

MODEL ENGINEER

Vol. 197 No. 4287

24 November-
7 December 2006

**SOUTH
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STORY**

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UPDATE**

**ANTHONY
MOUNT'S
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PRICE
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CODE	SHANK	PRICE
XC91	6MM HIGH	£32.00 £29.00
XC92	8MM HIGH	£35.00 £31.00
XC93	10MM HIGH	£39.95 £37.00
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XC95	SET 7 INSERTS 8MM	£14.00 £12.00
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Anthony Mount begins a new series where he describes the construction of his latest project, a stationary steam engine of delightful design.
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I/C TOPICS

Nemett begins work on the timing case, electronic ignition and carburettor for his NE15S 4-stroke engine, which is designed to be built by the average model engineer.
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AN ENGINEER'S DAY OUT - SUPERB WATERWORKS MUSEUM AT HEREFORD

Roger Backhouse visits one of the best volunteer-run museums he has come across in his many travels, with plenty to inspire the model engineer.
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ANNA A MANNING WARDLE LOCOMOTIVE

D. A. G. Brown and Mark Smithers give builders another update on building this popular and powerful engine.
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LIFTING AND SHIFTING LONG AGO

John Ditchfield continues his look at the early technology of cranes with a look at some Victorian factory models.
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FOREIGNERS, AND OTHER ASSORTED ITEMS

Mike Zanker revisits his youth to a time when his father's ingenious projects inspired him to find out 'how things work'.
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MODEL ENGINEER

**SOUTH
AFRICAN
LOCOMOTIVE'S
STORY**

**ANNA
BUILD
UPDATE**

**ANTHONY
MOUNT'S
NEW
MODEL
BOTTLE
ENGINE**

On the cover ...

Model of a James Beggs and Co bottle frame engine constructed by Anthony Mount. Anthony starts his description of how to build this attractive model in this issue. As ever the articles will run in alternate issues, and follow in his tradition of detailed guidance for the less experienced builder. A kit of parts is available, but builders will need a lathe and, ideally, a milling machine.

(Photograph by Anthony Mount)

WELL TRAVELLED BUT SELDOM STEAMED!

Tony Mackay relates the construction of a large 5in. gauge locomotive which was built against the odds over several decades, and across several continents.
PAGE 636

LETTERS TO A GRANDSON

M. J. H. Ellis describes how the metre was evaluated in wavelength terms.
PAGE 637

LILLIAN

Keith Wilson covers several topics this time, including *Lillian's* overhang and different types of valve gear before visiting a railway repair shop.
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CLUB CHAT

News from model engineering clubs around the world
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CLUB DIARY

Forthcoming events.
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TURN TO PAGE 648 FOR SUPER SUBSCRIPTION OFFERS

S

STUART MODELS

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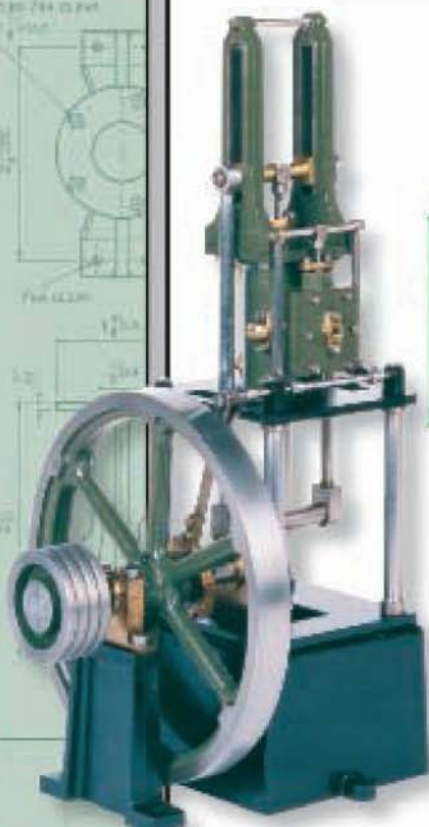
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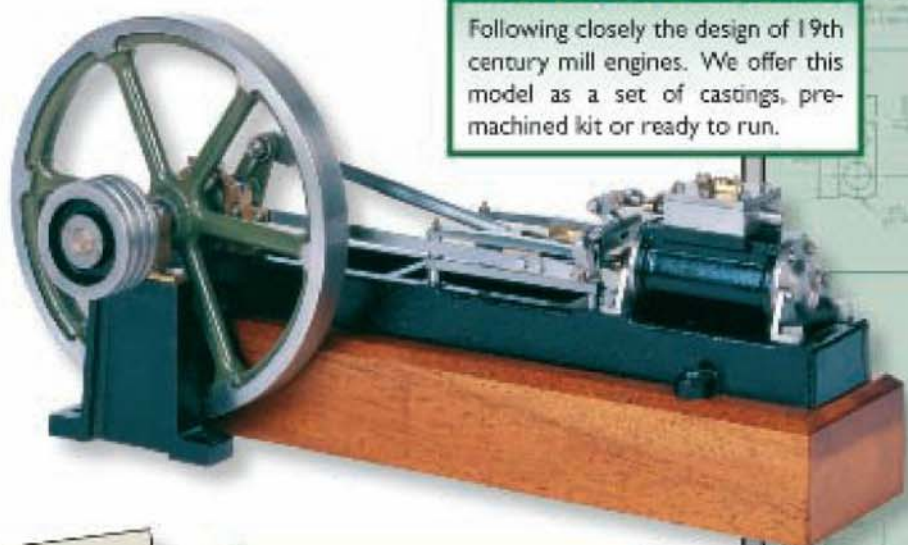
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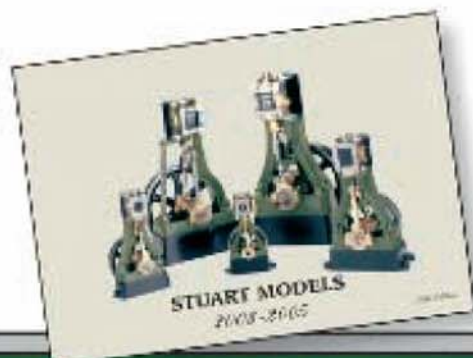
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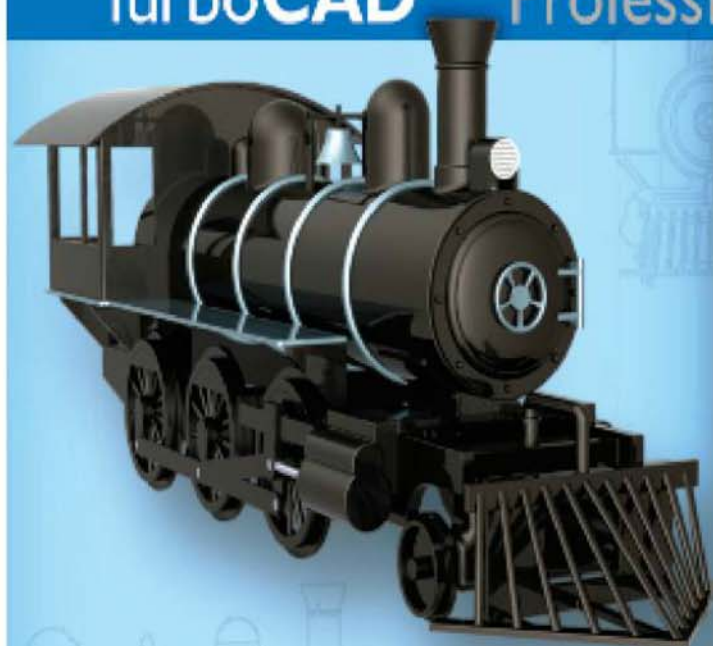


