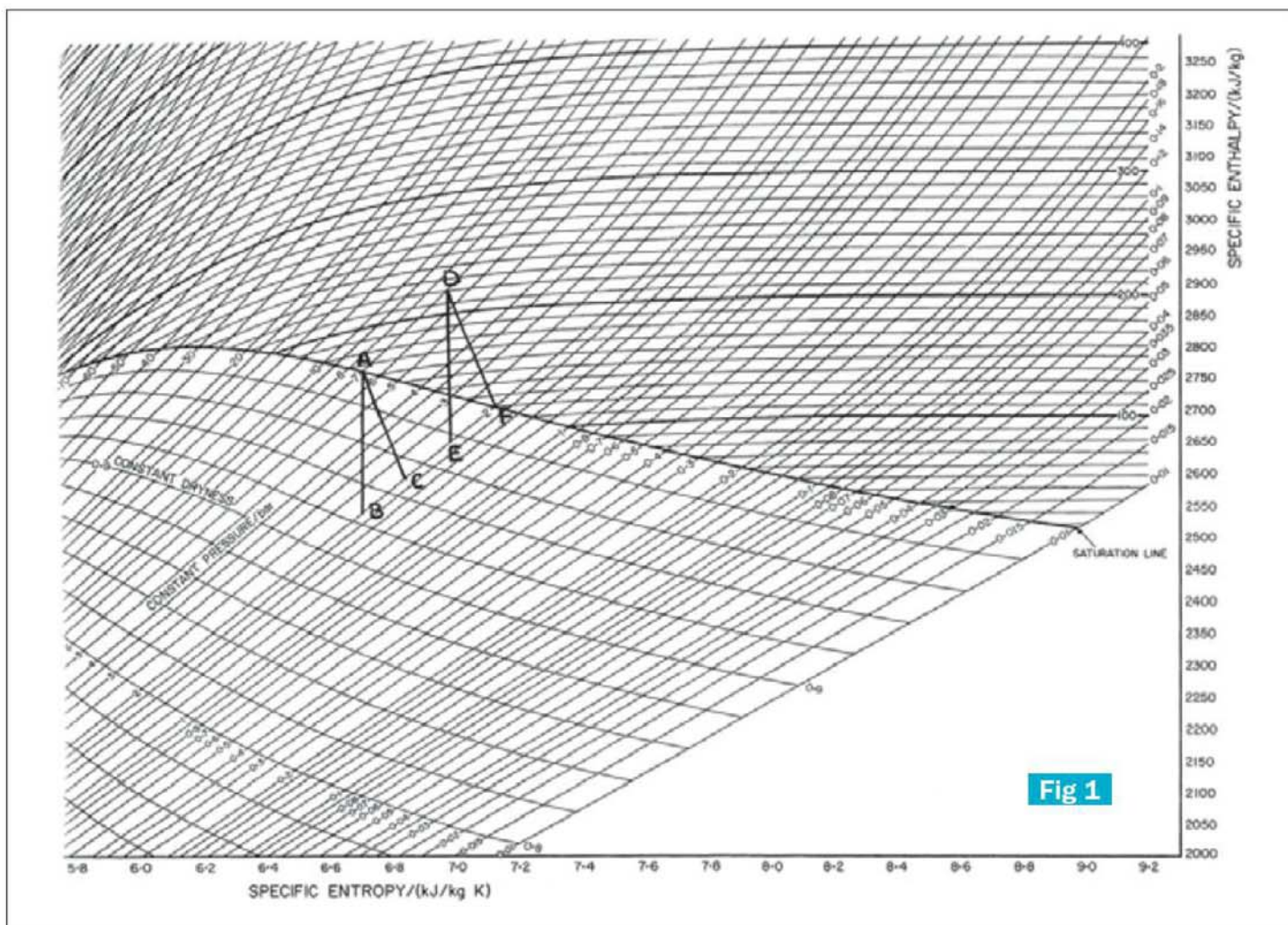
suddenly fill the available volume of the cylinder, nor is its departure instantaneous. The valve gear and steam passages have a lot to answer for, and an indicator diagram measures precisely how far the practical performance of steam is from ideal. I am arguing in our case that the indicated performance of the steam will be about 75% of the theoretical value. It is unlikely to be better than this figure.

The bold saturation line on the chart refers to dry saturated steam, whose temperature rises with pressure. The pressure is measured in absolute units of Bar, so that atmospheric pressure (14.7psi absolute) is 1.013 Bar. If we are working at 90psig, this is almost the same as 7 Bar, and this is the value that we shall use in our examples.

Below the line, the steam is partially wet (or partially dry depending on whether you are an optimist or a pessimist). In an engine working well, we can expect the exhaust to come out wet with a characteristic white plume. In the area above the line, the steam is superheated, its increasing temperature being clearly indicated on the lines which are nearly horizontal.

Enough of this lecturing! Let us now look at a practical example. The figures that apply will be accurately entered from the steam tables, which also contain data about steam volumes and water properties.

Steam at 7 Bar pressure has a specific volume of 273m³/kilogram. If it is put to work in the engine with a cut-off of say 30%, this results in its volume being expanded to 910m³/



kilogram. In this state the exhaust pressure is 1.95 Bar, or about $14\frac{1}{2}$ psig, which is not unreasonable. Starting with feed water at 20deg. C, the heat in the water $h = 84\text{ kJ/kilogram}$. Steam at 7 Bar contains $H, 2,763\text{ kJ/kg}$, with entropy $S, 1.5301$.

An isentropic (or ideal) heat drop is given by a vertical line to 2 Bar at which point the steam would be 92.5% dry, at an energy level 2,541.7kJ/kg. Taking one heat level from the other, the ideal heat drop is therefore 221.3kJ/kg (line AB on the chart).

But in the real world, nothing is ideal and we can assume an isentropic efficiency of 75%, meaning that the likely heat drop would be 166kJ/kg and the exhaust steam condition is 0.95 dry (5% wet, line AC on the chart). The vertical distance between points A and C is 75% of AB.

Now the energy input had been $(2,763 - 84) = 2,679$ and

the useful output is 166.
Therefore, the thermal efficiency
is 6.2%.

A digression

So that we may understand the significance of the 'wet' steam issuing from the exhaust, just look at the densities involved. One kilogram of steam at 2 Bar occupies a volume of 886m^3 . Whereas, the 5% of water liquid discharged with the steam occupies only 0.00005m^3 , in other words, only a tiny volume of the exhaust, finely divided as an aerosol. This is characteristically observed as a white plume.

If you have ever stood downwind of a steam locomotive on a fairly humid day, you will understand the significance of what I am getting at.

Back to the plot

We shall now explore the effect of superheating. Consider say 55deg. C superheat applied to

the steam. Steam from the superheater is at 220deg. C and the total heat starts off at 2,889kj/ kilogram. The isentropic heat drop is calculated as 241.0kj/kg (line DE). At 75% efficiency this is reduced to 180.8kj/kilogram.

Doing the same sums as before, the steam exhausts with still about 1deg. of superheat, virtually dry saturated (line DF), and the thermal efficiency becomes 6.44%, only marginally better than the saturated steam case.

Let us now look over our shoulder at the position if superheat were increased still further, say by another 50 degrees. For 7 Bar steam superheated to 270deg. C, the total enthalpy is calculated as 2,996kj/kilogram. Again isentropic expansion to 2 Bar would yield 11deg. of superheat and an enthalpy level of 2,729kj/kg, i.e., an isentropic heat drop of 267kj/kilogram.

Again applying an isentropic

efficiency of 75%, the actual heat drop is 200.25 kJ/kg and the thermal efficiency rises to 6.9%.

The effect of pressure drop

One thing which we have not considered is the effect of installing a superheater. Not only does it reduce the conventional tube surface area by taking up tube space, but there must also be a pressure drop across the superheater tubes from end to end. The effect of such a pressure drop is to lower the pressure at entry to the cylinders, not an easy quantity to calculate.

So, as an example, let us take a 3psig (or 0.2 Bar) drop across the superheater elements and rework the calculation for 55deg. of superheat.

The starting point now becomes 6.8 Bar and an enthalpy of 2,889.9kJ/kg, associated with an entropy of

6.9929. Isentropic expansion to 2 Bar at 75% isentropic efficiency leads to a heat drop of 177.1kJ/kilogram. Thermal efficiency is 6.3%, or very little different from the example without superheat.

The superheat temperatures in these examples are conjecture; in any case, conditions must vary greatly, depending upon the firing rate and the condition of the fire. So, although we may determine a certain set of conditions for analysis, the real world is very variable.

Achieving a superheat temperature

We have been examining various levels of superheat, without considering the temperatures which might be achieved in practice.

Stainless steel superheater elements are well-accepted installations, run in the firebox for maximum effect. However, to raise 55deg. of superheat in steam at 7 Bar pressure requires the addition of 4.7% of heat above the boiling point by the superheater itself.

Within the firebox, heat transfer from the fire is by a combination of conduction, convection and radiation.

Conduction from the solid materials in the area of the fire itself must account for much of the heat transfer.

Radiation from the incandescent mass occurs to the benefit of the water jacket around the firebox and also the superheater, the relative surface areas determining primarily how much heat is transferred in the two portions of the system.

However, within the superheater elements themselves, heat travels readily through the metal walls, but not very well into the steam itself.

On the other hand, in the firebox walls and roof, heat transfer to the water is extremely good. We know, therefore, that for like areas, heat transfer through the firebox walls to the water is significantly better than that through the superheater elements to the steam.

A lesser amount of heat transfer takes place by convection through the fire tubes, where turbulent movement of the exhaust gases passes heat through the walls both of the fire tubes and of the superheater elements.

The performance of the tubes will obviously deteriorate as they soot up or become blocked.

It would be possible to measure the thermal efficiency of the boiler itself, by measuring the temperature of the exhaust gases in the smokebox. The efficiency depends also on the composition of the exhaust gases, as indicated by the level of oxygen remaining in them. If the oxygen level is too low, accompanied by the presence of carbon monoxide, this indicates incomplete combustion and the efficiency drops dramatically below the ideal value when the combustion is complete and most of the oxygen is used up.

On the other hand, if the oxygen is too high, due to the presence of excess air, say by the firehole door being left open, then the efficiency also drops off significantly.

It is impossible to say just how high the boiler efficiency might be in our small sizes. From the industrial analogy it is likely to be in the range of 60% or so, but this value is likely to fluctuate wildly during operation.

A sting in the tail

It appears from this mathematical analysis that, in our process conditions, superheat is largely a waste of time; this must be true if the boiler is steaming freely and if dry saturated steam reaches the cylinders.

However, especially if the boiler design is fairly squat with little steam space, such as that in a Gresley Pacific, Stanier Duchess or Collett 4-6-0, the steam generation is likely to yield a certain amount of water spray, or priming, especially if the steam take-off is anywhere near the top surface of the firebox.

