

# MODEL ENGINEER

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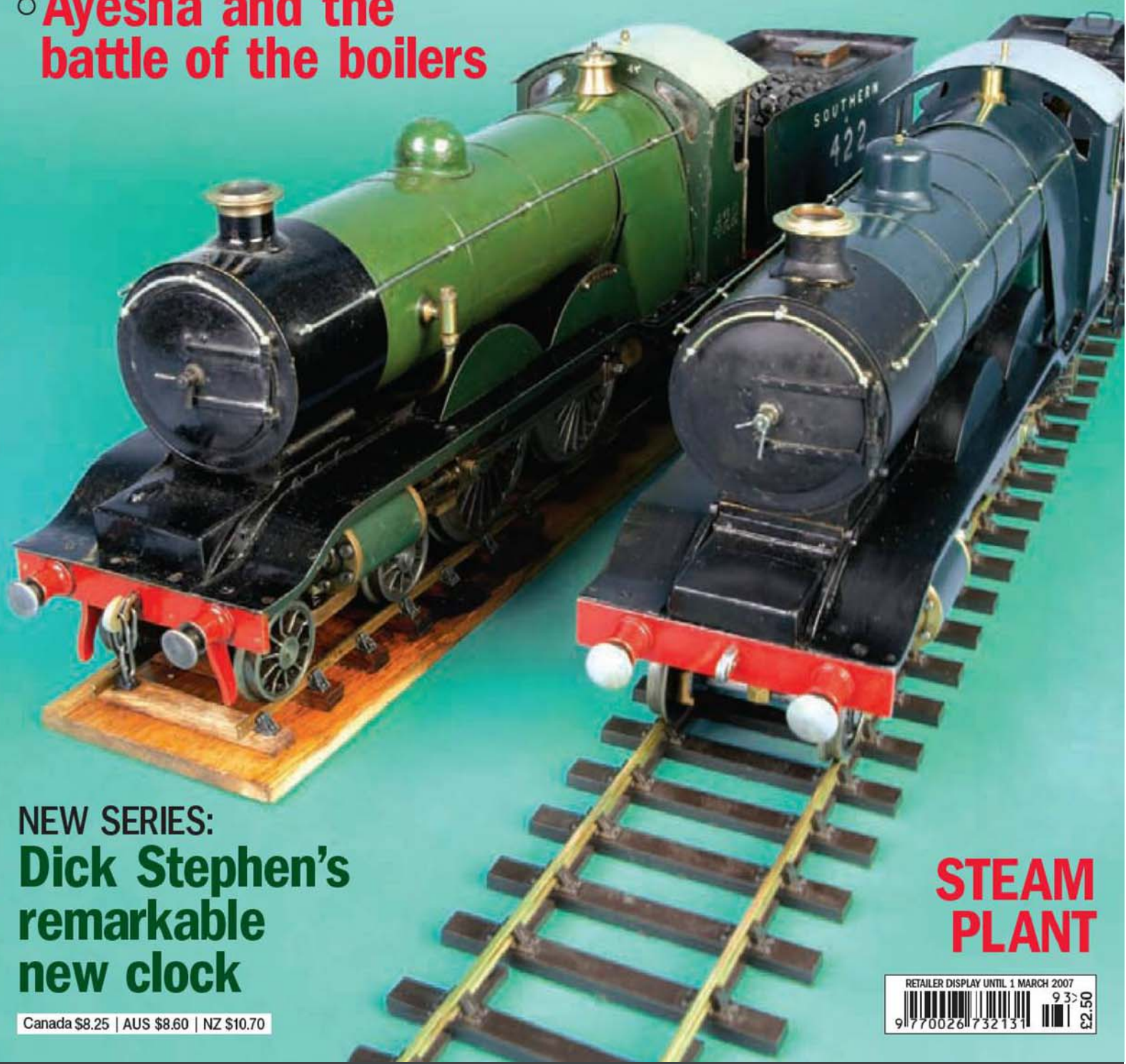
Vol. 198 No. 4293

16 February – 1 March 2007

## COVER STORIES

- **Build Ayesha II**
- **Ayesha and the battle of the boilers**

**THE GREAT BEAR**  
by Peter Rich



NEW SERIES:  
**Dick Stephen's  
remarkable  
new clock**

**STEAM  
PLANT**

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## NEW PROFESSIONAL PARTING SYSTEM!!

Ideal for owners for Boxford, Student and any other 4 1/2 centre height lathes! This set up is very well made and very rigid - just what you need when parting off!

The Shank that you clamp in your toolpost is only 1/2 wide thus allowing this excellent tool to be used in smaller lathes than usual. It can even be adapted to Myford etc. It is supplied with a HSS blade which is 4mm thick x 24mm wide and 150mm long - Spare blades are readily available



**£22.00!** (Code: PT2005)

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RANGE: 0-1"/0-25MM  
(Code: XC234)

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(Code: XC22)

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FIXED STEADY £18.00! (Code: XC24)



TRAVELLING STEADY £18.00! (Code: XC25)  
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## ER25 COLLET CHUCK FOR CLARKE 300

Top quality brand new British product - This collet chuck allows you to use the very flexible ER 25 split collets on your Clarke CL300 or other brand variable speed mini lathe. ER collets are available separately and cover the range from 1mm - 16mm



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## ER25 COLLET SYSTEM TO SUIT MYFORD ML7 ETC



**£87.00!**  
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(Code: XC152)



**£85.00!**  
SET 15 COLLETS 1-16MM  
(Code: XC153)

## SOBA 3" ROTARY TABLE EXCLUSIVE TO CHRONOS



OVERALL HEIGHT 1 1/2"  
CENTRE HEIGHT 1 1/2"

**£69.00!**  
WAS £79.95  
(Code: XC154)

## SET OF 5 INDEXABLE LATHE TOOLS 10MM INCLUDING A BORING BAR (8MM)

**£24.95!**  
(Code: XC68)



## SET OF 5 INDEXABLE LATHE TOOLS



SHANK: 1/4 £19.95! (Code: XC72)  
SHANK: 5/16 £19.95! (Code: XC73)  
SHANK: 3/8 £19.95! (Code: XC74)  
SHANK: 1/2 £26.95! (Code: XC75)  
5 X SPARE INSERTS 1/4 £10.00! (Code: XC76)  
5 X SPARE INSERTS 5/16 £10.00! (Code: XC77)  
5 X SPARE INSERTS 3/8 £10.00! (Code: XC78)  
5 X SPARE INSERTS 1/2 £10.00! (Code: XC79)

## SET OF 4 INDEXABLE BORING TOOLS SHANK SIZES 8, 10, 12 & 16MM

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6MM DIA/9MM SQ HOLDER £17.50! (Code: XC70)  
12MM DIA/18MM SQ HOLDER £26.95! (Code: XC71)

## PARTING TOOL WITH HSS BLADE



SHANK: 5/8 HIGH 5/16 BLADE £12.00! (Code: XC80)  
SHANK: 3/4 HIGH 1/2 BLADE £15.00! (Code: XC81)

## SET OF 3 8MM TOOLHOLDERS WITH HSS BITS STRAIGHT LH & RH

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WAS £19.95  
(Code: XC82)



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COMPLETE WITH 5 DIFFERENT TURNING TOOLS, A PARTING TOOL & THREADING



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SHANK: 8MM HIGH £31.00! (Code: XC92)  
SHANK: 10MM HIGH £37.00! (Code: XC93)  
SET 7 INSERT 6MM HIGH £12.00! (Code: XC94)  
SET 7 INSERT 8MM HIGH £12.00! (Code: XC95)  
SET 7 INSERT 10MM HIGH £12.00! (Code: XC96)

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**50MM BORING HEAD SET C/W 9 BORING BARS**

| CODE | SHANK | PRICE  |
|------|-------|--------|
| XC1  | 2MT   | £65.00 |
| XC2  | 3MT   | £65.00 |
| XC4  | R8    | £65.00 |
| XC5  | NT30  | £71.00 |
| XC6  | NT40  | £72.00 |



**STUB ARBORS FOR 1" BORE CUTTERS WITH FULLY GROUND COLLARS ETC**

| CODE | SHANK | PRICE  |
|------|-------|--------|
| XC7  | 2MT   | £29.95 |
| XC8  | 3MT   | £29.95 |
| XC9  | R8    | £34.00 |



**SMALL DIAMETER TURNING TOOL  
IDEAL FOR TURNING LONG THIN PIECES WITHOUT WHIPPING**

**CODE**  
XC10

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| XC13 | MAG  | £38.00 |

XC13B - MAG ATTACHMENT FOR YOUR EXISTING VERTEX LAMP - £9.95



**RIGID HALOGEN MACHINE LAMP  
WITH BOLT DOWN OR MAGNETIC BASE**

| CODE  | BASE | PRICE  |
|-------|------|--------|
| XC14  | BOLT | £44.95 |
| XC14B | MAG  | £49.95 |

XC13B - MAG ATTACHMENT FOR YOUR EXISTING VERTEX LAMP - £9.95



**IMPERIAL DIAL GAUGE AND NEW CLAMP TYPE DIAL GAUGE HOLDER**

| CODE | ITEM                  | PRICE  |
|------|-----------------------|--------|
| XC27 | 0-0.5" IMP DIAL GAUGE | £11.95 |
| XC28 | NEW CLAMP TYPE HOLDER | £12.00 |
| XC29 | BOTH ITEMS            | £20.00 |



**LATHE PARRALLEL TEST BARS**

| CODE | SHANK | PRICE  |
|------|-------|--------|
| XC17 | 1MT   | £35.00 |
| XC18 | 2MT   | £35.00 |
| XC19 | 3MT   | £39.00 |
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| XC31 | 18" BENDING BRAKE | £24.95  |
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**MACHINE TOOL COOLANT SYSTEM**

| CODE | TANK SIZE     | PRICE  |
|------|---------------|--------|
| XC33 | 5" x 12" x 8" | £89.95 |



**SMALL CLAMP TYPE KNURLING TOOL  
3/8 SHANK - SUITS MYFORD LATHES ETC - CAPACITY UP 1"**

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**PRICE**  
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|------|-------|--------|
| XC60 | 1/4   | £22.00 |
| XC61 | 5/16  | £24.00 |
| XC62 | 3/8   | £27.95 |
| XC63 | 1/2   | £34.00 |

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COMPLETE WITH MEDIUM DIAMOND KNURLS - 3/8 SQUARE SHANK**

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**PRICE**  
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**OPTICAL CENTREPUNCH**

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|-------|--------|
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**0-6" Dial Caliper**

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| XC1712 | £14.95 |



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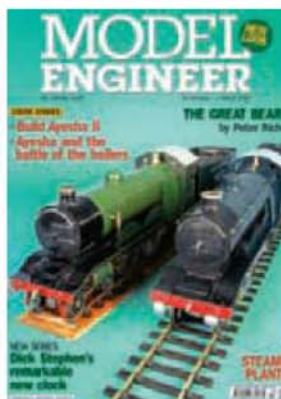
Keith Wilson continues with building Lillian and much else.

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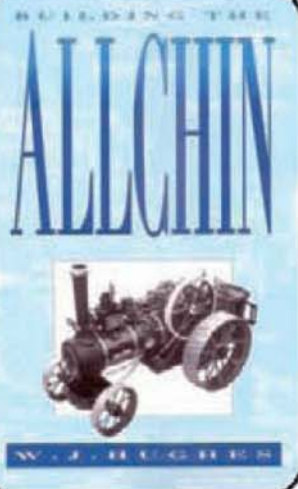
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| Seneca Falls Vintage Lathe, Needs TLC, 1ph                         | £ 125.00 |
| Mikron Lathe with stand, Collets, Chucks etc, 3ph                  | £ 750.00 |

## Milling Machines, Some prices reduced!

|                                                                    |          |
|--------------------------------------------------------------------|----------|
| AEW Viceroy Horizon Vertical Mill, Swivel head, Power Feed, 30INT  | £ 875.00 |
| Deckel LK Jig Borer with Jig Grinding Head and Tooling & DRO       | £3500.00 |
| Emco F1CNC Woodworker/High Speed Vertical Mill, 1ph                | £1350.00 |
| Emco Unimat 3 Mentor Bench Top Mill/Drill, 1ph                     | £ 250.00 |
| Gravograph Pantograph Engraving Machine, Type & Laminate, 1ph      | £ 550.00 |
| Greenbank Horizontal Broaching Machine                             | £ 850.00 |
| New SIP Mill/Drill, 3 MT, 1ph,                                     | £ 895.00 |
| Scripta SA Three Dimensional Engraver/Diesinker                    | £ 675.00 |
| Warco FV-320T Vertical Mill on Stand, 1ph, VGC                     | £ 750.00 |
| Tom Senior M1 Milling Machine, 3ph                                 | £ 600.00 |
| Gravograph Model IM2 Bench Pantograph Engraver, 1ph, Well equipped | £ 450.00 |
| KRV Turret Mill, Good Condition, 3ph, DRO                          | £2250.00 |

## Machine Tooling and Accessories, Workshop Equipment

|                                                            |              |
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| Newnes Engineers Reference Book, 1947, Edited By F Camm    | £ 20.00      |
| The Caxton Engineering Handbook, 1960, Compiled By J Oates | £ 20.00      |
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| Moore & Wright 25-50mm Micrometer, Good                    | £ 20.00      |
| 3 piece 1/2" Shank Flycutter Set                           | £ 16.00      |
| 2 MT Slitting Saw Arbor                                    | £ 12.00      |
| 2 x 2MT Blank End Arbors, Soft                             | £ 15.00      |
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|                                                                 |         |
|-----------------------------------------------------------------|---------|
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## Milling Tooling

|                                                                        |          |
|------------------------------------------------------------------------|----------|
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| Vertex 6" Swivel Milling Vice                                          | £ 100.00 |
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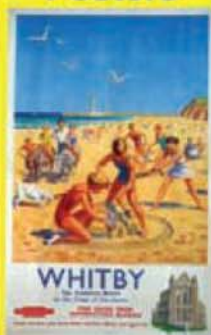


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• 1954 • South Bend Lathe Works • £11.25

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## Wood Pattern-Making • McCaslin • £12.70

Here you get the secrets of good pattern making. In the first chapters you get basic information on precision woodworking, but then it gets really useful. You learn how to make patterns so that you can cast a surface plate, clamp, bracket, pedestal, bell-crank, toolrest, steady rest, tailstock, gear case, cylinder head, water jacket, piston, handwheel, flywheel and a host of other interesting shapes. As you go along you are shown how to make the necessary cores, and how to pour complex castings. You get dimensioned drawings, demonstrations of how a mold is rammed up, and much, much more. All heavily illustrated. The "How to Make Sections" are amongst the clearest we have seen. There are a fair few pattern-making books around. This is one of the best (otherwise we wouldn't sell it). Buy a copy! 296 pages. Paperback.



## Electromechanical Building Blocks for the Model Engineer • Addy • £15.35

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## Making Simple Model Steam Engines • Bray • £22.35

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Here Stan Bray turns his attention to steam engines and boilers that can be used in model boats. As always with Stan, this is good, no-nonsense practical instruction, with numerous drawings and photos of various types of engines and boilers, not forgetting the fittings required, and ideas on firing the boilers. All in a 144 page, large format paperback.

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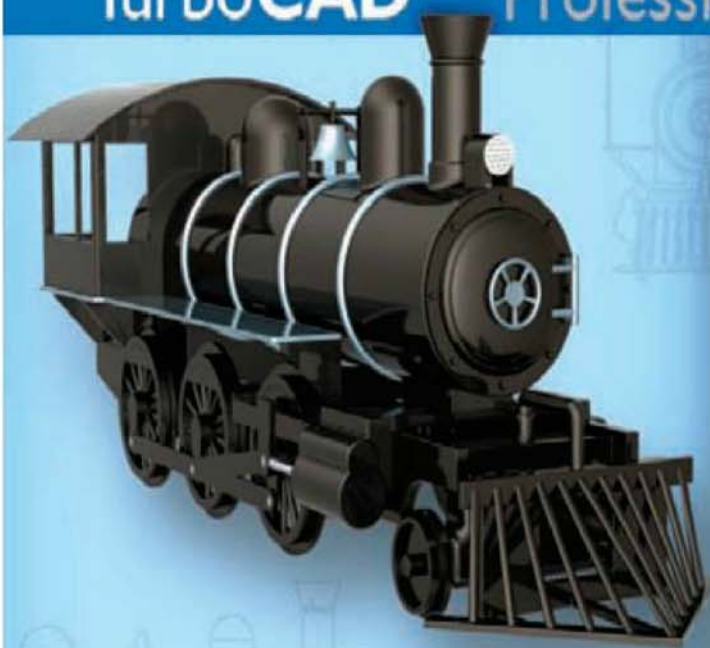
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## MBE for John

Our congratulations to John Wilding FBHI, the man who has inspired hundreds of amateur clockmakers and restorers through these pages and elsewhere, on his award of an MBE.

When asked to describe the attraction of clock making, John Wilding explains: *"Making a clock is a fascinating and satisfying experience. From the matching of the first two components, to the moment one hears the first beats of the escapement – it is as though one has created a living thing."*

John Wilding completed his first clock in 1958 and has designed and made some 45 different clocks in the 47 years since.

Although John has had an interest in horology since his school days, it was not until he acquired a lathe in connection with his agricultural contracting business that he began to be involved in the practical side of the subject.

He started by making clocks from designs published in *Model Engineer*. That was, in fact, the only magazine that produced descriptions with drawings and photographs on how to make a clock. He then started to write short articles both for *Model Engineer* and the *Horological Journal* who invited him to write a serial on how to make a simple weight driven 8-day wall clock without buying any parts ready made. This was the beginning of a series of constructional projects totalling more than 40 designs.

What sets John Wilding apart from other clock makers is the tremendous contribution he has made to promote the art of horology – sharing his passion with other enthusiasts. He does not just build clocks – he documents every stage in their creation, taking photographs, drawing diagrams and writing detailed instructions which are then serialised in magazines and subsequently published as construction manuals.

The clocks he builds range from simple projects, such as a weight driven egg timer, to



John Wilding: *"like creating a living thing."*

sophisticated regulator type clocks. He has written more than 35 books, all his manuals are written with the amateur in mind. In fact, he says that nothing gives him more pleasure than receiving a letter from a newcomer to metalwork, telling him that they have successfully completed their first clock.

The time and patience involved in producing these manuals should not be underestimated. Clock making is an intricate and time-consuming pastime – a true labour of love. Few craftsmen would be prepared to interrupt their work every step of the way, clean down their work area and take numerous photographs, just so that others can share in the pleasure and satisfaction of creating the same clock.

John Wilding's remarkable contribution to horology has not gone unacknowledged. He is a Fellow of the British Horological Institute and was awarded the Barret Medal for his outstanding services to horology in 1998.

One of the highlights of his career so far came at the end of last year, when he was awarded the very first Masters Medal at the annual banquet of the Worshipful Company of Clockmakers.

The medal was presented by the Lord Mayor of London and the citation reads: *"In recognition of the unequalled*

*contribution you have made over very many years to the furtherance and retention of hand skills in horology among a great number of amateurs.*

*"Additionally, your written and published work has been an inspiration to hundreds."*

He is also held in very high esteem by the horological community for the valuable work he has done salvaging and restoring old and unusual clocks.

Less well known is John Wilding's other passion: music. He is a keen horn player. He runs several groups which meet in his barn. One of these, a brass quintet, is well known in the local area. They perform regularly throughout the year at village fetes, flower shows, harvest suppers, private parties and the carol service at Lurgashall church.

*"We have also played at the Institute of Civil Engineers in London at Brunel's birthday celebration, where Patrick Moore kindly wrote a new march for us called Brunel on Parade."*

Now more than 80 years old, John is still in his workshop at his home near Petworth every morning. It is a picturesque setting, with one of his own clocks adorning the tower over the building.

John Wilding's clocks can be seen at

[www.RiteTimePublishing.com](http://www.RiteTimePublishing.com) and his book catalogue can be obtained by calling 01420 487747.

## EXTRA! EXTRA!

This issue sees the new look *M.E.* our response to readers' pleas to make it easier to read, and to try to attract some newcomers to the hobby.

To celebrate, for this issue only, we have added in some extra pages.

We hope that it all meets with your approval.





Technical Editor Neil Read inspects the coffee pot locomotive described by Peter Spenlove-Spenlove.

## Write to us

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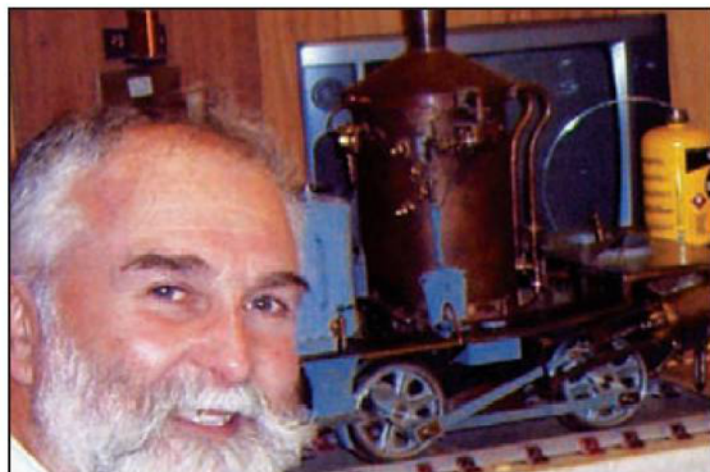
## Boxford lathes

SIRS, - I have just read Tony Griffiths' informative article on Boxford lathes (M.E. 4288, 8 December 2006). I was a full time metalwork teacher from 1975 until 2000 and the school (where I still work) purchased four brand new model BUD lathes in December 1984, bringing the total to six. Ever since then I have fought a constant battle to retain these excellent machine tools, while other schools across the country were stripping out their workshops in the pursuit of what became known as 'Blue Peter Engineering'.

Today, having lost the battle, or at least the will to fight it, I witnessed the sale of two of the last three machines, leaving only one still in use. I was fortunate enough to buy a long bed example for myself when the first three were sold about 10 years ago and I have never regretted it. I note with interest Tony's comment that the final version manufactured from May 1976 was known as the Mk. 3 by some people but not by Boxford and I have heard this stated before. However, my own lathe is clearly stamped with BUD - III - 42592.

Those that were sold today, and the remaining one, are all from the same batch with virtually consecutive serial numbers and all have the same 'III' markings. This suggests that the manufacturers did eventually classify them as Mk. 3. These four are all painted in Reseda Green but I vaguely remember the earlier grey and brown one we had was stamped BUD - II - \*\*\*\* but I am not certain. Someone out there must be able to tell if these were so marked.

I have always found them to be a lovely machine to operate, even though they have one or two idiosyncrasies. A clutch would be a nice addition but the strangest thing is the tailstock. Even on my late metric machine the barrel is marked in metric and imperial units (useful) but if you insert a drill chuck on a standard No. 2 Morse taper, or any No. 2 Morse taper drill, you



cannot align the zero because the self eject mechanism operates at least  $\frac{3}{16}$ in. too soon! I pointed this out to a Boxford representative at an exhibition years ago. I think his reaction was best described as 'gob smacked' as no one had ever queried this anomaly before! The answer is to grind short the tang of the taper. Maybe I'll get round to it one day!

**Rex Hanman, Wiltshire.**

## Coffee pot locomotives

SIRS, - During a recent visit, your Technical Editor, Neil Read was examining the intimate details of a 'coffee pot' locomotive when the photographer distracted him! The maker of this 5in. gauge exact scale model is a member of the Society of Model and Experimental Engineers (SMEE) of London. Very few locomotives of this type exist but one was found in the store area of an engineering heritage museum.

During several visits under health and safety supervision, lots of photographs, sketches and drawings were collected for cross checking and filing back at home. Although not yet complete, this model will surely attract praise when steaming on the tracks during visits. The 'coffee pot' design is a light 0-4-0 frame platform on which stands an early type vertical boiler with a coal bunker is at one end of the frame.

An inclined cylinder at each side drives the wheels via the usual connecting rod and coupling rods. This type of internal works machine is smaller than the Sentinel type

which is fully enclosed with a cab for weatherproofing.

Why is it called a 'coffee pot'? I don't know, but its tall boiler with coal firing at the bottom, conical top and central chimney make it look like one. I wonder, when lighting up and before any steam hissing starts, did the boiler rumble and gurgle? The sound could be likened to a breakfast table coffee percolator.

**Peter Spenlove-Spenlove, Leics.**

## Synchromer clocks

SIRS, - It is good to see the subject of these clocks kept alive (just!) in M.E. It flourishes elsewhere; a friend made his first in his late 80s and is now just finishing his third! There have been constructional articles in M.E. and *Engineering in Miniature* as well as Amateur Telescope Making and Hope-Jones etc. The main casting is still available, eBay invariably has at least one for sale.

I would like to comment on the very interesting article by Patrick Williams. Strangely he has described the system used by, I believe, Gent Clocks for obtaining an impulse i.e. the dropping of the hook into a notch. The Synchromer, Patrick's included, depends on a vane attached to the ratchet wheel releasing a trigger which allows the electrical contacts to close. This vane is the transverse rod shown beyond the wheel in his figure nine.

As for the gathering jewel (Brocot pallet stone) I obtained mine from a very nice lady in Arizona quicker and cheaper than those I tried for in the UK.



Polished silver steel preferably hardened does just as well but I wanted to restore mine as it was. The UK material suppliers I approached ignored my e-mails; Arizona could not have been more helpful.

I don't think the Jubilee Clock should be described as a Synchronome.

**Colin Hartwright, Worcs.**

### Fowler elevating gear

SIRS, - In his article in *M.E.* 4288, 10 November 2006, Martin Wallis asks if anybody knows the reason for the elevating gear on the front axle of Fowler A8 No. 12754.

The gear was fitted for elevating or lowering the boiler when descending or ascending steep hills. It was also fitted to engines supplied to the War Office for use in South Africa.

I refer to page 218 in *The Story of the Steam Plough Works* by Michael R. Lane. There is a photograph of the WD engine No. 9951 fitted with this gear. The pipe from the cylinder goes to a small tank on the side of the boiler.

There is an additional water tank under the boiler but it is impossible to see how the pressure was fed to the cylinder.

**Alun Morris, by e-mail.**

### Tired of global warming

SIRS, - Am I the only one getting a little tired with global warming being discussed at length within 'our' pages. It would be more appropriate if the protagonists came up with designs for windmills, generators, small scale embedded generators and inverter units for construction by the model engineer. So, when can we expect to see the 'M.E. Wind Turbine and S.S.E.G.'?

**Martin Johnson, by e-mail.**

### Web addresses

SIRS, - I am indebted to Ted Jolliffe for his letter (*M.E.* 4289, 20 December 2006) about blowing up plastic bottles and for his advice to call up <http://www.dti.gov.uk/files/file21474.pdf#search=plastic%20bottle%20pressure%20safety> for further information.

But I am intrigued to know why it takes 89 alpha-numeric

symbols to identify a single file on the Internet. Assuming there are about 40 to 50 such symbols, raising even the smaller of these two numbers to the power 89 gives a very large number indeed. Is it greater than the total number of atoms in the universe?

Of course even this number might have already been overtaken by the volume of inane blogs which are currently being spewed into space.

Has anyone worked out how long it will be before the net crashes under the weight of the garbage it is being asked to absorb?

Whatever the case it is really no excuse for the 'websters' not coming up with a sensible referencing system for serious items which are published on the Internet.

If they don't, I fear we will be moving to a position where the address will be longer than the article!

**Geoff Berriman, Doncaster.**

*The answer to Geoff's question may lie in the fact that the address is for a Government department, the Department for Trade and Industry! - ED.*

### Lynton and Lynmouth Cliff Railway

SIRS, - I wish to make a working model of the Lynton and Lynmouth Cliff Railway as it was when it opened in 1890. I have spent a year researching the project, but cannot find copies of drawings, or plans of the original cars anywhere. I have lots of photos, provided by many kind friends, of the railway as it is now, and quite a few of it over the years, but I really need some drawings or plans of the first cars which ran in 1890. The present management of the Cliff Railway have no drawings in their archive. Please can anyone help me?

**May King, Kent.**

### Crane history

SIRS, - The history of crane technology has been an interest, both private and professional, over a number of decades, and so you may assume that I welcome the current Lifting and Shifting series of articles by John

Ditchfield as a welcome departure for *Model Engineer*. If I had one tenth the skill of some of your contributors I would have built a veritable fleet of cranes of all types by now for they are inherently interesting machines, both mechanically and structurally.

However, if I might in the interests of accuracy make clear one point from the article in *M.E.* 4289, 20 December (page 751), the chains and associated screw and clamp described play no part whatsoever in the stability of the crane. They are to be found in various forms on most travelling cranes which have a large wind profile and are fitted to prevent the structure being blown along the tracks in a heavy gale, an occurrence which is not as infrequent as it should be. When the crane is to be left unattended, best practice is to activate each clamp, obviating the above circumstance, whilst conversely, the slewing brake is released in order to allow the revolving portion to 'weather-cock' in the wind.

The stability of such cranes depends on the extent to which the centre of gravity is maintained within the supporting structure, and this is achieved by means of both fixed and moving balance weights in jib cranes where the luffing range is great. In cranes supported on a live-ring it is usually assumed for design purposes that the centre of gravity will approach the centre of the roller path (not to be confused with the slewing centre) to within 10% of the diameter of the ring both at the front under maximum live load condition, and at the rear when in unloaded condition, with a strong wind blowing from frontal to rearward direction.