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A3	1/4 x 3/8 - 1/2 - 5/8 - 3/4 - 7/8 - 1.	11.75	J2	3/16 x 22g - 1/4 x 20g - 5/16 x 20g			07.45
A4	5/16 x 1/2 - 3/4 - 1 - 1 1/2.	14.55		STAINLESS STEEL ROUND 303 F/C			
A5	3/8 x 1/2 - 3/4 - 1 - 1 1/2. EN8M	15.35	K1	3/32 - 1/8 - 5/32 - 3/16 - 7/32 - 1/4			10.00
A7	1/2 x 3/4 - 1 - 1 1/4 - 1 1/2.	23.10	K2	3/16 - 7/32 - 1/4 - 5/16 - 3/8 - 7/16 - 1/2			25.90
BRIGHT MILD STEEL ROUNDS				BA STAINLESS STEEL HEXAGONS 303 F/C			
B1	1/8 - 5/32 - 3/16 - 7/32 - 1/4 - 5/16 - 3/8.	05.75	L1	.152" - .193" - .220" - .248" - .275" - .312"			15.45
B2	1/4 - 5/16 - 3/8 - 7/16 - 1/2 - 5/8 - 3/4.	10.10		BA BRASS HEXAGONS			
B3	5/8 - 3/4 - 7/8 - 1	17.35	M1	.152" - .193" - .220" - .248" - .275" - .312"			11.80
B6	3/8 - 1/2 - 5/8 - 3/4 - 7/8 - 1 EN8M	22.95		BA STEEL HEXAGONS			
BRIGHT MILD STEEL HEXAGONS				M2	.152" - .193" - .220" - .248" - .275" - .312"		05.15
C1	3/16 - 1/4 - 5/16 - 3/8 - 1/2	08.00		BRASS FLATS			
C2	1/4 - 5/32 - 3/16 - 3/8 - 7/16 - 1/2 - 5/8	10.90	N1	1/16 x 1/4 - 3/8 - 1/2 - 3/4 - 1			09.50
BRIGHT MILD STEEL SQUARES				N3	1/8 x 1/4 - 3/8 - 1/2 - 3/4 - 1		20.50
D1	5/32 - 3/16 - 1/4 - 5/16 - 3/8	05.00	N4	3/16 x 1/4 - 3/8 - 1/2 - 3/4 - 1			20.35
D2	7/16 - 1/2 - 5/8 - 3/4	10.90	N5	1/4 x 3/8 - 1/2 - 3/4 - 1			30.70
BRASS ROUNDS				ALUMINIUM ROUND F/C			
E1	1/8 - 3/16 - 1/4 - 5/16 - 3/8 - 1/2	15.40	P1	3/16 - 1/4 - 5/16 - 3/8 - 7/16 - 1/2			13.65
E2	1/16 - 3/32 - 5/32 - 7/32 - 9/32 - 7/16 - 5/8 - 3/4	24.00	P2	5/8 - 3/4 - 1			23.75
BRASS SQUARES				PHOSPHOR BRONZE ROUND			
F1	1/8 - 3/16 - 1/4 - 5/16 - 3/8	13.10	Q1	1/8 - 5/32 - 3/16 - 1/4			12.75
F2	1/4 - 5/16 - 3/8 - 7/16 - 1/2	26.95	Q2	5/16 - 3/8 - 7/16			31.50
BRASS HEXAGONS				SILVER STEEL			
G1	5/32 - 3/16 - 7/32 - 1/4 - 5/16 - 3/8	11.00	S1	3/32 - 1/8 - 5/32 - 3/16 - 7/32 - 1/4 - 5/16 - 3/8 - 7/16 - 1/2			22.45
G2	1/4 - 5/32 - 5/16 - 3/8 - 7/16 - 1/2 - 5/8	31.25	S2	3mm - 4mm - 5mm - 6mm - 7mm - 8mm - 9mm - 10mm - 12mm			19.50
BRASS ANGLE				ALUMINIUM FLATS			
H1	1/4 x 1/4 x 1/16 - 5/16 x 5/16 x 1/16		R1	1/8 x 1/2 - 1/8 x 1 - 1/4 x 1/2 - 1/4 x 1 - 5/8 x 1 1/2 - 1/4 x 2			18.90
	3/8 x 3/8 x 1/16 - 1/2 x 1/2 x 1/16	13.75	R2	3/8 x 1/2 - 3/8 x 1 - 3/8 x 1 1/2			15.55
H2	5/16 x 5/16 x 1/16 - 3/8 x 3/8 x 1/16		R3	1/2 x 1 - 1/2 x 1 1/2 - 1/2 x 2			23.75
	1/2 x 1/2 x 1/8 - 3/4 x 3/4 x 1/8	21.30	R4	1/2 x 2 1/2 - 1/2 x 3			27.85

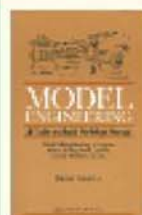
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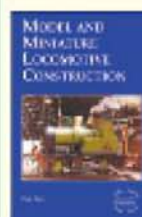
Model Engineering: A Guide to Model Workshop Practice • 1915 • Greenly • £17.35

Henry Greenly was perhaps the first writer of what one could call modern model engineering articles, a few of which have been assembled in this book, first published in 1915 - it is a salutary reminder of what a good writer he was. The range of subjects covered is considerable, ranging from workshop practice, through general guides to certain items, such as cylinders, assorted models of stationary engines, steam and electric locomotives, mainly in the smaller gauges, and much more including (sorry!) two on making miniature ordnance. It may be over ninety years old, but the vast majority of this book is useful today, even the chapter on model boilers, which covers model stationary and marine boilers as much as locomotives. An excellent text, with 85 photographs and no less than 724 line drawings in 407 pages - this really is a book you will refer to time and time again. Paperback.



Model Steam Locomotives • 1954 • Greenly rev. Steel • £19.35

In effect the first edition of this book appeared in 1904; five further revised editions appeared over the years before the outbreak of World War II; a seventh edition appeared in 1951, and the eighth edition, reprinted here, appeared in 1954. The last two editions were revised and updated by Greenly's son-in-law Ernst A. Steel, but remain very much the work of Henry Greenly. Perhaps because of the work he undertook for Messrs. Basset-Lowles, Greenly's experience of designing and building model locomotives covered all gauges from Gauge 1 to 15" gauge, and the major changes between editions of this book chart the gradual increase in gauge of the models being built by model engineers. However the smaller and larger gauges are also well covered, and the range of gauges is unique. The first four chapters are general, covering choice of scale and gauge, locomotive types, principles of model locomotive design and boiler design. Twelve further chapters follow, each devoted to specific parts of the locomotive. All are very fully illustrated with drawings, tables and photographs - many of the latter illustrating models built by some of the twentieth century's finest builders. Any book which effectively remained in print over fifty years has to have been top quality and a century after the first version of it appeared, *Model Steam Locomotives* remains one of the very best books written on building model and miniature steam locomotives, and one which will prove an invaluable reference for locomotive builders in the 21st century. 322 pages and paperback.



Model and Miniature Locomotive Construction • Bray • £33.45

Here Stan Bray covers the construction of model and miniature locomotives from Gauge 1 to 7 1/4" gauge, with the accent on the passenger hauling gauges. Stan passes on hints, tips, ideas and practices he has picked up over fifty years as a model engineer, and covers the subject with chapters on each major part, such as frames, axles, wheels, valve gear, cylinders, boiler, plating etc. Stan also covers electric and I.C. powered locomotives, a subject not covered before in a book on this subject. Each chapter is illustrated with drawings and photographs of the relevant parts of the locomotive, and there are eight pages of Appendixes of useful charts. Written in Stan's inimitable style, there are numerous asides, so this book is a good read, as well as containing a huge amount of practical and useful information and ideas. Whilst especially useful for the beginner, the ideas, hints and tips in this book make it one every model or miniature locomotive builder should have on their bookshelves. Quality hardbound A4 format book 200 pages, 158 drawings, 300 B & W, and 32 colour photographs, 12 charts.



Making Simple Model Steam Engines • Bray • £22.35

Here Stan tackles the subject of simple steam engines for the beginner. The 10 main chapters each cover a simple engine of varying configurations, and including oscillating and double acting engines, as well as an unusual Clapper engine. 8 chapters then follow on boiler designs and boiler construction, before the final chapter covers building an O gauge vertical boilered De Winton type locomotive. The full drawings for each item are dimensioned in both Imperial and Metric, and there are numerous photos of parts and machining set-ups. Tis good! 158 pages. Loads of drawings and photos. Hardbound.



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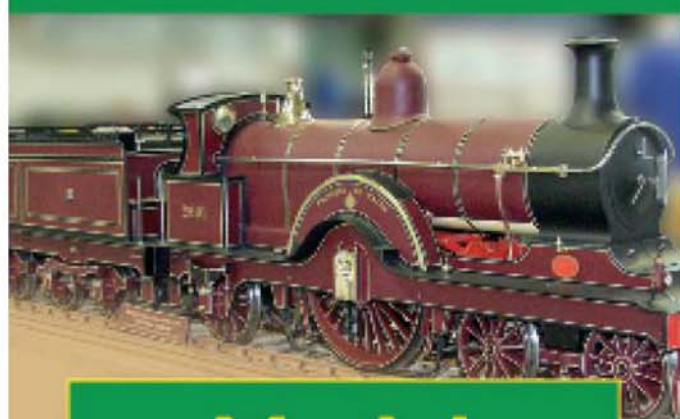
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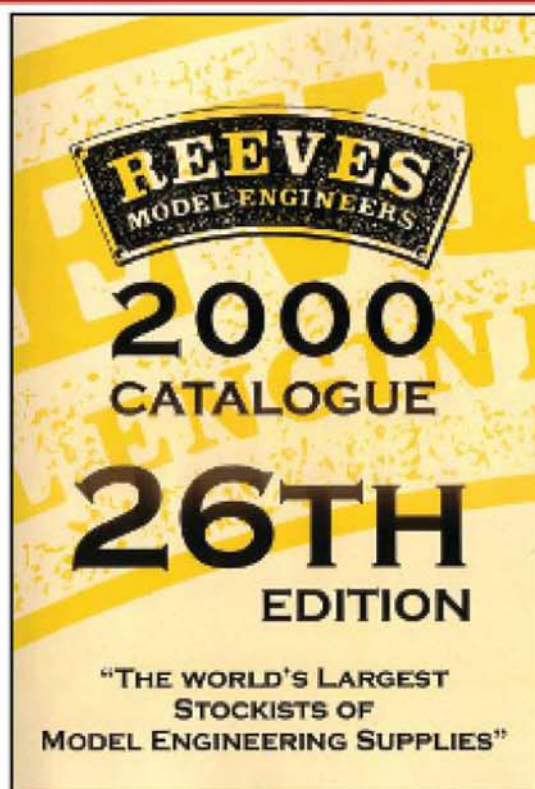


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With the Editors

Exhibition all change

Owing to circumstances beyond our control it has been necessary to postpone the Model Engineer Exhibition until after the New Year. Unfortunately this year the Christmas and New Year period has presented difficulties with staffing which meant that we could not guarantee our usual high standards.