In such circumstances, the function of the superheater becomes that of a steam dryer, merely evaporating the droplets of water that escape the evaporating surface.

In such conditions, the superheater's value outweighs its disadvantage and you are likely to end up with dry steam entering the cylinders.

It would be interesting if we could see inside the steam generation space of a boiler. Would the violent rate of steam release lead to dense clouds of water droplets, or not?

The nearest I have got to it is during my years in the sugar industry. Saturated syrup was boiled in large steam heated pans to encourage crystallisation. The syrup circulated through vertical tubes, which were steam jacketed and the whole thing worked under vacuum. In order that the operators could see what was going on, glass portholes were provided for illumination and observation. So, the boiling process was visible; no steamy atmosphere was apparent and no obvious entrainment of the liquid in the vapour leaving on its way to condensation. Such an example is not directly transferable to our operations, but the point it teaches is that steam release

from a liquid surface can be neat and orderly.

On the other hand, the phenomenon of priming is well known, especially if the water level gets too high. It is not unreasonable to assume that water entrainment will take place in the miniature environment.

So you can weigh up the position for yourself; in a large mainline prototype of boiler, superheat is likely to be a worthwhile proposition adding to the efficiency of working, or rather making sure that the steam is dry. In a narrow gauge industrial type of locomotive it is a waste of time, provided that there is a good separation area for the steam above the firebox crown.

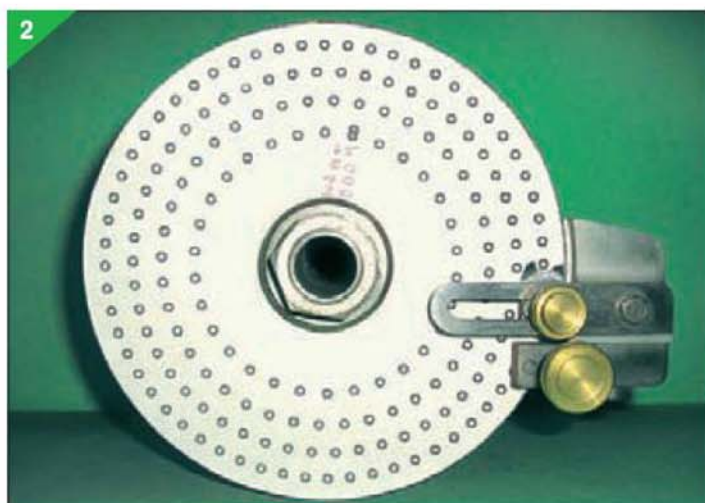
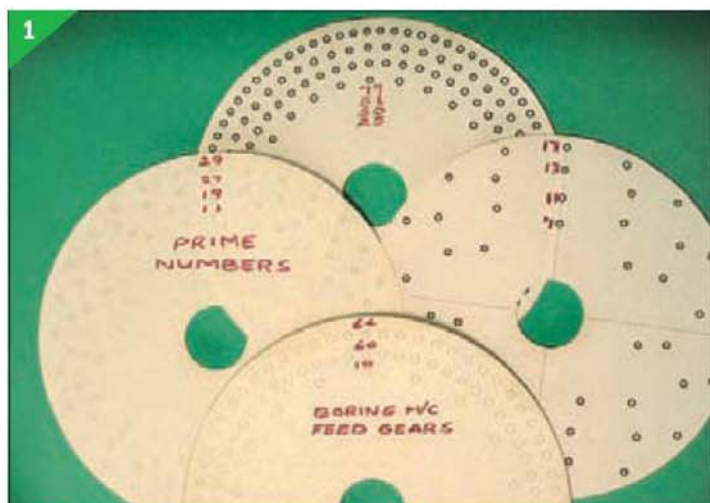
I thought long and hard about what to put into my *Anna* design and opted for saturated working. In this case I was running true to prototype.

Incidentally, a side benefit accruing from saturated working is the possibility of lubricating the cylinders with the thinner grade of steam oil, which is likely to reduce friction, albeit imperceptibly in a free-running design.

ME

Anna photographed at a recent exhibition (photo: Neil Read).





DIVIDING WITH PAPER PLATES

Maurice Turnbull describes his method of producing gears and other components that involve prime numbers or awkward indexing arrangements.

1. A selection of paper dividing plates made by the author.

2. A paper plate in use on the home made dividing head.

In M.E. 4298, 27 April 2007, Mr. Dick Clifton of the Isle of Wight wrote a letter describing his ideas and methods on dividing, particularly awkward numbers. I would like to describe a method I devised some years ago to do the same. I have two dividing heads, one commercial and one home-made. Like most model engineers, when cutting gears I have waited with trepidation to see if after one revolution the cutter will pass cleanly through the gap between the first and second tooth. So far it always has done, but the stress I can well do without.

My preferred method therefore is to use my home made head with the worm removed and the plate mounted on the end of the spindle for direct dividing. This of course means that in most cases a plate with the exact number of holes is required, but if one is not available this is not a problem as I can print one on a computer. Various examples can be seen in **photo 1**.

I think that the most basic CAD programs (i.e. cheap) have

the ability to do radial copying.

To start making a plate, first draw vertical and horizontal centre lines. About the intersection draw a circle equal to the diameter of your normal division plate, mine is 6 inches. Again draw another circle, but this time slightly smaller than the mounting hole of the normal plate. Why smaller? That will be explained later.

At a short distance inside the outer circle draw a much smaller circle, say about 0.125in. (3mm) dia.; this represents the 'hole'.

Using the radial copy/circular array facility copy this 'hole' as many times as required. This is usually done by, indicating the object, the 'hole', the number of copies required including the original, the angle of rotation (360deg.) and the centre of rotation. The computer doesn't care how many it has to draw, or if they are prime numbers or not (note: *CAD for Model Engineers* by D. A. G. Brown, Workshop Series No. 29 explains this type of copying).

Personally I then delete the centre lines but this does not

matter one way or the other.

The 'plate' can now be printed out using the printer's maximum dots/inch (resolution). Thick paper or thin card is best.

Roughly cut round the outside with scissors then place, printed side down, onto an ordinary division plate. Adjust it until it is truly concentric then clamp with strong paper clips of the bulldog type.

The 'slightly smaller' circle should be clearly visible in the centre hole of the metal plate. As a check of concentricity, this is very important. With a very sharp knife, of the scalpel type, cut out the centre of the paper or card, using the metal as a guide. Trim up the outside, write on it any information that is required, and the 'paper plate' is finished.

The new plate is fitted onto the dividing head spindle, backed up with an ordinary plate and clamped with a large washer (**photo 2**). As can be seen in **photos 3** and **4**, I rather went to town over the 'detent'. This was just for the fun of it (but isn't that what it's all about?). A much simpler reference point would do just as well. All that is required is some kind of fixture with which to align the printed 'holes'.

The top knob allows the fiducial to be slid along its slot to cover different rings. The fiducial itself is a piece of shim steel which is bent to press lightly on the paper, so in effect giving a knife edge to align the circles with. It should also



should also be truly radial to the spindle. I always choose to align the bottom edge of the circles.

The lower knob operates what is a kind of calliper brake. Nylon pads clamp the plates front and back and are pivoted vertically so as to be self aligning, so preventing them from turning. This is used as well as the usual spindle lock. In Mr. Clifton's case the disc mounted on the lathe mandrel was much larger than my dividing plates, which is all to the good. The paper plates fixed onto the face can be up to the full diameter and, the bigger the 'hole' circle diameter, the better the radial accuracy.

Some years ago this system was exhibited at Alexandra Palace where it received some criticism as to accuracy, being regarded as only suitable for items like cylinder covers, etc. I would certainly argue about that, and though I would never claim this to be a precision system I do believe it is as good a way of getting practical results for unusual and prime numbers as many others and probably better than some.

Cards once printed can be kept and used again if required. I have used it to produce several sets of gears having unusual ratios, all of which run smoothly together.

I had the honour to be invited to exhibit at the Bristol Exhibition in August 2007 and I included this dividing head with all its accessories. It is also hoped that it will be on the SMEE stand at Ascot in September.

Postscript

After writing this article I wondered if there was any way it could be used with my other dividing head. This is a Vertex BS-0, which I believe is quite common amongst model engineers. Referring again to Mr. Crofton's need to make 63 divisions, I checked the tables in the manual and found that this was not possible with this machine using the division plates supplied. Differential indexing is really required and this would need the more complex BS-2 head. However, I thought that it may be possible to make a paper plate to give the necessary divisions and so, after some experimentation, it proved to be.

The angle between two adjacent 63 divisions is 5.71428° . The BS-0 ratio is 40:1, therefore one turn of the handle is equal to 9 degrees.

If a paper plate with 63 'holes' is made then 1 hole equals 0.14285° . ($9/63$).

If 40 of those 63 holes are counted off then

$0.14285 \times 40 = 5.71428^\circ$, which is the target division.

A plate with 63 divisions was quickly made up and attached to one of the commercial plates supplied with the machine. The fingers were set to count 40 divisions and the zero on the output faceplate protractor lined up with the marker on top of the head (see **photo 5**). Sixty-three movements later the zero was again in line, so obviously it worked.

However, there are a few points that need watching.

1. The paper needs backing up with a normal plate but the



circle of printed 'holes' must lie between two rings, or the detent may punch through and cause misalignment. Perhaps a better solution would be to make up a dummy backing plate.

2. The outside of the plate is 100mm in diameter and the bore is 21. I found that a printed circle of 88mm dia. was suitable. The printed 'holes' should be about 3mm in diameter.

3. Cut out the paper as already described for the direct head and stick it on using small pieces of double sided tape (carpet tape is ideal). Cut holes for the mounting screws.

4. On the BS-0 the fingers are pressed on to the plate by a spring clip fitting into a groove. The addition of the thickness of the paper makes this tight, but with care it can be managed.

5. Because the detent is not positively located care must be taken when moving the fingers so as not to knock it.

Photograph 5 shows the set up.

3. Another view of the home-made dividing head.

4. A close-up of the fiducial and the clamping device.

5. A paper plate in use on the BS-0 dividing head.

This then is another way of using paper plates. Personally I would only use it for a one off. If I wanted to make more than one item I would use the paper plate to make a metal one with drilled holes. Any slight radial error which may occur with the paper plate will be reduced by 40 times on a drilled one and then again by 40 times on the workpiece. I do not know to what extent this method can be used as a substitute for differential indexing and I do not intend to try and find out. However, I offer the idea as a possible way of getting round a workshop problem. **ME**





PART 2

Continued from page 134
(M.E. 4305, 3rd August 2007)

M. K. Ranson

The construction notes for Julie Anna continue with descriptions of the gas tanks, their valves, and the engine.

JULIE ANNA: from Sketch to Steam

My methods of building gas tanks and their related valves (photo 5) have evolved as solutions to problems that arose from operating scale steamboats.