I have yet to see a large travelling jib crane, and I have direct experience of many such cranes from 5 to 180-tons capacity, which does not have a rail clamp of some sort, although this most commonly consists simply of a large vertical screw with a thick circular disc at the bottom end which bears upon the rails, and at the upper end, a

large handwheel or ratchet for maximum leverage. It is as common for two of these clamps to be fitted as it is for four.

However, this is bordering on the pedantic against the general high quality of the presentation and the resulting interpretations and John Ditchfield is to be congratulated for this. I should add that I have covered a huge amount of the ground researching such structures in both English, German, Japanese, French and even Russian texts! That said, I couldn't find any direct or reliable evidence that the Otis excavator was ever built (and neither can a handful of 'fellow conspirators' as old LBSC used to say, that I debate such matters with via the internet). A paper to the The British Association for the Advancement of Science at their Newcastle Meeting in 1863 mentioned a 'self-contained steam crane for discharging ballast on Newcastle Quay in 1821', however it is not known what form this took.

**Dr. Brian Newman, by e-mail.**

### Bellis and Morcom

SIRS, - I respond to the letter from Paul Campbell, *M.E.* 4289, 20 December 2006. A reply to a query in *M.E.* 395 of 19 November 1908 stated that drawings for a high-speed self-lubricating Bellis and Morcom engine appeared in *Engineering* of 6 August 1897. If Paul is unable to get a copy of this journal, I will try through my local library. A short history of the firm appeared in *M.E.* 2899 of 13 December 1956.

**Chris Orchard, Northamptonshire.**

### MEEX dates

SIRS, - I know some people will have 'rude' comments to make; but I say - 'Hoorah!' for the change of date of the Model Engineer Exhibition. As I have said in previous letters, Christmas was a bad time for visitors and the trade. I just hope that you can get a good slot in the busy year ahead.

Keep up the good work.

**G. H. Passey, Somerset.**



# NO. 111

**Peter Rich**

takes a serious modeller's look at the largest locomotive to run on Western rails.

# THE GREAT BEAR

I was up on Caerphilly Mountain again the other day, having a quite blast on the pipes, when my mind drifted off to a recent article where I mentioned that there were a number of locomotives about which little has been written and I have to say that in spite of the fact that *The Great Bear* is a well known locomotive it seems to me that No. 111 does fall into this category and it won't do any harm to approach the engine from a model engineer's point of view. But first, here is a potted history of the engine. The design began in 1907 while G. J. Churchward was the locomotive engineer at Swindon. It was basically an enlargement and development of his very successful smaller four cylinder 4-6-0 locomotives of the 'Star' class, which were being built at around this time. The 'Stars' were masters of the trains they were required to work at that time. In view of this there has always been speculation as to why *The Great Bear* was built. However, what I think people forget is that the 'Bear' appeared in February 1908 which was less than a year after the first batch of 'Stars' had been built, and they

would not have had time to get into their stride before the 'Bear' appeared. Indeed No. 111. was actually running a month before the second batch of 'Stars' appeared and in its first few years it suffered problems that had to be ironed out. Meanwhile, any problems the 'Stars' had were solved in 1906 with No. 40 *North Star* and the early batch of 'Stars'.

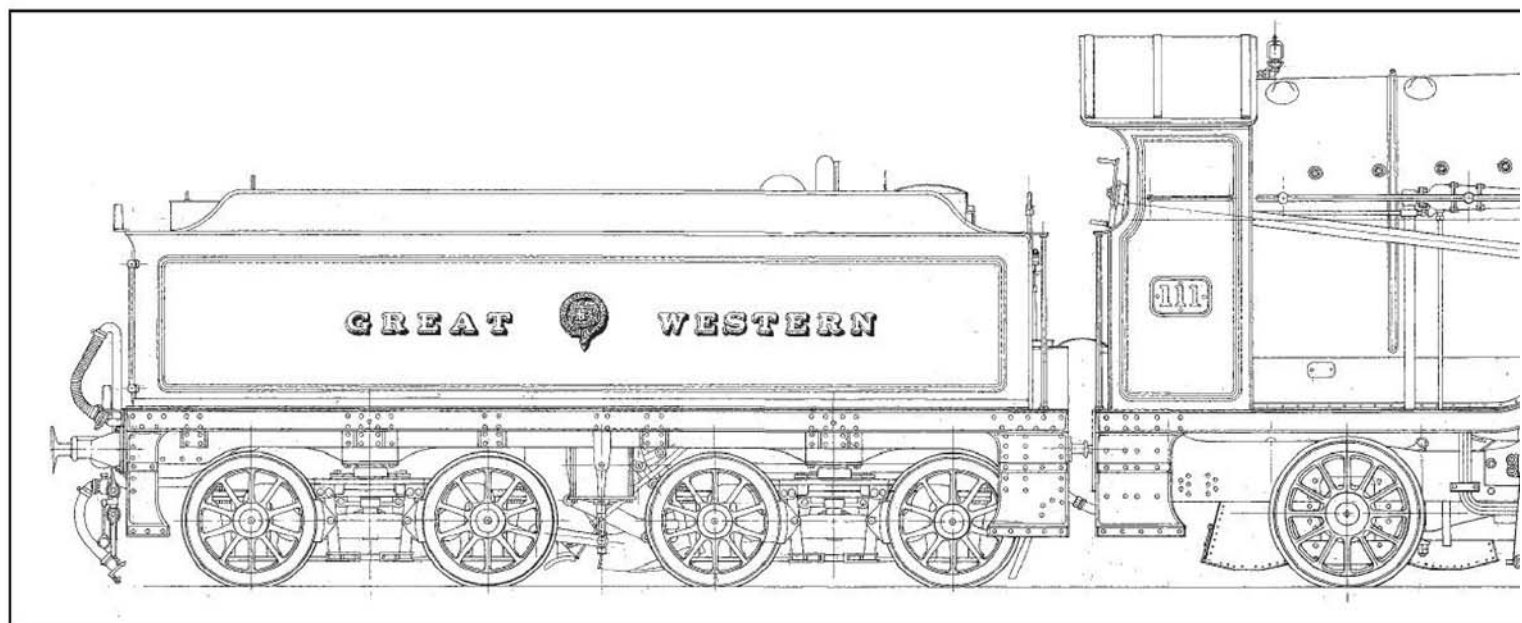
## Why was it built?

One reason for its construction was that Churchward had a view of the future in which more powerful locomotives would be required for trains whose weights were on the increase. Other reasons given were that the Board of Directors wanted an impressive machine on the Western. Other people have suggested that Churchward was looking to achieve more boiler power hence the large boiler. However, there never has been a really satisfactory answer. One reason, which seems to be overlooked is that Churchward was renowned for constructing a single prototype for each of his classes and thoroughly trying them out, and ironing out any faults, before starting a production run. However, nobody seems to mention this

in relation to *The Great Bear*. Could it have been that this is exactly what was intended with the 'Bear', but while it was having its problems ironed out the 'Star' class proved to be so very successful that he felt there was no need to develop No. 111 any further. Whatever the reasons were for its construction, at this distance in time we will probably never find out, but one thing is certain and that is that it did exist for 16 years from Feb, 1908 to Jan, 1924.

To those of us who think we know about Great Western locomotives of the time it is very tempting to dismiss *The Great Bear* as simply a large boomed 4-6-2 version of the very successful four cylinder Star class 4-6-0s. However, the more I have looked into the engine from a model engineer's point of view, the more I have become convinced that this locomotive was unique in a number of ways other than simply being an assembly of standard parts to make a large 4-6-2.

When built, No. 111 was among the first wide firebox standard gauge engines to run in Britain and certain accounts have said that in its early days





it was difficult to steam due to the firemen not being used to its wide firebox, but I have my doubts on this because at that time there would have still been many people around who had fired the old broad gauge locomotives which had wide fireboxes. Probably most of the senior drivers in 1908 had been firemen on broad gauge engines before they disappeared in 1892, so their knowledge and expertise would have been available. The biggest problem those firemen probably would have had was how to keep the back corners of the fire-grate covered with fire which must have been quite difficult with a round fire-hole. I well remember the technique used by firemen at Ebbw junction when firing the wide firebox 92xx locomotives that had oval fire-holes. To fire to the back corners of the box they would drive the shovel into the firebox at the opposite side of the fire hole to which they were firing and, all in one movement with the blade inside the box, would tilt the shovel at 90deg., strike the back of the handle on the fire hole side, and at the same time use this to flick the coal backwards into the opposite back corner.

Many years ago J. N. Maskelyne published in *M.E.* an excellent article and drawing of the 'Bear'. It was published after he died and I don't think

he had entirely finished the drawing. In view of some recent enquiries in *M.E.* about my 5in. gauge 'Castle/Star' class design of 30-odd years ago I am again working on the design and incorporating the 111 into the drawings. One of the products of this is the necessity to produce a model engineer's general arrangement drawing of this locomotive to be included in the series of drawings. The drawing very closely follows the full size and I thought that while I would not in any way wish to detract from J.N.M.'s drawing, which is excellent, my drawing may fill in some of the gaps left off his drawing and also show some more details of the right-hand side.

### Truly impressive

When the engine was built and put into service in February 1908, it must have been one of the most impressive locomotives to take to the rails in this country at that time. Enthusiasts must have been in awe of it. Just imagine, its massive boiler and smoke box surmounted by the clean brass safety valve cover and brass topped chimney. Yes I know that G.W. locomotives had copper topped chimneys, but not this one. J. N. Maskelyne in his article recorded this fact and he actually saw the 'Bear'. Also there are a few references to this in other publications and the very fine model, built by the

Crewe apprentices, at the Swindon Museum has a brass-topped chimney.

Picture also the middle chrome green paintwork of the boiler, cab and tender tank, all highly gloss varnished, all surmounting the gloss black painted chassis, picked out with the orange chrome lining on the cylinders, hanging plates, etc. In those days the finish on locomotives was all very high gloss, indeed this was so right up to the end of steam overhauls, so where this modern day preponderance for semi-matt finish in our model world has come from I don't know and as far as I am concerned it is a load of rubbish, so if you are finishing off a model at the paint stage can I urge you to finish it in high gloss. No G.W. locomotives ever left the factory in anything less than a high gloss finish (except as a wartime economy). If you don't believe me then look at photographs of ex-works locomotives. To achieve the best finish I always apply the main colour coat in flat paint and put the gloss finish on with clear varnish.

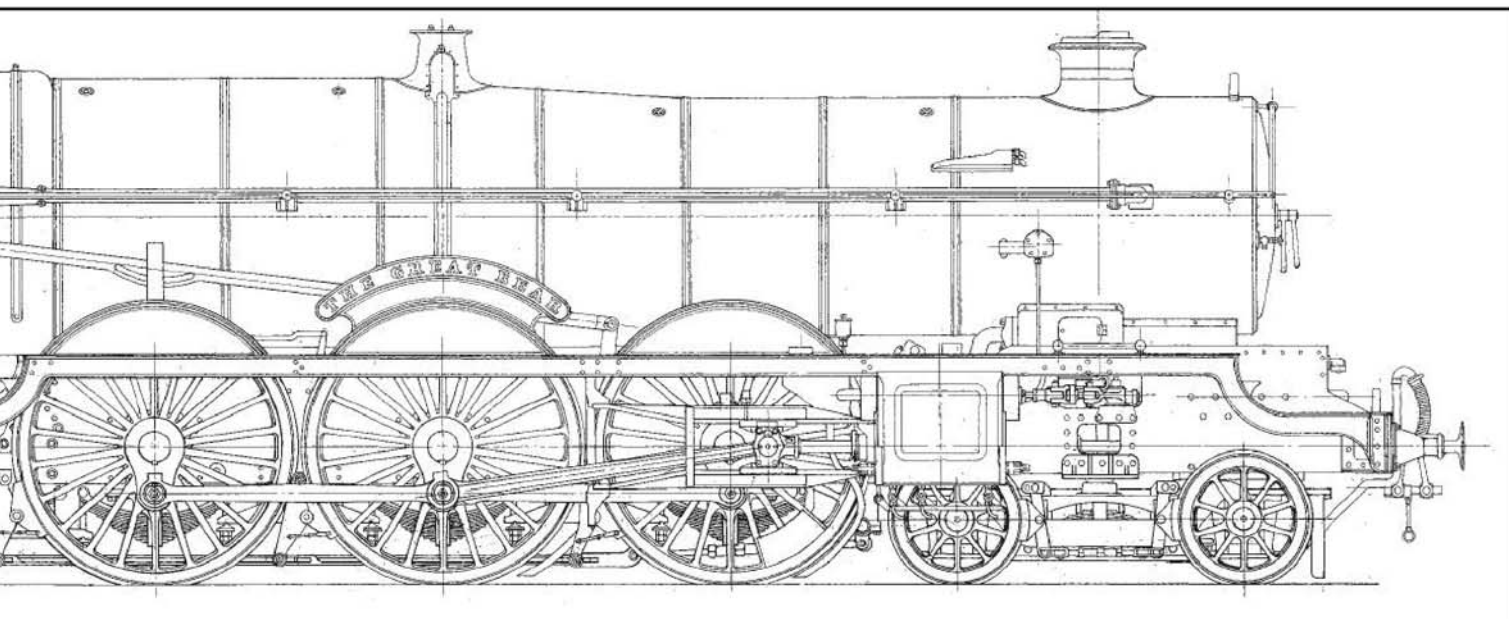
The 'Railwayacs' (that's what railway enthusiasts were called in those far off days) must have gone to great lengths just to view this engine and must have recorded it many times in photographs. In view of this, and of the fame of the engine, I find it strange that so few

photographs of it survive. In my collection of publications are a total of 17 different photographs of the engine that I feel is very small. These days whenever the 'Bear' is mentioned and a photograph is published you can guarantee that it and what is said will already have been published many times.

### Some new facts

C. B. Collett's 'Castle' class of four cylinder 4-6-0s appeared in 1923 in the shape of No 4073 Caerphilly Castle, were an enlargement of the 'Star' class, and proved to be very successful. So much so that I feel the 'Bear' became a bit of an embarrassment. So in January 1924 it was taken into Swindon and rebuilt as a 'Castle' class retaining the number 111 but renamed *Viscount Churchill* and eventually withdrawn for scrap July 1953.

By looking at the 'Bear' from a model engineer's standpoint, I have come up with quite a few facts about the engine which do not seem to have been published before and which the present day railway enthusiasts may also care to take note. When I started looking deeper into the design of the locomotive and its tender by examining the official Swindon Works drawings, I began to realize that No. 111 was unique in a number of ways other than >>>





#### VITAL STATISTICS

As originally built and in working condition The Great Bear weighed in at 97tons 0cwt while its tender weighed 45tons 15cwt when fully loaded. Other dimensions were:

|                  |                                                                                                                 |
|------------------|-----------------------------------------------------------------------------------------------------------------|
| Cylinders (4):   | Dia. 15in. Stroke 26in.                                                                                         |
| Boiler:          | Barrel 23ft 0in.<br>Dia. Outside 5ft 6in. and 6ft 0in.                                                          |
| Firebox:         | Length outside 8ft 0in.                                                                                         |
| Working pressure | 225psi                                                                                                          |
| Wheels           | Bogie 3ft 2in. Coupled 6ft 8.5in.                                                                               |
| Wheelbase:       | 7ft 0in. + 5ft 6in. + 7ft 0in. + 7ft 0in. + 8ft 0in.<br>Leading overhang 3ft 6in.<br>Trailing overhang 6ft 0in. |

simply being the only 4-6-2 engine built by the Western and it contained a number of components which were not standard and not carried by other locomotives.

So let's have a general look at the locomotives and my drawings which are intended to show the 'Bear' in the period just prior to the First World War when its works plates had been removed from the centre driving wheel splasher and top feed for the water feed had been combined with the safety valve fitting. Prior to this the engine had the plain safety valve cover without the top feed shoulder covers, the feed being by combined clacks via the underside of the boiler barrel.

We will also see that an external four cone vacuum ejector has been fitted at boiler handrail level. The fact that only one steam pipe comes from the cab to attach to the ejector tells us that all four cones were controlled by one single pull down valve on the driver's brake valve. Later these ejectors were altered so that one cone could be operated independently from the others and was used to maintain the vacuum in the brake system while the engine was stopped, in which case the driver's brake valve had an additional small steam valve on top of it for this purpose. Photographs just prior to its withdrawal show that No. 111 retained the original full four cone operation type until its end.

In the First World War most G.W. engines had their brass beading removed from the driving wheel splashers, but not the 'Bear'. However, at some time during that conflict its chimney was replaced with what appears to be a cast iron type but with the gap between the base and the copper top considerably reduced. Later again, probably at its last major overhaul, the chimney was replaced by a cast iron version of the 47xx class type. The fluted slide bars on the 'Bear' that were the same as on the first batches of 'Star' class locomotives but which, unusually, it retained to the end of its working life.

#### Original condition

In its original 1908 'as built' condition footstep and hanging plates were fitted to the valance angle just ahead of the outside cylinders with a short horizontal handrail fitted on top of the foot plating above the steps. Apparently on its first visit to Paddington the footsteps had an argument with one of the platforms and they were quickly removed from the engine. The odd thing is that the small handrails on top of the footplate were left in place and remained there for many years, probably until its last major overhaul, hence the view of them on my drawing. On this last point. The official Swindon works drawings show these handrails to be quite short, about 18in. long but photographs show them to be quite long, about two feet.

The 'Bear' was unique among G.W. engines in that it carried three different types of brake hanger brackets, the middle bracket being attached to the pivot bracket for the compensated springing while the leading hanger was suspended from the guide bar frame bracket. The rear hanger was suspended from a special bracket arranged to properly align the brake blocks with the wheel from the frame that was set inwards at this point.

Readers will notice the fitting on the side of the smoke box below the handrail and towards the rear. This fitting indicates that the engine has a superheater, and the fitting contained a small steam cylinder and lever mechanism that operated the superheater damper. In those days it was considered inadvisable to have the fire passing through the superheater flues when the elements were empty of steam and, therefore, a box structure was built around the superheater header with a flap type door arrangement operated by the cylinder fitting. The steam supply to the apparatus was taken from the regulator box on the front tube plate and automatically opened the damper when the driver opened the regulator.

It will be noticed that, on the front view, the right-hand middle driving wheel splasher is set wider than the leading splasher. The rear right-hand splasher was also wider, the reason being that these two splashers had to accommodate the reverser reach rod and steady bracket. The steady bracket for the reverser reach rod is a substantial affair, and is either a casting or a forging, which is unique to this engine, other engines being fitted with a much simpler arrangement. Prior to the fitting of the top feed at the safety valve the left hand middle driving wheel splasher was the same width as the front and rear splashers, but the down pipe from the top feed fitting necessitated the splasher being made wider as shown to allow the pipe to pass behind the nameplate. Simply

removing the splasher front and riveting a spacer onto the splasher top thus moving the front outwards achieved this.

Another unique difference on the 'Bear' was that its boiler handrails were set at 6in. above the boiler centre line whereas on all other larger locomotives they were set at 12in. above the centre.

When I came to make the additional working drawings for my series my greatest fear was that I would be unable to get a decent ash pan under the firebox due to the presence of the trailing axle boxes and springs, but when I tackled the job I found that there was plenty of room for the pan together with its working front and rear dampers.

Another point, which readers will notice, is that the 'Bear' is fitted with bogie brake gear, which it retained throughout its existence. It has always puzzled me that very few people seem to understand how this gear operates as it is one of the simplest mechanisms in a brake system I have ever found. Its main problem was that it required frequent adjustment and a lot of provision for this was built into the lever arrangement. It was found that the gear added very little to the braking of the engines, which eventually led to its removal from all G.W. engines from that date. This is also the reason why the first batch of 'Castle' class locomotives built in early 1924 had the gear but the rest didn't.

#### Wider cab

The 'Bear' was also different from other Churchward locomotives in that its cab was made wider at 8ft 3in. whereas his other tender locomotives were 7ft. 10in. A curious fact about this cab is that it was unique in that the top of the cab-side cut outs were turned inwards by an inch or so. I have yet to discover the reason for this. This is shown on my cab view where the top of the cab-side T-irons are shown turned in. The width across the foot plating was also made wider in the area of the cab and was



increased to 9ft 0in. from the normal 8ft 8in. If you are the kind of person who wants to build to medal or award standard, this is the kind of information you need to have about your prototype.

Being such a large engine you would think that the interior of the cab would have been quite roomy but this was apparently not so on the 'Bear'. Although no dimension is shown on the works G. A. drawing, by measuring the distance from the base of the rear of the firebox to the rear buffing plate this comes out at 2ft 3inches. That means that while firing the locomotives the fireman must have had to have one foot on the fall plate at all times which could not have been very comfortable. I find this aspect of locomotives rather curious because it is often the smaller tender locomotives that had the longest footplates. Not satisfied with having a unique locomotive Churchward also made the tender unique in that it was carried on two four wheeled bogies.

The design of these closely followed that of the two cylinder 4-6-0 locomotives

engine except that their wheelbases were shorter. The bogie bolster was different to that of the four cylinder locomotives in that the side bearers were situated immediately above the bogie top frame as on the two cylinder engines whereas on the four cylinder engines they were set outside the frame. I have the patterns for sand castings for this bogie bolster but some years ago I made up the patterns for a lost wax casting of this for my 'Saint' class design, which proved to be very good, so I'm considering doing the same for this design.

The weight transfer beams, or yokes, also differed from the engine bogie in that they were curved upwards at their support centres. On the locomotives they were straight. When originally built the tender carried the small toolboxes of the 'Dean' design but from September 1912. they were altered to the more familiar large type.

## Different scoop

Besides being a bogie type tender its water scoop was also unique. The standard water

scoop was suspended from a pedestal from which it was hinged and pivoted up when raised. Not so the 'Bear's'. The scoop blade operated on levers.

The initial movement when being raised was to slightly tilt the scoop upwards and away from the pedestal. Further operation of the lifting mechanism brought into operation two levers that pivoted the scoop upwards further away from the pedestal. The tender was further unique in that the water control valves for the injectors had to be pulled up and down through 90deg. rather than horizontally as for other tenders.

In his article J. N. Maskelyne stated that when originally built the water filler for the tender was situated on top of the dome for the water scoop. He related the story that, of course, some unfortunate fireman was bound not to secure it at some time and, yes, it happened, at the first water troughs the lid burst open and flooded the leading coach of the train.

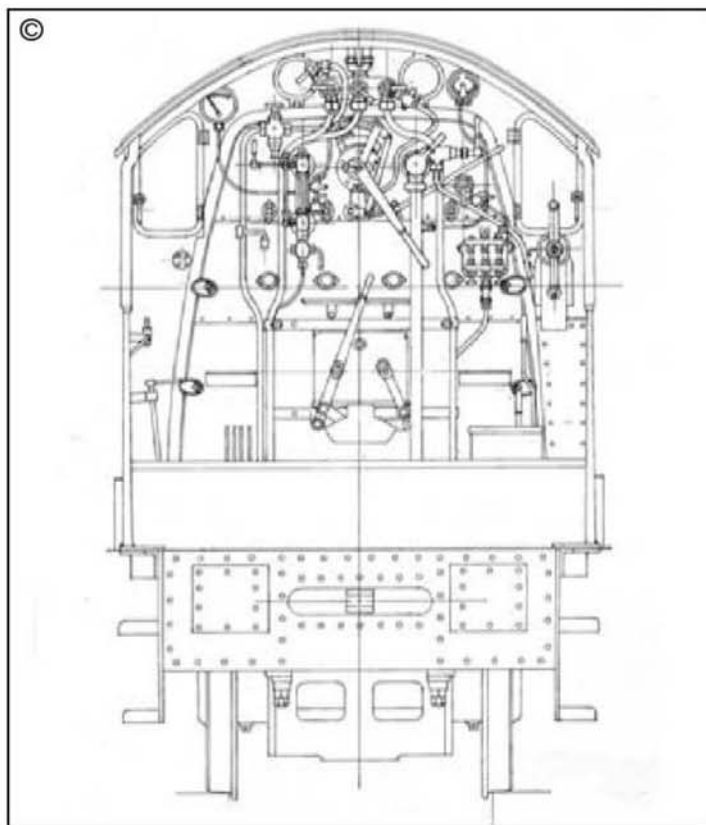
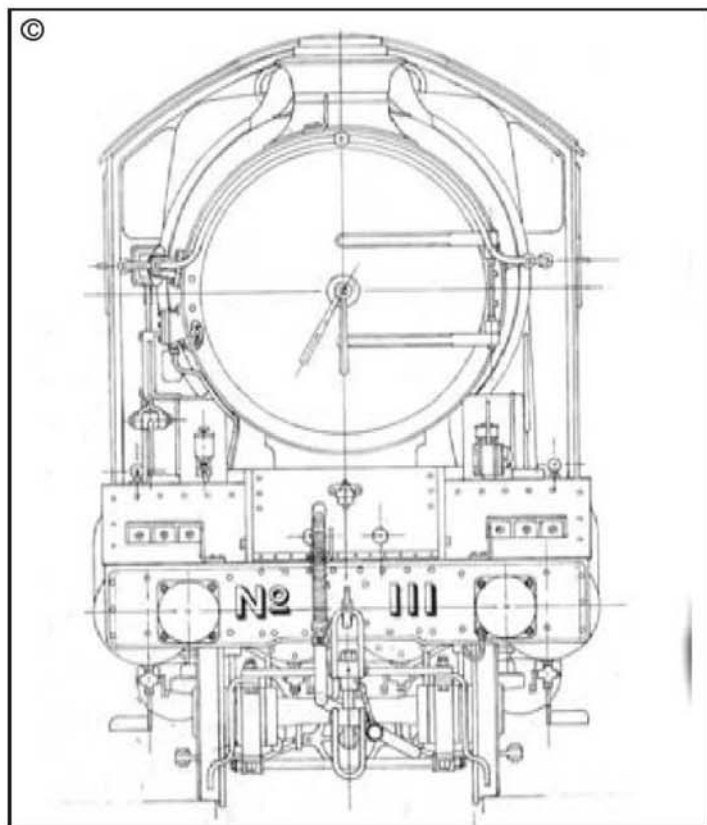
The width over the tender tank was also increased to 8ft 3in. from the normal 8ft 0in. to match the engine cab.

In service the engine was always allocated to Old Oak Common depot in London. In operation it was confined to the main line between Paddington and Bristol, although I have seen references that it was once seen at Exeter and also once at Wolverhampton. I don't know of any 5-in. gauge working models of this engine so any appearance of one should be a first.

My workshop walls recently collapsed on me (those Romans!) but one good thing which came out of that is that an inside cylinder block for my 'Castle' design has come to light which I had cast about 30 years ago and forgot about it. All the patterns from my Star/Castle/Great Bear design are still available so I am debating whether to have a go and build *The Great Bear* or give them away to someone who would like to have a go. My main problem at present is that I have three 'Saints', a 'Duke', and a 3521 class under construction which, together with my full size work does not allow me a great deal of time for anything extra.

For more on the drawings see [www.churchwardlocomotives.com](http://www.churchwardlocomotives.com)

ME





# ONCE I BUILT A RAILROAD



## PART 3

Continued from Page 91  
(M.E. 4291, 19 January 2007)

**Tony Finn** concludes his description of how he constructed a 5in. gauge track in his garden using commercial components.

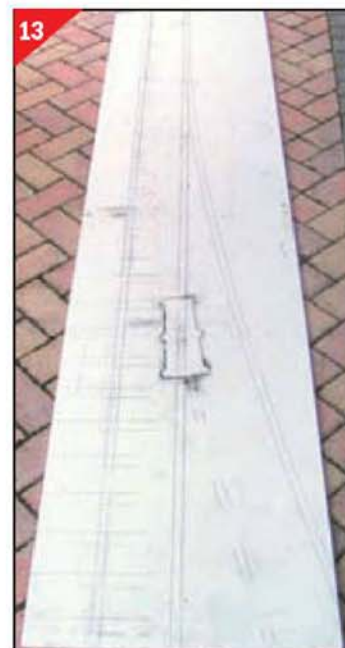
**H**aving got a complete loop, it was time to tackle the first pair of points (photo 14). The chaired track on plastic sleepers has a nice appearance, but I still had to use wooden sleepers for the points, because they don't make longer ones for points unless you buy lengths of the cut recycled plastic stock elsewhere, but they tend to be of a different cross-section: the overhangs are too great to get small quantities of the uncut plastic from the main producer.

I had some scrap teak from an old lab bench, so I turned that into a set of sleepers for the first pair of points. I set out the points on TurboCad on the computer, which made measurement of the required sleepers easy, and enabled the most economic use of the material I had. The point sleepers were secured to three

longitudinal battens, one on the straight side, two on the curved, which are below the ballast level and thus invisible after installation. When I went to the timber merchant for some more wood for the second pair of points, I was shocked at the price of real teak: they advised me to buy iroko which looks fairly similar, but is half the price. I picked my own two planks for straightness out of a large stack, and the sawn wood has proved smooth enough to use after cutting to size without any need to plane it. The planks were of the same thickness as the plastic sleepers, to within a millimetre or two.