So watch this space for new details. As the event will now be in 2007, this will be in the 100th year of the exhibition.

This delay will be welcomed by readers who have told us clearly that they would prefer to see the event at a different time of year, to avoid clashing with family and other occasions, not to mention the difficulties of travel at that time from some parts of the country, and especially overseas.

This move is being especially welcomed by the model engineering trade which also has great difficulty in finding staff to work over that period between Christmas and New Year, and which is costly in terms of accommodation and so on.

We anticipate that more clubs will also now be able to take part.

Negotiations are already advanced to secure another great venue. We will publish the revised exhibition details shortly.

Entries already received will be retained for the revised dates.

For those who have booked advanced tickets, these bookings will be carried forward, although refunds will be given. Please address requests for refunds to:

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The organisers apologise for any inconvenience this change causes.

However, we can now get on with producing the sort of event that we would all like to see, and look forward to the best one yet in its 100th year.



Hand scraping a bearing at the Myford works. This photograph was taken at a recent Myford open day, when visitors were treated to a tour of the works, and a display of the company's products, plus a few bargain sale items. A report will appear in the next issue.

Contact

Just lately our postbag has been quite light. The reason is that many people have not updated their address books. All post with now defunct addresses on no longer reaches us. Please use only the following postal address:

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IMLEC DVD

Copies of a DVD of the IMLEC 2006 event held at Fareham on July 1 and 2, are now available. Reasonably priced at £12.50 including post and packaging they can be ordered from W Pearson on 02392 380664 or by email wallycpearson@aol.com

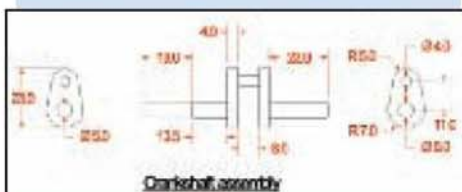
The DVD covers all the runs over two days of competition.

Join Chronos

Chronos has an open weekend this weekend, November 24-26. The company will have many special offers, demonstrations, and a free gift for every visitor. Refreshments will be available. You can find Chronos at Unit 14 Dukeminster Estate, Church Street, Dunstable, Beds LU5 4HU, which is close to the A5 and junction 11 of the M1. Tel 01582 471920.

Gremlins

Unfortunately in the article in the series on overhead valve engines in *M.E.* 4282, 15-28 September 2006, an incorrect drawing of the crankshaft assembly was shown in Figure 7 on page 343. The correct drawing is shown here.



Line from Neil

Our Technical Editor, Neil Read was recently despatched on a training course to learn more about the art of lining or pinstriping as our American friends call it. This was organised in collaboration with our sister magazine *Model Engineers' Workshop* and a full report will appear in that magazine in due course. The event attended was organised by Pinstriping UK who specialise in training aspiring pinstripers and can supply the necessary paint and other materials associated with the craft. Many model engineering projects need lining out to finish them properly and sourcing the proper materials can be difficult. If you have a need for proper lining paints or brushes give Pinstriping UK a try. They can be reached at 7 Gees Lock Close, Glen Parva, Leicester, LE2 9GS; tel: 0116-283-7651; mobile: 07947-695640; website: www.pinstripinguk.com



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POST BAG

Cheap indexing

SIRS, - I am enclosing my idea for a cheap and simple dividing device. It's the old adage, finances and necessity being the mother of invention. The two photographs show the construction.

The cost was £1.99 for a circular protractor and the rest from the scrap box. It is simple to make and the dimensions can be set to suit individual needs. The protractor itself is screwed to a piece of Perspex with the white packing sandwiched between the two for ease of reading. The pointer is a 1 1/2in. length of 3mm mild steel with a turned point. The chuck mount is mild steel and made to suit.

I hope this will be of some interest to readers.

F. A. Hammond, Lancashire.

More on casting quality

SIRS, - I have just read the letters about casting quality (*M.E.* 4280, 18 August 2006). The problem overseas is actually much worse than that found in the UK, because when one receives a faulty casting or any other item, the supplier requires that the faulty casting or item is returned before they will supply a replacement. While it is difficult to achieve a 100% quality for all goods, especially castings, if the faulty ones are returned to the foundry directly, they will be credited, instead of the end customer actually doing the inspection for the supplier.

Unfortunately the cost of shipping, and possibly customs charges, for the faulty item often exceed the value of the goods, so it is often cheaper to just buy another item. All too often it seems that there is no inspection of the goods being shipped so if it fits in a box then ship it!

I recently ordered three different sizes of spring steel strips. Of the

three only one was correct, one size was of the incorrect gauge, the other being so rusty and pitted that it was only fit for the scrap bin. The reply that I got from the girl on the telephone was that the goods were correct when they were shipped! How the trade has changed now that having got their money, why should they bother about the customer overseas?

On the other hand there are many very good suppliers, who bend over backwards should there be any fault. It is a pleasure to buy from them and I get very good service, for which I must pay them a compliment.

Philip T. Bellamy, Switzerland.

IMLEC 2006

SIRS, - Now that the dust has settled on yet another very good IMLEC I would like to mention a few points which I feel need looking at. In 2004, John Hurley and Kinver completely revamped the rules regarding entry, doing away with all restrictions, introducing the 'Previous Winners' class and gave IMLEC a new lease of life. I think we all owe John a debt of gratitude for this. However, now that the winning locomotive automatically goes into the all-winners class, I think this should be reconsidered.

Up to 2003 the winner with the same locomotive always had the chance, if they wished to defend the cup the next year, traditionally having the last run. There are some who think it is not the same competition with the previous winner not competing. Every winner, except the last three has had this chance and I think that it is not really fair on these three. Why should they, and subsequent winning driver/locomotive combinations, not be allowed to defend their title because of an anomaly in the rules? Until a

couple of years ago, the invitation to enter was always in *M.E.* early in the year, but this seems to have stopped. Last year Northampton did most of the entries by e-mail, which is fine if you are on the Internet. This year, apart from a few lines in *Smoke Rings*, there was no mention of it. Indeed the entry was full up very early and never advertised which led to a few regulars not knowing who to contact and losing the chance of an entry. The rules say that entries are open to competitors on a first come first served basis. This is the normal procedure, but for this to happen we must have a level playing field. Can I ask that we go back to the invitation early in the year in this magazine with no entries being accepted until it is published? That way every one who wishes to enter will have the same chance.

The rules for IMLEC have developed over the years and organising clubs add their own for the event as they think necessary. This year Fareham added a rule regarding safety chains or cables and advised that there would be local extra speed restrictions on parts of the track. Every competitor received a set of rules early so there was no excuse for not complying with them. The extra speed restrictions did cause a few problems, the majority doing their best to comply. The winner, Les Pritchard who had problems with the speed restrictions completed 10 laps in 29 minutes, 22 seconds. If the time taken to start and stop the run is not considered, this gives an average lap time of 2 minutes 56 seconds, which I think we can take as the quickest a lap could be completed with a good load more or less obeying the speed limits. The results show that three competitors completed eleven circuits and that one had time to do a twelfth. The

report of this run (*M.E.* 4280, 18 August 2006) comments on the speed, and possible breaking of the speed limits. If the same is done to these three we get one taking 2 minutes 52 seconds a lap with a very light load. This could be accelerated out of the restrictions and up the banks quickly, so hopefully no problem here. However, the other two runs give times of 2 minutes 46 seconds and 2 minutes 25 seconds. As far as I am aware every competitor except one made some provision for a safety chain or cable as the rules stated.

All I am going to say is that it looks as if the rules were not enforced on everyone evenly and fairly. A few were allowed to quite seriously break them and get away with it. I assume the organisers had a reason for this, but all it does is to leave the event open to comment, like this letter and ill feeling, which does not really need. If the rules had been applied to everyone, with appropriate action taken to those who did not comply, the results could have been a little different.

Please, future clubs who run IMLEC, enforce the rules evenly and fairly on all competitors, and if it means excluding or disqualifying someone, then so be it. As I have said, all entrants know the rules long before the event, so there are no excuses. Model engineering is a hobby and IMLEC is a very enjoyable fun weekend, but there are cash prizes and a little glory up for grabs. Rules are made to run the event fairly and safely so that no one has an unfair advantage.

Jim Elliott, Buckinghamshire.

IMLEC report

SIRS, - Having just read the report on the 2006 IMLEC (*M.E.* 4280, 8 August 2006) which was held at Fareham in July, I felt that perhaps the spreadsheet showing the competition results required some explanation in order to help those readers who like to study 'form' and compare results from year to year.

I refer in particular to columns 14 and 15, Driving Car Constant and Driving Car Work Required respectively.

When we started planning IMLEC at the start of the year (bearing in mind we had never held it before) the first thing we did was to read some of the *M.E.* reports on previous IMLEC events. One of the most important things we had to consider was the positioning of the dynamometer car relative to the driver/driving car, ref. Arthur



Above left: indexing device produced by Mr. Hammond. Above right: component parts of the indexing device.