The layout of valves permits reliable filling and allows residual fuel to be removed at the end of the season without wasting gas.

Gas tank

The construction details of the gas tank are shown in fig 3.

There are only two common sizes of thread – $\frac{3}{16}$ x 40tpi and $\frac{1}{4}$ x 40tpi, chosen so that any tank or burner I made could be swapped to another vessel, when needed, simply with the

removal of one bolt and a union nut.

The bushings are straightforward turning jobs, but note that the bushing on the side of the tank is blind tapped for mounting the heat shunt.

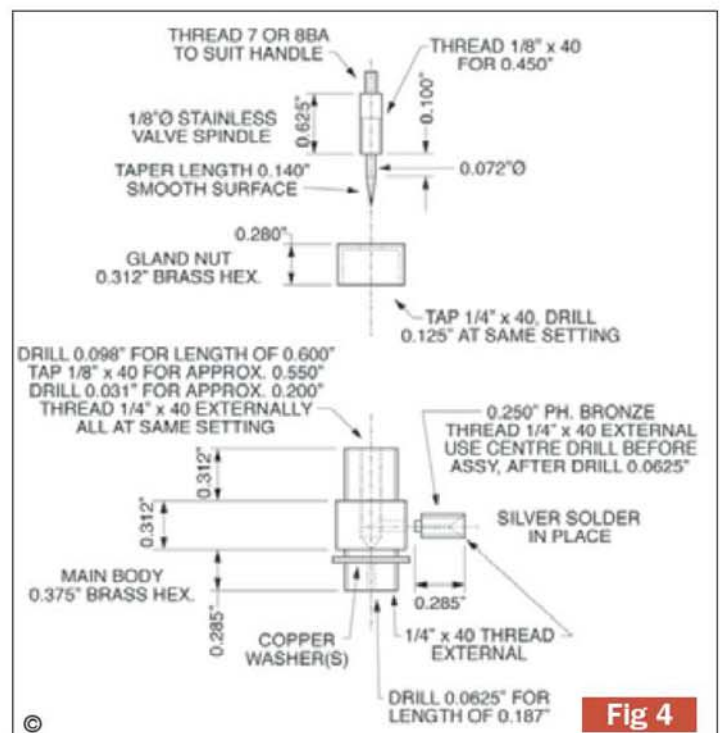
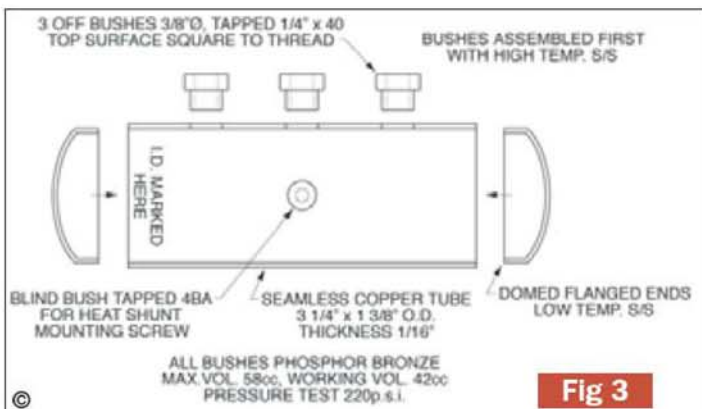
Heat shunt

The tank features a small heat shunt device for warming it up a bit during cooler or cold

weather operation. It is a moveable copper strip attached to the tank and positioned, when needed, above the back end of the burner. Photograph 6 illustrates the shunt in the operating position, e.g., up where it is able to transfer a small quantity of heat into the tank, solving a few problems associated with gas-fired steamboats.

5. Gas tank with valves (l. to r.) for venting, burner control and filling.
6. Heat shunt in position to transfer heat to gas tank.

Fig 3. Gas tank.
Fig 4. Fill valve.





In the North of England, even in summer, there are a few cold days. If this is not compensated for, burner operation differs markedly from the hot ones.

I discovered that the pressure inside a gas tank goes up and down like a yo-yo depending on ambient temperature. A tank



at 55deg. Celsius can have an internal pressure of about 100psi, but at seven deg. C just 20psi – quite a difference. These figures vary slightly between samples of supposedly identical gas or mixes.

Another reason for the heat shunt is that as gas is

consumed, its expansion cools the tank and with no external heat source the pressure goes down. Particularly on cool days, the flame may go out. So, it is necessary to warm the tank up a little, not too much, just a bit.

In the past, I made automatic pressure regulators to keep a steady pressure at the burner. They took a lot of work to make and did not function on a cold day. It took years to recognise that the tank was cold. Hence, the pressure went too low to work any regulator or keep the flame lit properly.

It became a priority to keep the tank warm, but, too hot is just as much a nuisance as either the flame blows out or the safety valve releases.

For a very hot summer day, the heat shunt can be easily removed with one nut. It could

7. Heat shunt in 'off' position. (see text for description)

8. Close-up of gears showing thickness of rims for flywheel effect.

Fig 5. Vent valve.

Fig 6. Supply valve.

Fig 7. Base plate.

Fig 8. Cylinder.

even be made spring-loaded, or just pushed out of the way as shown in **photo 7**.

Shunt adjustment

A spare pressure gauge is easily attached to the fill valve bush and the tank pressure monitored over a period of time, say 15 minutes. For an example, a starting pressure of 35psi can be kept to about 30psi if the heat shunt is the

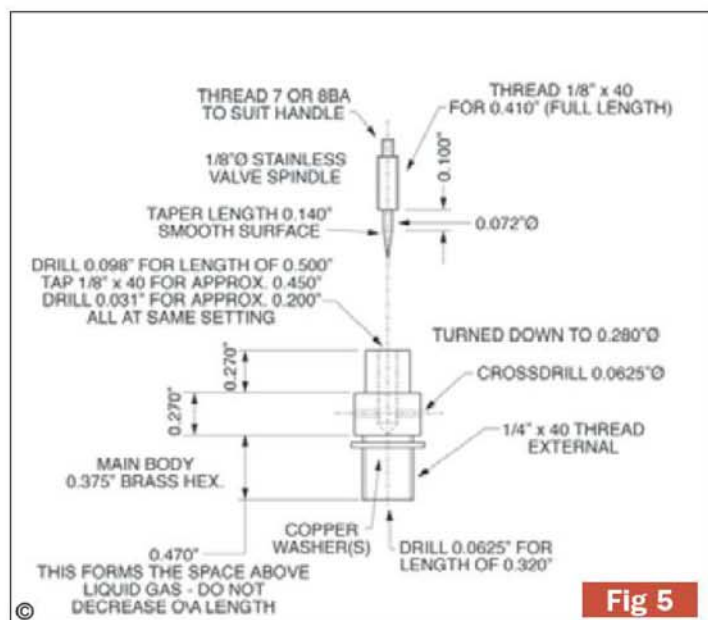


Fig 5

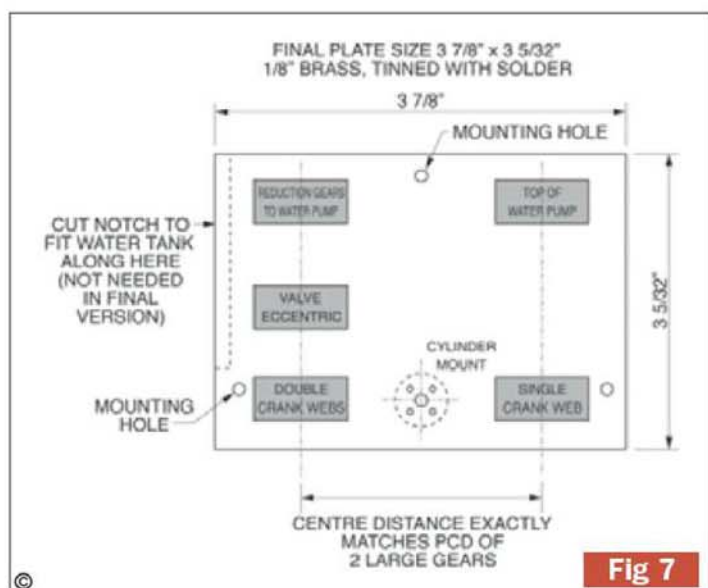


Fig 7

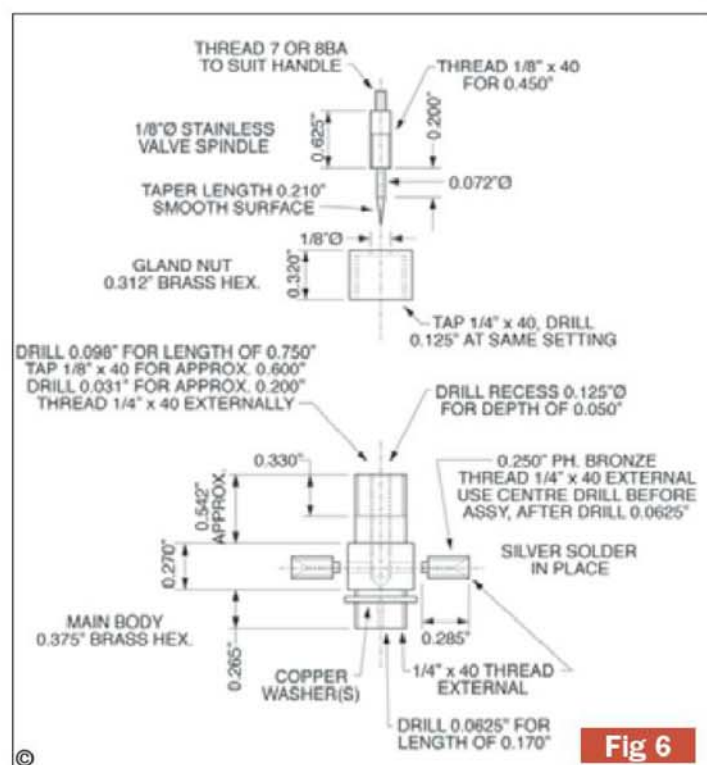


Fig 6

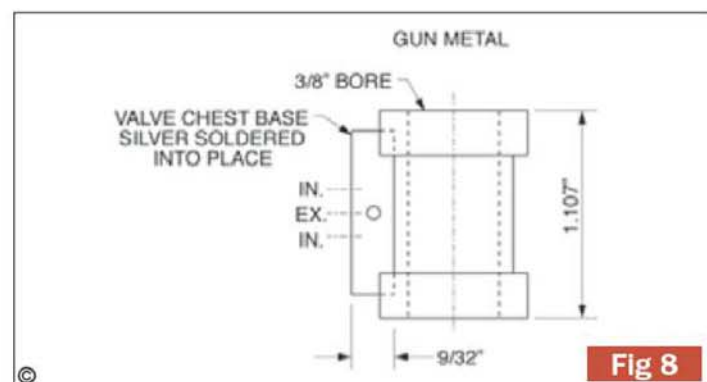


Fig 8



9. Main cranks and connecting rods.



10 Left side secondary drive with valve eccentric and waterpump drive pinion.

11. View of the valve rod's rocking arm drive and its mount.

12. Cross-beam assembled on piston rod.

Fig 9. Crossbeam.