### A bit tricky

The first pair of points were made basically to Doug Hewson's instructions as published in a certain other model engineering magazine, using a frog built from rail. The rail has to be bent before machining to make the splice (as in the full size world!) and this looks a bit tricky but I eventually got the hang of it and the splice was bolted together with steel 4BA screws and nuts. Doug suggests brass for this purpose, but in fact steel is better, the difference in electrode potential to aluminium being less than for brass and making galvanic (dissimilar metals) corrosion less likely. The 1/2in. recesses in the wing rails were milled out, and the switch blades also scarfed on the miller. If you haven't a miller, they have to be filed out, a tedious process. I found that milling didn't get the profile quite right: the rail again has to be bent before machining to ensure that you



take off both sides of the rail head down to the web, and I found that I had much filing to do after machining, before the switches would fit satisfactorily. If you don't fancy the work involved, you can buy ready-made switch blades from one of the suppliers mentioned earlier, at a price which rather reflected the many hours of finishing I had to do!

The points were made using PNP chairs to hold the rail where there was room. Where there wasn't room for a chair, I cut one in half and this was screwed to the sleeper on the outside of the rail, with a spike on the inside to retain the rail. Doug Hewson sells some useful



13. Construction board marked out for building points using a cast frog.

14. The first pair of points finished.

15. After installation of the points, construction was started on the east spur.





spikes with L-shaped heads which are ideal for the job, but not easy to get otherwise, since they are no longer used in shoemaking. The slot in the middle of the chair was filled with a plain (pipless) plate for full chairs. Where the switch rail slides, a long piece of 3mm PTFE was inserted into the half

chair to provide a bed for it. On the second pair, I hadn't any more PTFE so I used Tufnol, which proved just as good. The built-up frog was secured to the sleepers over a brass packing plate with screws and washers into the sleepers. The point rail and sleeper positions were drawn out on the chipboard



surface (photo 13), using the outline of the bottom rail flange rather than the gauge: this made the position easy to check with a small square when the rail was sitting on the chairs/sleepers rather than on the board. The straight wing rail was fixed first, then the frog was fixed in the correct position.

### Important

Note that it is important that the sleepers are correctly positioned to support the frog, and it was necessary to insert fill-in pieces of sleeper to ensure this. The switch rails were then fixed in position and their tie-bars bolted in, before finally fixing the curved wing rail to gauge. This is trickier than it looks, and where the switch rails mate with it, its position is wider out from the straight wing rail than you might expect. As well as checking with the track gauge, I also had a pair of wheels on an axle which I ran over the points from time to time. The outer check rails were originally held in half chairs but this was not firm enough on its own, and now they are bolted to the switch rail with spacers as well as being held in the chair halves. This was done when I had to rebuild the first set of points as a way to get over a bad riding problem due to a reverse bend, about which more later. The inner check rails are an extension of the fixed point

rails, and are firmly fixed so it was not necessary there. When first built, the flangeways were too narrow, as the information I had related to an older standard, and I had to increase them; they are now to the dimensions given in Tubal Cain's 'Handbook' I haven't, to date, provided point levers, as the points are only intended to switch the track from circular to up-and-down running, so the points are locked with a simple clamp and thumbscrew on each side, photo 14.

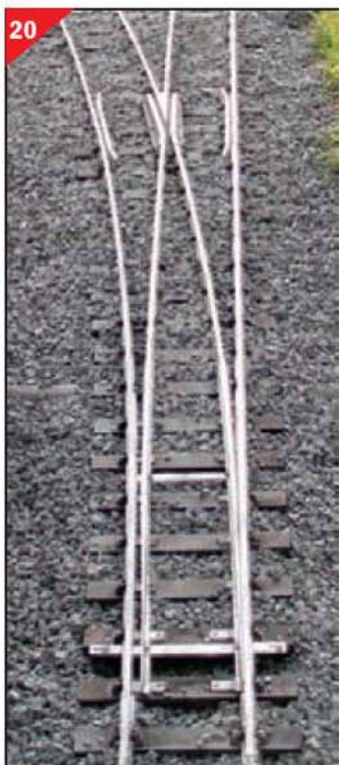
The first pair of points were finished during August 2005, and the next job was to install them and construct the east spur (photos 15 and 16). The curved part of the point had been made as a copy of the plain curved section of track it was to replace, and now the section removed was put on one side to be dismantled and used to make the second pair of points. The east spur was dug >>

16. The east spur completed. The reverse bend into the points to avoid a tree branch helped to cause a derailment and was straightened out later after the removal of the offending branch.

17. Clinometer used to set superelevation to approximately 1.5 to 2 degrees.

18. Rails across the drive; the car can safely be driven over them.





out, ballasted and tracked: the track initially had to have a slight reverse curve in it to avoid an immovable tree, but this kink was later removed as a consequence of the straightening of the main circuit.

### Maximum speed

It then remained to add the ballast around the sleepers, and

19. November 2005. The points rebuilt to straighten out the reverse bend. As in full size, we too get leaves on the line!

20. The second pair of points finished and laid, awaiting construction of the west spur. These points have a cast aluminium frog.

21. The finished west spur of the up-and-down track.



set the superelevation which, on such sharp curves, becomes particularly important. I thought a maximum speed of 3mph was indicated, since proved correct in practice, and the angle of superelevation for this was calculated at about  $1\frac{1}{2}$  degrees. I made a clinometer to indicate the angle directly and this is shown in **photo 17**. The ballast was packed to give  $1\frac{1}{2}$  to 2deg., and this has proved satisfactory.

With the main loop and first spur now completed, I found enough time to get construction of the locomotive finished for the 2005 Annual 'Polly' Rally in Sheffield in September. The removable parts of the track across the block paved drive were pegged with cut-off four inch nails through holes in the sleepers into holes drilled in the block work, to stop movement under the train. I had previously conducted a test on one of the first lengths of track to check whether it would be damaged by driving the car over it. No harm was done, proving the very high strength of this construction system, (**photo 18**). It is only necessary to ensure that the car wheels do not put any significant torque on the trackwork when passing over it. I have driven over it many times now and it is still in one piece: I occasionally have to straighten out a

sleeper which has got knocked cock-eyed. Visitors do have to step over it, of course, and need to be sensibly careful. I had to put wooden shims under this part to get the superelevation correct, as the drive drainage slope was in the wrong direction, and it rides acceptably now. I considered milling a slope on the bottom of the sleepers for this section, and this may be a better solution in the future.

### Getting there

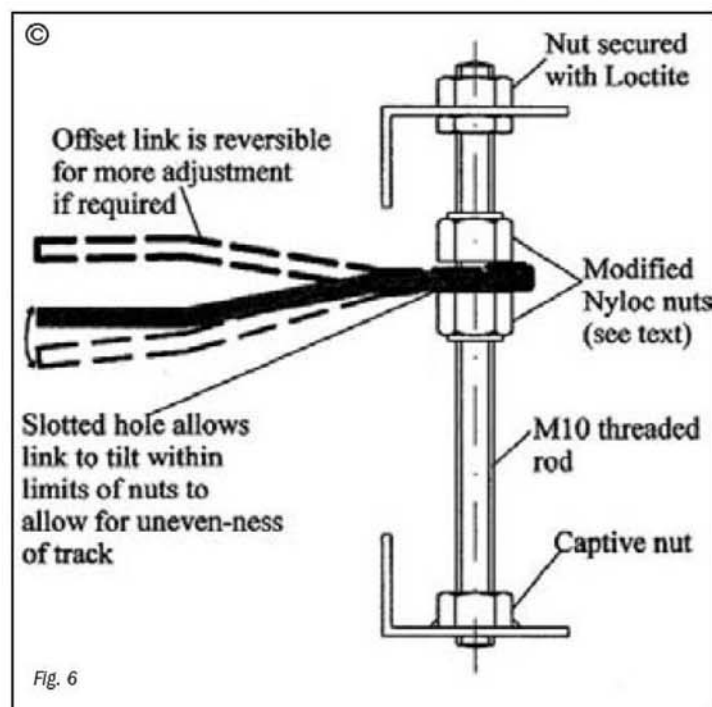
I was given a driving truck, which had to be rebuilt, and

also built a 4ft. long riding car, using some second-hand bogies I had been given on a raised track driving truck. These bogies proved to have wheels of LBSC's narrower back-to-back dimensions and they would not traverse the flangeways on the points, so the wheels had to be spaced out on the axles by inserting a shim washer.

The locomotive passed its steam test, so I now had an engine and rolling stock, but I very soon found out the disadvantages of owning a tank engine. Firstly, the tanks get in the way of half the things you need to lubricate, so it becomes partly a 'point (the oilcan) and shoot' situation. I fitted a little total loss oil pot with feeder pipes to oil the eccentric sheaves, but the rear axle journals still have to be oiled through the wheel spokes. One consequence of this is that too much oil tends to get onto the track, which doesn't help, especially on aluminium rail. Secondly, the water in the tanks gets hot so that the injector won't work: I plan to feed it from a separate tank on the driving truck to get over this.

### Off the rails

In due course, a Family and Friends' Day was organised





for 1 October 2005, for an inaugural run, but really to celebrate the commissioning of the engine rather than of the track, since the track wasn't quite complete yet. We had a good day generally, but the second-hand bogies' wheels were somewhat worn in profile, and this combined with the rather sharp reverse bend through the points, led to a derailment in which my sister-in-law and one of my friends, another lady, were tipped off onto the grass. Fortunately, no serious harm came to them, but it made me realise that the reverse bend was not really necessary, since it had only been put in to clear an obstructing tree branch. It could therefore be taken out, so during November the tree branch was cut off, the points were rebuilt, and the track realigned. (photo 19)

I bought new equalised and sprung bogies at the Midlands Exhibition, and rebuilt the riding car over the following spring. It now has safety bars so that in the event of a derailment, it does not so readily catch in the sleepers and chairs. In the course of rebuilding it, and with a view to accommodating visitors, I

devised couplings which are adjustable in height (fig 6). The coupling link has a slotted pivot hole through which passes a fixed vertical M10 screwed bar about 4in. long, and on each side of the link is a Nyloc nut which has been carefully partially tapped out, so that it grips well enough not to move on its own, but can readily be turned with the fingers. By screwing the two nuts up or down, the height of the link can be adjusted, and also the amount of vertical free play which allows the link to tilt up and down to cater for springing and slight unevenness in the track. The link is cranked in a vertical offset, and so, by undoing a locknut on the threaded bar and undoing the bottom Nyloc nut, it can be turned over to allow for coarser adjustment. In use this summer the new riding car has proved a much better ride, and the removal of the reverse bend at the points has made a big improvement. The riding car itself has no brakes: these are on the driving truck, and seem more than adequate for such a light train.

### More points

When it came to building the second pair of points during the

winter, I sought to avoid having to build another frog from rail, and bought a cast aluminium one from Jeff Price at the Midlands Show. He said that for  $\frac{1}{2}$ in. rail, I would have to recess this into the sleepers, but that assertion was based upon rail spiked direct to the sleepers. Because I was using PNP's chairs which raise the rail up from the sleepers by just less than 3mm, checking the thickness of the base of the frog casting showed that there was enough there to allow the removal of a measured amount, about 3mm, by milling. This then brought the top of the frog and the chaired rail perfectly into line vertically when lying on top of the sleepers. This simplified things a great deal, and the second pair of points was finished in time for installation in the spring of 2006, (photo 20).

The west spur of the up-and-down was now to be built over significantly falling land across the front lawn, and the track bed had to be built up. After the side slabs were in place and pegged, I built a small brick wall each side and capped it off with cut slabs before tipping in the ballast and fixing the track. I have very little experience of bricklaying, and was glad that it was only a very small wall, though now it is capped, the fact of its being not quite vertical is quite well hidden! On the north side there was a strip of grass which was too awkward to mow, and this was concreted before being paved with slabs and steps (photo 21). The buffer stops, a finishing touch, are laser-cut steel, bought in kit form from PNP. The buffer beams are machined pieces of rail.

### Opening day

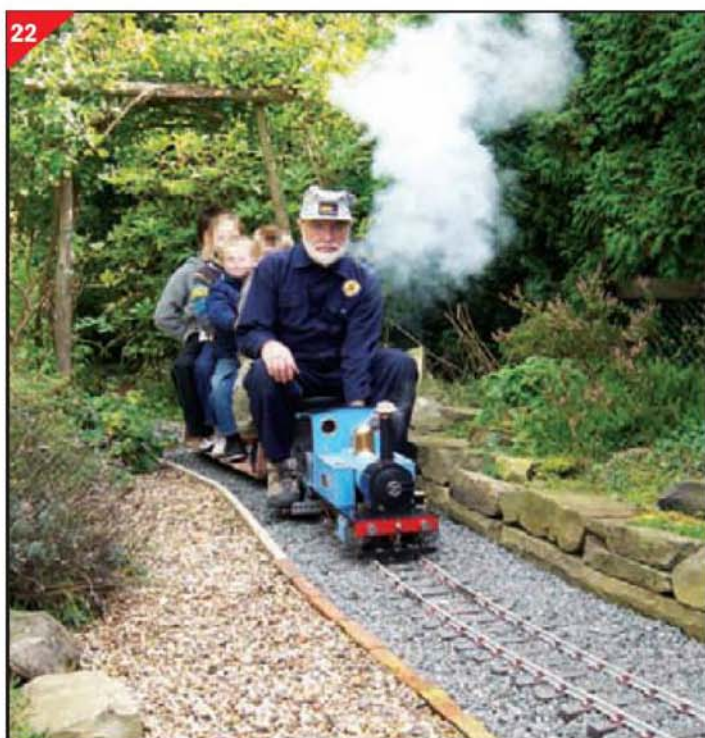
So that was the track finished. To celebrate, I organised an Open(ing) Day and Barbecue for the Hull Society, and one of our members, Brian Rylance, brought over his Sweet Pea, and ran with passengers for most of the afternoon, (photo

22). I had trouble firing Sam up, as I had forgotten to tighten the boiler drain plug, which was cracked open, and once water and steam were hissing from it, I couldn't get near enough to stop it. So, since Polly locomotives have a fusible plug, I needed to drop the fire in a hurry where the locomotive stood. This was when I found out that plastic sleepers melt very quickly and burn quite well! However, I eventually got Sam fired up for the track's official celebratory run. The two damaged sleepers were easily replaced, by undoing the screws and screwing the undamaged chairs to new ones. I have since forged a square key spanner from silver steel to enable the drain plug to be tightened or undone without getting scalded. It's called learning by your mistakes.

I don't think there is much else that I can say about the track, except that the physical effort in moving seven tonnes of soil and gravel and nearly seven tonnes of ballast helped me to lose eight or nine pounds in weight!

To sum up, I think the PNP track system is very good, and easy to put together, and I would recommend it to anyone interested in building their own track. I have no connection with any of the companies mentioned here, other than as a satisfied customer of some of them, and I have received some good advice from them too, as well as courteous service.

Now that the track is finished I can turn my attention to the garden, which is currently being redesigned by a professional garden designer, to simplify the gardening workload (since I'm not getting any younger!) and to blend the railway into its surroundings. She says it is quite a challenge! **ME**



22. The Merryman Garth Railway is open at last! All photos: Tony Finn and Geoff Thorne.

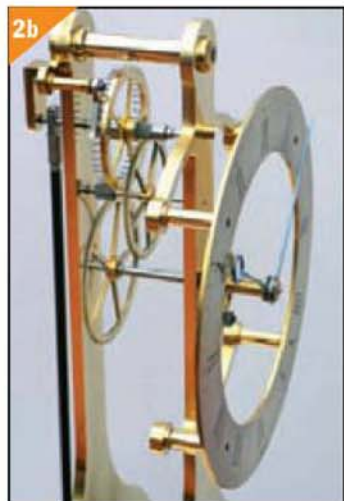




## PART 1

**Richard Stephen** describes a most interesting, different, and attractive new clock to challenge readers.

1. Big balance version.  
2a. Half second pendulum clock.  
2b. Side view of pendulum clock.



# Magnetic drive CLOCK

**S**everal months ago I decided to construct a large balance wheel clock. The design of the clock was particularly interesting as it presented a number of interesting challenges. Initially I wanted the clock to be weight-driven with a lever escapement. The clock was eventually constructed. Unfortunately the weight required to run the clock was excessive and the use of weights to drive it had to be abandoned.

I was reluctant to toss the whole thing into the scrap box and so I began thinking of using a magnetic drive for powering the movement. I wanted to use modern electronics for the drive circuit and, in particular, I did not want to have to use any electrical contacts. These contacts, nearly always, eventually give problems.

I was aware of a possible technique using two concentric air cored coils, which might fit the bill. It did!

This drive system works as follows: The inner coil is used as a sensing coil. A magnet attached to the bottom of a pendulum sweeps over the sensing coil and generates an electromotive force (e.m.f.) in the windings of the coil. This e.m.f. is used to generate a delay of duration equal to half the period of the pendulum (balance). As the pendulum passes the centre point of the two coils the delay triggers a pulse in the outer coil, which repels the pendulum and generates the required impulse. **Photo 1** illustrates the big balance version of the design. The arm attached to and extending below the balance arbor carries the drive magnet. The two coils are placed under the base plate, which is recessed to reduce the distance between the magnet and the coils to about 1 millimeter.

With all the drive system hidden in the base, the clock appears to have no motive power, an aspect that adds to the interest of the design. A further feature of the design is that unlike traditional movement trains which are 'wheel' driven this train is pinion driven from a pinion attached to the balance or pendulum arbor. The pinion drive used in this movement, as far as I am aware, has not been used before. More of this later.

As the design proved so successful I decided to develop a version using a half second pendulum and a further version with a seconds pendulum instead of the balance wheel. The pendulum is attached directly to the pinion drive arbor and is thus suspended on ball races. This version is illustrated in **Photos 2a and 2b**.

Of the two versions the pendulum one is I think the most successful as it is relatively easy to construct and a clock that should appeal to most amateur makers. The construction is very straightforward as it requires only two wheels and two pinions apart from the drive wheel and the motion work.



# MATERIALS REQUIRED FOR THE HALF SECOND VERSION

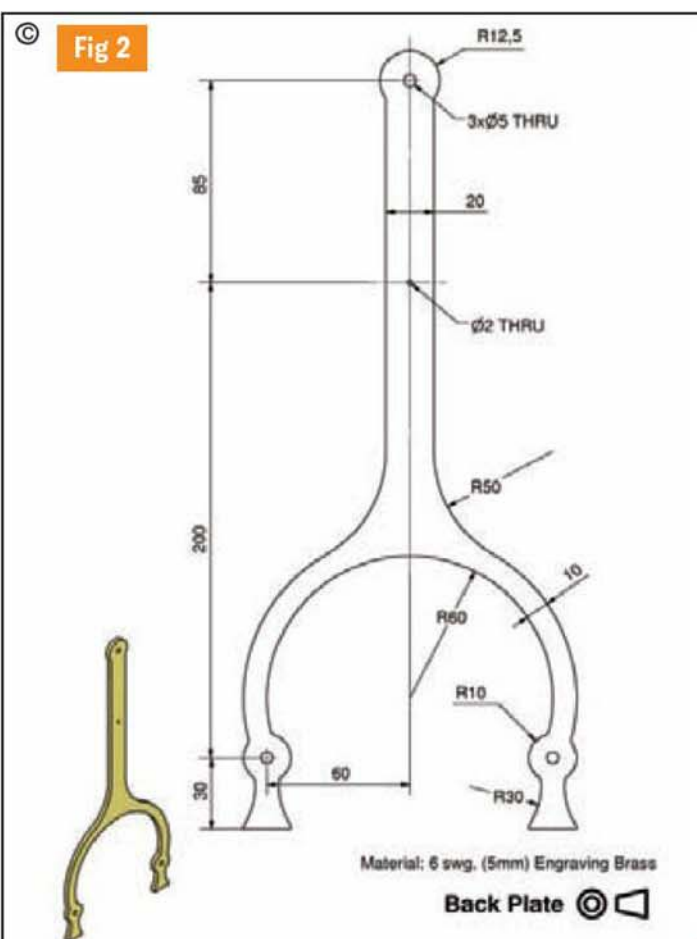
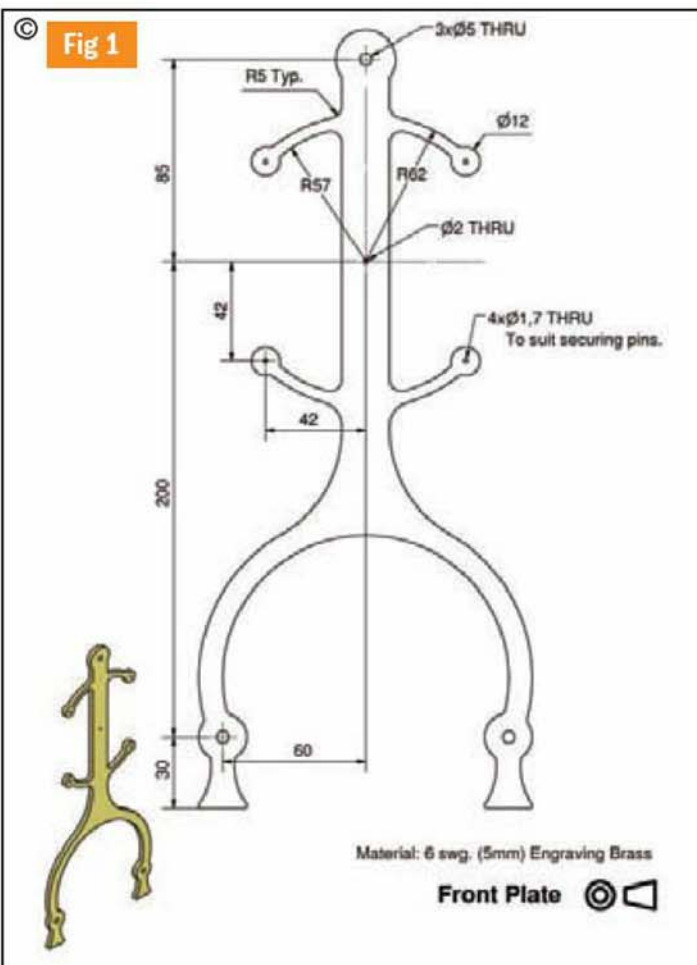
|                     |                                                                                                                                                                                                                       |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Plates:             | Two pieces of 6 gauge ( $\frac{3}{16}$ in. or 5mm) engraving brass sheet 350 mm x 160 mm.                                                                                                                             |
| Base:               | 10 gauge ( $\frac{1}{8}$ in. or 3mm) engraving brass 200mm x 120mm                                                                                                                                                    |
| Feet blocks:        | 120mm of 30mm diameter brass rod                                                                                                                                                                                      |
| Pillars:            | 200mm length of 12mm diameter brass rod                                                                                                                                                                               |
| Dial Pillars:       | 150mm length of 8mm diameter brass rod                                                                                                                                                                                |
| Wheels and Dial:    | 16 gauge ( $\frac{1}{16}$ in. or 1.5mm) engraving brass sheet 300mm x 160mm                                                                                                                                           |
| Drive wheel:        | 30mm x 50mm engraving brass 6.0 mm thick                                                                                                                                                                              |
| Bearings:           | For the half second pendulum version                                                                                                                                                                                  |
| 5                   | 1.5mm i.d. shielded stainless steel ball races (681XZZ)                                                                                                                                                               |
| 1                   | 3mm i.d. shielded stainless steel ball race (MR63ZZ)                                                                                                                                                                  |
| 1                   | 3mm i.d. roller clutch (HF0306KF). The roller clutches are only supplied by INA.                                                                                                                                      |
| Drive magnet        | Half second pendulum version: 7 mm diameter 4 mm long samarium-cobalt magnet DCSC01454 These magnets are supplied by Magnet Developments Tel: + 44(0)14793 833200.                                                    |
| Silver steel:       | 300mm lengths of 2,5mm, 3mm and 4mm diameter rod                                                                                                                                                                      |
| Carbon fibre rod:   | a 1m length of 4mm diameter tube for the pendulum rod                                                                                                                                                                 |
| Pendulum Bob:       | 30mm of 25mm brass rod<br>Pivot steel 4, 1 mm diameter 100mm lengths. 1 length of 1,5mm pivot steel.                                                                                                                  |
| Drive PCB           | The drive PCB is available from Model Engineers Electronic Workshop Tel:- +44 (0)1586 852122                                                                                                                          |
| Drive coil:         | 50mm length of 50mm diameter Tufnol rod.                                                                                                                                                                              |
| Sensing coil:       | 50mm length of 25mm diameter Tufnol rod                                                                                                                                                                               |
| Wire for the coils: | 1 500 gram spool of 40 SWG.(~36AWG or 0.125mm) enamelled copper wire. Available from Scientific Wire Co.<br><a href="http://www.wires.co.uk/acatalog/List05R2c.pdf">http://www.wires.co.uk/acatalog/List05R2c.pdf</a> |

In addition to the above you will need some short lengths of EN1A (Free cutting with sulphur but no lead) mild steel 10 mm, 8 mm and 6 mm diameter and 12 mm, 6 and 4 mm brass rod.

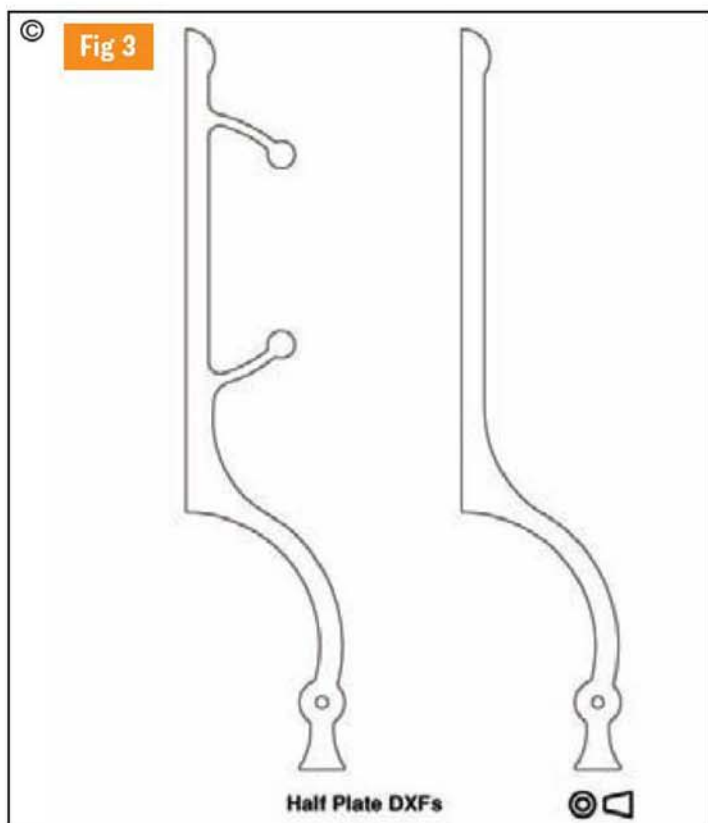
Sphinx micro drills are available from Fenn Tools <http://www.fenntool.co.uk/html/products.html>. These drills are best for drilling small accurate holes.

The construction series will begin with the half seconds pendulum version. As in my previous series, CNC has been

extensively used in the construction of the components of the movements.







This clock needs to be carefully constructed in order to reduce the friction in the train to a minimum. Detailed drawings and instructions have been provided for this series along with all measurements. It must be stressed, that although the dimensions given are precise, these must only be taken as a guide.

As each component of the clock is made its dimensions may need to be tailored to fit with the parts already made. Especially as material sizes may differ from those used in the prototype clocks. Do not attempt to make all the parts, put each aside and when all the parts have been made attempt to assemble the clock. If you do this do not be surprised if nothing fits correctly.

### Cutting out the front and back plates

The front and back plates are illustrated in **Figs. 1** and **2**. Full size drawings of the plates will be made available as .dxf or .bmp files. I profiled my plates on my X3 milling machine, which has a maximum travel along the x-axis of 350mm and on the y-axis of 150millimeters. The total length of the plates is 330mm and the width is 140millimeters.

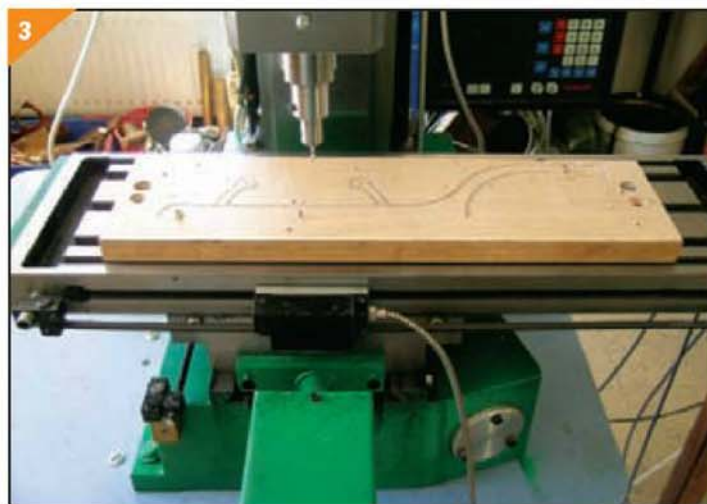
The x-axis travel was just adequate provided the work was accurately positioned. The y-axis travel was I felt just a bit marginal to allow the plate to be profiled in a single operation. To overcome this problem the drawings of the plates were halved along the centre line.

The half plates are illustrated in **Fig. 3**. Drawings of the half plates will also be made available. Each plate is then profiled in two operations.