Bellamy's letter published in *M.E.* last year and my subsequent reply also published in *M.E.*

This discussion posed the question "should the driver ride on the dynamometer car or on a driving truck with the dynamometer car behind him?"

After considerable thought we concluded that the driver should ride on a driving truck in front of the dynamometer car thereby enabling him to lean on his tender if he needed to without any possibility of influence on the dynamometer car readings.

However, this arrangement inevitably leads to an error in the recording of the work done by the locomotive, as the work required to propel the driving car and the driver is not included in these recorded figures. This becomes progressively less fair for small locomotives pulling fewer passengers behind the observer.

So what to do? We concluded that the best compromise we could make was to measure the amount of work required to propel the driving car loaded with an 11 stone man around our track, whilst adhering to the speed limits, to provide an allowance which would be added to each competitor's result. This measured figure was divided by the distance travelled and gave a value of 3.3648ft. lb/ft. travelled (column 14 on the spreadsheet).

Column 15 on the spreadsheet is the result of multiplying the distance travelled by the competitor by the above constant. This new figure is added to the work done recorded by the dynamometer car (column 16) and is the value of actual work done shown in column 17. Column 17 in its turn is used to calculate the overall thermal efficiency.

To conclude, although the work done which is recorded in column 15 makes no allowance for drivers of less than or more than 11 stones in weight we felt that it was a compromise solution which was somewhat fairer for the small locomotives than last year's system whilst still leaving the drivers free of any worry if they inadvertently leaned on their locomotive or tender.
Brian Fisher, Chairman
Fareham DSME.

Sifbronze alloys

SIRS, - I have been reading with interest the arguments concerning Sifbronze brazing etc. As is mentioned Sifbronze is 60/40 copper zinc alloy. What is not

mentioned is the use of Sifoubron No. 17 and No. 17-2AG (also from the Suffolk Iron Foundry). Both these rods are used in brazing copper and bronze alloys e.g. copper hot water cylinders. They contain no zinc and therefore cannot suffer from dezincification. Melting range is from 707deg.C-840deg.C. The 2AG - rod has the addition of 2% silver which gives it greater ductility and it runs like silver solder. These rods are similar to Silfos and Silbralloys as far as I can see from Johnson Matthey.

I propose soon to build a small copper boiler and would like to use the Sifbronze rods I have instead of silver solder as it is a lot cheaper - also it does not need any flux. Is there any objection to use these rods in model engineering boilers?
P. H. Lewis, Norfolk.

A unique 'Curly' locomotive?

SIRS, - Recently I entered my 3 1/2in. gauge *Duchess Of Swindon* locomotive in the LBSC Bowl at Sunderland. I bought this locomotive from the builder Mr. Roy Boulcott in 2002. He built it in 1960/1961 and was then a member of the North London Society of Model Engineers. This design was started by LBSC in the 16 April 1959 *Model Engineer* magazine, but this series was stopped when LBSC resigned in 1959.

Mr. Boulcott completed the model by using other LBSC designs mainly *Britannia* and *Hielan Lassie*. He also corresponded with LBSC himself and I have the drawings of the valve gear LBSC drew for him. A photograph for this locomotive is on page 85 of the book *LBSC his Life and Locomotives* by Brian Hollingsworth.

To keep the record straight his name is spelt wrong and neither Mr. Boulcott nor the model has been to Canada. In the book it says one or two Duchesses were built but no one I have spoken to knows of any others. I would be interested to know if any reader knows of another model built to this design or is the example built by Mr. Boulcott unique.
Mr. J Lummas, Cleveland.

Sourcing drills and end mills

SIRS, - Dennis Randall in his letter (*M.E.* 4281, 1 September 2006) requests information on sourcing drills and end mills. Through my association with Bruce Engineering

(Tel: 0115-9736700) I know they can supply good quality drills in fractional and metric sizes, and British made HSS steel end mills and slot drills made by APEX.

J&L (usual disclaimer) the well-known engineering suppliers on 0800-663355 supply a whole range of drills and cutters. I had some drills from them made by Hertel and interestingly the shanks of the drills were hard as well, which puts a stop to the chewed up shanks when a drill slips in the chuck.

With regard to four-flute end mill and two flute slot drills I often wonder why they are still made when a three-flute end mill will do the job of both. Whatever the quality of HSS end mills they do not keep their sharpness for long. It is well worth considering carbide end mills they may cost more but they last about five times as long, which makes them cost effective.

Peter King in his letter to *Postbag* (*M.E.* 4282, 15 September 2006) mentions 'American' calibration to cross-slide dials. My last two lathes had this and I must admit I found it took some time to get used to. However, it does have its downside where model engineers are concerned as many use the cross slide for milling with a vertical slide and here straight linear movement is required and having to double all the dimensions is a pain. Similarly the same argument occurs for the depthing of threads. I made up an additional dial to read off the actual movement of the cross-slide.
Anthony Mount, Devon.

Engine identified

SIRS, - With regard to Peter Spenlove-Spenlove's letter (*M.E.* 4282, 15 September 2006); I can confirm that his memory is fairly accurate. The engine shown in the picture is a Deller 1cc.

Designed by W. H. Deller and described in a series of seven articles between January 1938 and August 1938 in *Newnes Practical Mechanics*.

The explanation for the blueprint that Peter mentions is given in a box advert in the first article.

The text reads:

"Those readers who wish to complete construction of the engine before publication of the concluding articles can obtain a set of blue prints for 5/-".

The engine shown in your picture varies slightly from the published design in that the fuel tank is an extra by the reader and the original had the spark plug

built in to the cylinder head.

The engine is quite interesting, it was designed as an aero engine, the prop driver serving as the points timing cam. The timing was fixed. The vertical face of the prop driver featured another cam. This drove a piston valve which controlled the fuel induction. Rather innovative and possibly unique in the aero engine sphere.
Tom Crompton, Manchester.

Pressure vessel testing

SIRS, - I wish to reinforce Mr. I. D. Priest's views on Vessel Pressure testing (*M.E.* 4282, 15 September 2006). I was in the past involved in extensive pressure testing of pipe work and vessel pressure testing, in building services.

I was witness to a near disaster when we were involved in testing an extensive compressed air distribution system. The system had been tested to twice working pressure with water in the usual manner. During the draining down process prior to re-testing at working pressure on air, someone unknown removed a pressure gauge from the system and replaced it with a 1/4in. BSP taper steel plug.

When the system pressure was raised to the working pressure of 100psi, because the offending plug had not been fully engaged, it blew out and went right through a 4 1/2in. brick wall. Imagine the consequences if somebody had been in the way! Moral, always pressure test with water however inconvenient, and change nothing between the water test and normal contents test.
Ron Hobdell, Croydon.

Whistle design

SIRS, - I am building a Burrell 1 1/2in. scale 7hp traction engine with much help from members of Nottingham SMEE.

I have read with great interest, the articles on whistles and would like to build one, preferably based on the Ted Martin's design, if not a bottom entry pipe organ type.

Having nowhere to hide it, my whistle can only be 1.6in. long max.

I would be grateful if anyone could provide a rough drawing and dimensions:

If not can the length for the whistle be divided in two again and if so what do I do about the other dimensions?

I would be pleased with any help.

Andrew Taylor, by e-mail.

Synchronome clocks

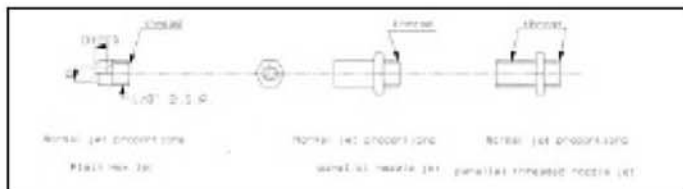
SIRS, - I was interested to see more about synchronomes in your pages. My boarding school had one which ran a score or so of slave clocks around the premises. At a reunion several years ago, I learned from a chance remark that this had been removed and was lying idle in an attic! After my brother kindly made a replacement for a missing pendulum support bar, the unit is now on the wall at the top of our stairs, serving one slave (in my garage), with the thought that it might one day also run a second one on an outside wall, if I were able to engineer a weatherproof housing for it (I guess it will never happen...)

My clock had no NRA mechanism in all the time I knew it (from age 10 in 1952), though the holes are there in the backplate. To retard it by one half-minute, I simply hold up the dropping bar until the pendulum has passed and the catch returns to support it. To advance it, I have a button wired in parallel with the impulsing contacts. Hence, come each spring, I have to give it 120 impulses...

The motive power in its original site was, I believe, either dry cells or accumulators. These were not with it when I acquired it, though I was lucky enough to get three of the slaves, one having now been passed to another synchronome owner. The clock now runs on three C cell Nicads, trickle charged from a mains unit. I once ran it without external power to see how long it would run, it was still going a week later.

One feature of my unit, not evident on the one illustrated (*M.E.* 4281, 1 September 2006), is a circular table on the pendulum rod, approximately opposite the rest of the works. This accepts small weights to achieve regulation (I use 4 and 6BA nuts and washers). The short-term regulation is around three seconds a week. I believe that its long-term regulation, averaging seasonal climate changes, could be better than this. I am thus trying to leave it alone in between the two days per year when we all adjust our timepieces.