Fig 10. Connecting rod.

Fig 11. Small displacement lubricator.

Tank valves

The three valves, filling, vent, and supply, are mounted on the gas tank (figs 4, 5 and 6). They follow a similar pattern and are straightforward to build.

The long taper on the stainless steel needles should be as smooth as possible and the internal drilling and tapping must all be done at the same setting.

You could reduce the dimensions, if desired, they may be a bit heavy; very few are critical.

The packing is graphited yarn.

The length of the lower threading on the fill valve is important as this determines the free space for gas to exist above the liquid fuel.

right size and position. If the pressure goes up too much, snip a bit off the copper strip. No science in this, just do it slowly and patiently, then watch the spare pressure gauge

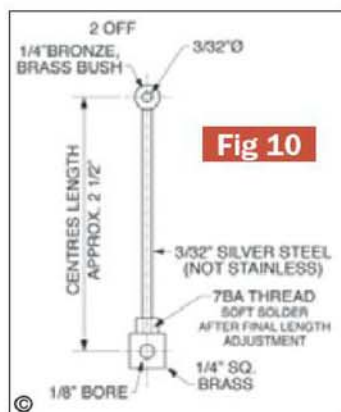
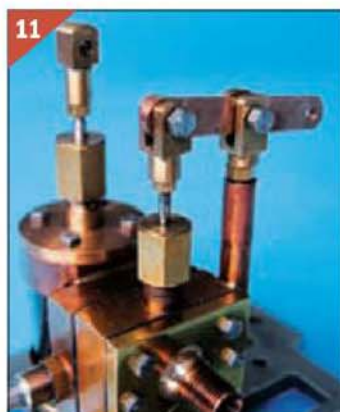


Fig 10



11



12

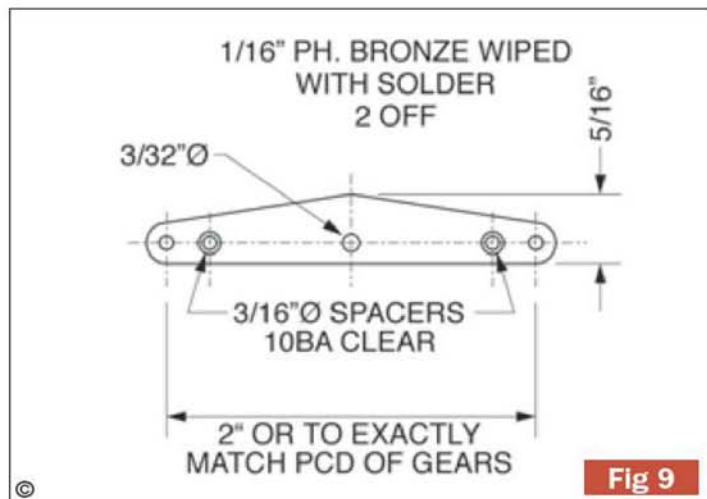


Fig 9

The supply valve has two outlets threaded $\frac{3}{16}$ in. x 40tpi, one feeds the burner, the second is for a pressure gauge.

Pressure gauge

The pressure gauge (about $\frac{3}{4}$ in. dia.) is needed to observe the pressure in the supply line to the burner (photo 5). Because the pressure can be easily observed, if the jet is blocked, the tank is empty, or it is a very cold day, these will all be indicated on the gauge.

Adding the gauge means a bit more work and time, but with this installed, you will not be baffled at the pond-side

because the burner will not light. A glance at the gauge will tell you the problem!

Engine

There are few detail drawings for the engine because I did not draw many at the time. However, three things were sketched out: the base-plate, the cylinder, and the cross-beam.

The distance between the propeller-shaft centres must be the starting point for all other dimensions. This determines the size of the gears. After much head-scratching, I decided to make the centre-line distance exactly 2 inches.

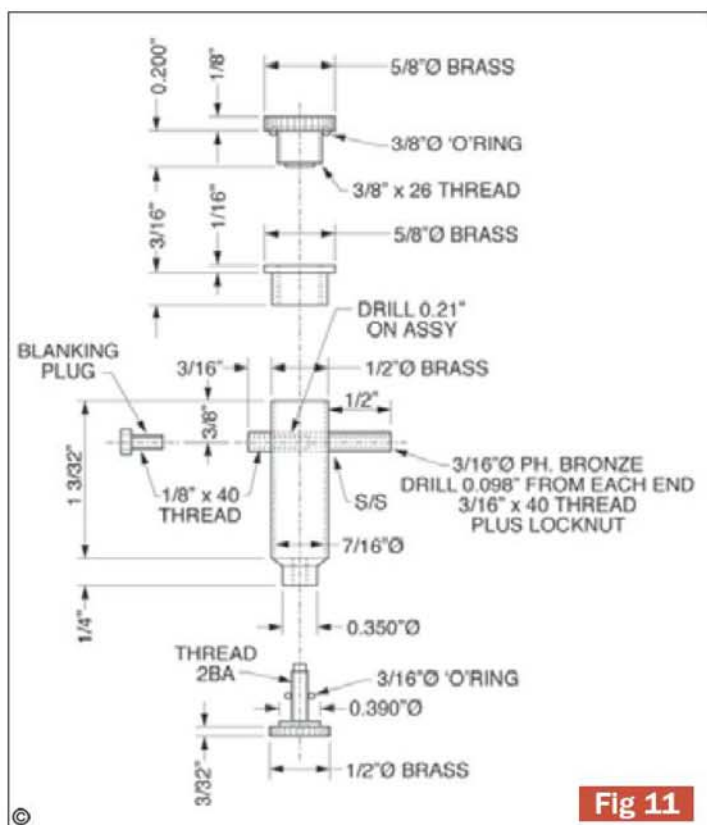


Fig 11

Gears

I studied the gears in the two photographs of the prototype and counted 16 teeth in one-quarter of the circumference - a total of 64 teeth. The gears needed for a centre-line distance of 2in. were 32DP (0.8MOD might due) and were purchased.

As delivered, the gears were solid, so the centres were recessed, drilled and filed to make four spokes or quadrants. Looking at them in the photo the rims may seem quite thick. This is necessary to act as flywheels (**photo 8**).

Bearing supports

Next, I made the two bearing blocks for the gear shafts (**photo 9**). The blocks each house two ball bearings.

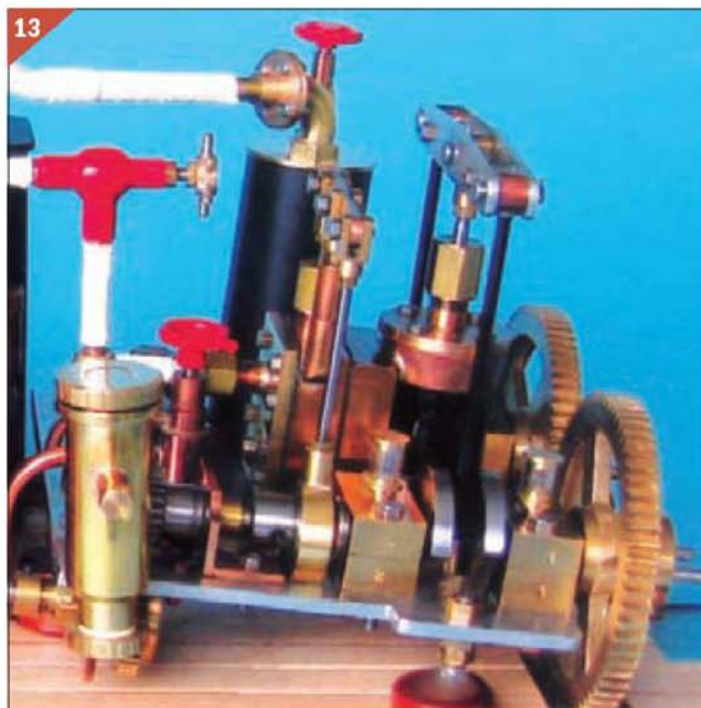
The valve eccentric bearing support contains another two ball bearings in the block stamped, '2' (**photo 10**).

The engine just grew gently towards the space allocated for the water-pump, with each item being fitted as it was constructed.

The cylinder block was temporarily fitted in place with a small amount of epoxy resin after the crossbeam and two crank webs had been made.

Baseplate

The base plate is $\frac{1}{8}$ in. thick



13. Left side of the engine showing double crank bearing supports, valve eccentric and waterpump drives.

Fig 12. Boiler check valve.

with a width of $3\frac{7}{8}$ by $3\frac{5}{32}$ in. long (**fig 7**). On the left-hand side can be seen a cut-out notch, this was originally 'plan A' to allow for the installation of the water tank. However, 'plan B' saw the displacement lubricator fitted there instead.

Cylinder

The cylinder (**fig 8**) was another 'guesstimate'. It has a bore of $\frac{3}{8}$ in and a stroke of $\frac{5}{8}$ in. The cylinder's length is 1.107 inches and a rectangular valve chest base is silver-soldered on the side.

Valve spindle

I determined that the valve spindle should be driven from the top and the valve eccentric would be down low, driven from the crankshaft. This meant a vertical support bracket silver-soldered on the top corner of the valve chest. Thickness of the chest is 0.325 inches (**photo 11**).

The valve rod is driven by a small horizontal rocking beam with a slot at the end above the valve chest. This slot compensates for the slight difference in length needed as the beam rocks up and down. Valve travel is $\frac{1}{8}$ inch.

Piston rod

There are no guides whatsoever on the piston rod. Providing the two cranks are synchronised exactly, there should be no sideways force on the piston rod and the main cross beam should go up and down always remaining perfectly horizontal. To allow for any tiny differences, the top end of the piston rod pushes the cross beam via a fork and pin which can swivel (**photo 11**).

Once, I managed to set the engine up with a slight error; all that happens is the beam rocks like a see-saw and the engine does not rotate.

Cross beam

The cross beam (**fig 9**) is an

assembly built-up from two pieces of $\frac{1}{16}$ in. flat phosphor-bronze (**photo 12**). These two pieces are held apart by two bronze $\frac{3}{16}$ in. dia. spacers. All the beam parts are wiped with soft solder prior to assembly with 10BA bolts.

The three pins for the piston and connecting rods are mild steel and are $\frac{3}{32}$ in. diameter, retained with small split pins.

Connecting rods

At each end of the beam is a connecting rod made from $\frac{3}{32}$ in. dia. silver steel, not stainless (**fig 10**). They are soft soldered at the lower end after a final adjustment of the length. They could have been made from $\frac{1}{16}$ in. dia. rod instead. It would have been lighter, but also might have been rather wobbly on the 'push' stroke.