### Profiling the plates in two operations

To profile the front and back plates in two operations start by cleaning the surfaces of both plates to remove all grease and dirt. I find household cream cleaner works very well as a degreasing agent. Dry the plates and stick them together with double sided adhesive tape. A piece of tape top and bottom will be adequate.

Lightly scribe lengthwise a line in the centre of one plate. This side of the plate will eventually be used for the outside of the front plate of the clock. The rear of the underside plate will be the back of the back plate. It is worth marking these two sides so that you will not make a



mistake later. Mark, on the line, the position of the centre arbor on the plate. Put the two plates to one side. Cut a piece of 18mm thick Melamine covered MDF board the same width as the plates and about 60mm longer. Attach the board to the table of the mill with suitable countersunk screws (see **Photo 3**) Clamp the two plates to the MDF board using hold-downs.

Centre the mill exactly on the marked position of the centre arbor. The best way of doing this is to use a centring microscope fitted in the spindle of the mill. If you don't possess a centring microscope you should get one or make one using the Hemmingway centring microscope kit. It will soon become an indispensable tool. I use mine continuously for accurate setting up, accurately positioning pivot holes, setting lathe tools at the correct centre height, etc etc.

Drill a 2mm hole at the position of the centre arbor through both plates and 10mm into the melamine board. Remove the two plates and insert a piece of 2mm silver steel 20mm long into the hole in the board. Remember to chamfer both ends of the 2mm peg. Replace the plates using the 2mm peg to position them.

The scribed line must now be orientated precisely along the x-axis of the mill. This is most easily done using a centring microscope. Centre the spindle on the 2mm peg and set the digital readout (assuming you have one) on both x and y to zero. Move the table to x = -80 mm and rotate the two

*Base for holding the plates.*

plates until the scribed line intersects the cross hairs. The plates will now be precisely lined up along the x-axis.

Clamp the plates in this position. Move the table a further 5mm to x = -85mm, the position of the top pillar. Drill and ream a 5mm hole through both plates and 10 mm into the board. Make a 5mm brass peg 20mm long, chamfer both ends, and insert it into the hole just drilled. Now move the table to the position of the on the lower pillar i.e. at x = 200mm y = 60mm and drill and ream a second 5mm hole 10mm into the board.

Leave the spindle in this position, remove the plates and turn them over and replace the plates using the top 5mm peg and the centre 2mm one to position the plates. Clamp firmly down and drill and ream the 5mm hole for the second pillar. Remove the two plates and separate them. Double sided tape holds very securely, to make it easier to separate the plates warm the plates to soften the adhesive. Clean off any remaining tape and adhesive using solvent.

Two further 5mm pegs drilled and tapped for 2.5mm metric screws need to be made. These pegs should extend 4.5mm above the surface of the board. The pegs are secured in the two holes in the board using superglue. The length of the 2mm centre peg should also be reduced to 4.5mm above the board.

● *To be continued*





# LBSC, AYESHA, and the battle of the boilers

**Tony Weale** previews his series on *Ayesha II* with a look at what gave the original a unique place in model engineering history.

**T**he *Model Engineer* and *Amateur Electrician* first appeared - price two pence - in January 1898.

It was the first magazine to be aimed at the growing number of amateur engineers, at a time when there were few reference books or sources of drawings, parts and materials outside the engineering trades. Some of the pioneers of the hobby were wealthy gentlemen with time on their hands, but there was strong enthusiasm for such a creative pastime among the middle classes, often from those with no technical background.

Among those who avidly read that first issue of *Model Engineer* was one Lillian Lawrence, a young railwayman from South London. Curly, as he was nicknamed, had been building and experimenting with small steam locomotives since childhood. From initial efforts, built with hand tools, tinplate, and much ingenuity on the kitchen table, these grew more sophisticated alongside his working knowledge of the full-sized machine. He bought one of the first 3½in. Drummond

lathes on the instalment system, and set up a small workshop, and by the early 1900s he was contributing to the *Model Engineer* under a variety of pen names, describing his own work.

## Different background

On the technical staff of the magazine by this time was another railwayman with a very different background to Lawrence. Henry Greenly was a professional engineer, and formerly a draughtsman with the Metropolitan Railway. He was an acknowledged expert on locomotive matters, both full-size and miniature. In years to come he would mastermind the building and equipping of the Romney, Hythe and Dymchurch Railway, but one of his most significant contributions to the model and miniature railway scene was to work out a standard scheme of scales, gauges and basic dimensions, which is still in general use.

At that period, commercially available model steam locomotives were a mixed bunch. They were not always

efficient, or well designed. They were usually expensive, and they seldom bore much resemblance to any prototype. If you wanted a little locomotive which worked well and also looked like the real thing, you could either commission an engineering firm to build it for you, or, if you were an average man with an average income, you would have to design and build it yourself, perhaps incorporating a few commercial parts. This would lead you towards a relatively small-scale model, intended to run on a scenic layout, and you would soon discover that your main design and construction problems would concern the boiler, and the type of fuel.

Coal firing was obviously more like the real thing, but a locomotive type boiler was not an easy thing to build. Liquid fuel, though more expensive than coal, seemed to be more practical in a small model, and allowed the use of a simplified boiler. It was inevitable that a locomotive as small as 2½in. gauge - a convenient size to build at home and run in the garden - could develop enough power to haul its own driver. For a low-powered scenic runner, a water-tube boiler, burning petrol, paraffin, or methylated spirit was adequate, and easier to control.

But ideas were changing. Many amateurs were experimenting successfully with coal firing in small boilers, constructional problems were being solved, and it was becoming clear that a well-designed 2½in. gauge locomotive would pull many times its own weight, and





# BATTLE OF THE BOILERS

maintain steam pressure for long runs.

The correspondence pages of *Model Engineer* were, then as now, full of interest and controversy, and by the early 1920s the relative merits of coal and spirit firing were being debated there at great length. Greenly and Lawrence, by now using his pen name of LBSC, were just two of the contributors, and somewhat surprisingly they were generally in agreement on the subject.

The trouble began when the haulage capacities of the two types of model came under discussion. W.J. Bassett-Lowke, whose company mass-produced mainly spirit-fired locomotives for the smaller gauges, entered the fray with a letter disputing LBSC's claim to have hauled a load of 180 lbs, with his 2 $\frac{1}{2}$ in. gauge Brighton Atlantic. This was the locomotive later named *Ayesha*, and it was fitted with a prototypical, coal-fired boiler. The claim was supported by several leading model engineers of the day.

LBSC maintained his position, and challenged Bassett-Lowke to match the Atlantic's performance with a spirit-fired engine. Bassett-Lowke presented a good case for his firm's choice of spirit firing and water-tube boilers, but apparently felt that his commercial position was being threatened. He organised a public contest to promote his own product and meet LBSC's challenge, commissioning his regular designer to produce a spirit-fired 2 $\frac{1}{2}$ in. gauge locomotive which would pull a living load. The designer in question was none other than Henry Greenly.

Greenly must have been well aware that LBSC's claims were plausible, since he had produced small coal-fired designs himself. He is said to have been puzzled as to why his friend and client Bassett-Lowke wanted to pursue the matter, but he duly designed a suitable locomotive, which was built in Bassett-Lowke's workshops. This was *Challenger*, an impressive, freelance 2-8-2 with a similar

outline to Greenly's recently completed 15in. gauge *River Esk*. It had three cylinders and a water-tube boiler, spirit fired of course, but the cylinders and valves were designed for power, and with small driving wheels and 100psi the nominal tractive effort was high. It weighed 28lb, and presumably to ensure adhesion was ballasted with lead to weigh 36pounds. LBSC proposed to compete with his large and newly-built 4-cylinder Pacific, *Vindictive*, but when this was disallowed on the grounds of its being over scale, he substituted the much smaller *Atlantic*, which weighed only 18lb.

## Let battle commence

The 'Battle' itself took place at the 1924 *Model Engineer* Exhibition. It was hardly conducted on scientific lines, and was not much more than a publicity stunt. It took place on the SMEE's end-to-end track, and each locomotive was required to complete as many runs as possible in 15 minutes. It should be added that Bassett-Lowke's driver weighed only 9 stone against LBSC's 12 stone, and *Challenger* was clearly the more powerful locomotive. In the event both locomotives proved to be quite evenly matched. *Challenger* completed 23 trips in the time allowed, while *Ayesha* managed 22, practically a dead heat.

Bassett-Lowke claimed victory, and had certainly proved that a spirit-fired 2 $\frac{1}{2}$ in. gauge locomotive could do the work, though its fuel consumption, which does not seem to have been measured accurately, must have been high. It would have required considerably more than 15 minutes' testing to establish any meaningful results, but even so it is surprising that *Challenger* did not do rather better. Whatever the technical merits of the two designs, and whoever actually 'won,' the model engineering public saw the contest in quite a different light. Here was a small steam locomotive built by a self-taught amateur in a home workshop, which had acquitted itself very well against a competitor built - no doubt at great expense - by

the world's leading professional model-making company.

There were two consequences. The first, sadly, was a long-standing bitterness between Lawrence and Greenly, who continued to snipe at each other, with varying degrees of seriousness, for many years. It is clear that they respected each other during the years before the Battle, and that the real troublemaker was Bassett-Lowke. It is unfortunate that these three men, all true locomotive enthusiasts, and skilled in complementary areas of a specialised field, could not have collaborated.

The second, more positive consequence was that *Model Engineer* was inundated with enquiries from enthusiasts who wanted to build their own locomotives along 'LBSC' lines. Percival Marshall, the founder and publisher of the magazine, had been shrewd enough to employ Greenly in the beginning, and he now secured the future of the magazine and the hobby by inviting LBSC to contribute a regular feature. That was the beginning of the hugely popular *Shops, Shed and Road - A Column of Live Steam* which became LBSC's life's work, continuing from 1924 with only one short break until his death in 1967.

## inimitable style

In that time he published more than 100 locomotive designs, and described in his inimitable and entertaining style how to build many of them. His enthusiasm was infectious, and his locomotive building instructions still have the power to make the casual reader reach for a hacksaw and rummage for a piece of frame steel by the end of the first page. He also found time to write for other magazines, and to build around 50 small locomotives - he would not have them called "models" - of his own. *Ayesha* was probably not the first 2 $\frac{1}{2}$ in. gauge locomotive to haul live passengers - there are at least two other contenders for that honour - but the performance in the Battle of the Boilers proved conclusively that it could be done.

The locomotives concerned are still with us. *Ayesha* remained in Curly's hands, travelled with him to America in 1929, and ran on a passenger hauling line at the New York Society of Model Engineers' exhibition. Curly made and fitted a new boiler to *Ayesha* in 1936 (in just a few days, over Christmas!) and it is thought that the engine was last steamed in 1964. Bassett-Lowke sold *Challenger*, and built a few other models of similar general design. The original locomotive, somewhat modified, surfaced fairly recently, and fortunately came into the hands of someone who recognised it and knew its significance. It retains a water-tube boiler, which contradicts the story, probably emanating from Curly, that it was later converted to coal firing. *Vindictive* had been built by Curly for a customer, but seems to have come back into his possession since there is proof that he sold it in about 1934. It changed hands at a Christie's auction in the 1970s, but has not been seen since. It would be interesting to hear from the current owner of the locomotive which Curly considered to be his *Magnum Opus*.

Greenly's contribution to the live steam movement should not be underestimated. His standardisation of scales, gauges, and major dimensions was timely and valuable. However, if it were not for LBSC and the Battle of the Boilers, miniature steam locomotives would have remained the preserve of a few wealthy enthusiasts, and many of us would never have attempted to build locomotives, or anything else. Some of his methods offended the purists, but that did not matter. It is unlikely that the *Model Engineer* would have flourished without Curly's constant but rather mysterious presence. As our current editor said to his staff when he had the original *Ayesha* in his office recently: "This is the most famous locomotive in model engineering. If it wasn't for this, none of us would have jobs!" **ME**



NEW  
SERIES

## AYESHA II

## PART 1

**Tony Weale**

describes a project to build a locomotive based on the original Ayesha of LBSC.

This project began almost by accident. In 2003, I was helping to organise a Model Engineer

Exhibition stand for the National 2½" Gauge Association, and with the 80th anniversary of the 'Battle of the Boilers' approaching, it seemed a good idea to display both the locomotives involved, The Greenly/Bassett-Lowke *Challenger* had recently come to light, and LBSC's *Ayesha* proved to be in safe keeping, and almost on my doorstep. An extended loan followed, with the kind co-operation of *Ayesha*'s owner.

Here was a chance for a group of Association members to study the locomotive in detail, and compare it with the design which LBSC had published in *English Mechanics* in 1930. There were two surprises. First, we were dealing with two quite separate designs. The 1930 *Ayesha* was clearly an enlarged and updated version. Secondly, we discovered that the original locomotive of 1921-22 was based on commercial castings and parts from Bassett-Lowke and Bond's o' Euston Road, which, ironically, were of Greenly design.



There had been frequent thoughts within the 2½in. gauge movement about reviving the *Ayesha* design, but the 1930 drawings were incomplete and lacked detail, and there were no drawings at all for the earlier locomotive, which was a more attractive machine and somewhat closer to scale dimensions. Castings for both versions were problematic and we would clearly have to start from scratch. A survey of Association members produced great interest and many offers of practical help, which has led to this 'second edition' of *Ayesha*.

The design follows LBSC's original concept and dimensions, but incorporates a little extra power and adhesive weight, plus an up-to-date boiler and superheater, and some modifications to simplify construction and operation. There is no direct interchangeability with the 1930 design for which it is understood Reeves 2000 holds the copyright. There are some similarities in construction, but there are many dimensional differences.

**Variations on a theme**

The new *Ayesha* can be built either as a close copy of LBSC's original, or with the outline of a GNR Ivatt or a 'Brighton' Marsh Atlantic. A look at the elevation drawing will show that the differences are mainly cosmetic. The Ivatt is slightly more complicated, and the Marsh is possibly the best looking, but you will no doubt have strong views about your own version. Castings and water-cut frames for locomotive and tender are available from the 2½" Gauge Association - you do not have to be a member, but you would be very welcome to join us.

If this is your first venture into live steam, be assured that *Ayesha II* is a straightforward project. It is interesting to build, and no more difficult than some

of the simple tank locomotives which you may have considered. At the time of writing the 2½" Gauge Association has one prototype complete and working, and there are several more under construction. Very few problems have emerged, and the finished locomotive steams well and has plenty of power. LBSC himself used very basic equipment in the early days, and all the machining for *Ayesha II* can be done with a small lathe, plus vertical slide, and a pillar drill. However, we will adopt modern techniques and materials where appropriate.

**Where to start**

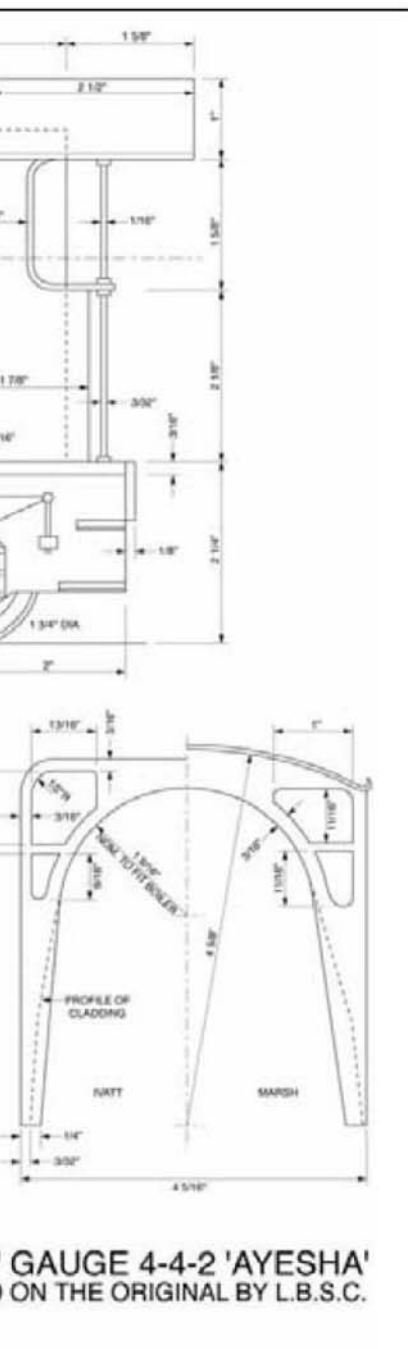
It is usual to start building a locomotive with the main frames, but with *Ayesha II* this is not essential since the chassis consists of three separate units: leading bogie, main frames, and trailing frames. I started mine with the trailing frames, just to see what would happen - and now look what I am doing! I suggest that if you are a complete beginner you should start with the bogie. This will give you the feel of the job, any mistakes will not be too serious or expensive, and it is very nice to have a complete bogie on the shelf, ready for use.

The bogie consists of a cast stretcher, two cast equalisers, a pair of sheet steel frames, four wheels, two axles and four small springs, and it is held together with four 6BA screws. The weight of the locomotive is taken on the equalisers, and the frames perform only guiding and locating functions. Starting with the stretcher casting, this can either be faced top and bottom in the 4-jaw chuck, then transferred to the vertical slide for the remaining operations, or we can start in the vertical slide, with an endmill in the chuck. Having faced the top surface, scribe the centre lines, and from these mark a line 13/16in. either side to give the positions of the side >>









**GAUGE 4-4-2 'AYESHA'**  
ON THE ORIGINAL BY L.B.S.C.

attach the side frames. Check that these really are 90deg. angles, and adjust if necessary by filing. Clamp one piece in position, drill four or five equally spaced  $\frac{1}{16}$ in. holes, countersink the top surface deeply, and use steel rivets, filing them flush with the stretcher. Locate the second angle by measurement from the first, and repeat. You will have to do without side-control, but the upstand can be replaced by a loose rubbing piece - any suitable washer - during final assembly.

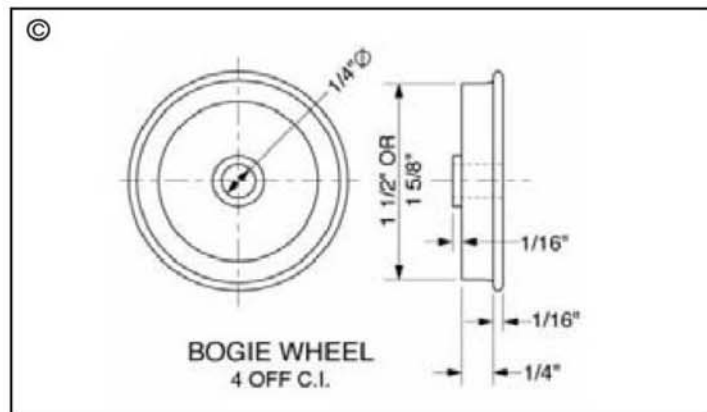
The side frames and equalisers are required next. The equaliser castings

incorporate the axle boxes. The important parts are the back and front faces, and the faces of the axle boxes. These can be milled on the vertical slide, or turned in the 4-jaw chuck. If the casting is a clean one, other surfaces can be merely filed. In fact the whole piece could be done this way if you are good with a file.

Turning is probably the quickest method. Chuck the casting, back outwards, with suitable packing pieces so that it stands proud of the jaws and runs as truly as possible. Face the back, then reset with the back inwards and centralise the casting carefully. The projecting front section can now be faced to  $\frac{5}{16}$ in. and the faces of the axle boxes to  $\frac{1}{4}$ in. thickness. For the  $\frac{3}{16}$ in. blind holes which locate the springs, plain drilling, preferably using a depth stop, is adequate. Leave the axle holes themselves until the next stage.

## Easy to make

Water-cut bogie side frames that require minimal finishing are available, but they are easy components to cut and file from  $\frac{1}{16}$ in. mild steel plate. Make one first, then use it as a template for the other. Drill a  $\frac{3}{32}$ in. pilot hole at each axle location, then lay the frame over the equaliser, centralise the square axle box ends of the equaliser under the pilot holes, and spot through with a drill to give the location of the axle holes in the equaliser. Open out these holes to be a loose running fit on  $\frac{5}{16}$ in. axles - there is no need for reaming or for a close fit - and put the equalisers to one side. Next, mark out and file the  $\frac{5}{16}$ in. wide axle slots in the frames, working from the pilot holes. The water-cut frames will include two pilot holes at each axle location, to position the ends of the slots. Finally, offer up the frames to the stretcher. The 1in. long cutaway in the top edge of the frame should fit tightly around the lug on the side of the stretcher. Clamp one frame in position, drill, tap and countersink, and put the screws in.



Repeat with the second frame, ensuring that both frames are parallel and that the axle slots are in line. Check this by sighting across lengths of  $\frac{5}{16}$ in. rod put through the axle slots. When satisfied with the alignment, put the screws in permanently with a drop of Loctite, then if necessary file the screw heads flush with the side frames, so that they will clear the equalisers. That completes the bogie frame; if you wish to paint it (LBSC did not paint his Ayesha frames, wheels or bogie) this is best done now, before adding the equalisers and the wheel sets.

## Starting on the wheels

Machining the bogie wheel castings will use the same method as the more critical driving wheels; so let us look at this in detail. A simple wheel profile will work in  $2\frac{1}{2}$ in. gauge. Any sophistication will be negated by the vagaries of the track, which is not usually machined all over to fine tolerances. The critical areas are:

1. Make all the treads the same diameter and width. They do not need to be coned, and it is easier to turn them parallel.
2. Taper the front face of the flange at an angle of about 20degrees.
3. Blend the tapered flange into the tread with a constant radius. This 'root radius' is what really keeps the thing on the rails. For  $2\frac{1}{2}$ in. gauge it is officially 0.035in. or 0.9mm, but up to  $\frac{1}{16}$ in. is commonly used.

Therefore, you require a round-nosed tool with a nose of your chosen root radius, and a flank tapering at 20deg., and a

set of digital callipers. Cast iron has a tough skin, so a carbide-tipped tool is highly desirable, and a slow speed must be used. Once the skin is removed, turning becomes easier, but be prepared for plenty of dust and swarf. Each wheel requires several operations, and the procedure is to carry out the same operation on each wheel in sequence noting the lathe dial readings on each final cut to ensure that all wheels are identical.

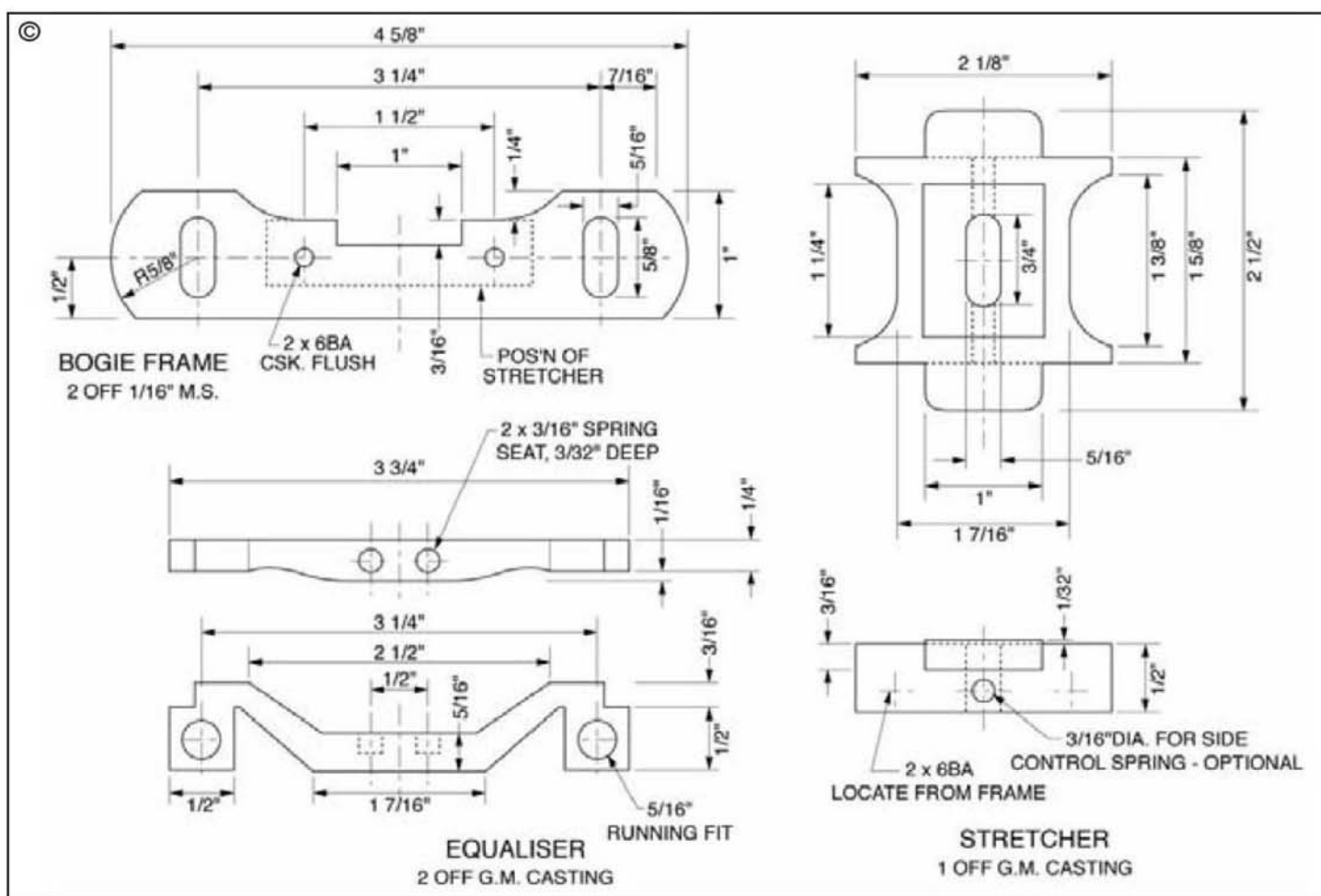
Start by cleaning up the castings as far as possible with files. Clear any flash and sand from between the spokes, and consider how much metal to remove from the back to produce a wheel of the required width. It may only be  $\frac{1}{32}$ in., and probably not more than  $\frac{1}{16}$ in. Chuck the first casting by the tread, back outwards, and set as truly as possible. Set the tool to face right across the casting so that the boss finishes flush with the rim. The first cuts will be impeded by the hard skin on the casting, but will gradually become easier. When you have removed the required amount, treat each of the other castings similarly.

Now chuck each casting in turn, facing outwards, get the machined back running true, and centralise the wheel in the chuck so that the inside of the rim also runs true. If you lock the lathe saddle, and set up each wheel against a packing piece so that they all project equally from the chuck, they can all be finished to the same setting of the top-slide dial.

Face the front of the rim and the boss to the dimensions given, noting that the boss







stands proud of the rim. Then take a light cut from the inner edge of the 'tyre' to form a step where it joins the spokes. Next, use a centre drill in the tailstock to start the axle hole, follow with a pilot drill right through the wheel, and then open out to the required diameter. Bogie and tender wheels can be drilled undersize and finished with a reamer. When dealing with the driving wheels it may be better to finish the axle hole with a boring tool.

For the next operation we need to mount the wheel on a true-running spigot, and support it with a specially made backplate. Turn the backplate from scrap steel at least 1/4in. thick, and a little smaller than the finished diameter of the wheel. Bore the backplate to be a tight push fit on a piece of steel rod of any convenient diameter - say 3/8in. for bogie wheels - and put this combination in the 3-jaw chuck with the backplate against the jaws, and about 3/4in. of the

rod projecting. Turn this down to a hand push fit in the wheel bore, and thread the outer end for a retaining nut. As long as the spigot is not repositioned in the chuck, any wheel mounted on it, and tightened against the back plate, will run true,

Mount the first wheel face outwards, reset the tool at right angles to the lathe axis, and turn the outside diameter of the flange to size. Next, working from the face of the wheel towards the headstock, take several cuts to finish the tyre portion to the correct diameter. The flank of the tool will produce the flange and tread profile, but take care to maintain the 1/16in. thickness at the edge of the flange. Next, with a file, round off this edge, and put a tiny chamfer on the edge of the tread. There is no need to put a high finish on wheel treads. If the wheel slips on the spigot, drill a hole in the backplate, put a small bolt between the spokes and through the hole, and secure with a nut. If the backplate

itself slips, the bolt can rest against one of the chuck jaws.

With a set of bogie wheels turned and bored, we can clear away the cast-iron dust, and make axles to fit. Ordinary 5/16in. mild steel rod is adequate, and it can be turned in the 3-jaw chuck if this is reasonably true (driving wheel axles will need more care, as we will see). Adjust the length of the wheel seat if necessary to suit your finished wheels, and aim to make the wheels a hand push fit. They can be secured with Loctite on final assembly. It is not quite as easy to make axles as it looks, and if you are a novice you may like to cut the axle blank rather longer than necessary. If you then fail to produce a decent fit the first time you turn the shoulder, you can chop it off and have another go. The other end of the axle will be more of a challenge, since you will have to maintain a back-to-back measurement of 29/32in., but by then you will have had more practice!

To assemble the bogie, put the axles through the frame slots, set the springs in their seatings on the equalisers, fit these over the axles and against the frames, and then put the wheels on. Very light springs are required. Cut-down ballpoint pen springs are a good starting point. The correct Loctite for driving wheels is 601 or 603 'High Strength Retainer', but for bogie wheels that are lightly loaded and may need to be removed, a weaker grade such as 'Stud and Bearing Fit' should be adequate. Only very little adhesive is required, and keep it away from the bearing surfaces if you want the wheels to rotate!