Alongside the clock, though completely separate, was a mains-driven unit, which I also acquired. It used to ring the school bells to a weekly timetable determined by pegs inserted in holes in a ring. This ring was double, in order to accommodate a different bell regime at weekends. (The bell-ringing time was determined by a slug of mercury running through a glass tube!).



Dave Robinson's propane injector designs.

I also have a long-case clock, which had a broken pendulum support spring when I got it.

For this repair, I used a portion of an 'old-style' razor blade!
Chris Finn, East Yorkshire.

Propane injectors

SIRS, - In reply to Ken Surrey's enquiry regarding injectors for propane (*M.E.* 4281, 1 September 2006), I wrote a little program for my computer (an MZ 80K, with all of 48k memory) in the late 1970s. With this I can give you jet sizes for gas injectors. For information four parameters are needed to obtain the fifth, in this case the injector size. They are S.G., calorific value, operating pressure and input in BTUs. Sorry about the 'old currency' but one can easily convert if necessary.

In this case the parameters are:- S.G. - 1.5; pressure: 14in. water gauge; calorific value: 2500 BTUs per cu.ft.; input - unknown but I have provided a list, together with the throughput.

BTUs	Injector dia.
10,000	0.0343in.
20,000	0.0485in.
30,000	0.059in.
40,000	0.068in.
50,000	0.076in.
60,000	0.084in.
70,000	0.090in.
80,000	0.097in.
90,000	0.102in.
100,000	0.108in.
110,000	0.113in.
120,000	0.118in.
130,000	0.123in.
140,000	0.128in.
150,000	0.132in.

All these are at standard 14in. W.G. pressure. If you need to vary pressure a little, that will be okay.

As for the making of the injectors themselves, I believe that

Amal small injectors were 0BA. Next were (and probably still are) 1/8in. BSP, 1/4in. BSP. Bigger than this is not likely to be needed.

The actual injector diameter needs to be proportioned as follows: The length of the parallel portion should be around 20% greater than the diameter. Too much less will reduce the actual jet of gas and induce eddies, too much greater will increase frictional resistance. Accuracy of these proportions does not have to be slavish but the nearer you get, the more efficient. The lead angle to the parallel portion should be around 60deg. Included. As fortune has it a centre drill does the job nicely.

To make, use, for normal jet, 10mm hex brass or anything conveniently near; turn thread O/D.; thread 1/8in. BSP; use a centre drill with a diameter smaller than finished diameter; drill right through undersize slightly for jet; drill or ream final size. Put a taper on the output end; part off.

Sometimes it is useful (for fixing purposes) to part off before final taper, to turn the jet the opposite way round and turn a threading diameter so the jet may be fixed by a nut. As long as you maintain the correct jet injector diameter and the proportions of the lead taper are the same, then you can suit yourself about the rest as long as you allow minimum interference with the secondary air round the jet.

Dave Robinson, Hertfordshire.

Propane fired furnaces

SIRS, - In *M.E.* 4281, 1 September 2006 a query was made for information on propane fired crucible furnaces, a great deal is available on the internet, I can strongly recommend joining the Yahoo group 'Castinghobby' at this link:



Frank Hasieber's propane burner, still under construction.

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Responses to published letters are forwarded as appropriate.

<http://groups.yahoo.com/group/castinghobby/> You will be required to join the group.

If required I can give links to a number of websites with information. A great book on the subject *Gas Burners for Forges, Furnaces and Kilns* by Michael Porter, ISBN 1-879535-20-3, available through Amazon.

This book gives step-by-step instructions for building a couple of furnaces and burners to go with them, which can all be made using simple hand tools, a lathe however is a big help.

I have attached a photo of my burner still under construction.
Frank Hasieber, Durban.

Gorgon progress

SIRS, - I am making slow but steady progress with my *Gorgon* steam engine and, as a beginner, found that it required a lot of thought as to how to produce items like the complicated cylinders accurately. Nonetheless, I'm enjoying the challenge!

I'm not ready to start on the condenser boxes yet but I have spent much time trying to locate a supplier who can offer a suitable section and I wonder if any other reader can help with the name of a stockist? Smiths of Clerkenwell used to stock a drawn brass tube but, alas, no longer. I have had no luck finding the bearings either.

Later on I shall require help in setting up the valve timing accurately, and having spent a lifetime with the infernal combustion engine, I know how important this is to performance. Perhaps one of the 'old hands' can oblige with an article for the less knowledgeable, please?

If only there was a model engineering group in this area life would indeed be full.

A. H. Middleton,
Gloucestershire.

We are not aware of a Gloucester club. If any readers know of a suitable local group we will publish contact details.

Moore and Wright boxes

SIRS, - The Moore and Wright precision tool box No. 930 (*M.E.* 4278, 21 July 2006) contained: 1 outside caliper, firm joint, No. 331, 4in.

1 pair spring dividers, No. 50, 3in.
1 precision feeler gauge, No. 22
eight blades from 0.002 to 0.015in.
1 rule, three fold, 9in.

1 box with hinged lid.
Priced at £1.3s.0d in August 1949.
Robert Craig, Devon.

1



A model of the bottle frame engine with an overhung crank and the outside end of the crankshaft carried in a separate pedestal bearing.

JAMES BEGGS AND CO. BOTTLE FRAME ENGINE

Anthony Mount describes a delightful design of engine that is believed to have originated in the USA.

●Part I

It must seem quite strange to many people that a stationary steam engine could be called a bottle frame engine. There is a logical explanation but we have to go back about a century to get the answer. In those times it was customary for chemist shops to advertise their existence by having three large, coloured bottles in the shop window. The bottles had a narrow neck and opened out to a large, rounded bottom. As you can see from the photograph of the engine the main frame has the same shape as the chemist shop bottles, hence the name. I think the colours of the chemist shop bottles were red, blue and green.

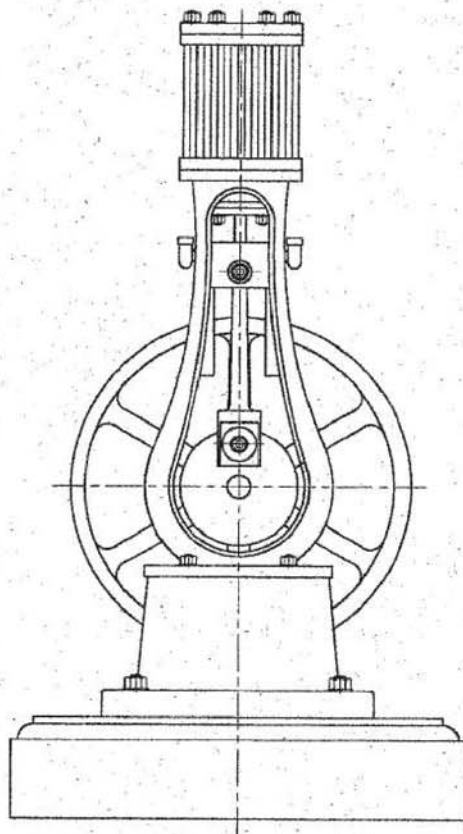
I have had it in mind to do one of these engines for some time, so when we were discussing which prototype to make as the next engine with Cotswold Heritage I brought along

a drawing of a bottle frame engine amongst others and was pleased when the decision fell on the bottle frame design. It was built in a number of forms and originated, I believe, in the United States of America. Some engines of the type had a two-webbed crankshaft, with both bearings in the base of the bottle frame. Other engines had an overhung crank and the outside end of the crankshaft was carried in a separate pedestal bearing.

The outer bearing can lead to problems with lining up the crankshaft, however the prototype chosen conveniently had a separate base casting that united the two halves making the job easy.

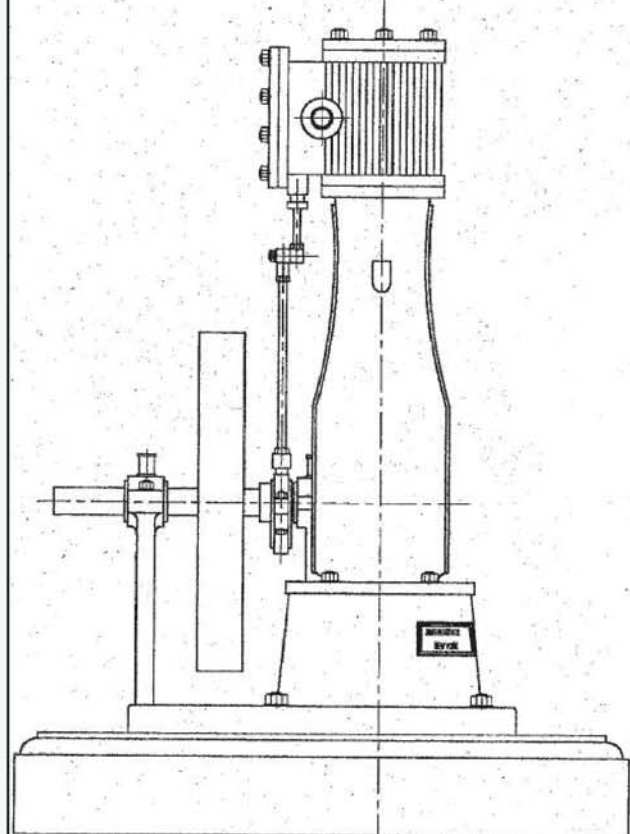
There was a third version of the engine used for marine work. This was the same overall design as the first engine with both bearings in the main frame. However, it had reversing gear and, instead of a flywheel, had a tiny wheel on the crankshaft for turning the engine over top or bottom dead centre as all these engines seemed to be single cylinder.