Crankshaft

The crank pins are made from $\frac{1}{8}$ in. dia. mild steel mounted on turned and cut-out steel webs. On the right side of the engine is a single web. In photo 13, are two bearing blocks labelled '1' and '2'. This split crankshaft arrangement allows the webs to be separated to allow insertion of the connecting rod.

The second shaft (passing through block '2'), is supported by two ball bearings and also drives the valve eccentric. The drive continues to the waterpump pinion gear which is supported by a sleeve bearing (**photo 10**).

● To be continued.

Boiler thread correction

In the previous article in this series, M.E. 4305, 3 August 2007, page 133, the safety valve bush should **not** be made with a fine thread as stated.

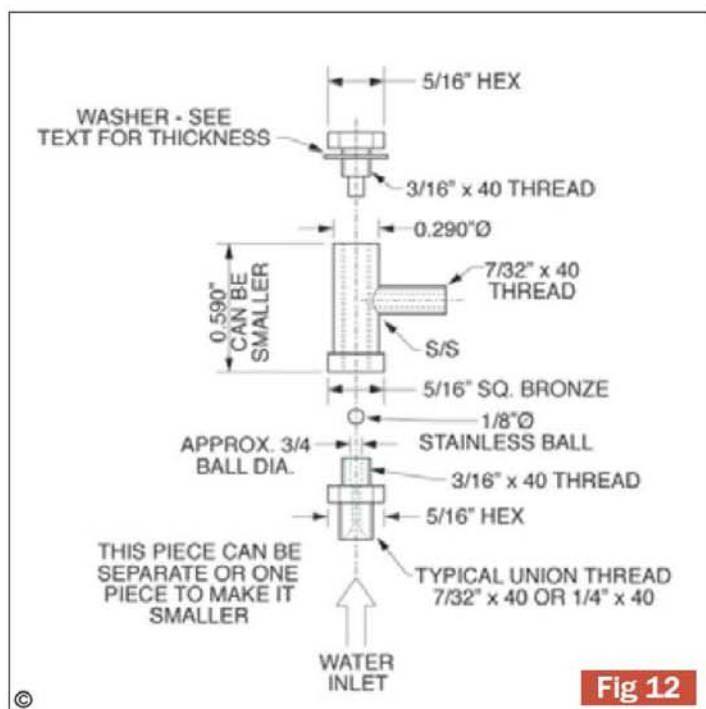


Fig 12

LETTERS TO A GRANDSON

NO. 104

M. J. H. Ellis
concludes his
look at gear trains
with a worked
example plus
a summary of
results.

Continuing from last time, my procedure was now to use this table (fig 3, M.E. 4305, 3 August 2007) in the way I am going to describe. As an example, I will choose a thread at random; I will take OBA. Incidentally, there is something a little odd about OBA as both my engineers' tables show it as 25.38tpi, whereas OBA is supposed to be identical with 6mm, which has a pitch of 1.0 millimetre. Confusion is only worse confounded when I turn to Fowler's *Mechanics and Machinists' Pocket Book*, in which the pitch is confirmed as 1.0mm, but the Imperial equivalent is shown as 0.0394in., which translates into 25.381tpi. And all the time, the Metric equivalent is 25.40mm = 1 inch.

Now, I don't pretend that these discrepancies are of much practical importance. Yet I am fussy enough to think that such discrepancies ought not to exist; if you think that I

am excessively pemickety over such a matter, let me remind you that there have been occasions when apparently trivial discrepancies have had very important consequences.

I call to mind, for example, the discovery by the distinguished physicist Lord Rayleigh that the density of nitrogen obtained by decomposing nitrogenous compounds was a little less, (just under half a percent) than of that extracted from the atmosphere by the removal of the oxygen, carbon dioxide and water-vapour.

Further investigation by Lord Rayleigh and William (later, Sir William) Ramsay revealed that the nitrogen from the atmosphere contained in small proportions the inert gases helium, neon, argon, krypton, and xenon. In the course of the inquiries, 120 tons of air were examined. From the practical point of view the inconsistency was well worth investigating, if only because it made argon-arc welding possible.

Digressing again! I see

2007) is merely fortuitous. Under each of these I now enter the quotient obtained by dividing it into the ratio required overall: 3.175. If the top line is regarded as trial values of x, the second line now gives the corresponding ideal values of y.

Finally, I compare each of these possibly desirable values of y with the available values (i.e., those listed in fig 2) to see if any of them are close to each other. In practice, I found that this meant a difference of no more than about 0.0050. This difference I then entered underneath. All this may seem at first sight rather complicated, but with a little practice I found myself running through the procedure quite smartly.

You will see that for x = 2.60 and 2.20 the differences in the fourth line are quite small, and the figures in the first and third lines correspond to ratios of 13/5 x 11/9 and 11/5 x 13/9, which are actually identical, and would give a thread of 8 x 13/5 x 11/9 = 8 x 65/25 x 55/45, = 25.42tpi.

The error amounts to only 0.02 of a thread in the inch, and this is representative of the kind of result which the method is capable of producing, even using no more than the shorter range of change wheels with from 20 to 65 teeth.

You may like to note that I did not carry the process beyond x = 1.75. This was because up to this point the figure in the top line had been greater than that in the second line, but with 1.75 and 1.8143 this became reversed. To have carried the calculations any further would have been pointless, since they would only have produced the same ratios in the reverse order. On the graph, this is tantamount to moving along the graph across the axis of symmetry KZ.

By using this same procedure plus a certain amount of patience, I was able to produce the results which are summarised in the table (fig 5) On a final blast on my own trumpets, I observe with Toad-like gratification that at 19.067 my approximation to 19tpi is a little better than I claimed in the first place.

Your affectionate Grandpa.

FIGURE 4

Worked example: No. OBA 25.4tpi. Reduction Factor required, $25.4/8 = 3.175$

Value of x.	3.25	3.00	2.75	2.60	2.50	2.40	2.25	2.20
$3.175 / x$	0.9769	1.0583	1.1545	1.2212	1.2700	1.3229	1.4111	1.4432
Nearest value	-	-	-	1.2222	-	-	-	1.4444
Difference	-	-	-	0.0010	-	-	-	0.0012
(Continues	2.1667	2.00	1.857	1.833	1.80	1.75	etc.)	
	1.4654	1.5875	1.7097	1.7321	1.7639	1.8143		

The best fits are obtained with 2.60×1.2222 and 2.20×1.4444 .

From the table (fig 3) these correspond to $13/5 \times 11/9 = 65/25 \times 55/45$ and $11/5 \times 13/9 = 55/25 \times 65/45$, both of which give $8 \times 55/25 \times 65/45 = 25.42tpi$. Error, 0.02 of a thread per inch.

FIGURE 5 SUMMARY OF RESULTS

THREAD	TPI	GEAR TRAIN COMBINATION	TPI	ERROR TPI	%
1/4in. and 1/2in. pipe	19	55/25 x 65/60	19.067	0.067	0.35
OBA	25.4	55/25 x 65/45	25.42	0.02	0.079
1BA	28.25	55/20 x 45/35	28.29	0.04	0.14
2BA	31.35	50/20 x 55/35	31.43	0.08	0.26
3BA	34.84	40/20 x 65/30	34.67	0.17	0.49
4BA	38.46	35/20 x 55/20	38.50	0.04	0.10
5BA	43.1	45/20 x 60/25	43.20	0.10	0.23
6BA	47.85	50/20 x 60/25	48.00	0.15	0.31
7BA	52.91	55/20 x 60/25	52.80	0.11	0.21
Metric Pitch					
0.6mm	42.33	65/20 x 65/40	42.25	0.08	0.19
0.75mm	33.87	65/20 x 65/50, or 65/25 x 65/40	33.8	0.07	0.21
0.9mm	28.22	65/30 x 65/40, or 55/25 x 40/25	28.167	0.05	0.18
1.0mm	25.40	55/25 x 65/45	25.42	0.02	0.079
1.25mm	20.32	60/20 x 55/65	20.31	0.01	0.05
1.5mm	16.93	50/20 x 55/65	16.92	0.01	0.06
1.75mm	14.51	40/20 x 50/55	14.55	0.04	0.28
2.0mm	12.70	35/20 x 50/55	12.73	0.03	0.24
2.5mm	10.16	50/35 x 40/45	10.159	0.001	0.01
3.0mm	8.467	55/40 x 50/65	8.462	0.005	0.06

no good reason not to take the pitch of OBA as 25.4tpi; in one of my letters (No. 86 - Ed.) I mentioned that the Weights and Measures Act, 1963 established the Imperial Yard as 0.9144 of a metre, so that the legal conversion factor, inches to centimetres, is $91.44/36 = 2.5400$.

Accordingly, we can now take the pitch of OBA as 25.40tpi, and the reduction ratio required by an 8tpi leadscrew is $25.40/8 = 3.175$.

Please refer now to my working sheet (fig 4). First, I set out in a row the available values of x and y; the fact that they are in inverse order to my list (fig 3, M.E. 4305, 3 August



ON NEEDLE ROLLER BEARINGS, SHAYS and other matters...

Keith Wilson

discusses how he solved a problem with a needle roller bearing application, then describes a fine model Shay locomotive and the grand opening of the new Echills Wood Railway.

It would not be quite correct to ignore a certain point on the use of needle roller bearings. As used in 'our' sizes they are generally completely 'snag free' and I only know of one minor worry.

Our puffers utilise under-stressed bearings, mainly because of the old 'square-cube' law of physics. This means that main bearings such as all axles are suitable for many miles of operation on ordinary silver steel. It may come as a surprise that silver steel is often easier to machine than mild steel. Of course slightly different methods have to be used, such as slower cutting speeds, but with a sharp tool - preferably a carbide tipped lathe tool or titanium nitride coated - and some juice (soluble cutting oil) with marginally slower speeds and finer cuts there is no problem.

From my own experience, on main or driving axles after something like 3,000 miles of heavy duty working you can only see where the bearing has rolled, wear is undetectable.

An interesting verification of this lies in my first GWR 4700 in 7 $\frac{1}{4}$ in. gauge. I used only a set of $\frac{1}{8}$ in. dia. rollers, running in the outer race (axlebox) of cast iron and an inner bearing surface of mild steel (axle).

This Consolidation was made about 1967, and has done some worldly work in Bahrain, Mombasa, and Wales; and I understand is still going strong. Not much wrong with those bearings!

However, there is one position (at least!) where trouble can arise. Assuming that your quartering is immaculate, the highest forces in 'the works' are in both ends of the connecting rods.

In the case of my own Prairie the main crank pin had worn away until it was about $\frac{1}{32}$ in. below diameter. Wear was not uniform, for the loads are oscillating. I had tried hardening the main crank pins of my own 1366, and one of them snapped like the proverbial rotten carrot with very little force when I tried to line-up the little end with the crosshead.