It is a worthwhile precaution to place a paper washer over the end of the axle against the axle box before fitting the wheel, tearing it off when the compound has set. It is hardly worth trying to press-fit the bogie wheels, but this technique will be discussed when we deal with the driving wheels.

● *To be continued*



# A marine STEAM PLANT

## PART 2

Continued from page 87  
(M.E. 4291, 19 January 2007)

**Michael Duggan** continues describing his experiences with this superb steam power plant for a river boat.

**D**uring construction several modifications were made and the most important of these was the fitting of two copper baffles in the steam drum to reduce the carry over of water due to ebullition.

The casing and uptakes will be fabricated from 18/8 stainless steel plate 18 gauge thick, and will be lagged on the inside with Kaewool, but access to all pressure parts is possible for inspection. Two adjustable baffles will be fitted to the uptakes to vary the flue gas path and temperature as in normal full scale boilers of this design.

It is intended to fire the boiler with propane gas through a reducing valve for cleanliness and ease of control. There will be a pilot burner and two main burners but clearly some experimental work is necessary. By good fortune a model engineer enthusiast on the SMEE stand at the Model Engineer Exhibition in 1997 had



some experience of a Yarrow boiler firing, and the year before they had a similar boiler on their stand, although it was smaller and not so comprehensive, (fig. 4). It is intended that each of the main burners will be made of stainless steel tube with slots cut every 1 1/4 in. facing upwards and running the full length of the combustion space. The pilot burner will initially be fitted with a 0.050 in. nozzle. A photograph of the completed pressure parts of the boiler are shown in photos 16 and 17.

### Condenser

The main engine and all the auxiliary engines exhaust into the condenser, photo 18. This is a cylindrical return tube type, and cooled by a circulating pump which draws its water via a strum box from the river. The water boxes and both covers are made of cast gunmetal, the shell and bigger tubes of copper, the smaller 5/16 in. tubes of brass and the angle

flanges and tube plates of 1/2 in. hard brass. All the nuts and bolts are brass.

The main shell is a solid drawn tube of 4 in. O/D and 12 1/2 in. long and is 18 gauge thick. It contains 19 tubes that are 5/8 in. O/D and I have designed it to have a surface area exposed to steam of 430 sq in. (fig. 5)

The patterns and core boxes I made of wood and was a new experience, (photo 19). The foundry that did the casting did a good job so the machining was straightforward. Both the angle plates were riveted to the shell and then silver-soldered and all the bosses of brass were silver-soldered and then drilled. The tubes were screwed into their respective tube plates and then soft-soldered.

The water connections are standard domestic 3/4 in. fittings; the four gate valves were bought at a local builder's merchants, but the two strum boxes are described later. Two engine air pumps, feed pumps, >>

16 and 17. Completed pressure parts of boiler.

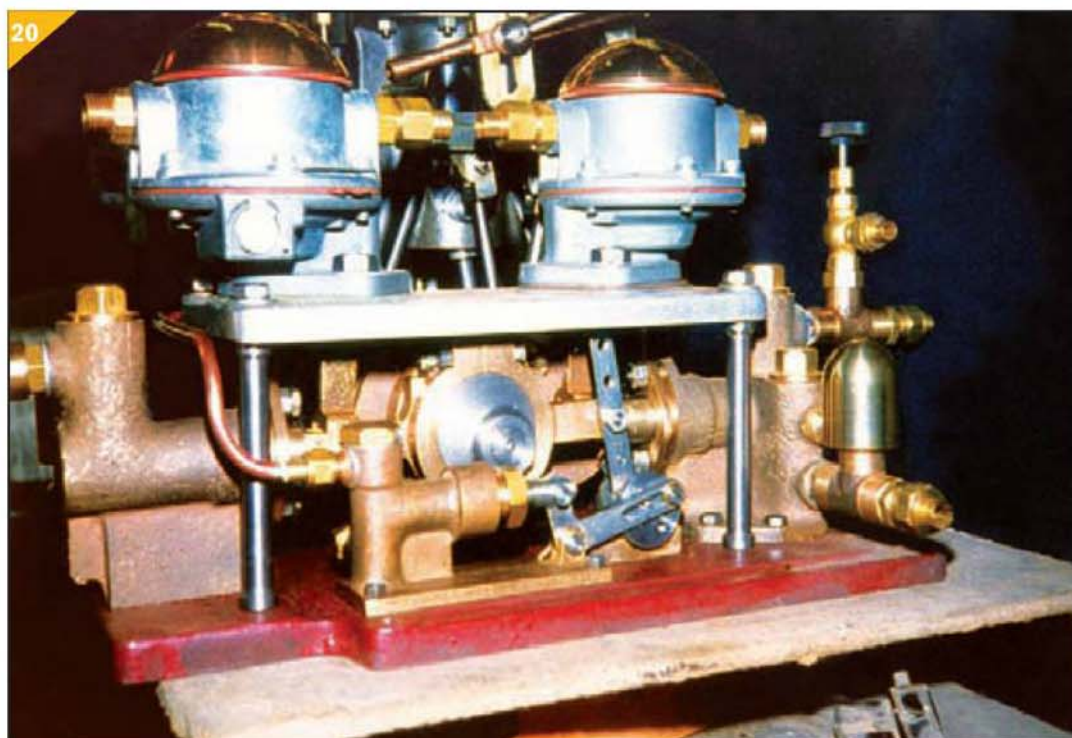
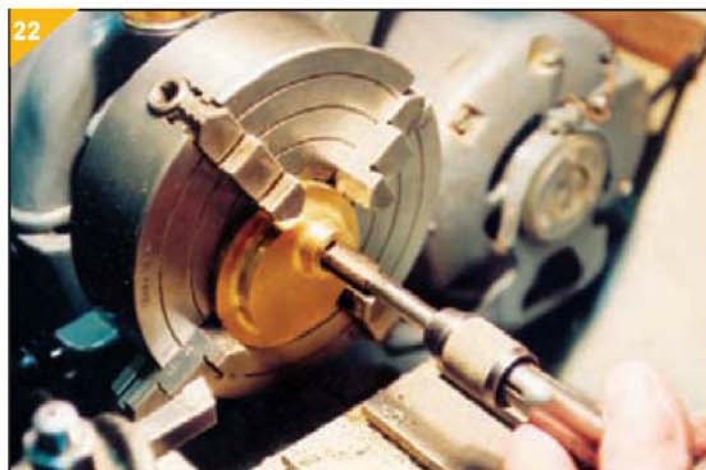
18. The Condenser.











and the LO pump are shown in **photo 20**. The amount of vacuum remains to be seen and is near impossible to calculate. It is quite certain that any lowering of exhaust pressure will be very helpful to all the engines, but I foresee initially there may be many small leaks that will need attention.

## Feed heater

This is also of the shell and tube and contra flow type. It is

mounted horizontally directly above the condenser and receives exhaust steam first, (**photo 21**). It is as described by K. N. Harris on page 141 of his book, *Model Boilers & Boilermaking*. Both end covers

were cast from my patterns and I then machined them, (**photo 22**).

In this case the  $\frac{1}{4}$ in. I/D tubes are drawn brass and screwed one end into the plate and fitted by ferrules into the

19. Condenser patterns.

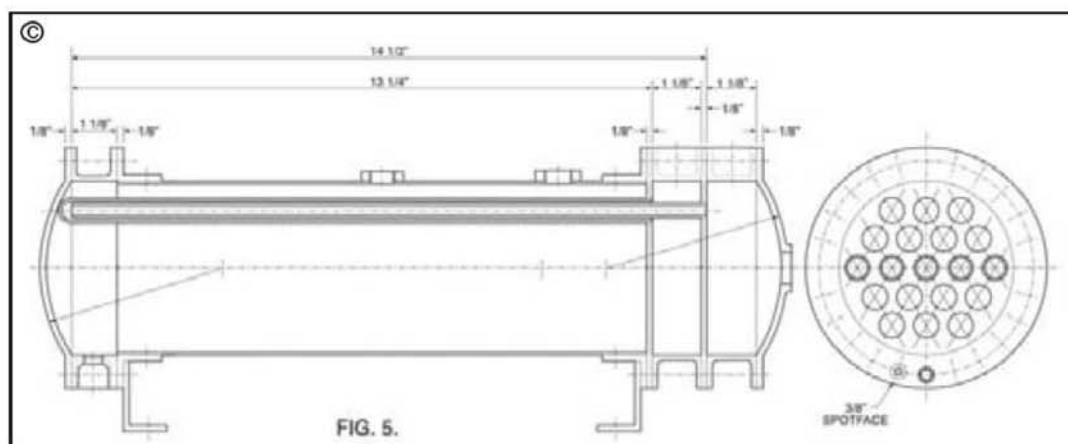
20. Air pumps, feed pumps and L.O pump.

21. Feed heater.

22. Feed heater end being machined.

Fig. 4. Super heater (page 212).

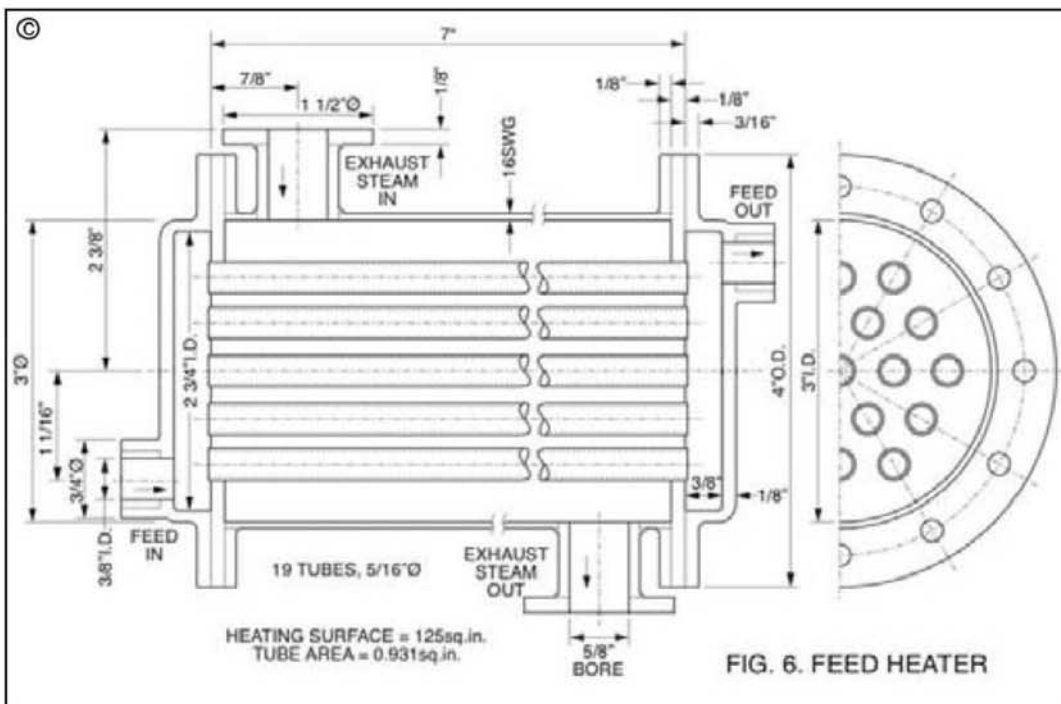
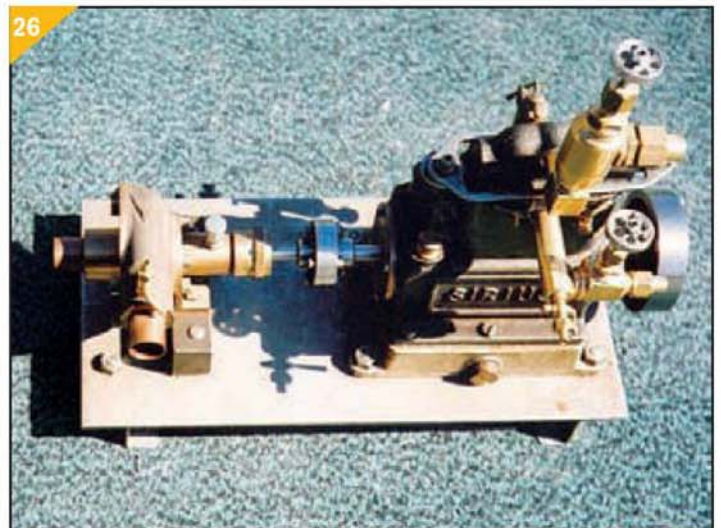
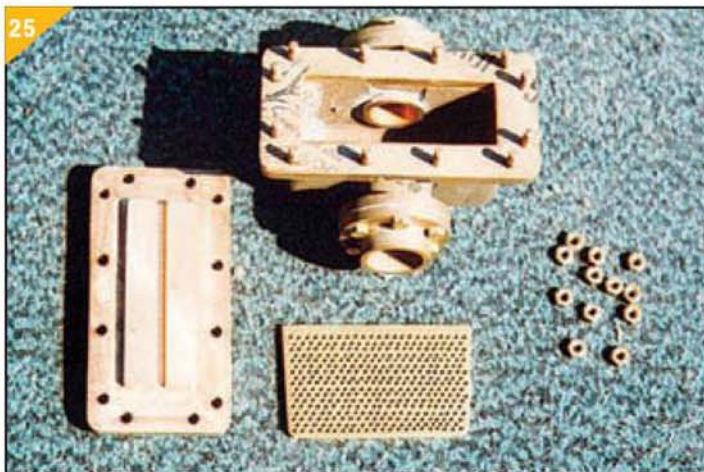
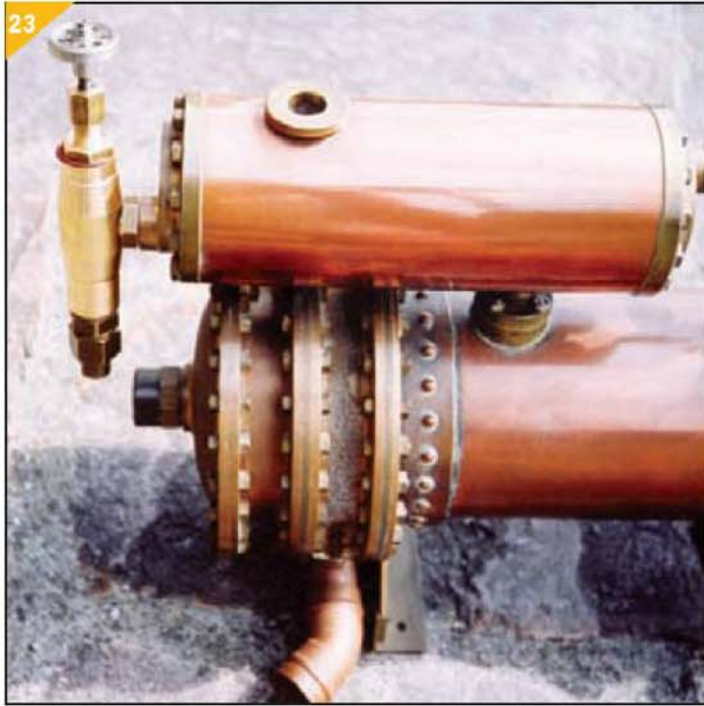
Fig. 5. Condenser.



other. It should be relatively easy to clean from time to time, (**fig. 6**).

The feed connections are both for  $\frac{3}{8}$ in. O/D pipe, and a non-return valve has been made for the inlet. It is lagged and cleaded with copper sheet, (**photo 23**).





23. Feed heater finished and mounted on condenser.

24. Strum box patterns.

25. Strum box open.

26. Circulating pump and engine.

### Circulating system

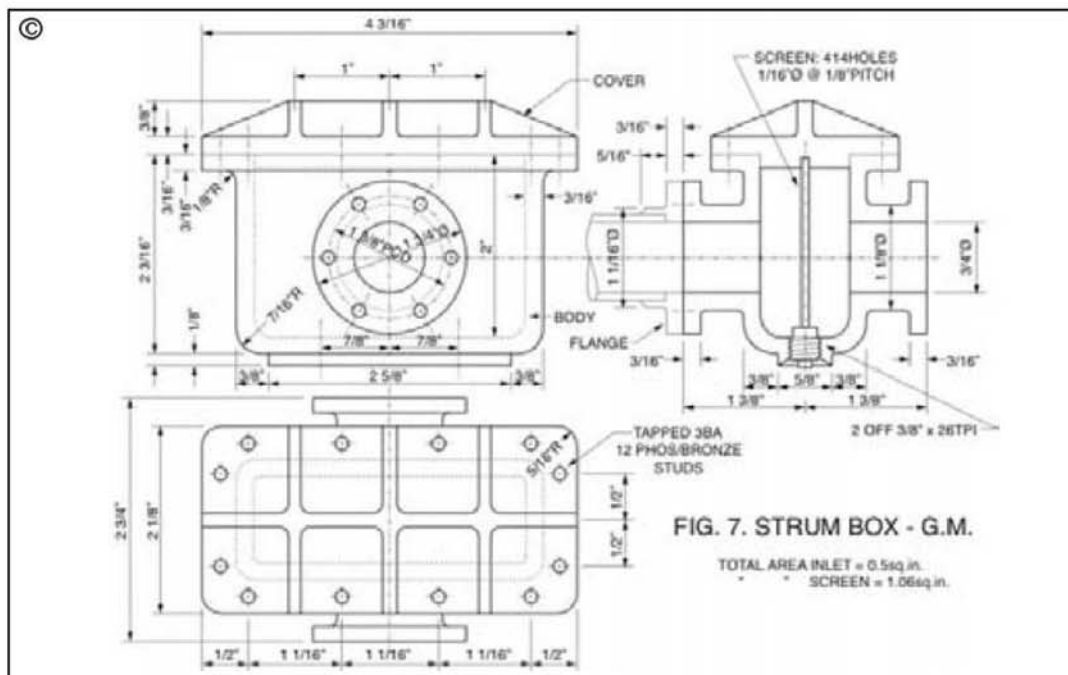
The system is shown schematically in fig. 1 (M.E. 4291, 19 January 2007). Water is drawn in through either of the strum boxes which are in parallel although connected by two L-ported T-cocks and a shut off valve on the hull. From there it passes into the suction of a No. 2 pump which is rotated by a Sirius engine and is rated to pass 850 gal/hour to the condenser, and it then passes overboard and as before a gate valve is fitted at





the hull. The maximum pressure of the system is measured at the pump outlet.

The strum boxes were designed similar to full-scale marine units and a drawing is shown in **fig. 7**. The patterns and core boxes were, however, more complicated than at first anticipated. These are shown in **photo 24** and both halves were precisely doweled together. The castings were made in gunmetal and machined. The centre plates were drilled with  $1/16$ in. holes and this took some time as each had 414 holes. The final result is shown in **photo 25**, but the central plate is easily removed for cleaning.



The pump and engine were mounted and aligned on a common base plate made of stainless steel (**photo 26**). The engine is supplied by saturated steam from the boiler and is fitted with screw down valves

on the inlet and exhaust and this then goes to the condenser. A displacement lubricator is fitted and a typical screw-down inlet steam valve I have made is shown in **photo 27**.

● To be continued.

27. Typical s/d steam inlet valve.

## NO. 98

**M. J. H. Ellis** explains to Adrian more of the mysteries of sound frequencies.

**D**ear Adrian, I'm sorry, but I didn't quite finish off my last letter properly. I should have said that in the key of C the note D is called the super-tonic because it is the next note above the key-note or tonic, C. The name given to B is not so obvious, but musicians think that it leads naturally to the tonic, and it is therefore called the leading-note.

If you have thought over what I have told you, you may feel a little perplexed because I first said that the octave comprises 12 semi-tones, between which the successive frequency ratio is  $12\sqrt{2}$ , (approximately 1.059463), which is irrational (it must be, since  $\sqrt{2}$  can be proved to be, irrational); whereas later, I changed my tune and said that

the notes of the basic scale had frequencies which were rational fractions of that of the key-note. I doubt whether your father could see why, but you will see that these two statements are inconsistent with one another. I had no intention of deceiving you; the fact of the matter is, that both statements were approximations to the truth, introduced with the object of making things easier for you.

When I started to learn about chemistry, which would have been about 1927, I doubt whether anyone understood the true nature of valency as it is known to atomic physicists today. In any event, it would have been beyond the comprehension of 11 year-old schoolboys, and so we were quite happy to believe that

atoms were something like little balls, provided with hooks which enabled them to join together to make molecules. As one learns more about the subject, so simplified concepts can be replaced with more elaborate ones which are nearer to the truth. I shall go on to explain that in the present instance there are two different concepts which, by good fortune, approximate closely to each other. It is an example of the kind of serendipity alluded to by Jerome K. Jerome (1859-1927), who was rather like an English Mark Twain. In his book *Three Men in a Boat*, written in 1889 but still a classic, one of his characters remarks that he knew of no better example of the almighty Providence than the fact that when ducks were



created, so, too, were green peas! (They were having dinner in a riverside inn).

### A happy fact

Put in a nutshell, the happy fact is, that the frequencies of the notes of the basic scale, bearing a simple ratio (such as  $3/2$  or  $4/3$ ) to that of the key-note as I explained in my last letter, all approximate closely to one or other of the frequencies represented by  $f \cdot 2^{n/12}$  where  $f$  is the frequency of the key-note and  $n$  can have an integral value from 0 to 12. There are important advantages to be gained by tuning key-board instruments to a scale of the latter kind, which was advocated by, amongst others, no less an authority than Johann Sebastian Bach (1685-1750). I shall explain why this is so, but before going further, I think that it would be as well to forestall a possible cause of misunderstanding. In French and German there are distinctive names for (1) the levers which form a key-board (*la touche; die Taste*) and (2) the scale which begins on a particular key-note (*le ton; die Tonart*) but the English word 'key' has to serve for both of them. To avoid confusion, I am going to write 'key' for the first meaning, and 'Key' (capital 'K') for the second.

May I remind you that in my last letter I demonstrated that the frequency of D is  $288 \text{ c/s}$ , the ratio to that of C being  $3/2 \times 3/2 \times 1/2 = 9/8$ .

The next note, E, has a frequency ratio to that of the tonic of  $5/4$ ; hence the frequency ratio of E to D is  $5/4 \div 9/8 = 5/4 \times 8/9 = 10/9$ . In the same way, we can work out the frequency ratios between all the notes of the scale of C, with the result shown in my diagram (fig. 1)

You will see that three different intervals (frequency ratios) occur;  $16/15$ ,  $10/9$ , and  $9/8$ . The two larger ones,  $10/9$  and  $9/8$ , do not differ by very much, the difference only amounting to  $(81-80)/72 = 1/72$ . As a percentage this is  $[1/72 \div 10/9] \times 100 = 1/72 \times 9/10 \times 100 = 10/8 = 1.25\%$ . In practice, musicians make no bones over so small a difference, and regard, both

intervals indifferently as being whole tones. Indeed, I question whether many of them so much as realise that any difference exists at all.

They call the smaller interval,  $16/15$ , a semi-tone, i.e., half a tone, but if you think about it, on any showing it is really rather more than half.  $16/15 = 1.0667$ , whereas the greater of the 'full-tone' ratios,  $9/8 = 1.125$ . I can't make my mind up as to whether I should take  $1 + (0.125/2) = 1.0625$ , or  $\sqrt{1.125} = 1.0607$  as the corresponding frequency ratio for a semi-tone, but it doesn't matter, since both these figures are less than  $1.0667$ . I hardly think that Beethoven or Mozart ever worried over such mundane matters.

You will now be able to see that the eight notes of the scale fall neatly into two groups of four, each embracing a frequency range of  $9/8 \times 10/9 \times 16/15 = 4/3$ , while the interval between them, F to G, is  $9/8$ , or a full tone. These two groups are called the lower and upper tetrachords, and in practical terms they are identical. True, the  $9/8$  and  $10/9$  intervals occur in reverse order, but as nobody else cares, (or even knows), about that, why should we? My diagram (fig. 2) illustrates the point.

### Logical basis

Perhaps you have been wondering what all this waffling was about, but it was necessary, to provide the logical basis for the formation of all other Keys apart from the basic Key of C. Let us start by considering the upper tetrachord of the Key of C. This can equally well be regarded as the lower tetrachord in the key of the note from which it starts, i.e. G. But a snag now arises, as its top-most note is C', and the scale cannot therefore continue with the lower tetrachord in the next octave above of the Key of C, but has to extend into a tetrachord beginning with D'. But we cannot just borrow notes from the scale of C for this purpose, because they are D-full-tone-E-semi-tone-F-full-tone-G, which

FIG. 1. INTERVALS BETWEEN NOTES OF DIATONIC SCALE

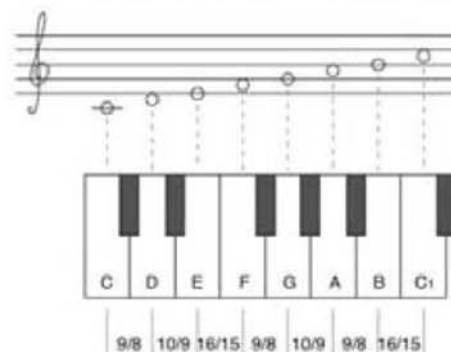
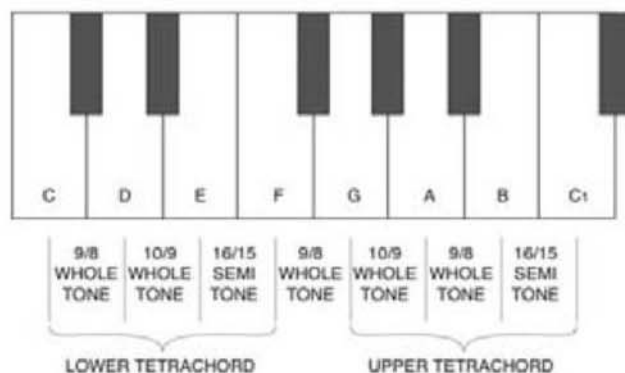


FIG. 2. LOWER AND UPPER TETRACHORDS



means that the semi-tone comes in the wrong order. In the old Mixolydian Mode based on G it was all part of the game, and no one would have worried; but in modern music all scales, in whatever Key, have to follow the same pattern. Accordingly, the order of full-tone, full-tone, semi-tone is restored by raising the pitch of the F by a semi-tone, so turning it into F Sharp, denoted by  $F^\sharp$ , the note sounded by the black-key between the white keys of F and G. If the music is written in the Key of G, so that the performer has to play  $F^\sharp$  wherever the note F appears on the staff, the 'sharp' symbol<sup>#</sup> will appear in the F space at the beginning of the line; this is called the 'Key signature'.

Starting in the same way with the upper tetrachord in the Key of G, it is now possible to create the Key of D, which requires the note C to be sharpened in addition to F. In like manner, the Keys of A (three sharps), E (four sharps), B (five sharps) are created. All five black keys have now been brought into use, but it does not stop there. The Key of  $F^\sharp$

brings in  $E^\sharp$ , which is really F natural, and finally, in the Key of  $C^\sharp$ ,  $B^\sharp$  is introduced but is really C natural. Using seven sharps as Key signature, every note in the scale of C has now been sharpened. I suppose that there must be professional organists who have been trained to play in these outlandish Keys, but your Grandpa is certainly not one of them. My mother, your Great-grandma, could do so however; had she been so minded, she could have been a professional pianist, but became a school-teacher instead.

Before I end, I will just mention that by a similar process, it is possible to work downwards from the lower tetrachord of the Key of C, but in this case it is necessary to flatten a note each time, so giving rise to a second series of Keys with 'flat' symbols 'b' in their Key signatures. You might well ask, "Why does it all have to be so complicated?" Your affectionate Grandpa.





A very mixed bag this time from **Nemett**, including stationary engines, updates on readers' progress on the NE15S and news of the first run of a superb new engine.

## The NE15S

Several readers have sent me updates on their progress on the NE15S. There is one engine completed and running together with several others in the latter stages of construction.

The first engine reported running is that of Mark Evans from Kent who has completed his water-cooled version of the engine (**photo 1**) and has even sent me a video of it running. Mark has used a commercial OS carburettor on his engine and intends to put it in a 46in. Fairey Huntsman boat. Mark has also come up with an interesting cooling set up to bench run his engine. This consists of a miniature cooling radiator (for high powered computer processors) which has a built in fan and is connected to a car windscreen washer pump to circulate the water.

Mark tells me that the cooling radiators are no longer sold by his source but I have searched the Internet and found a several companies who do computer water cooling kits and parts. Two companies in the UK who supply a wide range of such radiators are [www.tekheads.co.uk](http://www.tekheads.co.uk) and [www.coolercases.co.uk](http://www.coolercases.co.uk). For those outside the UK [www.sharkacomputers.com](http://www.sharkacomputers.com) also stock a range.

Another man from Kent with a completed (but not yet run) engine is Ian Maxwell-Hart who has done a superb job on his engine (**photo 2**) and has also made some changes to the carburettor. Ian wanted a positive lock and also has also altered the slow running adjustment mechanism (**photo 3**).

I met both Mark and Ian on the Tonbridge MES stand at the Alexandra Palace exhibition. Ian (**photo 4**) had trouble finding small springs for the throttle adjustments and has used springs from old type bicycle tyre valves. During my visit to the exhibition I did spot some lengths of small diameter spring on the Bruce Engineering stand, so other builders with the same problem might like to try them.