I have drawn the model with an overhung crank and outer pedestal bearing as I think it



©

END ELEVATION



©

SIDE ELEVATION

James Beggs and Co. Bottle Frame Engine Metric parts list				
Part No.	Drw. No.	Description	Material	Quantity
01	06	Base	Cast bronze	One
02	07	Main frame	Cast bronze	One
03	08	Bearing pedestal	Laser cut mild steel	One
			Laser cut cap and seating	Two
04	09	Flywheel	Cast iron	One
05	10	Cylinder	Cast bronze	One
06	11	Top cylinder cover	60mm dia. mild steel	40mm
07	11	Piston rod gland	30mm dia. brass	25mm
08	12	Valve rod gland	20mm dia. brass	25mm
09	12	Cylinder bottom cover	40mm dia. continuous cast iron	50mm
10	13	Piston	35mm dia. brass	13mm
11	13	Piston rod	6mm dia. stainless steel	100mm
12	13	Slide valve	30 x 12mm brass	30mm
13	14	Slide valve nut	6 x 6mm brass	12mm
14	14	Eccentric rod head	6 x 6mm mild steel	50mm
15	14	Valve cross head	6 x 6mm mild steel	Part of 14
16	14	Valve rod	3mm dia. stainless steel	170mm
17	15	Eccentric rod	3mm dia. stainless steel	Part of 16
18	15	Eccentric sheave	40mm dia. continuous cast iron	Part of 09
19	15	Eccentric strap	Laser cut mild steel	One
20	16	Crankshaft	12mm dia. mild steel	115mm
21	16	Disk crank	60mm dia. mild steel	Part of 6
22	16	Crank pin	10mm dia. mild steel	40mm
23	17	Connecting rod	20 x 15mm mild steel	150mm
24	17	Big end bearing	20 x 15mm bronze	15mm
25	18	Cross head	20 x 15mm mild steel	Part of 23
26	18	Cross head pin	10mm dia. silver steel	25mm
27	18	Cross head washer	10mm dia. mild steel	Part of 22
28	18	Saddle key	22mm dia. mild steel	50mm
29	19	Bearing pedestal	40 x 8mm mild steel	40mm
			laser cut cap and seating	Two
30	20	Wooden base	Hardwood (elliptical)	One
31	21	Steam chest cover	Mild steel 50 x 4mm	60mm
32	21	Nameplate	Brass acid etched	Bought in
33	21	Big end wedge	4 x 4mm mild steel	25mm
34	22	Cylinder cladding	Hardwood or brass tube	One
35	22	Studs	7mm dia. mild steel	100mm
36	22	Main bearings	18mm dia. bronze	50mm
37	24	Crankshaft	12mm dia. mild steel	115mm
			10mm dia. mild steel	40mm
38	24	Fitted bolts	6mm dia. mild steel	75mm
39	24	Cylinder studs	4.6mm mild steel	500mm
40	25	Connecting rod	25 x 12 mild steel	100mm
41	26	Wooden base	Hardwood (round)	One
42	27	Oil cup	6mm dia. brass	50mm
43	27	Oil cup cap	7mm dia. brass	25mm
44	27	Steam chest studs	3mm dia. mild steel	250mm
45	27	Valve rod gland studs	2.5mm dia. mild steel	Part of 44
46	27	Piston gland studs	3mm mild steel	Part of 44
47	27	Main bearing oil cups	8mm dia. brass	50mm

James Beggs and Co Bottle Frame Engine Parts list				
Nearest Imperial stock sizes				
Part No.	Drw No.	Description	Material	Quantity
01	06	Base	Cast bronze	One
02	07	Main frame	Cast bronze	One
03	08	Bearing pedestal	Laser cut mild steel	One
			Laser cut cap and seating	Two
04	09	Flywheel	Cast iron	One
05	10	Cylinder	Cast bronze	One
06	11	Top cylinder cover	2 1/2in. dia. mild steel	40mm
07	11	Piston rod gland	1 1/4in. dia. brass	25mm
08	12	Valve rod gland	7/8in. dia. brass	25mm
09	12	Cylinder bottom cover	1 3/8in. dia. continuous cast iron	50mm
10	13	Piston	1 3/8in. dia. brass	13mm
11	13	Piston rod	1/4in. dia. stainless steel	100mm
12	13	Slide valve	1 1/4 x 1/2in. brass	30mm
13	14	Slide valve nut	1/4 x 1/4in. brass	12mm
14	14	Eccentric rod head	1/4 x 1/4in. mild steel	50mm
15	14	Valve cross head	1/4 x 1/4in. mild steel	Part of 14
16	14	Valve rod	1/8in. dia. stainless steel	170mm
17	15	Eccentric rod	1/8in. dia. stainless steel	Part of 16
18	15	Eccentric sheave	1 3/8in. dia. continuous cast iron	Part of 09
19	15	Eccentric strap	Laser cut mild steel	One
20	16	Crankshaft	1/2in. dia. mild steel	115mm
21	16	Disk crank	2 1/2in. dia. mild steel	Part of 6
22	16	Crank pin	3/8in. dia. mild steel	40mm
23	17	Connecting rod	3/4 x 1/2in. mild steel	150mm
24	17	Big end bearing	1 1/4 x 3/8in. bronze	15mm
25	18	Cross head	1 1/4 x 1 1/4in. mild steel	16mm
26	18	Cross head pin	1/2in. dia. silver steel	25mm
27	18	Cross head washer	1/2in. dia. mild steel	Part of 22
28	18	Saddle key	7/8in. dia. mild steel	50mm
29	19	Bearing pedestal	1 1/2 x 3/16in. mild steel	40mm
			laser cut cap and seating	Two
30	20	Wooden base	Hardwood (elliptical)	One
31	21	Steam chest cover	Mild steel 2 x 3/32in.	60mm
32	21	Nameplate	Brass acid etched	Bought in
33	21	Big end wedge	5/32 x 3/32in. mild steel	25mm
34	22	Cylinder cladding	Hardwood or brass tube	One
35	22	Studs	3/16in. dia. mild steel	100mm
36	22	Main bearings	3/4in. dia. bronze	50mm
37	24	Crankshaft	1/2in. dia. mild steel	115mm
			3/8in. dia. mild steel	40mm
38	24	Fitted bolts	1/4in. dia. mild steel	75mm
39	24	Cylinder studs	3/16in. mild steel	500mm
40	25	Connecting rod	1 x 1/2in. mild steel	100mm
41	26	Wooden base	Hardwood (round)	One
42	27	Oil cup	1/4in. dia. brass	50mm
43	27	Oil cup cap	5/16in. dia. brass	25mm
44	27	Steam chest studs	1/8in. dia. mild steel	250mm
45	27	Valve rod gland studs	1/8in. dia. mild steel	Part of 44
46	27	Piston gland studs	1/8in. mild steel	Part of 44
47	27	Main bearing oil cups	5/16in. dia. brass	50mm

looks the more impressive engine of the three, but will include details of the two webbed crank should you wish to build the engine as such. If you turn the base casting over you will notice a reinforcing web across the underside of the base. This is so positioned that you can saw off the outer part and end up with a square base to take the overhung flywheel of this type of engine.

I have no idea what colour the engine may have been painted, I wonder if James Beggs and Co. had a house colour. One thing I do find odd when looking at model stationary engines at exhibitions is the number of builders who paint their flywheels pillar-box red. I have never seen this on full size engines, the flywheels were usually painted the same colour as the main body of the engine.

Information for our engine came from a reprint of the original catalogue that I came across years ago. I do not know if it is still available. James Beggs and Co. were based in New York and the catalogue is dated 1906 so our model design is one hundred years old. The engine would have been used for all manner of work, from driving an individual machine to a small workshop of machines, all by overhead belting from a line shaft.

The engine was made in a surprising number of sizes and for reader's interest I include a list of the range. Interestingly the steam pressure is not given. Later in the section of the catalogue on boilers some of the larger ones are given as 100psi, hydraulically tested to 150psi

The company also supplied horizontal engines of different sizes and the boilers to go with the engines. All were of substantial design, so would have given many years of hard work with little need for maintenance. I wonder if any of the original engines have survived into preservation.

As the engine was built in a range of sizes I will not give an exact scale, the model has a cylinder of 32mm diameter so is a reasonable size without too many tiny pieces to make and the nuts and bolts are of a reasonable size as well so there is less danger of broken taps. However, the overall size of the engine is only 300mm high and the flywheel 150mm diameter so it is easily machined on the average model engineer's lathe.

I have shown metric size nuts and bolts and have also given the nearest alternative in BA, which can be used if preferred. The engine is drawn to metric standards, however many UK model engineer suppliers still market the majority of their bar stock in imperial sizes, so you may need to substitute imperial stock items here and there. For example, 1/4in. diameter stainless steel piston rod instead of 6mm. This in turn will require an imperial thread on the rod and in the cross head.