A bit of thinking took place and I theorised that it might be possible to harden only the outside of the pins, leaving the core relatively soft. The trick is to make the crank pin, with a tapped hole in the 'inside' of the pin (the part to be bonded into the wheel) and thread it onto a piece of mild steel to act as a handle.

Using preferably an oxy-acetylene torch, heat up to bright red as fast as you can and immediately quench in water. The theory is that the outside is the only part to reach hardening temperature and therefore the only part hardened, the inside or core remaining soft and therefore much more shock resistant.

As long as the pin is heated up quickly and not held in the flame, the core remains relatively cool. In any case only the outside is quenched quickly enough to harden, for it takes time for the core to cool.

I therefore made two new crank pins and heat-treated as above, bonding them into the crank pin holes in the wheels. I then gave of the old crank pins a dose of the same treatment and gripped it firmly in a vice. Taking a 7lb club hammer, I smote it pretty hard, of course at right angles to the vice jaws. The pin remained immaculate, but a small dent appeared in the hammer; so I decided the heat treatment was okay.

HSE!

It must be obvious that there are jobs of almost incredible risk, but if people know what they are doing all goes well. I am writing of a fascinating piece of work I did back in the '50s, in fact 1953. ➤

1. The engine of the Shay locomotive referred to in the text.

2. The locomotive itself taken at rest.





3. The Shay cab and control layout.

4. The non-drive side of the Shay.

5. Another example of a model Shay. This one was built by Mr. E. Addington and is to 3¹/₂ in. gauge. It was seen at the Harrogate Show this year (photo: Neil Read).

I was described officially as a student assistant, in fact, working at the Research Laboratories of the General Electric Co. at East Lane, North Wembley. One of the research tasks was dealing with the making of glass in furnaces in the range of 1,000deg. C to 1,800 ditto depending on the type of glass.

It may come as a surprise, but as temperatures rise, electrical conductivity increases in many substances, particularly in this case, glass. At about 500deg. C. the conductivity starts up, the hotter the better, if you follow me. It follows that it can be better to cook up the furnace (size - a small swimming pool!) with electricity.

Now one problem is: What do we make the furnace of? Obviously, most metals are ruled out except those with a melting point of at least

2,000deg. C, preferably more. One firm, at least in America, has or did have a tank of platinum. I don't know its cost, but the tanks we dealt with in Wembley were ceramic (correctly pronounced 'keramick').

On the tank we were dealing with, quite small compared to the 'commercial ones', the two sides were built with specially shaped blocks leaving three 'portholes' each side. Tank was loaded with a mixture of cullet, sand, etc. and cooked up by a big fat oil-burning jet over it. This took it up to the 1,400-1,500 mark, and of course the semi-liquid glass ran through the portholes and froze, (yes, Froze) thus acting as a plug (not the famous 13 amp one!).

It was therefore necessary to melt these plugs (one at a time!), insert a big graphite electrode, bolt on its shield (hollow, water-cooled) and chuck some water to freeze the porthole. This had to be done six times. How to melt the plugs in the first place?

For some reason oxy-acetylene would not or could not do, so we did it electrically. I, wearing thick asbestos gloves, held a wedge-shaped piece of graphite in each hand, my 'boss' had the control of a twin Variac set plus a hefty ballast resistor capable of about 100 amps. (Variac - a rotary autotransformer adjusting voltage from zero to about 280)

Once switched on, I went close to the porthole and touched the graphite electrodes together. This, of course, stuck



a nice fat arc with which I started melting at one edge of a porthole. Once we had a bit melted, it was possible to use the glass itself as one of the electrodes. When we had melted all across it was a case of shoving up the voltage and lowering the ballast resistance, the glass could be seen actually boiling! Now was the time to shove in the main electrode and couple up the water supply.

The ambient temperature (the air temperature around the tank) was not actually low, I can only guess that it was below 50, about the highest temperature that can be borne on the back of the hand. After a rest of about an hour, we started on the next porthole. It took the two of us a good long day to complete the job, and after the last one I was too knackered to do anything but sit in a cool draft for a time. Any questions?

The point of this story, which is perfectly true, is what would the HSE say about it? Perhaps just as well that in general, scientists were not covered overmuch on the grounds that we knew what we were doing!

Make (S)hay while the sun shines

Visiting the Echills Wood Railway at Kingsbury Water Park, my attention was taken (and how!) by the second Shay that I have ever seen. The first one is not far south of the Columbia River, which marks the southern boundary of Washington state in north-west America. Unfortunately, it is 'stuffed and mounted' on a big concrete plinth, barred off by a sort of tiger-cage which makes photography difficult.

The one shown here is somewhat more accessible, and whilst I am a teeny bit biased toward a certain Railway, I can tell an impressive



WILSON'S WORDS OF WISDOM

There is honesty in disbelief, whereas there is none in the distortion of facts.

Elizabeth van Buren



locomotive when I see one. I did not get a chance to take any measurements, because as some readers know I cannot get around as well as I would like. I'm not too bad within the house on flat surfaces, but to step outside even into my own back garden is another matter, preferably I require two walking sticks, mainly to keep balanced.

When in hospital recovering from my spinal re-bore, I was being 'kept in' by a very nice physiotherapist, mainly because I occasionally stumbled. It took the original top surgeon to authorise my discharge. I firmly believed that this was due to the evil habit now commonplace in this country; that of grossly exaggerating a minor injury in order to sue anyone in sight. In actual practice, if I fall it is my own fault. I have for amusement kept count of the number of falls since discharge, only counting those when I have gone all the way to the ground, total so far 46, one or two minor scrapes and a cracked rib or two. Not bad for

nine months, nerve recovery and toning of the peripatetic muscles cannot be fast. Lucky I learned how to fall about 70 years ago!

I do not see any great point in describing how a Shay works; it is pretty clear from the photographs. The driving of it is similar to any steam locomotive, but the exhaust is interesting having no simple relationship to the ordinary 2, 3 or 4-cylindered locomotive. I don't know what its nominal tractive effort is, apart from "sufficient, Sir" rather like the horsepower of a Rolls-Royce.

My wife Brenda and I had a trip all the way round the current layout, before it was open for passengers. A special train was laid on for staff only; the eight carriages were pulled with very little noise from the exhaust, which was quite rapid. Of course, running is quite steady, as occasionally doesn't happen with 'normal types of locomotive'. I believe full-size Shays were mainly used on logging trains, slow speed and good pulling being the rule. Old Ephraim Shay certainly had a good idea!

To modern times

The above was written several months ago, about March. Since then, on 14 July, the 'official opening' took place. Pete Waterman cut the famous 'pink ribbon'. There were some other 'bigwigs' present - no offence intended. I have no pictures, for electric chair and



I were located where there was a reasonable chance of getting pix of the 'grand parade'. I couldn't get all of them, but considering there were at least 26 steamers plus numerous diesel-electrics, good working locomotives, like a Hymech, and a Western class, and some that might best be described as modified lawn mowers. I intend no disrespect, for they demonstrate much sheer ingenuity on behalf of the builders thereof. It is encouraging to the newcomers, for such are vital for us all to survive.

With public paying passengers no longer around, one or two of the youngsters present had a go at driving the steam trains. There was no danger in this, at least I have never heard of any, and generally some of them are better than some of the oldsters. I was pleased to see some of the youngsters that I had helped this way back when we were still at Stoneleigh.

I found that I had taken over 150 pix, but when shoved in the computer and 'customised' there remained 90 to be considered as possibles for publication, so I have tried to settle a good selection. There were eight GWR puffers: King, (modest blush) Hall, County, 1400 class, 1501, 3150 (another blush, but its present finish is far better than anything I could do), two of the 55xx class ('Fireflies'). It was nice to see some double-heading - King

6. A nice Britannia.

7. BR 2-6-2T

8. GWR small 2-6-2T.

9. The flying mangle.

and 3156 for example, and a County-Hall pair. Among other locomotives were a 4-4-0 inside cylinder job, a fine Britannia, some narrow-gauge types, a 'Black 5', a Garratt, the Shay above mentioned, a B2 (I think) a BR Standard Prairie, a Royal Scot, a couple of Darjeeling-Himalayas, even a locomotive with a snow-plough!

After the main ceremonies and grand procession, passenger trains were run, three at a time. Even so, there were long queues waiting. Some traction engines were in use on the Echills Wood car park, including one that looked like 6in. to the foot, half full-size.

As usual at Echills big events, fresh pork baps were available, plus large quantities of salad materials, drinks of wine all round etc. Not that it matters much, but I never drink any form of alcohol, even disliking sherry trifle.

The Saturday weather was perfect, Sunday somewhat different, but I managed a drive in spite of the rain. This presents one of the problems with a long circuit (about $\frac{3}{4}$ of a mile) for if *Jupiter Pluvius* (rain!) strikes it can be some time before you can get back to the station.

● To be continued.

Notices

The next two talks at **Chelmsford SME** are *Distilleries* by John Smith on 25 September and *Life as a Blacksmith* by Harold Clements on 30 October. Both events will be at the Club House, Meteor Way, Waterhouse Lane, Chelmsford, Essex. The contact for further information is Tom Sharich (T. 01277 222611).

Those who attended the Guildford Model Rally in July (as I did) will not need reminding that it took place in the middle of the severe wet weather that caused much devastation across the country. We are pleased to publish the following note received from John Jones:

"Despite the dreadful weather the **Guildford Model Engineering Society** was still able to continue with their Model Steam Rally and Exhibition over the weekend of the 21/22 July, albeit with reduced attractions to normal. The society would like to thank all those visitors, exhibitors and trade stand holders for their patience and forbearance under what were, to say the least, difficult conditions. Next year's rally will take place, as usual, on the 19/20 July 2008 and the society looks forward to seeing everyone under better and hopefully dryer circumstances. Thank you all."

The **Southern Federation Autumn Rally** is being hosted by **Canvey Railway & MEC** over the weekend of 15/16 September at the society track site off Somnes Road, Canvey Island, Essex SS8 9RA. Saturday will be the actual rally day with the Sunday being an open and public running day for those staying on.

Barry Glover, President of the **Australian Association of Live Steamers**, intends to visit the rally at which the AALS Trophy will be awarded. The facilities at Canvey include a 1500ft. dual 3½ and 5in. gauge raised track, a 4,200ft. 7¼in. gauge ground level track, and extensive space to operate miniature road vehicles. Refreshments will be available (including a Saturday evening barbecue). Trade stands will be in attendance.