1. Mark Evans' completed water-cooled NE15 running on the bench. The photograph shows the computer cooling radiator Mark has used.

2. Ian Maxwell-Hart's very well finished NE15 on its display stand.



Last time I featured John Brown's engine. John now reports that the mechanical construction is finished (**photo 5**). John "cheated a little" (his words!) and used a commercial cylinder/piston assembly and carburettor from a Super Tigre engine.

## Valve seating

A couple of builders have had trouble with the valves seating. This is possibly due to the guide not being quite straight and can be a problem with separate guides and seats. If you make up the simple jig described in the series (*M.E.* 4277, 7 July 2006) and press the guide in using the mill/drill as described you should not get a problem. The head is designed to sit flat on the valve box spigot for this purpose and if the valve seat and guide hole are drilled/bored at the same setting everything should be in line.

If you have a problem with the valve seating, then either press/drill out the guide and replace it or as an alternative a one piece guide and seat of the type used by Edgar Westbury on several of his engines could be made and pressed in. The head will need the valve guide and seating flange carefully boring out and the valve spring will then seat

on the top of the combination guide.

You could also press in a separate valve seat but this is probably more difficult. Those with a slightly slack fit to the valve stem will get away with a slight misalignment!

## Another Superb Engine

An engine on display on the Tonbridge stand was the latest masterpiece from Bill Connor who has completed his half-size 1938-9 works Velocette KTT 350cc racing motorcycle engine (**photo 6**). Bill is a member of the Tonbridge club and I was told on the stand that the engine had a brief run earlier in the year. I look forward to seeing, hearing, it and smelling it running later in the year.

## Open Crank Stationary Engines

This topic was prompted by two things, firstly some exhibits, and secondly by Alan Thatcher sending me a note on his early experiences with such things.

Adrian Grimmett of the Engineers Emporium had one of his Economy gas engines (**photo 7**) sitting on the stand ticking over gently. It is actually running, but the electronic flash has done a good job freezing the motion on this slow running engine. This engine is large with





3. The carburettor of Ian's engine showing the modification to the slow running adjustment.

4. Ian Maxwell-Hart displaying his engine on the Tonbridge MES stand at Alexandra Palace

5. John Brown's completed NE15 showing his alternative mounting system.

6. A view of Bill Connors latest masterpiece, the 1/2 size 350cc Velocette KTT motor cycle engine, also displayed on the Tonbridge stand.

flywheels 10 1/2 in. diameter. However, Adrian can provide ready machined flywheels and kits if required.

Alan Thatcher's interest in model engineering was sparked by seeing full size hit and miss engines in use on the family farm in his early years. His story of such things takes us back to a lost age.

"My experiences with hit and miss I/C engines started when I was about seven years old. The family had a small holding, and at harvest time we would get the local contractor in to make the corn ricks. He would bring with him an elevator and an open crank stationary engine



and set it up for building the ricks. The tractors and trailers would then bring the sheaves over and they would be loaded onto the bottom of the elevator.

When the engine was running light (with no sheaves going up) it would almost stop and then with a bang it would kick back to life. This fascinated me and I would get right up close to it to see what was happening and why it was running erratically. Then my father would shout



'Keep away from that \*\*\*\*\* engine, it'll have your arms off.' I knew that if my father swore it was serious and he must have meant it!

"The story is leading up to taking the load of sheaves over to the elevator where that little hit and miss engine, which seemed so reliable with its firing every so often and then opening up the governors to keep up with the load.

I would climb up onto the load of sheaves to throw the sheaves into the elevator hopper. Then I started wondering if it was possible to stop the engine by throwing too many sheaves into it, but the engine just opened up and ran faster! Then came some more swear words from the top of the rick, '\*\*\*\*\* well cut that out, we can't cope with the \*\*\*\*\* sheaves you little \*\*\*\*\*!'





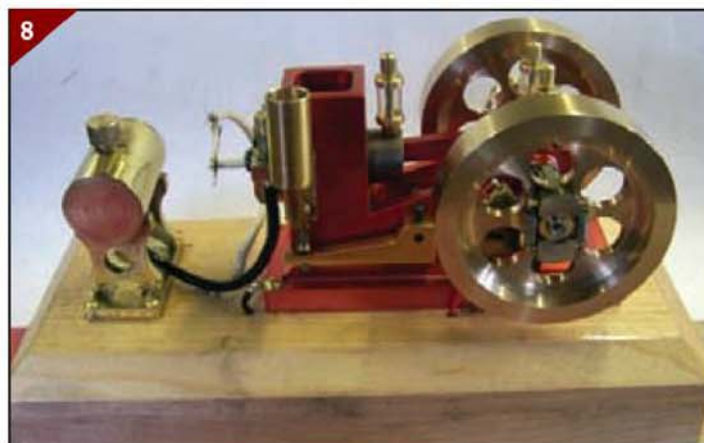
"Since I started model engineering I have built several models of this type of engine and am still fascinated by the sound of them in operation."

These engines make for a very interesting model because all the motion work is exposed and the valve gear can be seen in operation. For those unaware of such things, the 'hit and miss' referred to in Alan's note is the method used to govern the speed on many such engines. It usually consists of a pair of pivoted weights on the flywheel which, as the engine speed increases, lock the exhaust valve open thus preventing the engine firing. This leads to the characteristic uneven interval between the firing strokes when running light. As the load increases and the engine slows; the exhaust valve is released and the engine starts to fire correctly thus increasing the power to cope with the higher load.

There are many different designs for models of such engines available ranging from the large designs such as the *Economy* and the similar sized R&B gas engine (from Bruce Engineering) down to the diminutive *Little Angel* design (photo 8) by the late Bob Shores. This example is by Alan Thatcher who has anodised the base and other aluminium parts. The size can be judged by the scale of the spark plug which is a standard 1/4 x 32 tpi plug. The only problem Alan has found with this engine is that it is very critical to set up, probably

because of the small size. If any readers have experience of the design we would be interested to hear from you.

Other designs include the *Centaur* and *Wyvern* (photo 9) by Edgar Westbury and the popular RLE engine, originally by Alyn Foundries. There are many more designs around from our usual suppliers and a search of the internet will unearth many more. Bear in mind that if you are buying from overseas, customs duty may



well add a substantial amount to the price in the UK.

Those wishing to build an engine of this type should look carefully at the components before choosing a design. In particular the base casting and flywheels may be difficult or impossible to machine on a small lathe because of the size or the odd shape in the case of the base.

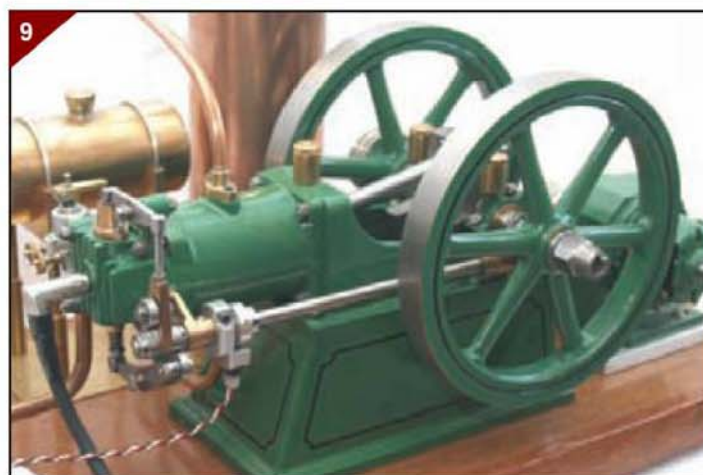
One of the more uncommon designs is the Galloway round rod engine (photo 10). This engine has low tension ignition and readers may remember this example by Alan Thatcher which I

7. The *Economy* gas engine running on the Engineers Emporium stand at Alexandra Palace.

8. The diminutive *Little Angel* stationary engine by Alan Thatcher.

9. Nemett's example of the Edgar Westbury designed *Wyvern* gas engine.

10. Alan Thatcher's *Galloway* round rod engine running at Reading SME.



featured in a previous issue (*M.E.* 4261, 25 November 2005).

I would welcome more photographs of such engines from readers, particularly the more unusual prototypes.

### Modelectric ignition coils

I have recommended this coil for the ignition system on the NE15S, based on experience with using it over a number of years. Unfortunately the manufacturer in the USA is no longer supplying the coils and I have spoken with Kirk Burwell of Hemingway Kits (01746-767739) who confirms that he is looking for an alternative supplier. He would be very grateful for any information. In the meantime I suggest builders look at

[www.mjnfabrication.com](http://www.mjnfabrication.com),  
[www.gettig.com](http://www.gettig.com) or  
[www.jerry-howell.com](http://www.jerry-howell.com) for other coil options. The other site to look at for complete capacitor discharge ignition modules is [www.ch-ignitions.com](http://www.ch-ignitions.com). I have had a couple of these units for many years but do not know if there is still a supplier in this country. Perhaps a couple of articles on building ignition coils are in order?

ME



# James Beggs and Co.

## BOTTLE FRAME ENGINE

### PART 4

Continued from page 94  
M.E. 4291, 19 January 2007

**Anthony Mount** finishes the bearing pedestal and then discusses the flywheel and cylinder block for this elegant engine.

The drawing of the pedestal shows that the studs are also utilised as bolts to hold the bottom of the bearing to the pedestal. The bottom bearing housing has the stud holes counter bored to a depth of 2.5mm at 7mm diameter. The stud is turned down from 8mm mild steel rod. Turn to 7mm diameter, turn down the end for 13mm to 5mm and thread part way M5 (or turn for 2BA). Turn down behind the flange to 5mm diameter and part off. For turning down behind a flange I use a short carbide-parting tool about 3mm wide with the sides given a cutting angle. The tool can be plunged in behind the flange and then traversed to the left to reduce the rod to the required diameter.

Part off and reverse in the chuck, face off and chamfer the end and thread all the way up M5 (2BA). The stud can now be screwed into the pedestal and will trap the bearing housing in place, and the top of the stud can be used in the normal way to bolt on the top housing.

The studs can be wrung up tight by gripping them in the 'V' in the vice jaws and turning the pedestal. I placed some epoxy filler between the two surfaces to act as an adhesive and, with

the rounded end of a small strip of aluminium alloy I keep for such jobs, I formed a fillet with the squeezed out epoxy between pedestal and housing so that it looked like a casting when painted to cover the filler. This can be seen in **photo 14** which shows the completed pedestals.

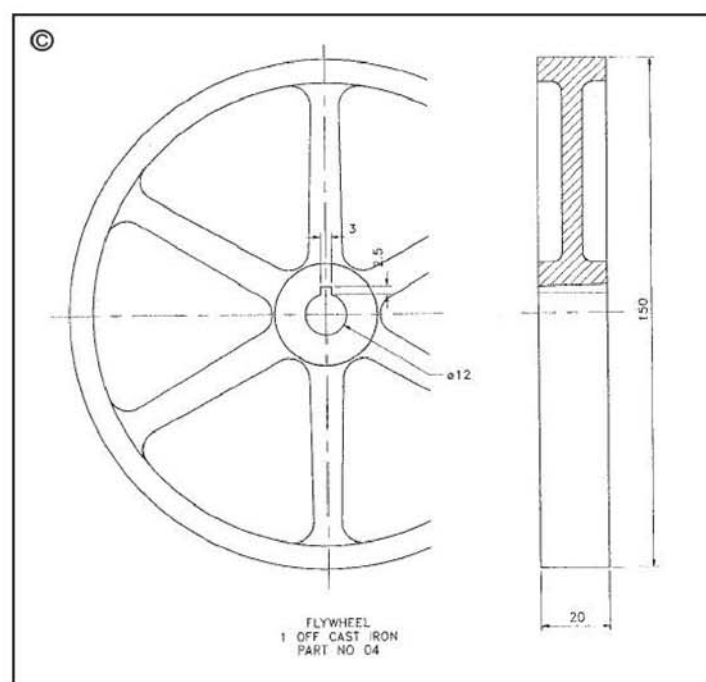
The stud should be long enough to have a full nut and a half thickness-locking nut. The thinner nut goes on top. There has been considerable discussion over the years on whether the half

nut should go on top or below the full nut. Once technology had advanced far enough for the equivalent of X-rays to be taken of the stresses inside the metal to be revealed, sometime in the 1940s I believe, it was seen that the thin locking nut should go on top. Anyway, whatever the theory it looks right with the thin nut on top, the stud should stand slightly proud of the top nut.

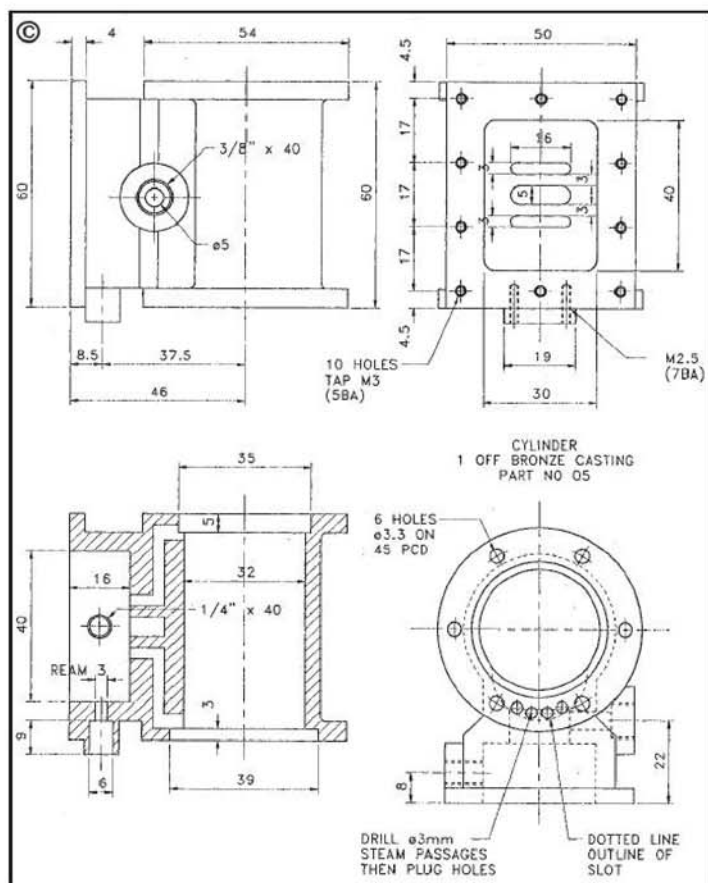
One final thing to check when fitting the bearing housings to the pedestals is that they go on

14. The pedestal is made with a separate bearing but epoxy resin makes it look like a single casting.

15. The flywheel was machined using the 4-jaw chuck with reversed jaws. Here the main shaft hole is being bored.







square. Remember they have a slight undercut from the cutting process. Use a square off the face of the pedestal with a parallel under the stock so that it clears the housing.

The blade of the square can now be brought down onto the bearing seating to see if it is at 90deg. to the pedestal face. If it is not square file a slight angle on the top of the pedestal to counteract the undercut.

## Flywheel (part 04)

The flywheel is the only casting in iron. Being only 150mm diameter it can be held easily in the 4-jaw independent chuck.

Use the stepped jaws to hold the flywheel on the inside of the rim. **Photograph 15** shows this set up.

As the material is cast iron it is useful to have a carbide cutter, which will stay sharper a lot longer than high speed steel. In fact, while I had no trouble in filing the spokes and turning the boss, the rim of my flywheel had a very hard skin and only a carbide tool would touch it. Once under the skin the material was machinable but, while I would not term it hardened, it was tougher than the usual form of cast iron, easily seen by the shiny surface as opposed to the more usual grey.

Set the inside edge of the rim to run true, and then take a skim off the outside diameter to true it up. Then machine the face, measuring beforehand the wheel's thickness so that equal amounts will be taken off both sides, follow up by bringing the flywheel to finished diameter and then drill and bore out for the crankshaft.

Cast iron is a strange material in some respects as, during machining, a very fine dust can be produced. If you try the crankshaft in position it may seem tight. However, after it has been in and out a few times it will suddenly seem loose. All that has happened is that the dust has been pushed out. So clean the bore out carefully before trying the crankshaft for fit.

While set up in this position it is as well to plane in the slot for the key. As there is only one to do, a boring tool with a square-ended tool can be used set on its side and the top-slide used as a planning head to put in the groove. This is shown in **photo 16**. Only about 0.025mm (0.001in.) can be removed at a time, as there is quite a force required to push the cutter through.

Remove from the independent chuck and fit a self-centring chuck with outside jaws. Hold the flywheel casting by the outside of the rim and machine off the other side, see **photo 17**. Finish all the sharp edges with a small chamfer.

## Cylinder block (part 05)

The cylinder block is a little different from the usual type used for model steam engines

in that the steam chest is integral with the cylinder. It is also quite a large size compared with some model engine cylinders. It would have been nice to have cored the steam and exhaust passages in the casting, but that would have added considerably to the cost.

The material is bronze so it is nice to machine and takes a good finish. Start by filing off any imperfections and generally tidy up the casting. If there are any small cavities on the external surfaces they can be filled with car body filler or the like. An area on which I needed some filler was at the ends of the steam chest where the foundry had been a little too enthusiastic during fettling. It is easy to complain about the standard of fettling from foundries, but can you think of a worse job than using an angle grinder all day grinding away flash. At the foundry I use, all the founders take a turn at fettling so that one chap does not have the worst job all the time.

Set up in the 4-jaw independent chuck to bore out the cylinder. One jaw, reversed, can bear on the steam chest face the other three on the periphery of the flange as indicated in **photo 18**. Set the outside trunk of the cylinder, not >>>

16. Planing the key way in the flywheel in the lathe using a cutting tool mounted in a boring bar.

17. Turning the second flywheel face. Note the use of the 3-jaw chuck fitted with the reverse jaws.







18. Boring out the cylinder. One jaw of the chuck is reversed so it can bear on the steam chest face. The other three locate on the periphery of the flange.

19. Boring out the cylinder. One jaw of the chuck is reversed so it can bear on the steam chest face. The other three locate on the periphery of the flange.

the flange rim, to run as true as possible, ignore the cored hole, which might not be central, though mine was pretty good.

As the set up is very unbalanced due to the shape of the cylinder, run the lathe at a lowish speed to avoid any vibration. Take a facing cut across the end of the cylinder and, as it is the same length as the cylinder, the end of the steam chest flange as well.

Then turn the edge of the flange to finished diameter, you can use a knife tool but be careful on the edge, as you do not want to foul the steam chest flange. This is especially important where the valve rod gland boss protrudes; a parting type tool will be needed here. Close observers of the photographs will notice that I did not have the gland boss on my castings (I forgot to put it on the pattern). Stop when the end of the tool just touches the steam chest end. That surface can be cleaned up with files as can the burr that will be left on the inside edge of the flange.

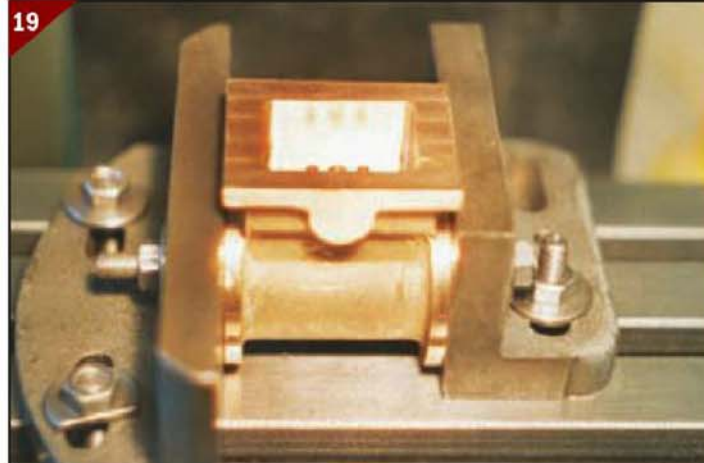
The cylinder flanges are the same thickness each end so

measure them to ensure you only take enough off so that the thickness remains equal and the overall length correct.

For machining the bore of the cylinder use a stiff boring tool to avoid chatter and aim to finish dead on diameter, especially if you intend to use an O-ring with the piston. On the last few cuts put the boring tool through under auto-feed and pass it through at least three times on the last cut at the same setting. This is to work out any spring in the tool.

### A good finish

With a well-sharpened tool the finish may well be good enough straight off the tool, as the material being machined is bronze. However, if you are not satisfied with the finish it can



be further worked on by using a lap or honing tool.

If you use lapping then you will need to make up a lap yourself. This is in effect a piston that can be expanded slightly on the end of a rod that can be held in the tailstock chuck. The lap is usually made of a metal softer than that being lapped and is charged with an abrasive such as valve grinding paste. As the cylinder revolves the lap is moved up and down the cylinder.

When it becomes slack in the bore the lap is expanded and the process continued until you have the desired, smooth finish throughout the length of the cylinder.

A hone is available off the shelf and consists, usually, of three spring-loaded abrasive stones mounted in a holder. This too is

held in the tailstock chuck and is fed up and down the cylinder as it revolves. Set a stop on the tailstock so that you do not run the hone into the chuck. The springs keep the stones in contact with the cylinder wall while they hone (grind) the surface. The stones are lubricated with a thin oil, a special honing oil also being available.

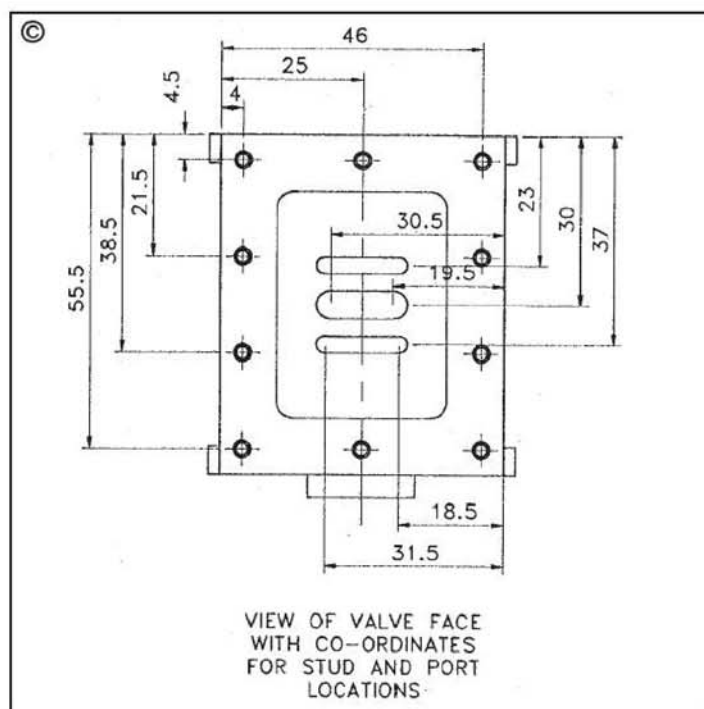
With either lapping or honing when the process is finished the cylinder must be thoroughly washed to remove every last trace of abrasive. You will have noticed on the drawing that the bore is counter bored both ends. If at some time in the future the cylinder should need re-boring it can be done without having to make up new cylinder covers, as the originals will still fit.

### Secure set-up

To machine the other end you could use an expanding arbor to grip the cylinder by the bore, which will allow for counter boring and facing off.

Transfer the cylinder to the vertical milling machine. The cylinder casting could be clamped by the ends in a large machine vice, however for a more secure set-up I used two angle plates and clamped the cylinder by the ends between the angle plates, see **photo 19**. An end mill can then be used to first face off the top of the steam chest face, and then the side of the cutter can be used to finish the edge of the flange to size. You can use an edge finder off the machined end cover flanges to find the centre of the cylinder to centralise the steam chest.

● To be continued.





# LIFTING AND SHIFTING LONG AGO

## PART 5

Continued from Page 95  
(M.E. 4291, 19 January 2007)

**John Ditchfield** concludes this popular series with a look at some of the problems met with lifting devices and load shifting techniques of the past plus a review of the products of Cravens of Manchester.

**C**ranes, being mechanical contrivances operated by human beings, are inevitably troublesome, and featured in many terrible accidents. Some of the causes of problems are so obvious that you would think that designers of equipment subject to significant fatigue loading would have learned, long ago, to design shafts with decent fillet radii.

A more common cause of problems is abuse, particularly overloading. More of a problem with outside cranes than with those in factories, where there are more watchful eyes and where loads are more likely to be matched to lifting capacity. Outdoors, where cranes might be engaged in the likes of construction and quarrying, gross overloading was more common. Attempts to move weights well beyond the crane's capacity often involved attempts

to 'snatch' the load. Failures due to this form of abuse, or due to unexpected sudden failure of ropes or chains, could result in a jib crane going over backwards as the tension was suddenly released. Another occasional problem involved something snapping when slewing the crane round, due to the action of suddenly arresting and reversing the direction of rotation.

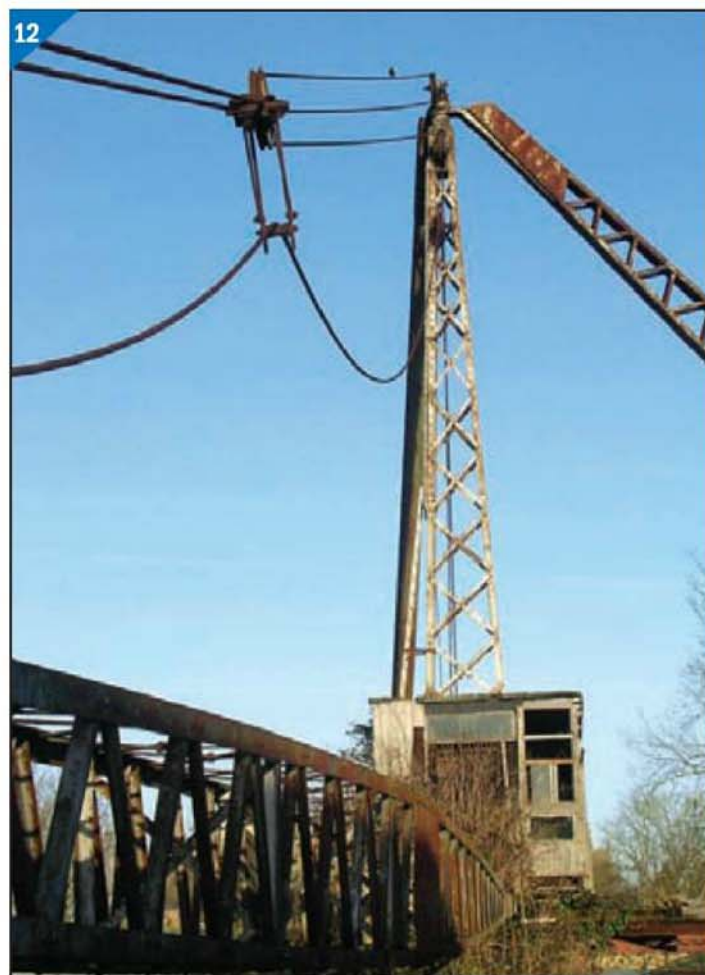
### Risk of overloading

Various methods were invented in Victorian times to reduce the risk of overloading. For example, in 1869 a Mr. Duckham patented a simple hydrostatic 'load cell' consisting of a piston in a cylinder, with a hook attached to the piston rod, the cylinder being suspended from the crane's hook. The cylinder was filled with liquid, and a pressure gauge was connected to the

cylinder. The gauge was calibrated to show the suspended weight, based on the nett piston area. A good, simple arrangement, as long as friction remained low, the liquid did not freeze, and the pressure gauge continued to read accurately. A more direct method of preventing overload was adopted in the early 1870s by the Austrian North West Railway for their jib cranes. The lifting chain passed over a pulley at the top of the jib, in the normal way. The pulley was notched to engage the chain. The chain went round the hook's pulley, and then back up to be attached to the top of the jib, again as normal. However, instead of being attached directly to the jib, the chain was fixed to a spring-loaded bolt. Excessive tension would overcome the spring force, and pull the bolt downwards. This caused a brake to be pressed down on the hub of the notched pulley, preventing the load being raised any further.