The model can be built on the average model engineer's lathe but as with nearly all model engineering there is a fair amount of milling involved so a vertical milling machine will prove very useful. A vertical drill is of course pretty essential along with the usual hand tools.

There are 28 A4 drawings in the set supplied with the kit which, as mentioned above, is available from **Cotswold Heritage at N.E.S. Bird Industrial Park, Long Marston,**

		Metric Fasteners		
Size	Description	Location	Material	Quantity
M5	Nuts	Base	Steel	8
M5	Nuts	Bearing caps	Steel	4
M5	Half nuts	Bearing caps	Steel	4
M4	Nut	Piston rod	Brass	1
M3.5	Nuts	Main frame flange	Steel	4
M3	Nuts	Cylinder	Steel	6
M3	Nuts	Steam chest	Steel	10
M3	Nuts	Piston rod gland	Steel	2
M3	Nuts	Piston rod	Steel	2
M3	Nuts	Valve rod	Steel	1
M3	Nut	Con-rod wedge	Steel	1
M3	Nuts	Fitted bolts	Steel	2
M2.5	Nuts	Valve rod gland	Steel	2
M2.2	Nuts	Valve cross head	Steel	1
M2.2	Nuts	Eccentric strap	Steel	2
M5	Studs 50mm long	Wooden base	Steel	4
M3.5	Studs 19mm long	Main frame flange	Steel	4
M4	Allen screws 15mm long	Base	Steel	3
M3	Allen set crews 3mm long	Eccentric sheave	Steel	2
M3	Hexagon bolt 10mm long	Crank pin	Steel	1
M3	Hexagon bolt 10mm long	Little end pin	Steel	1
M2.2	Hexagon bolts 15mm long	Eccentric strap	Steel	2

		Alternative BA Fasteners		
Size	Description	Location	Material	Quantity
2BA	Nuts	Base	Steel	8
2BA	Nuts	Bearing caps	Steel	4
2BA	Half nuts	Bearing caps	Steel	4
3BA	Nut	Piston rod	Brass	1
4BA	Nuts	Main frame flange	Steel	4
5BA	Nuts	Cylinder	Steel	6
5BA	Nuts	Steam chest	Steel	10
5BA	Nuts	Piston rod gland	Steel	2
5BA	Nuts	Piston rod	Steel	2
5BA	Nuts	Valve rod	Steel	1
5BA	Nut	Con-rod wedge	Steel	1
5BA	Nuts	Fitted bolts	Steel	2
7BA	Nuts	Valve rod gland	Steel	2
8BA	Nuts	Valve cross head	Steel	1
8BA	Nuts	Eccentric strap	Steel	2
2BA	Studs 50mm long	Wooden base	Steel	4
4BA	Studs 19mm long	Main frame flange	Steel	4
3BA	Allen screws 15mm long	Base	Steel	3
5BA	Allen set crews 3mm long	Eccentric sheave	Steel	2
5BA	Hexagon bolt 10mm long	Crank pin	Steel	1
5BA	Hexagon bolt 10mm long	Little end pin	Steel	1
8BA	Hexagon bolts 15mm long	Eccentric strap	Steel	2

List of range of engines produced by James Begg and Co.

Hp	Flywheel dia.	Cylinder	Steam pipe	Exhaust pipe	RPM
3	18in.	3 x 4in.	1/2in.	3/4in.	250
4	20in.	4 x 5in.	3/4in.	1in.	200
5	24in.	5 x 6in.	1in.	1 1/4in.	200
6	24in.	6 x 6in.	1 1/4in.	1 1/2in.	180
7	28in.	6 x 7in.	1 1/4in.	1 1/2in.	180
9	32in.	7 x 7in.	1 1/2in.	2in.	180
10	32in.	7 x 8in.	1 1/2in.	2in.	180
14	34in.	8 x 8in.	1 1/2in.	2in.	180
20	38in.	9 x 9in.	2in.	2 1/2in.	170
25	42in.	10 x 12in.	2 1/2in.	3in.	150
35	42in.	12 x 12in.	3in.	3 1/2in.	150
50	48in.	14 x 14in.	3 1/2in.	4in.	150

Stratford Upon Avon, Warks, CV37 8RP, tel: 01789 721 444.

There are a number of castings in the kit starting with a cast iron flywheel, then in bronze, the base, mainframe, and cylinder. The bottom cylinder cover and eccentric sheave are in continuous cast iron. The pedestal, bearing caps and eccentric strap are laser or water jet cut from mild steel. Some of the other material may be

supplied as well but not the fastenings.

The first photograph (photo 1) is of a completed engine. Hopefully it will fire up your enthusiasm. I think you will agree it does have rather a lovely shape.

The constructional details are quite straightforward so next time we will make a start on part 01, which is the base casting.

●To be continued.

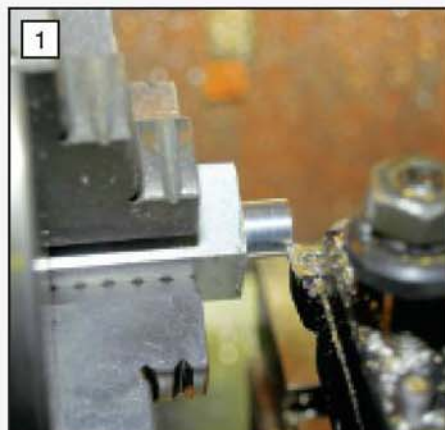
Nemett

continues construction of the NE15S with the timing case, electronic ignition and carburettor.

Before I continue the construction, I have an apology to make. During my preparation for publication, the drawing of the cam box (M.E. 4279, 4 August 2006) got distorted and the measurements were corrupted. I apologise for this and show the correct version here. This does not affect those who have purchased drawings.

21 Timing case

If you are only going to use glow plug ignition, this item and item 23 are not required. I started



Turning the spigot on the timing case.

with a piece of square HE30 bar in the self-centring 4-jaw chuck (photo 1) and turned the round spigot. Initially I made this longer than finally needed because it is used to hold the item for the milling operations.

Set the rotary table and 3-jaw chuck on the mill, set the case vertically in the chuck, gripping by the spigot. Zero the rotary table with one of the case edges parallel to the Y-axis. Centre the work under the quill.

Now mill the corners off of the bar (photo 2) to leave the curved portion at the correct diameter. This involves turning the rotary table through a 270deg. arc and then using the Y-axis



Milling the timing case outer profile.

to mill the straight parts. Make sure that the case has the correct orientation when doing this.

Return the case to the lathe and grip by the spigot to drill and ream the centre hole and then bore the cavity to size (photo 3).

Reverse in the chuck and face the spigot to the correct length. Check against the camshaft bearing housing spigot for this. The bottom face of the cavity should be level with the end of the camshaft bearing spigot when assembled.

To drill the hall detector mounting hole, set the case in the milling vice with the correct straight section vertical and the other one at the top horizontal.

The edge between the two straight sections is to the top right looking into the cavity when in the correct orientation with the hole pointing upwards. Find the edges and drill the hole 6mm into the cavity (photo 4), being careful when the drill breaks through. Rotate in the vice and drill the 3mm hole for access to the timing disc grub screw opposite the point where the other hole enters the cavity.

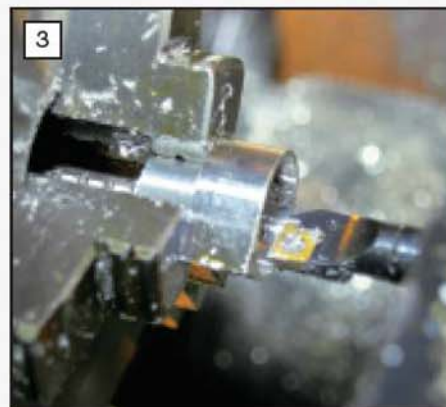
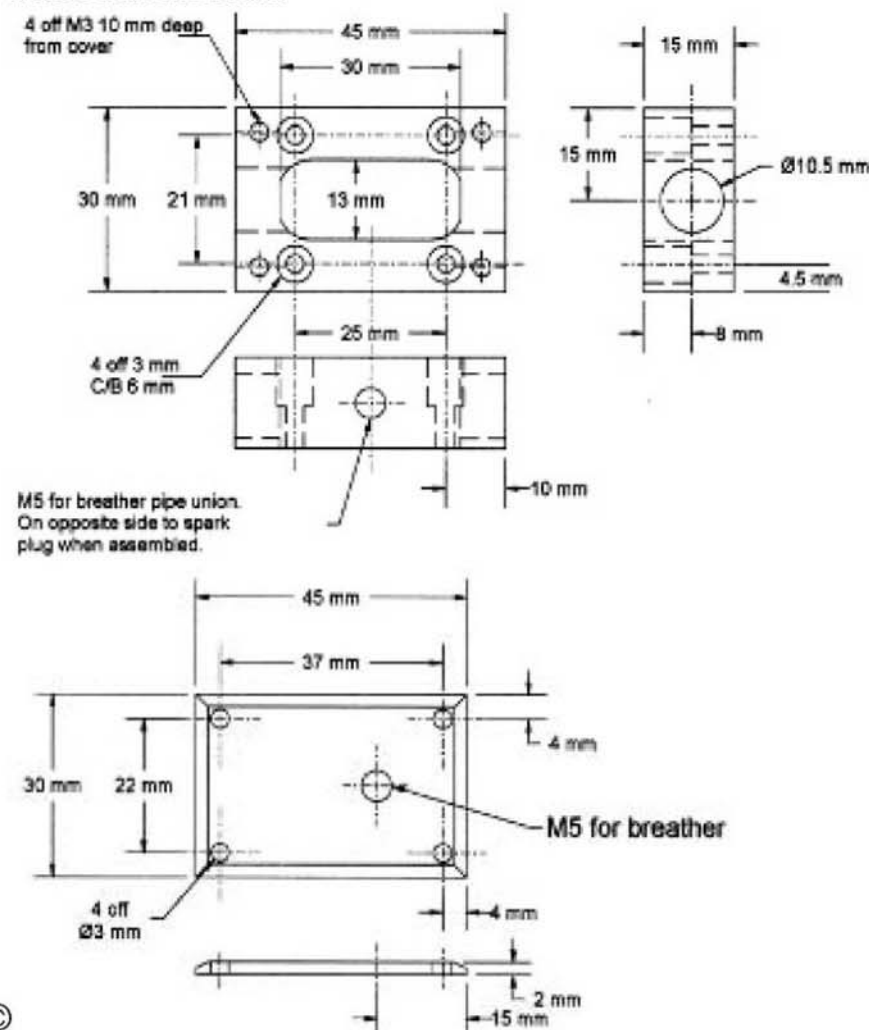
Now set the case up in the vice with the Hall detector hole vertical and facing downwards and drill and tap the M2.5 hole in the spigot for the timing lock screw.