Camping facilities are available but must be booked in advance (contact Brian on 01702 512752). Further details can be obtained from Greg (T. 01375 373402) or the web site at www.cramec.org

The 60th Anniversary **St. Albans MES Model Show** will take place over the weekend of 29/30 September at the Francis Bacon School, Drakes Drive, St. Albans, Herts. The show will be open from 10.00am – 5.00pm each day. Admission is £3.50 (50p for

children) and car parking is free. The attractions include free train rides, working and static models, helicopter and control-line flying displays, vintage model displays, 'have a go' radio control model boats, Meccano models and a 'whole lot more'. Further information can be obtained from the society website at www.stalbansmes.co.uk

The **Kew Bridge Steam Museum** will be holding its Model Steam Extravaganza over the weekend of 6/7 October 2007. The event will be open from 11.00am until 5.00pm each day and further information can be obtained from the museum (T. 020 8568 4757, W. www.kbsm.org).

The **National 2½" Gauge Association, South Eastern Area** Autumn Rally will be held on 22 September (not the 29 as originally planned) at the **Surrey SME** track site at Mill Lane, Leatherhead, Surrey. Further information can be obtained from Des Adeley (T. 01722 718463) or Peter de Salis-Johnston (T. 01782 396990).

The **New Jersey Live Steamers** have a new secretary. Michael Plihcik (correct spelling) has taken over from Karl Pickles. Mike can be contacted at 810 Brown Road, Bridgewater, New Jersey 08807, USA. The society can also be contacted by email at njlivesteamers@gmail.com

UK Club News

The various rallies of the **National 2½" Gauge Association** have suffered mixed fortunes so far this year. Romney Marsh was very successful, there was a low turnout of locomotives at Cheltenham, Stafford had rain all day, but Rugby was an outstanding success and made up for things. The association has seen an influx of new members, possibly due to Tony Weale's articles describing the construction of *Ayesha II* in this journal.

Work continues apace at **Ascot Locomotive Society** on the new track site. Derek Alford behind his locomotive Wendy

1. Derek Alford having the very first run on the new track at Ascot.





2. A locomotive crossing the bridge at Canvey Railway and MEC.

3. Steve and Tim Harris' fine Deltic at Nottingham.

was the first to explore the relocated track on 21 May. The report states "it seemed a good idea after Wendy passed its boiler test." In all, 51 sections of railings, 57 posts and 100m of kerb stones have been laid in the last six months. This has consumed 45 bags of cement and seven tonnes of ballast.

The colour light signals made during the winter at **Ashcombe Miniature Railway** have been installed at Meadowbank. The process went well and they are now in use. Unfortunately, the society did suffer from some vandalism to the signals shortly after they were installed. Routine maintenance work, such as sleeper replacement, has also continued. The society visited the Mid-Hants Railway's wartime weekend on 23 June. In spite of mixed weather, it was an enjoyable visit. The visitors saw a good selection of locomotives and were also fortunate to see a flying display over Ropley station by a *Hurricane* from the RAF Memorial Flight and report that "Its Rolls-Royce *Merlin* engine sounded almost as good as a steam locomotive". At the last running night, locomotive No. 1, *R. Davidson*, failed at the start of the evening. A proper inspection still needs

to be carried out, but first signs are that the problem is with the motor. Members are hoping it is just worn brushes and that replacements can be found. If not, it looks as if the locomotive's future is not too certain. The present motor was fitted about 17 years ago as part of a power upgrade, but the locomotive is nearly 30 years old and that is a longer life than some full-size locomotives have managed.

Work on the raised track renewal at **Bristol SMEE** is progressing well and is currently completed up to the swinging beam. The society has acquired two new locomotives to boost the motive power available for running days. The first, built by member John Coleman between 1991 and 1993, is a GWR Class 28xx based on the Martin Evans *Swindon* design. The second is a BR Western Class 52 diesel locomotive.

The May Spring Rally at

Chesterfield DMES was a great success with good weather and a good collection of models both inside and out.

The May public running event at **Chichester DSME** was almost washed out, but "thanks to a few impermeable members," running did carry on throughout the afternoon. To make up for the low passenger count, an extra running day has been organised in October.

Activity during the working days at **Crawley Model Engineers** has centred on drinking tea by the gallon and putting the world to rights. The excuse is all the wet and windy weather at the time. In spite of this, the old coal bin was broken up and required two trips to the municipal dump to get rid of the concrete. The May Bank Holiday was particularly wet and cold with the result that passenger numbers were down in spite of the carnival in the park. Newsletter editor Jack Darby comments: "Most drivers could only manage a half hour session before hypothermia set in." Some activities in June fared much better with some fine weather and passenger numbers boosted by a band playing behind the big house in the park on Sunday 17.

An event at **Guildford MES** which did take place in reasonable weather was the annual Diesel & Electric Day and is the first visitors' event in the society calendar. Although visitor numbers were lower than recent years, those that came enjoyed themselves and could make full use of the un-crowded

track. The planning application for the redevelopment of the club house has been submitted, thanks to the sterling efforts of Harold Wells who produced the drawings, did the estimates and submitted the required six copies of everything to the planning authorities. I would say that makes Harold a "Sweet Po tater" – see *Humour Time* below.

Tony Smith was awarded the **Tony Baker Award** at **Harrow & Wembley SME** this year. Brian Tilbury is seeking information about a model engineering company set up in Essex in the 1950s by the late John Coombes. It is reported that the company made kits for miniature railways and aircraft. The proprietor also set up a Mid-Essex model railway club based in Chipping Ongar. If anyone has any information, we will be pleased to pass it on.

The wet weather has taken its toll at **High Wycombe MEC**, with the forced cancellation of the May event due to the torrential rain. A replacement event will have taken place by the time you read this and hopefully the weather will continue to improve. In spite of the weather, work on the track has included replacement of sleepers in the section from the bridge to the traverser, thorough overhaul of the traverser and replacement of several planks on the bridge. Four members have successfully completed their driving assessments and are now passed to drive on public running days. Members are being asked to check and



self-certify the wheel profiles on their locomotives and rolling stock to ensure that they meet the required standard.

North London SME hosted the **Gauge 1 Model Railway Association** 60th Anniversary celebrations on 13 June and the event was a great success with lots of larger locomotive and boating activity alongside the G1 activities. The sun shone for most of the day, so those attending were able to enjoy organiser Malcolm Read's barbecue in the evening. Another barbecue was held two days after this to start the evening and night running session for the locomotive section. Those who had camped overnight were treated to breakfast the next morning prior to the club invitation day on the Saturday. A very busy few days!

Members of the **North Norfolk MEC** have been busy with the result that several new facilities are now in operation including the new station *Holt Minor*, which is complete with hand painted station signs. The new turntable and points are also now working, although the heat caused some expansion problems on Easter Sunday. The star exhibit at the *May Bits & Pieces* meeting was the *Napier Dagger* engine being constructed by Norman Lawrence. Many readers will have seen this magnificent engine (most recently at Guildford at the time of writing) and are always amazed to learn that Norman does all the work by hand and makes great use of small mini-drills to achieve the high finish and fine detail. Another item at the meeting was Andrew Dawson's almost unused *Seagull* outboard motor. Anyone who has done any sailing will remember this once popular engine.

Adrian Pickering has set up the web site for **Norwich DSME** at www.ndsme.com and hopes to add to the site shortly. The return loop was opened in time for the Easter running session, which proved to be a very busy time. The visiting locomotives and drivers on the Sunday were

a great help in this respect. The return loop has reduced the queue times for passengers and speeded up operations generally.

The Diesel Gala Weekend at **Nottingham SMEE** was well attended and, from the photographs in the newsletter, was graced with blue skies and sunshine. Highlights included a well turned out Rio Grande diesel from Birmingham, the first outing of the Class 17 Clayton locomotive by Mick Roberts and Robert Whomsley, and Tim and Steve Harris's *Deltic* locomotive.

Work on the new ground level track at **Tyneside SMEE** has slowed due to the need to make the site safe for the open weekend. A load of ballast was brought in and stored across the site. The next task is to prepare the formwork for the concrete track bed.

I am pleased to welcome a new addition to this report. **Winchester MES** has sent a copy of their latest newsletter which reports that they need to attract more members. Anyone in the area who is interested can contact secretary, Nigel Woodham at 2 South Close, Alresford SO24 9HS. Judging by the newsletter, the society has regular and interesting meetings. The March meeting featured a talk by David Cameron on repairing musical instruments. He showed a video of instruments being made in the Boosy & Hawkes factory before going on to demonstrate some of the techniques used in removing dents, etc., from brass instruments. The April meeting was a *Bits & Pieces* evening which included Nigel Woodham giving a brief talk on pen knives. Nigel demonstrated a special knife designed to cut quill pens (the origin of the pen knife) and members tried the knife before attempting to write with their pens. The May meeting was held jointly with the local horological institute and included a talk by Eddie Cloutman entitled *Clock Hunting in Bermuda*.

World Club News

Australia

The convention of the Australian Association of Locomotive Societies took place in May and the Bolton Cup was awarded to **Adelaide Miniature Steam Railway Society** member Bob Williams for his fine SAR 'X' Class Baldwin 2-6-0 locomotive.

A post-hole digger was hired to aid the erection of the fence round the waste bin and whilst it was available several other jobs were tackled. These included moving some unused seats to a better position, re-locating the flag pole and digging some sump holes near the level crossing to aid the drainage of standing water. I suppose I should not mention that during the digging of one sump hole some suspicious bits of red and white plastic were found which turned out to be the signal cable which had been drilled through exactly on centre. The cable has now been repaired by the "trustworthy" electricians.

The *Show of Work* evening in May was less well attended than usual, although the size of the exhibits on display made up for this. Items included a finished locomotive, two others approaching completion, a 1927 motor-cycle engine, the back half of a Mallet locomotive and some other interesting smaller items.

Canada

A new locomotive has been acquired by the **British Columbia SME**. The new addition to the fleet is a battery electric FP45 in Canadian Pacific Railroad colours. The locomotive was originally built by Walt McGowan and was powered with a 5hp Briggs and Stratton engine. It is now powered by a 10hp Etek motor controlled through a 4QD 300amp controller.

United States

Work at **New Jersey Live Steamers** has included repairs to the signalling system, and repairs and new panels for the 1in. scale and G1 tracks. In the grounds, the winter fall-out has been cleared up

and some dead trees have been removed. Member Adam Madlinger has graduated from Massachusetts Institute of Technology (MIT) and also graduated as the Henry Ford Scholar for 2007. This prestigious award is given to the student "with the leadership skills and potential to make the most impact in the engineering field in the future". We express our heartiest congratulations to Adam on his achievement.

Humour Time

The following appeared in the **Norwich DSME** newsletter:

"Committees

Some people never seem motivated to participate, but are just content to watch while others do the work.

They are called "Spec Taters"

Some people never do anything to help, but are gifted at finding fault with the way others do things.

They are called "Comment Taters"

Some people are very bossy and like to tell others what to do, but don't want to soil their own hands.

They are called "Dick Taters".

Some people are always looking to cause problems by asking others to agree with them. It is too hot or too cold, too sour or too sweet.

They are called "Agle Taters".

There are those who say they will help, but somehow just never get around to actually doing anything.