### Downfall

Natural phenomena also play their part in the downfall of cranes, and a particularly unusual event will now be described. This comes from a reliable witness, Joe Michaels, a much-respected engineer in the USA. The incident involved a large overhead crane of the modern box girder type, being installed in the turbine hall of a power station. It was on its rails, but the assembly work was incomplete. A state of incompleteness also applied to the building, whose skeleton frame was not yet fully clad. A strong mid-Western wind developed, and the crane started to move. It was unmanned, and unbraked. As it gathered speed, hasty thought was given to means of arresting its progress. One witness, with a vested interest, urged his men to lasso the errant machine. This possibility was rapidly rejected in a blunt announcement by the >>



12. A scotch derrick. Note the ladder on the side of vertical mast fitted to provide access for maintenance purposes.



13

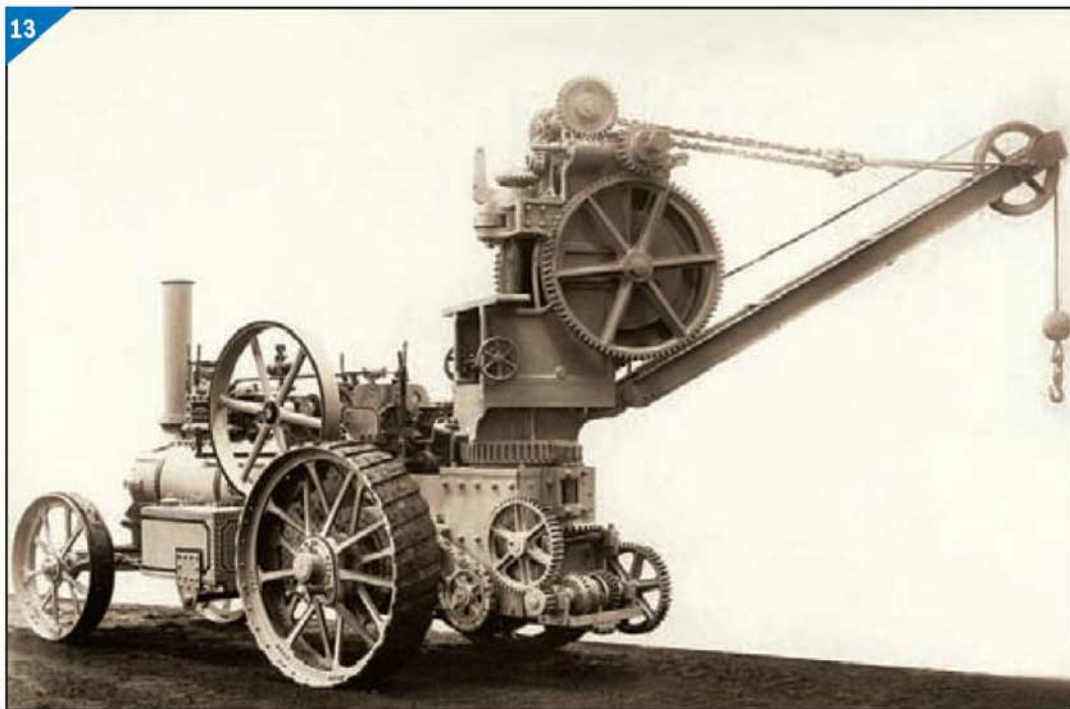
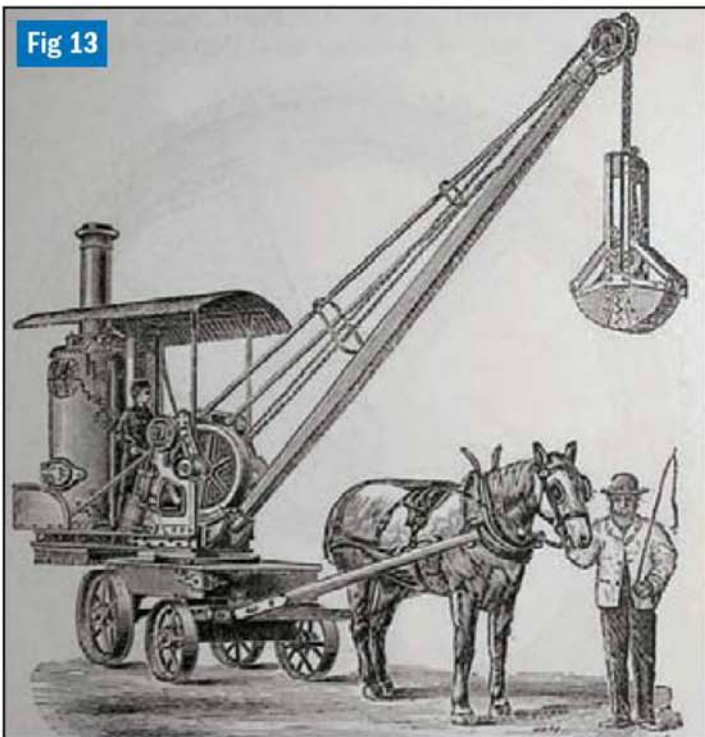


Fig 13



13. An unusual Fowler traction engine fitted with an elaborate lifting device. Note the extensive use of gears in the design. The balance of the machine could be in question if the lifting of heavy loads was attempted.

Fig. 13. A horse drawn, steam driven crane built by Priestman of Hull for dredging purposes and fitted with a suitable, clam shell grab.

urged ones. Speed increased, and the large crane headed on towards the end of the rails, where the 'travel stops' are normally fitted. That's 'normally' as in cranes normally have functioning brakes, and turbine halls are normally enclosed by walls. The crane did not drop clumsily off the end of the tracks. No. It sailed gracefully. A parked car provided little cushioning to the landing. No injuries, other than bruised vocal chords. Difficult reports

were written, and the insurance inspector ordered all parts of the crane to be cut up on site. Looking on the bright side, I suppose they were able to use those parts that hadn't yet found their way onto the crane. The brakes, for example.

## Scotch Derrick

The type of crane known as a 'Scotch Derrick' was once a common sight. The name Derrick apparently honours a 17th century Tyburn hangman, while 'Scotch' is presumably used in the 'prop up' sense.

**Photograph 12** shows such a derrick, and the position of the two backstays would allow it to slew through an angle of about 270 degrees. Clearly the driver would be well advised not to try for 271 degrees. In the photograph, the connection between one of the backstays and the top pivot can be seen, the two being joined by a bent piece of metal called a 'gland iron'. Gland was an old English word for a clamp. A simple-enough piece of equipment, but fracture of a gland iron was often cited as the cause of failure of derricks. They weren't ideally placed for ease of inspection, although the location had to be visited frequently for lubrication. You may spot a ladder on the left side of the mast. This starts off

at a slight angle, so as not to discourage the climber, but then becomes vertical, without any safety hoops to allow the man to lean back and admire his neat oiling work. There was normally a pulley located inaccessibly between the top of the mast and the end of the jib. Inaccessible by today's health and safety standards, but yesterday's derrick oiler was also a tightrope walker.

I will mention, in passing, my first day's work in the real world (a steelworks). I was assigned to a fitter, who was engaged in frowning at a flanged railway wheel. "Look at the state of that!" he said, with an air of disbelief. I could see nothing wrong, and certainly nothing that warranted an exclamation mark, and I adopted a puzzled expression.

## In the real world

Was this an initiative test? Throw someone into a strange and bewildering environment, and ask them a simple question? My vacant countenance must have signified my grasp of the problem. "You see that flange there?" he shouted, above the rumble and clatter. I nodded. "Well, there should be another one on the other edge of the wheel". The wheel belonged to an overhead crane, and one of the pair of flanges had completely worn away due to the crane's tendency to try to twist its way off the rails. Fortunately the crane was still safely perched far above, in the gloom and fumes. My first job was to help fit a new wheel. I was struck by the lack of sophistication of the equipment, the wheel having a simple grease-lubricated bronze bush and running on an axle that took the form of a plain steel bar with a notch near one end. A rectangular plate engaged in a notch on the protruding end of the shaft, and two bolts attached this plate to the crane's structure. However, I soon appreciated the benefit of simplicity. Handling heavy objects, precariously positioned on a crane rail, really doesn't need the additional stimulation



of complicated assembly procedures.

The poor old steelworks crane was worked to death. Its main task was lifting and shifting materials during maintenance, but not infrequently a siren screamed out to signify that a 'cobble' had occurred. This was a burgeoning bundle of writhing red hot steel rod, formed when a long length of bar emerging at high speed from a roll stand failed to enter the succeeding rolls, and piled up at an alarming rate. A rapid fishing expedition by the crane was the order of the day otherwise the rolling apparatus would be firmly enmeshed in a web of steel spaghetti.

Steam cranes inevitably had their own intrinsic dangers. Serious failures were more common before legislation and insurance inspections took hold in the 19th century, but mention will be made of a tragic failure in the UK as late as 1955. This involved the explosion of a boiler, which had been in service for only 5 years. The main shell seam failed, and the shell opened out. The boiler was thrown 75 feet from the crane, and the main stop valve was found 330 feet away. Unfortunately, the driver and a slinger were killed. The root cause of the failure was corrosion fatigue. Poor workmanship was implicated, in respect of producing the rivet holes, rivetting, and caulking. (ref 10).

## Shifting

Having gone on at length about the use of cranes, I will just say a few words about moving heavy loads once they left the workshop. It is clear that heroic efforts were involved in transporting heavy objects, especially by road, and particularly so before the days of smooth, strong tarmac surfaces. The days or weeks taken for heavy loads to reach their destination would have been anxious ones for those with an interest in the condition of the equipment being delivered. Gentle handling was not the haulier's first consideration. Some very

unsophisticated trailers were used, with iron wheels and plain bearings. The high rolling resistance at least compensated to some extent for the dubious brakes. To make matters worse, many of the biggest capacity trailers had no provision for steering, unless the ability to drag them sideways to negotiate corners is classified as provision. There are some interesting books on heavy haulage written by Tom McTaggart. One of these (ref 11) records that in the early 20th century most heavy haulage crews had toes missing and bits out of their legs. These injuries were the result of pieces flying off granite sets (cobbles) when a bogie was being dragged round a corner.

## About town

Movement of heavy loads through cities was done in the dead of night to avoid traffic hold-ups. A 100-ton load on iron wheels hauled over cobbled streets by a team of traction engine was probably not conducive to a good night's sleep for the residents. However, some cities, notably Glasgow, had flat slabs of granite laid out to provide smoother track-ways ('slabways') in the midst of the picturesque sets. Mr. McTaggart mentions the difficulties of using weak roads, where steel plates had to be laid to spread the load. These were usually overlapping round plates, obtained from beneath the big, hole punches used by boiler makers. Being circular, they could be picked and readily rolled along to place in the path of the rumbling juggernaut. McTaggart quotes a case of a heavy transformer taking 3 weeks to move 10 miles, plating the road every inch of the way.

After surmounting these obstacles, there was the question of unloading and perhaps erecting these heavy items at their destination. Major ports had huge dockside or floating cranes, but transferring heavy objects at construction sites usually involved much jacking, packing and dragging,



or in the case of circular vessels such as boilers, rolling. Jacking and dragging are still used today for very heavy objects such as transformers. The erection of beams for bridges, and sometimes for overhead cranes, was done with very simple equipment, usually a tall, very stout wooden pole, guy ropes, and block and tackle.

## Apprehension

In the context of traction engines and lifting, the Fowler machine illustrated in **photo 13** (ref 12) was presumably designed by the manager of the gear production shop. It looks rather back-heavy, so much so that the rigger must have been apprehensive about subjecting it to the weight of an average chain sling, let alone a load. 'Wheelies' must have been a distinct possibility with that machine.

For a different form of mobile crane, imagine a conventional slewing steam crane, with corrugated iron roof and protruding chimney. Now imagine a horse, flat cart, and driver, the cart having fairly wide iron-shod wheels, the driver

14. Palmers shipyard in Jarrow was home to this complex overhead gantry system serving the slipway area.

having a good-sized whip. Priestman of Hull put these elements together in the 1880s, attached a clam shell-type grab, and offered the appealing contraption for sale for dredging purposes (**fig 13**).

Many readers will be familiar with the small 'crane locomotives' which combined a tank locomotive with a horizontal slewing jib. An updated version was introduced by Cowans & Sheldon in 1909 for steelworks use. This looked like a small four-wheeled tram, complete with collector poles for overhead wires. The body may be envisaged as an amply-glazed bus shelter, but distinguished by a horizontal slewing jib on its roof. An electro-magnet was carried for lifting steel plates. Its controller had four steps, to allow the lower plates of a load to be dropped without releasing the rest.





Fig 14

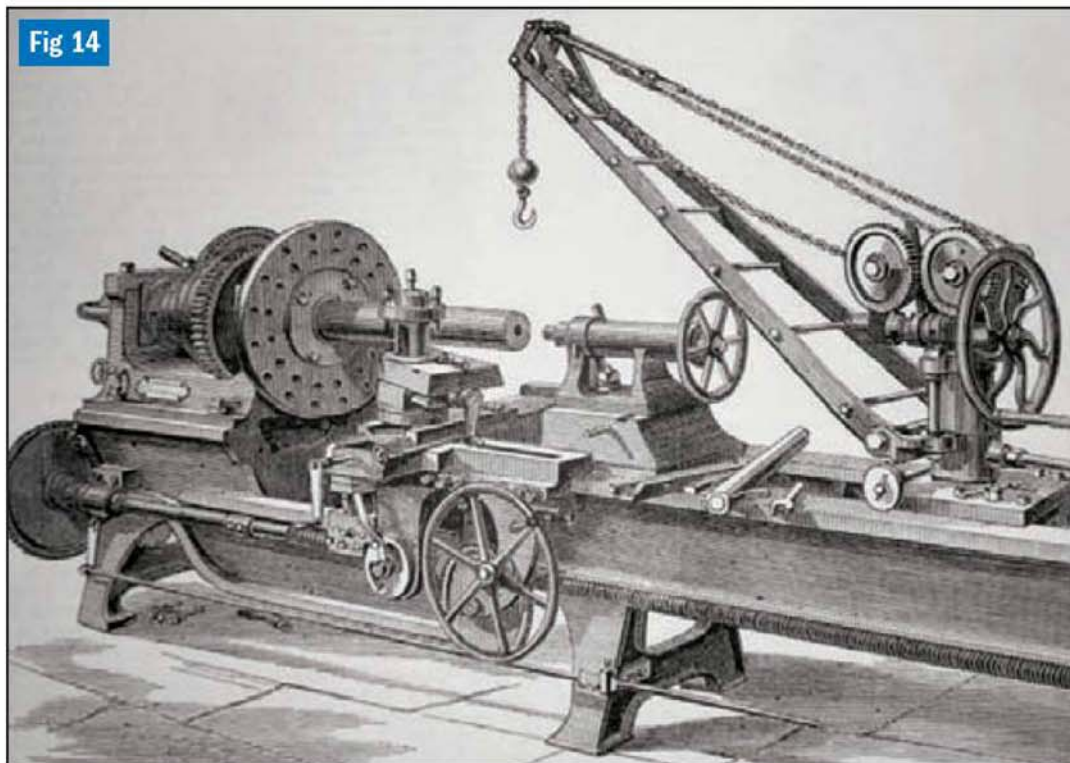


Fig. 14. James Watson of the USA was a maker of both lathes and cranes and could combine the two technologies to provide a machine tool that was easy for the operator to load and unload.

Before leaving the subject of hoists and transport, I must mention a system invented by Mr. John Aspinall, of the Lancashire & Yorkshire Railway, for moving parcels and other goods at Manchester Victoria station. It used a pair of close-pitched girders attached to the roof framework, on which ran a small four-wheeled electric carriage complete with driver's seat and hoisting machinery. From this was suspended a large basket. In true railway fashion, the wheels had connecting rods, and collector poles to obtain the electricity from conductors placed either side of the driver's cloth cap. The driver's position looked somewhat precarious, but on the other hand no-one looked over his shoulder, and he was left to his own devices, especially if the thing broke down above the main railway track. The system was introduced in 1898, and continued running until

damaged in the Manchester Blitz of 1940.

## Hair-raising

The attendant of Mr. Aspinall's aerial apparatus would no doubt consider himself lucky to have such a cushy job, compared with his opposite numbers at Palmers' shipyard in Jarrow. Readers may have seen an old film clip showing the demolition of the Palmers' big gantries, which sometimes gets an airing on TV in the context of the hungry 1930s. Those gantries were built c.1905 as part of an economical but hair-raising lifting arrangement, which can be seen in **photo 14**. A pair of gables supported a system of cables for three cable cars about 100 feet above the ground. These ran the 500 feet length of the slipway. Each car and its cables were attached to traversers that ran across each gantry, providing movement to port and starboard. The designer made a virtue of the system's flexibility, pointing out that a suspended vertical plate could be readily tweaked into position to line up the rivet holes. No doubt the driver's colleagues were tempted to tug playfully on the rope, abusing the

cable's flexibility to add to his queasiness, although they themselves were in a rather vulnerable position. It will be apparent that the driver's protection against Tyneside's bitterest weather was somewhat limited. His perch did have an electric motor and resistors to provide some warmth, and a roof to provide shelter on those rare occasions when the sleet obligingly came down vertically. Such a highly placed position may have little appeal, but then neither did the alternatives. Down a coal mine, for example. Something that may not show up clearly in the illustration is the tram-type collector pole protruding above the roof. Before leaving the photograph, note the object in the foreground, with its simple access ladder. This appears to be a large blowlamp for illumination.

That's all I have to say at present about lifting and shifting, but I did promise to say more about Craven Brothers Ltd. Read on.

## Craven Bros. Ltd.

In earlier instalments I discussed cranes made by Craven Brothers of Manchester, and promised to say more about the Company.

A burgeoning interest in cranes and machine tools led me to learn more about Craven Bros. Nearly all the great Lancashire engineering firms have something important in common: they no longer exist. Fortunately, the Museum of Science & Industry in Manchester are custodians of many records, and the helpful archive staff were able to show me some fascinating leather bound documents.

Craven were better known for their specialised machine tools. It seems odd that machine tools and cranes should come from the same stable, given the expectation of high precision on the one hand and high elevation, low precision on the other. However, many of the basic components of large old machine tools and cranes of the same era are broadly similar, namely castings, gears, shafts, pulleys, levers, bearings, and chains. Chains? Yes.

Craven's range of machine tools 100 years ago was huge. Big lathes, small lathes, horizontal and vertical boring mills, planers, shapers, grinders, millers, saws, and countless special purpose machines, especially for steam engine and general railway manufacture. They also made a wide variety of cranes large and small, capstans, and railway turntables, including one turntable fitted with its own diminutive steam engine and horizontal locomotive-type boiler, surely a candidate for befriending by Thomas the Tank Engine. They also made other machines for punching, shearing and rivetting, for waterproofing tarpaulins, and breaking coke (the carbon fuel, not the celebrities' recreational powder). Their products included horizontal hydraulic presses for forcing railway wheels onto axles, some of which incorporated rails on which rode two small carriages incorporating simple hydraulic jiggers for handling the axle.

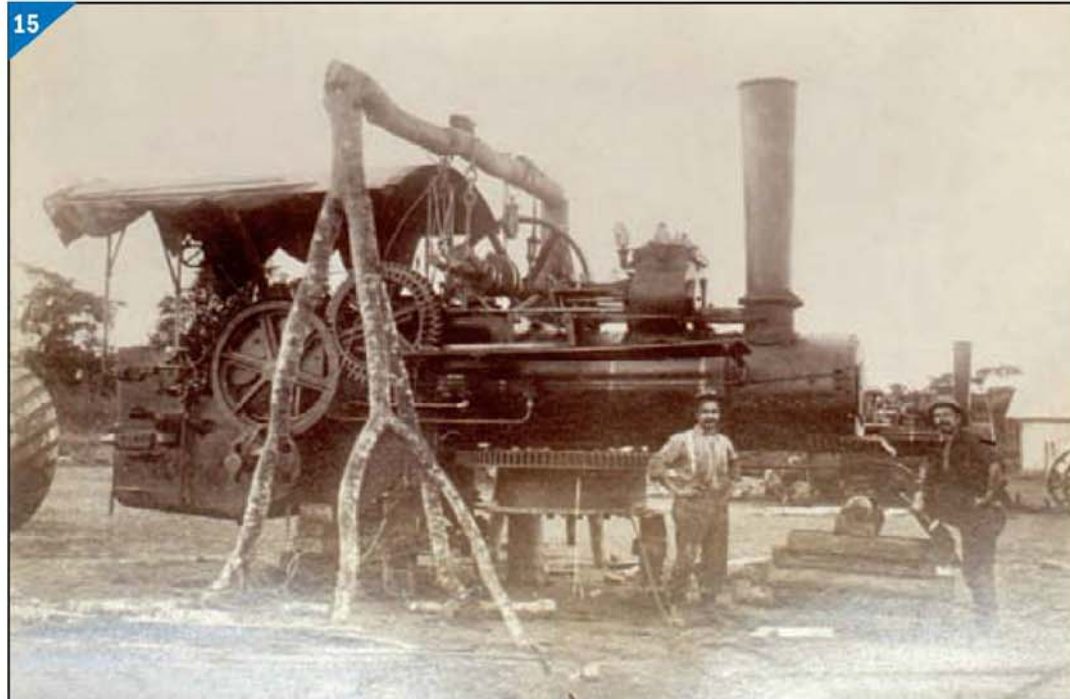
One volume in the Craven archives is dedicated to photographs of equipment sent to a customer in Japan, c.1909, under a contract to



equip a heavy munitions armaments factory. The products included very large machines for carrying out various aspects of naval gun barrel machining and ingot trepanning, and a range of large electric cranes including a 120 ton capacity ladle crane. Whatever one might think about the ethics of the business, it is a reminder of the vast industrial capacity and skill once present in Britain, and now dramatically diminished.

A Craven crane compendium of 1904, the same date as the rope-driven crane in Manchester's museum, shows no such examples of old-fashioned rope bondage, electric motors finding most favour, with a few examples being hydraulically worked. One all-hydraulic example was a stationary jib crane evidently intended for manipulating forgings, used 'jiggers' (vertical hydraulic rams with pulleys top and bottom, operating chains) for traversing the crab and for hoisting. The jib was rotated using hydraulic rams, while a three cylinder hydraulic motor drove a system of shafts and gears, culminating in a worm and wheel drive to a pitch chain to rotate the suspended, brightly glowing forging. Cravens also built 'radial travelling cranes'. In essence, these had a fixed central column from which was pivoted the crane's beam. The column was located within a circular framework, which was topped by a circular track to support the other end of the beam. Machines such as this were used to lift large gun barrels from the heat treatment furnace and lower them into the quenching tank.

I will elaborate on some of the features common to Craven cranes and machine tools. 'Flip-flop' bearings, similar to those on the Australian 1885 crane described in Part 1, were used on some long lathes to support the leadscrew or drive



shaft. Belt drive change mechanisms of the same type seen on the Manchester crane were found on some of the machine tool pulleys. As for the chains, well, they were part of the tool's automatic feed mechanism. Machine tools and cranes used large numbers of gears, and on many of these the teeth were cast and not subsequently machined.

### Historic pattern

The history of Craven Bros Ltd. follows the pattern of many great British engineering concerns. It was founded in 1853 by the brothers Craven, who learned their trade working for some of the great Manchester pioneering firms, Sharp, Roberts, Bodmer, and Fairbairn. Their company expanded to occupy several factories, and in 1928 took over some other once-famous machine tool firms, namely Armstrong Whitworth (Machine Tools) of Manchester, Joshua Buckton of Leeds, and Thomas Shanks of Johnstone. Production was moved from their factories to an expanded works in Reddish, near Manchester. Craven's survived the Depression partly because of their export trade, and in fact in 1930 75% of their production was destined for Russia. The Craven family ran the firm until

the death of J. R. G. Craven in 1959. After this, things went wrong. The Company was bought by Staveley Industries Ltd, and disappeared.

Craven's were not unique in making both cranes and machine tools in the UK, or even in the Manchester area, but they engaged in both activities on a large scale. Thomas Robinson of Rochdale produced a vast range of high-class heavy-duty woodworking machines, and their 1878 catalogue includes overhead cranes, featuring one with a boiler which travelled with the crab. Suitable for burning wood shavings, no doubt. Unlike Craven's, they also made a few locomotives, one being used in the New Zealand logging industry, which seems appropriate for a 'one stop shop' woodworking machinery supplier. Overhead cranes and machine tools were also made by James Spencer & Co. in Hollinwood, near Manchester. Away from Manchester, but not very far, the once-famous Leeds machine tool firm of Smith, Beacock & Tannett also made cranes. It is worth noting that this firm trained the brothers Krupp, an activity that, from Britain's point of view, was surely a 'Bad Thing'. Yet another occasional maker of overhead cranes was Thomas

15. A Fowler ploughing engine receives some mechanical attention using only rudimentary tools and an improvised gantry system made of stout tree branches.

Shanks & Co. of Johnstone who, as mentioned above, were taken over by Craven Bros. There are quite a few photographs to be found in books and on the internet showing the construction of the engines for Titanic and her sister ships, and Messrs Shanks' large machine tools can be spotted in some of these.

A US maker, James Watson, made lathes and cranes in the 1870s, and just could not resist putting them together (fig 14).

### And Finally...

I will bow out of my series of articles on cranes and their makers with a photograph.

Out in the bush, and want a gantry? **Photograph 15** shows that all you need is an axe. **ME**

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# LILLIAN

## A narrow gauge locomotive for 7¼in. gauge

### PART 30

Continued from page 103  
M.E. 4291, 19 January 2007

**Keith Wilson** discusses tenders, vacuum brakes and compensated brake gear.

**A** driving trolley or similar is obviously absolutely important. Although in theory one can drive from the first seat of the train, you would soon get a tender behind (the uncomfortable sort).

There is ample water supply in the side tanks but more is seldom anti-productive. No matter how careful you are, in concentrating on the driving sooner or later you will run short, invariably on the most distant part of the track. True, you can still run short of the essential condiment whatever the total capacity but it is a bit less likely, for we can insert a water gauge onto the tender without much trouble.

A common source of water is advisable, as distinct from one injector feeding from side tanks, t'other from tender. Some folk use this with pump

from tanks and injector from tender, the idea being that the cooler water from the tender would be better for injectors; however as I have shewn in the past, this is not a valid reason. It used to be, but an accidental discovery of mine some years ago made this idea irrelevant. For if the injector overflow is just over 4¼ times the steam cone diameter, water temperature becomes far less important and the injector will pick up water (if required, from a few feet if necessary) before it starts to operate and feed. Also, in the case of sudden hard braking or lurching the surging of the water will often cause the jigger to break off working. In which case take no notice but be well aware that it will re-start in a matter of seconds without further attention. Ooray!

Also, in the case of emergencies the extra weight is useful when (possibly if!) suddenly braking becomes necessary!

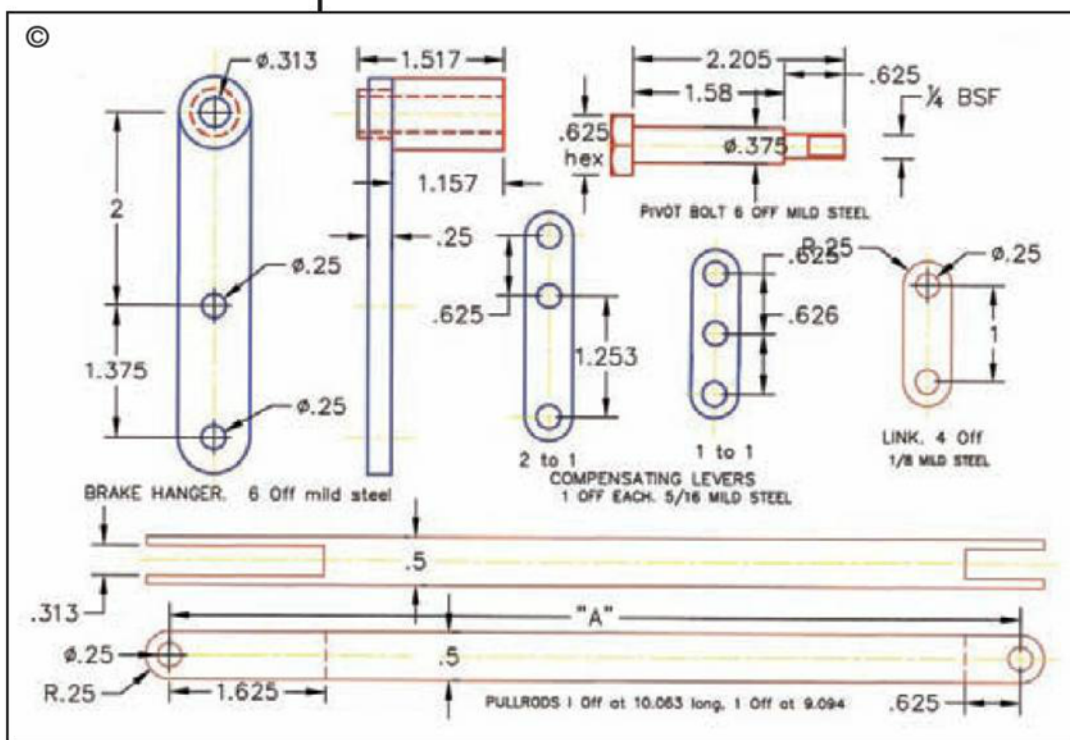
A handbrake is just about useless except when parking for it takes some time to wind on; and of course time is what we haven't got in emergencies. Smoking shoe-leather is not much help, and I wot not of anything else but a power brake fully compensated. I do not trust the simple or non-automatic type; for when you suddenly need 'em there's a good chance you ain't got 'em. Also that application would take more time than can be spared.

I have discussed this matter before, but (we hope) there are beginners. No use telling them to look up back issues, for if you are a novice, tyro etc. once again there's a good chance you ain't got 'em.

Whilst pressure brakes – as distinct from vacuum brakes – generally use smaller cylinders, the provider of the operating fluid (air is a fluid) is a lot bigger than the provider of vacuum – 'wackum'. There is equal need for 'wackum' reservoirs and for air pressure reservoirs, but thanks to our pal square-cube, less need for individual valves on each vehicle. There are obviously those with different opinions, please air them so we can all learn.

The provider of vacuum can be tucked in somewhere even in a 2½in. gauge locomotive without making much difference to the steaming, for not much steam is needed with a jet only 1/32in. diameter. It is a surprising fact that under most operating conditions on partially

Fig. 1 Brake parts





closing the steam-to-ejector control valve, the thing promptly becomes a lot more efficient, the vacuum jumping up by an inch or two of mercury. Doesn't make sense to me, but one or two other drivers have noticed the same effect.