They are called "Hezzi Taters".

Some people can put up a front and pretend to be something or someone else.

They are called "Immy Taters".

Then there are those who love others and do what they say they will. They are always prepared to stop whatever they are doing and lend a helping hand. They bring real sunshine into the lives of others.

They are called "Sweet Po Taters".

SEPTEMBER

- 1-2 Basingstoke DMES. Public Running.** Contact Guy Harding: 01256 844861.
- 1-2 Bedford MES. Rally Weekend.** Contact Ted Jolliffe: 01234 327791.
- 1 Canvey R&MEC. Orsett Show.** Contact Brian Baker: 01702 512752.
- 1-2 Chesterfield MES. Open Weekend.** Contact Mike Rhodes: 01623 648676.
- 1 High Wycombe MEC. Barbecue.** Contact Eric Stevens: 01494 438761.
- 1 Ickenham DSME. Public Running.** Contact David Sexton: 01895 630125.
- 1 SM&EE. Eric Offen: Model engineering as I see it.** Contact Maurice Fagg: 020 8669 1480.
- 1-2 Tyneside SMEE. Late Summer Rally.** Contact Malcolm Halliday: 0191 2624141.
- 1 York City & DSME. Summer Meeting.** Contact Pat Martindale: 01262 676291.
- 2 Frimley & Ascot LC. Public Running.** Contact Bob Dowman: 01252 835042.
- 2 Guildford MES. Driver Training.** Contact Dave Longhurst: 01428 605424.
- 2 Maidstone MES (UK). Public Running.** Contact Martin Parham: 01622 630298.
- 2 Malden DSME. Public Running.** Contact John Mottram: 01483 473786.
- 2 Northampton SME. Public Running.** Contact Pete Jarman: 01234 708501 (eve).
- 2 Norwich DSME. Public Running.** Contact Shirley Berry: 01379 740578.
- 2 Nottingham SMEE. Public Running.** Contact Pete Towle: 0115 987 9865.
- 2 Oxford (City of) SME. Public Running.** Contact Chris Kelland: 01235 770836.
- 2 Pinewood MRS. Members' Running.** Contact Ivan Hurst: 01252 510340.
- 2 Plymouth MSLS. Public Running.** Contact Malcom Preen: 01752 778083.
- 2 Reading SME. Public Running.** Contact Brian Joslyn: 01491 873393.
- 2 Saffron Walden DSME. Public Running.** Contact Jack Setterfield: 01843 596822.
- 2 South Durham SME. Running Day.** Contact B. Owens: 01325 721503.
- 2 Sunderland (City of) MES. Open Day.** Contact Albert Stephenson: 01429 299649.
- 3 North Norfolk MEC. Bits & Pieces.** Contact Gordon Ford: 01263 512350.
- 3 Peterborough SME. Bits & Pieces.** Contact Ted Smith: 01775 640719.
- 4 North Cornwall MES. Meeting & Maintenance Evening.** Contact Geoff Wright: 01566 86032.
- 4 Romney Marsh MES. Track Meeting.** Contact John Wimble: 01797 362295.
- 4 South Durham SME. Meeting.** Contact B. Owens: 01325 721503.
- 4 Taunton ME. Loco Running at Creech.** Contact Don Martin: 01460 63162.
- 5 Bradford MES. Workshop Techniques & General Natter.** Contact John Mills: 01943 467844.
- 5 Bristol SMEE. Locomotive Evening.** Contact Trevor Chambers: 0145 441 5085.
- 5 Chingford DMEC. Bits & Pieces.** Contact Ron Manning: 020 8360 6144.
- 5 Hull DSME. Video Show.** Contact Tony Finn: 01482 898434.
- 5 Leeds SMEE. Meeting.** Contact Colin Abrey: 01132 649630.
- 5 West Wiltshire SME. Steaming at club track.** Contact R. Nev. Boulton: 01380 828101.
- 6 Sutton MEC. Bits & Pieces.** Contact Bob Wood: 0208 641 6258.
- 7 Aylesbury (Vale of) MES. Track Night.** Contact Andy Rapley: 01296 420750.
- 7 Canvey R&MEC. Seen on the Table 5.** Contact Brian Baker: 01702 512752.
- 7 Maidstone MES (UK). Evening Run & Food.** Contact Martin Parham: 01622 630298.
- 7-9 Centenary Model Engineer Exhibition at Ascot Racecourse, Berkshire. Admission: Adult £9.00, Senior Citizen £8.00, Child Free. Fri/Sat 10am-5pm, Sun 10am-4pm.**
- 7 North London SME. Forum: Milling in the Model Engineer's Workshop.** Contact Rachael Chapman: 01442 275968.
- 7 Portsmouth MES. Meeting.** Contact John Warren: 023 9259 5354.
- 7 Rochdale SMEE. Meeting.** Contact Bob Denyer: 0161 959 1818.
- 7 Romford MEC. Competition Night.** Contact Colin Hunt: 01708 709302.
- 8 Adelaide Miniature SRS. Inter-Club Run Day.** Contact Peter Cooper: 8264 3471.
- 8-9 Ascot Locomotive Society. Model Engineer Exhibition 100.** Contact Lee Porteus: 01344 884385.
- 8-9 Birmingham SME. The National Locomotive Rally.** Contact John Walker: 01789 266 065.
- 8 Cardiff MES. Steam-Up & Family Day.** Contact Don Norman: 01656 784530.
- 8 Edinburgh SME. Night Running.** Contact Robert McLucke: 01560 655270.
- 8-9 Leighton Buzzard NG Rly. Steam-Up Weekend.** Enquiries: 01525 373888.
- 8-9 MELSA. Annual Competition & Display.** Contact Graham Chadbone: 07 4121 4341.
- 8 Midland Railway Society. Meeting.** Contact Andrew Surry: 01462 451090.
- 8-9 Urmston DSME. Open Weekend.** Contact A. L. Fussell: 0161 748 0160.
- 9 Bedford MES. Members' Running Day.** Contact Ted Jolliffe: 01234 327791.
- 9 Bristol SMEE. Public Running.** Contact Trevor Chambers: 0145 441 5085.
- 9 Cambridge MES. Public Running.** Contact Tim Coles: 01954 267359.
- 9 Canterbury DMES (UK). Public Running.** Contact Mrs P. Barker: 01227 273357.
- 9 Harlington LS. Exhibition Day.** Contact Peter Tarrant: 01895 851168.
- 9 High Wycombe MEC. Club Running.** Contact Eric Stevens: 01494 438761.
- 9 Leeds SMEE. Running Day.** Contact Colin Abrey: 01132 649630.
- 9 Leyland SME. Boiler Testing Day.** Contact A. P. Bibby: 01254 812049.
- 9 Lincoln DMES. Public Running.** Contact Paul Thompson: 01522 888228.
- 9 Maidstone MES (UK). Public Running.** Contact Martin Parham: 01622 630298.
- 9 Northern Mill Engine Society. Open Day.** Contact John Phillip: 01257 265003.
- 9 Norwich DSME. Public Running.** Contact Shirley Berry: 01379 740578.
- 9 Nottingham SMEE. Public Running.** Contact Pete Towle: 0115 987 9865.
- 9 Plymouth MSLS. Member's Running.** Contact Malcom Preen: 01752 778083.
- 9 Saffron Walden DSME. Public Running.** Contact Jack Setterfield: 01843 596822.
- 9 South Durham SME. Stephenson Memorial Miniature Locomotive Association - Locomotive Efficiency Trials.** Contact B. Owens: 01325 721503.
- 9 Stephenson Memorial Miniature Locomotive Ass'n. Locomotive Efficiency Trials hosted by South Durham Society**
- 9 of Model Engineers, Hurworth Grange, Nr Darlington. Start 10am.** Contact Eddie Gibbons: 0191 4107564.
- 9 Sutton MEC. Track Day.** Contact Bob Wood: 0208 641 6258.
- 9 Taunton ME. Public Running.** Contact Don Martin: 01460 63162.
- 9 Worthing DSME. Public Running.** Contact Bob Phillips: 01903 243018.
- 9 York City & DSME. Running Day.** Contact Pat Martindale: 01262 676291.
- 10 Bedford MES. D. Combes: Aliens of Bedford - memories and history.** Contact Ted Jolliffe: 01234 327791.
- 10 Saffron Walden DSME. Club Night.** Contact Jack Setterfield: 01843 596822.
- 11 Basingstoke DMES. Meeting.** Contact Guy Harding: 01256 844861.
- 11 Manx Steam & MEC. Meeting.** Contact Richard Rake: 01624 671258.
- 11 Romney Marsh MES. Track Meeting.** Contact John Wimble: 01797 362295.
- 12 Chingford DMEC. Derek Brown: Better by Design.** Contact Ron Manning: 020 8360 6144.
- 12 High Wycombe MEC. Bits & Pieces.** Contact Eric Stevens: 01494 438761.
- 12 St. Albans DMES. Jeff Carter: HMS Kent and the Trafalgar Influence.** Contact Roy Verden: 01923 220590.
- 13 Leyland SME. Giles Taylor: My Life at Crewe Works.** Contact A. P. Bibby: 01254 812049.
- 13 Sutton MEC. Busy Night.** Contact Bob Wood: 0208 641 6258.
- 13 Worthing DSME. Mike Flannery: World of Tickers.** Contact Bob Phillips: 01903 243018.
- 14 Canvey R&MEC. Visitors Running Day.** Contact Brian Baker: 01702 512752.
- 14 Chichester DSME. Auction at Club.** Contact Brian Bird: 01243 536468.
- 15 Bristol SMEE. Fun Day.** Contact Trevor Chambers: 0145 441 5085.
- 15 Canvey R&MEC. Southern Federation Rally.** Contact Brian Baker: 01702 512752.
- 15-16 Lincoln DMES. Miniature Steam Weekend.** Contact Paul Thompson: 01522 888228.
- 15 Maxitrak Owners Club. Factory Open Day and MOC AGM.** Contact Eric Penn 0208 979 4335.
- 15-16 Nottingham SMEE. Thomas The Tank Engine. T. 0115 987 9865.**
- 16 Basingstoke DMES. Lions Event.** Contact Guy Harding: 01256 844861.



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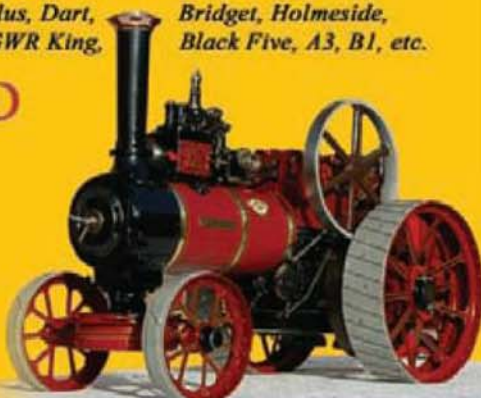
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