Technically of course, we should speak of high-pressure (Westinghouse) and low-pressure ('wackum') brake systems, but as long as we know which is which it shouldn't really matter.

For those fresh to vacua (plural of vacuum) they are normally measured in inches of mercury; that is the vertical length of a column of mercury that could be sucked up. The maximum possible at sea level is very close to 30in. (762mm) corresponding to 14.7lb per square inch. For our purposes, 10 to 15in. is a good working range providing a slight surplus of available power. 'Dag' Brown has produced an ejector providing up to 25in.; however if you are running on a 'turnover' system where you have to hand over the train to another engine it could be necessary to walk along the train releasing every carriage individually due to the difference, since not all locomotives will 'pull' the same vacuum. It is of course possible to put in a vacuum limit valve, but not every engine has one, and I don't know of any recommended standard working pressures. 10in. seems to provide all needed brake power.

### It's very small, so how do you find it?

It is harder to trace 'wackum' leaks than compressed air leaks; 'cos you can't listen with a stethoscope or use a soap/water solution. There are, however, several ways round this predicament.

Starting from the ejector, tighten all joints – it is to some extent true that apparently tightly done-up union nuts are in fact loose, for it is far easier to miss a joint than you might expect. Once satisfied that the ejector pulls a vacuum, then by isolating vehicles (or sub-sections) one by one the leak can be traced. Full-size, matters were helped by a can of paint.

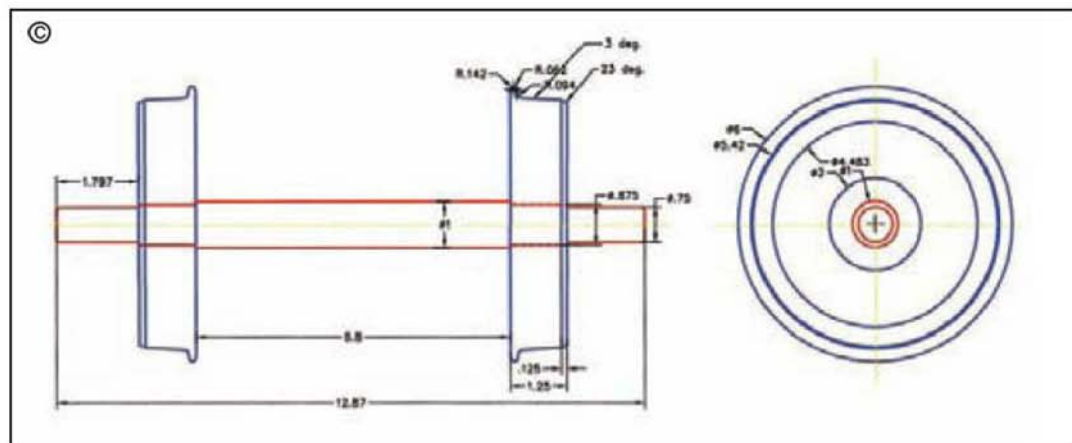


Fig. 2 Tender wheelset

Questions were sometimes asked: "Why the heck do you only need to partially paint a threaded steel item?" Of course, the paint would be sucked into a leaking joint and behold! It leaked less. You could air-check on leaks by using a low air-pressure into the system, however use no more than about 10p.s.i., and take care to disconnect any vacuum gauge(s). Stethoscope now very useful, as is a small paintbrush anointed with weak soap solution. Easiest approach to this is to put some washing-up liquid into a cup of water and stirring. The pleasure on eventually watching the vacuum-gauge needle creep upwards as you tighten the last joint is a nice sensation. If you have made a good job of the brake gear, you can run a rough test using lungs alone. As a guide, an adult can suck about 3p.s.i.; a fairly new-born baby can manage about 5 pounds per square inch.

A minor handicap to vacuum systems is that they are very sensitive to the tiniest leaks, especially in our sizes. For that matter, so is a pressure system, or Westinghouse but leaks are easier to detect. To couple vehicles together use plastic tube; at 6mm diameter ( $\frac{1}{4}$ in.). It works very well on  $\frac{1}{4}$ in. O/D copper pipe; it is adequate for the amount of air that needs to pass on a brake application.

In full-size 'wackums', an accelerating valve was used on each vehicle. When air rushes into the system, in our sizes the pipe capacities are adequate, remembering that all the air

needed for all the cylinders has to pass through the drivers' application valve. Full-size, old square-cube would mean trouble, for the ratio of pipe-size to cylinder volume is greatly increased; thus brake applications would be very much slower in emergencies. The accelerating valve opened another hole on each vehicle allowing air to pass in (in proportion of course), thus making application far more rapid. I don't know if anyone has made such a valve, for 'twould be a tricky job in our sizes. Also t'aint necessary for us.

I once planned a Westinghouse brake system, but I never got further than making a 'triple' valve. The triple valve is normally in neutral balancing train-pipe pressure with pressure in each reservoir. When pressure drops in the train-pipe the valve flicks over coupling the reservoir direct to the brake cylinder until once again the pressures balance out. If pressure is increased in the train-pipe, the valve moves the other way, venting the brake cylinder and re-charging the reservoir until once again the pressures are equal. I made my own little valve out of odd bits of aluminium alloy some 50 years ago; it still works on gentle breath pressure alone.

These brake systems have two interesting features. With vacuum brakes it is easy to control brake pressure, for the pressure can be raised or lowered. With Westinghouse, it can only be lowered by completely releasing the brakes and then re-applying them. Not

having used Westinghouse brakes in any gauge, I should imagine that it works out at 6 to one, half-dozen to t'other. Depends on what one gets used to.

There is another minor point with vacuum as distinct from Westinghouse. To completely release 'wackum' brakes restores full brake power, whereas with Westinghouse if there are too many applications within a short time, full power is not restored on release. To a great extent this matter can be overcome by a large pressure reservoir on the locomotive. Perhaps some may remember the three large reservoirs shown on the 'Ariel' design tender.

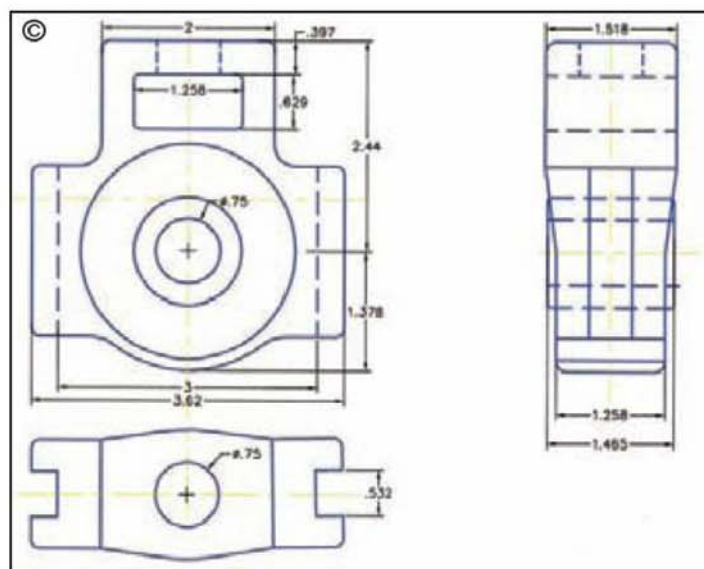
In modeling some older locomotives, there is not room to get a vacuum brake system in, steam brakes being the order of the day. The Great Western (standing up, facing West, and bow, dodging passing rock >>>

### Wilson's Words of Wisdom

The policy of deploying a 'scamera' at the sites of last year's road accident is like swatting the spot on the wall where you last saw a fly. But if it makes money for someone, that is all that matters. Accidents increase, but we only need to blame the driver even if there wasn't one.



Fig. 3 General bearing



from friend Ron Isted) had a driver's brake control in which the engine was steam-braked and tender could be vacuum-braked; applying the vacuum brake sent a proportional amount of steam to the engine brake cylinder. The late and lamented Bill Carter fitted one of these to his Earl of Berkeley 'Dukedog' model, but craftsmanship of his caliber is nearly as difficult to find as hen's teeth (or politician's I.Q.). I have had a good look at the original design, but not for long!

Some GWR tenders were steam-braked; others vacuum ditto, so a certain amount of care had to be taken when 'pairing them up'. For entirely steam-braked locomotives, there was always a risk that the flexible pipe 'twixt engine and tender could fail. Once again, it cannot be foreseen. A Bulldog once edged itself onto a siding at Didcot, bang went the pipe, and bang went the buffer stop on the siding. A few choice words split the air, but it was nothing to the words used later. For after replacement of the pipe, the Dog ran a successful return trip to Southampton, and edged onto the same siding just as the buffer-stop crew was packing up.

Lo and Behold!! the nice new pipe burst, and the crew watched with sheer horror and disbelief, as the shiny new buffer-stop followed its ancestor. Words, very loud and often. Any questions?

That is one of the reasons why I always prefer fully automatic (fail-safe) brake systems. The slight amount of extra bits required is very little and if for any reason the train becomes uncoupled, the brakes are applied rather than failing entirely. Also, if for some reason the brake system fails on one carriage, the other vehicles can help bring the train to a halt. *"The engine pulls the train; it is the train that stops the engine"*.

Due to the phenomena known as 'surface tension', the tiny jet 'pulling the vacuum' can clog itself up on a drop of water, hence if your urn primes or badly surges you might well be left unbrakeable with the simple (non-automatic) system; always too late! It is the same surface tension which accounts for water-gauge glasses reading a bit high.

It is largely a matter of personal preference, but I use 'scale' brake cylinders of the GWR type. The reason is that the travel of the piston is much greater than with the equally powerful commercially-supplied cylinder, the 'diaphragm' type. With greater travel, it is not so important to keep the system accurately adjusted. If others with greater experience than me on this matter disagree, then let us have a Post Bag discussion. I am always willing to learn.

### Compensation

The difference between compensated brake gear and non-compensated ditto has to be seen to be believed. In connection with this, it is best for the brake gear to be fairly stiff except for the pivots at the top of each brake lever. If this is so, then on release the whole system moves as a unit; this action removes the need for a return spring. Any trouble caused by slight differences of wheel height will immediately adjust on application.

A friend in Los Angeles told me he spent a whole afternoon

adjusting his non-compensated tender for ideal application, however once he stood up and sat down again on his tender then all this adjusting proved fruitless. So I set to and knocked up a complete compensated system for engine and tender and supplied it to him, the difference in breaking power was immediate. Incidentally, this is the King as shewn recently undergoing an overhaul.

A brief discussion on these tender brakes might prove interesting – I hope. There is ample room for a 30in. vacuum cylinder on the side of the frames, outside it is a bit more accessible. It will just stick out a bit beyond the tender side. Should you not desire this, then put a 22in. cylinder on each side of the tender. They will give between them just about the same brake thrust, about 80lbf on each wheel. The single 30in. cylinder gives about 72lbf on each wheel. I believe that this is sufficient. Full size, I believe that braking power was equal to about  $\frac{1}{3}$  of the tare vehicle weight, in any case for our size there is seldom any need to use full power; for should the wheels lock and skid then the wheels might well end up being other than truly round! Also, if the wheels do pick up and skid, lots of the effective braking power is lost. Many a time (especially on London Transport tubes) have I heard the results of this. (clonkclonkclonkclonk...)

Allied to this, when double heading only one driver was

allowed to apply the brakes, only one driver was allowed to use them. Which one could be settled between the drivers before starting. For bethink you, if both drivers applied the brakes at the same time it is very likely that in effect double the application would take place, with possible disastrous results. Locked wheels, skids, flat bits of wheel, crunches.

Also it applies to us when double-heading, so when on Fred Beacham's splendid railway south of Rugby, eldest son and I did some double heading with King and Prairie, he looked after the brakes whilst of course I only kept ejector full on. This system worked very nicely. On one occasion, our train came off the main line to top up water; when we had filled and were running back to the track along a loop line we saw that Jeff Stevens was nearing the points with a Black 5. Alan turned to me *"Let's beat him to it"* so both regulators were fully opened. I don't know just what speed was reached, in fact I'd rather not know! Anyway, my driving hat blew off in the slipstream – only the second time this has ever happened; the first being in Los Angeles in 1979. Jeff saw what we were up to, and had fits of laughing. Incidentally, we made it with room to spare. We were running tare at the time, i.e. empty trains, so the public were not exposed to danger.

Some other driver had a Black 5, with a speed registering device on his tender. On the long slightly curving bit of track it reached just over 31 miles per hour. I have some memories of a 'single wheeler' doing a measured 35mph some 45-50 years ago. The ratio of 'scale speeds' has many possible values, but direct scaling would mean speeds full-size rates of 241.8 and 273 miles per hour. Any questions?

There are still some details of the tender design to be solved, so I just show the wheel-sets, the bearings (commercially available). and some brake details at this time. Also, so far, no pix alas.

● To be continued





## FROM THE TRADE

A neat new device designed to help model engineers locate edges, hole locations, and the like is now available from Chronos in the UK. The Laser Center/Edge Finder was developed in the United States by SDA Manufacturing.

Its use is quite simple. Set it up on the lathe, milling machine, etc, line up the laser beam with an edge, or marked-out hole location, and off you go. You can also use it to set work in a 4-jaw chuck, align a tailstock centre.

If you drop it, and it goes out of alignment, a simple



procedure is given to set it again. If it is used on more than one machine tool, alignment may need to be tested and adjusted to take account of things like wear in quill bearings.

Contact Chronos on 01582 471920 or visit [www.chronos.ltd.uk](http://www.chronos.ltd.uk) Or [www.lasercenteredgefinder.com](http://www.lasercenteredgefinder.com)

## FORTHCOMING EVENTS

**Chesterfield DMES** will be celebrating its 75th Anniversary with the official opening of the ground level track woodland extension on Saturday 21 July 2007 at the Hady Hill track site. Further details can be obtained from Mike Rhodes on 01623-648676. Mike mentions that the society has "a very interesting ground level track with some 20ft. height difference from top to bottom".

**Edinburgh SME** sent us a sample of its membership card. This is a hard wearing plastic card, the size of a credit card with the space for writing member details on the reverse. The society found sources of supply in *Exchange & Mart* and has been using the card for three years. The minimum order quantity is 200 but this can be 100 for one year and 100 for the next year. Cost is approximately 50p each. These cards are obviously somewhat more oil and soot proof than a normal card.

The annual model rally and exhibition at **Guildford MES** will be held on 21/22 July. Further details from [secretary@gmes.org.uk](mailto:secretary@gmes.org.uk)

**Nottingham SMEE** has notified a change of contact details for its events and meetings. The contact for public running and events is Peter Towle, on 0115-9879865 and for other meetings Graham Davenport, on 0115-8496703.

**The Model Steam Road Vehicle Society** has sent the dates for the 22nd Anniversary celebration, which will be held over the weekend of 23/24 June 2007 at the Tewkesbury Rugby Club. Further details from John Bagwell on 01452-304876, or [www.msrvs.org](http://www.msrvs.org)

**The Bedford MES** end of year rally will be held on 1/2 September this year Further details later.

**Canterbury DMES** is holding several open days: a general open day on Sunday 17 June; a traction engine day on 1 July, and an electric locomotive day on 12 August. Details from Mrs. P Barker, 01227-273357.

## UK CLUB NEWS

Under the heading "Did you know", the newsletter of the **Bristol SMEE** notes that the angle of countersinks is different for imperial and metric options. The imperial value is 90deg. while the metric value is 81 degrees. This prompts the question: "What bright spark decided on the odd measurement of 81deg.?" As usual, answers on a postcard, please.

**Canvey Railway and MEC** is celebrating its 30th Anniversary in April and, as befits a society by the sea, will be having a fish and chip lunch and an afternoon steaming. The society is also hosting the Southern Federation Rally on 15 September.

Another society with an anniversary this year is the **Guernsey MES**, which celebrates its 20th birthday this year.

Several members of **Harlington Locomotive Society** have built personal driving trolleys using an interesting design that does not have a pivot for the bogies. Instead rubber flexible mounts are used which provide enough flexibility for cornering while holding the bogies in line. The design also

(Above) Laser centre and edge finder from Chronos.

(Below) The ground level track station area at Leyland SME.





has rubber bushes in the axle boxes and main bearing.

**Leyland SME** has announced the completion of the main line of its new ground level 7 1/4 in. gauge track in Worden Park, Leyland, Lancashire. Work started in June 2005 with the construction of 600m of new track.

Ground conditions forced a halt over the winter and work resumed in spring 2006. By mid November society members had completed the second loop, and sufficient of the infrastructure to start public running on the new 1km main line circuit.

The latest project at **Saffron Walden SME** is the new connection from the steaming bays direct to the access point on the ground level track. This is all to make life easier for the members. Another project for the winter is the installation of flexi points to connect the lay-by loop into the main line.

## IN MEMORIAM

It is with the deepest regret that we record the passing of the following members of model engineering societies. The sympathy of staff at Model Engineer is extended to the family and friends they leave behind.

**Kenneth Coombes**  
**Arthur Eastwood**  
**Philip Kelly**  
**Alan Veal**  
**Frank Walker**

**Harlington Locomotive Society**  
**York City DSME**  
**Harlington Locomotive Society**  
**Wigan DMES**  
**Docklands & east London MES**

## WORLD NEWS

### Canada

At a recent meeting of the **Toronto SME**, Pers Drewes gave a short history of wind generation starting with the 'traditional' windmill used in Europe for pumping water or milling grain. These are only about 3 to 4% efficient! In North America, many thousands were used for pumping water.

The present generation of wind turbines used for electric generation are generally three-

bladed (for aesthetic reasons, mainly – rather than having two or four blades).

There are many patents for many different designs – some vertical axis turbines were developed in Canada and various examples can be seen at the Kortright Centre north west of Toronto. There are now massive 6MW turbines being built.

At the same meeting Bill Huxhold showed his finished turbine generator running at an estimated 25,000rpm on air at

about 30psi. He said that the first generator didn't work properly and overheated but the second unit works well. Bill outlined the construction of the rotor with an 'embedded' magnet. He made a special non-magnetic static balance stand for balancing the rotors. He also showed a finish machined Pelton type turbine wheel that is used in the turbine generator set.

The generator puts out about 3-Volts at 1-Amp. Roy Elliott brought in various, mainly aluminum parts, for a model single-cylinder diesel engine he is working on. The engine has a 1 1/2 in. bore with 1 1/2 in. stroke equating to approximately 30cc. This interesting engine has an overhead cam, ball bearing crankshaft and splash lubrication.

Roy is hoping to get about a 20:1 compression ratio. We look forward very much to seeing further information on this engine.

# DIARY

## FEBRUARY

- 16-18 Brighton ModelWorld** at the Brighton Centre. 10am-5.30pm; Adult: £8, Child/Senior Citizen: £5, Family: £19. Contact Tim Steven: 01444-254057.
- 16 Canvey R&MEC.** Club Auction. Contact Brian Baker: 01702-512752.
- 16 Romford MEC.** Chris MacDonald: *LBSC his Life and Times*. Contact Colin Hunt: 01708-709302.
- 16 Romney Marsh MES.** DVD/Video Evening. Contact John Wimble: 01797-362295.
- 16 Steam LS of Victoria.** Gathering. Contact Graham Plaskett: (03) 9750-5022.
- 17 Canvey R&MEC.** Members' Only Running Day. Contact Brian Baker: 01702-512752.
- 17-18 Festival of British Railway Modelling** at the Yorkshire Event Centre, Harrogate. Advance booking (to 15 Feb 2007): Adults: £5.50, Children: £3.50, OAP: £4.50, Family (2+3): £18. Information and Ticket Hotline: 01778-392089. [www.brmodelling.com](http://www.brmodelling.com)
- 17 Steam LS of Victoria.** Club Running. Contact Graham Plaskett: (03) 9750-5022.
- 17 York City & DSME.** Malcolm High: *Laser Cutting*. Contact Pat Martindale: 01262-676291.

- 20 Chesterfield MES.** Meeting/Talk. Contact Mike Rhodes: 01623-648676.
- 20 Taunton ME.** Traction Engines. Contact Don Martin: 01460-63162.
- 21 Bournemouth DSME.** Richard Knott: *Annual Video Show*. Contact Dave Fynn: 01202-474599.
- 21 Chingford DMEC.** Keith Brunt: *The Larkwood Signalling Project*. Contact Ron Manning: 020-8360-6144.
- 21 Guildford MES.** Bits & Pieces. Contact Dave Longhurst: 01428-605424.
- 21 Hull DSME.** Any Questions? Contact Tony Finn: 01482-898434.
- 21 Leeds SME.** Bits & Pieces. Contact Colin Abrey: 01132-649630.
- 21 MELSA.** Meeting. Contact Graham Chadbone: 07-4121-4341.
- 21 Norwich DSME.** Annual Society Dinner. Contact Paul Reed: 01603-462925.
- 21 Staines SME.** Video/DVD Evening. Contact Stan Bishop: 01784-241891.
- 22 Cardiff MES.** Brian Davies: *Colliery Railways in the 1960s*. Contact Don Norman: 01656-784530.
- 22 Harlington LS.** Bring and Buy. Contact Peter Tarrant: 01895-851168.
- 22 Worthing DSME.** AGM. Contact Bob Phillips: 01903-243018.
- 23 Brighton & Hove SMLE.** Ian Wright: *Then West Somerset Railway*. Contact Mick Funnell: 01323-892042.

- 23 Hereford SME.** AGM. Contact Nigel Linwood: 01432-270867.
- 24 Chesterfield MES.** Public Running. Contact Mike Rhodes: 01623-648676.
- 24 SM&EE.** AGM. Contact Maurice Fagg: 020-8669-1480.
- 25 MELSA.** Sunday in the Park. Contact Graham Chadbone: 07-4121-4341.
- 26 Bedford MES.** AGM followed by presentation. Contact Ted Jolliffe: 01234-327791.
- 26 Canterbury DMES (UK).** Bob Goss: *Adhesives*. Contact Mrs P. Barker: 01227-273357.
- 27 Chelmsford SME.** AGM. Contact D. Blake: 01376-324205.
- 28 Chingford DMEC.** Barry Jones: *The Train Now Standing*. Contact Ron Manning: 020-8360-6144.

## MARCH

- 1 Cardiff MES.** Club Chat. Contact Don Norman: 01656-784530.
- 1 Harlington LS.** Loco Night. Contact Peter Tarrant: 01895-851168.
- 1 Leyland SME.** Project Night. Contact A. P. Bibby: 01254-812049.
- 1 Westland & Yeovil DMES.** Bill Wilks: *A Motoring Adventure*. Contact Gerald Martyn: 01935-434126.
- 2 Bedford MES.** J. Pether: *The first booster station*. Contact Ted Jolliffe: 01234-327791.

- 2 Canvey R&MEC.** Seen on the Table 2. Contact Brian Baker: 01702-512752.
- 2 Maidstone MES (UK).** AGM. Contact Martin Parham: 01622-630298.
- 2 North London SME.** Forum: *Painting our Models*. Contact David Harris: 01707-326518.
- 2 Romford MEC.** Competition Night. Contact Colin Hunt: 01708-709302.
- 3 Isle of Wight MES.** Track & Pond. Contact Malcolm Hollyman: 01983-564568.
- 3 SM&EE.** Bob Branson: *Railway Braking*. Contact Maurice Fagg: 020-8669-1480.
- 3 Sunderland (City of) MES.** Meeting. Contact Albert Stephenson: 01429-299649.
- 3 York City & DSME.** Workshop Equipment. Contact Pat Martindale: 01262-676291.
- 4 Reading SME.** Public Running. Contact Brian Joslyn: 01491-873393.
- 4 South Durham SME.** Running Day. Contact B. Owens: 01325-721503.
- 5 Bournemouth DSME.** Technical Discussion Meeting. Contact Dave Fynn: 01202-474599.
- 6 Northampton SME.** Auction of Materials & Tools. Contact Pete Jarman: 01234-708501 (eve).

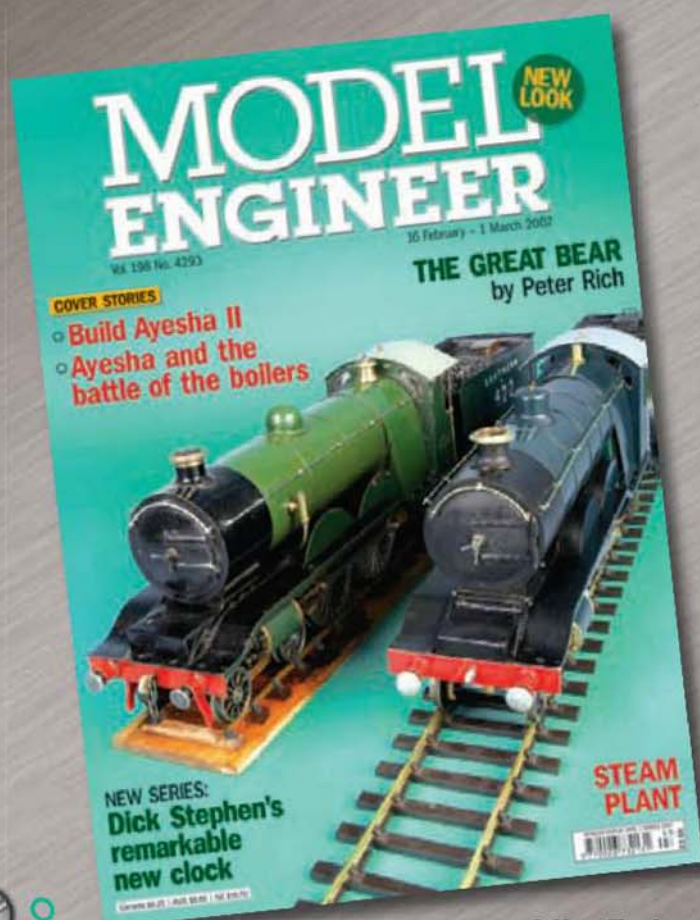
A minimum of 6 weeks notice is required for diary entries. Clubs and Societies are asked to include a telephone number for the assistance of would-be visitors.



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### Riding the Wall of Death • Ford & Corble • £16.94

Probably the most spectacular of all fairground shows, the Wall of Death has a long history, starting at the turn of the last century with cyclists in what looked like bowls, before the extra power of a motor made vertical walls feasible. This excellent book tells the history, but it especially relates this to the riders, a surprising number of them women, who have earned, or do earn, a living riding the Walls. It also makes clear why the favoured bike for Wall riders is the 1920s Indian Scout. If you are interested in the fairground, motor bikes, or distinctly free-spirits, then this is a great read. 160 pages. Around 150 illustrations (40 in colour). Paperback.



### Generators and Inverters • Chastain • £23.90

Steve Chastain shows how to build your own small combined heat and power systems for remote locations and emergency situations - this might even enable you to tell the utility companies where to put their fuel bills! Steve describes how to convert car engines for generator use, build a propane carburettor, make your own engine governor, how to safely silence generator sets and stop vibration, making and running on alternative fuels including bio-diesel, recover exhaust and jacket heat to heat water and your home, select batteries and chargers for inverter power systems, and a whole load more. It is assumed that you have a metal-working workshop, and also foundry skills, but these latter could be subcontracted to a local foundry. This is an American book, but we can't see that this in any way invalidates the information here, electric or otherwise. 351 page paperback, full of photos, drawings, sketches and tables.



### The Michael Winner Collection of Donald McGill • Beetles • £11.35

As the artistic maestro of the double entendre Donald McGill knew no master and he just kept drawing his incredible postcards, full of lecherous, and frequently red-nosed men, and statuesque, but normally rather innocent ladies, whose skirts seemed to frequently catch the wind. Shown in this book are 191 examples of his work, all from Michael Winner's collection; even if McGill was prosecuted for obscenity in 1954, his work no longer shocks, and its sheer joyful vulgarity will amuse and delight. 82 all colour pages. Paperback.



### The Ditcher's Stage • Grasby • £ 9.99

This lovely little book is the result of a fortuitous accident the author had whilst digging a drainage ditch around his hillside cottage. Written 'for those who dig', about half is devoted to digging and ditching in general, and the hand tools involved. The second half reveals the secret of the Ditcher's Stage - something which makes manually digging ditches much easier. Delightfully written, illustrated and produced, this is a joyful book even if you are not given to donning wellies, grabbing a spade, and digging ditches. 52 pages. Numerous drawings and sketches. Paperback.

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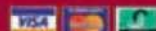


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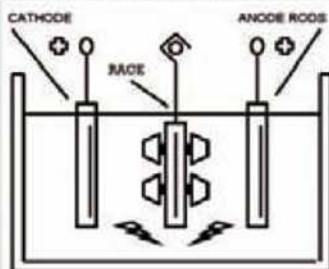
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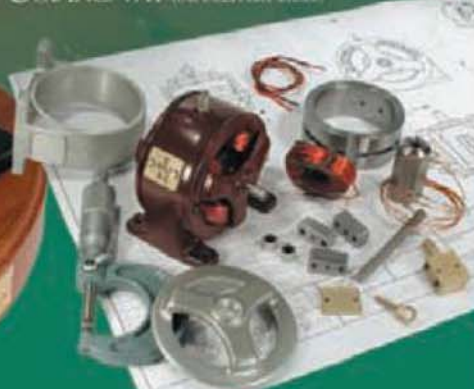
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