23 Timing disc

This is made from HE30 bar and is turned to diameter before drilling and reaming the centre hole. Part off to the correct length and then set the disc up in the milling vice to drill and tap the grub screw hole. Turn in the vice so that the grub screw hole is facing vertically downwards and drill the shallow hole for the magnet.

The magnets suggested are 1/8in. dia. and 1/16in. deep so it is best to drill just deep enough to get the hole located and then to use a small slot

REVISED CAM BOX DRAWING



Boring the timing case cavity.



Drilling the transistor mount in the timing case.

drill to finish to depth. Since I built the prototype, I have received another ignition module which is supplied with a smaller magnet, so check the magnet dimensions before drilling the hole.

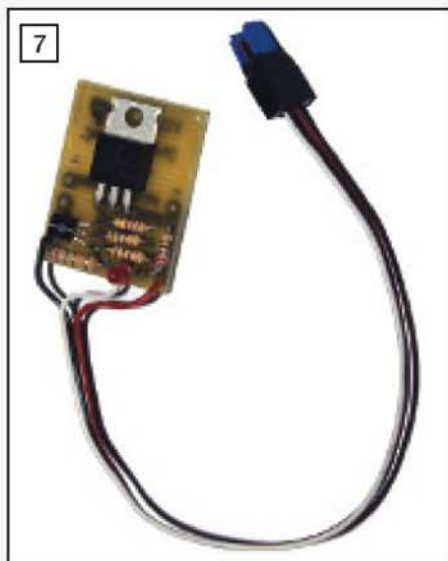
The magnet should be a fraction below the surface of the disc when in position and is fixed with Loctite. Note that the 'south' pole of the magnet faces outwards. This can be checked with a magnetic compass or a magnetised needle suspended from a piece of cotton if no compass is available. It is also worth just burring the edges of the hole over the magnet slightly for added security.

24 Timing lock screw

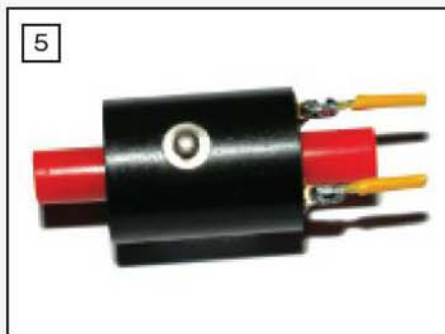
This is a simple turning job from brass and the only thing to note is to remove the very end of the thread to enable the screw to locate accurately in the locking groove in the camshaft bearing housing spigot. When in use, the timing screw locates in the groove in the spigot and when tightened locks the timing case in position. The ignition timing can then be adjusted by slackening the screw very slightly, rotating the casing in the direction required and retightening the screw. There is no friction from mechanical points, so finger tight is all that is required.

Electronic ignition module and coil

One point to make before I start this section is to take heed of the instructions that come with the module particularly the comments regarding use of the module without the engine earth connected. The module will be permanently damaged if it is used without an earth connected or with the spark plug not connected to the engine.



Assembled ignition module showing the plug used to connect the Hall Effect sensor.



Modelectric ignition coil used on the prototype.

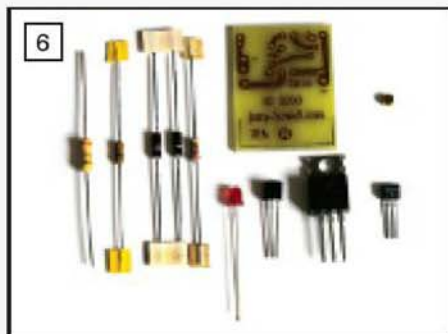
The electronic ignition module replaces the points and is triggered by a magnet moving across the face of a Hall Effect transistor. This switches a power transistor which switches the coil supply just like a set of mechanical points.

The recommended coil is the 'Modelectric' coil (photo 5) and the ignition module is the TIM6, both available from Woking Precision Models (www.wokingprecisionmodels.co.uk tel: 01706-377508). Woking also stock piston rings and other items for use with I/C engines.

The suggested electronic ignition module is supplied as a kit of parts (photo 6) to be assembled by the user. This involves soldering eight small electronic components into a circuit board and is not difficult if the correct procedure is followed.

I do not propose to describe this in detail because the kit comes with very complete instructions; I will just make some comments to emphasise a few things.

The first thing to point out is that a very small electric or gas soldering iron is needed for such things; too large a tip could overheat and damage the components. Also use the thinnest cored solder available to avoid spreading solder where



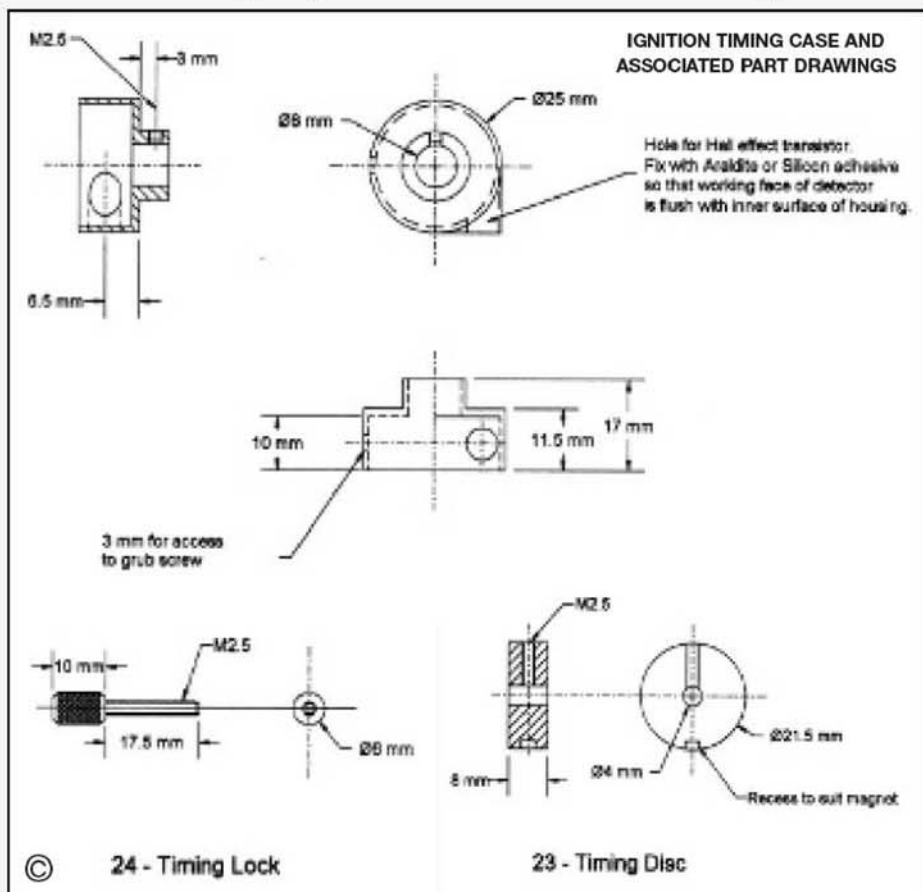
TIM6 electronic ignition module kit.

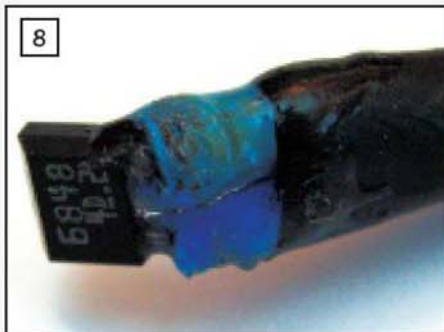
it should not be. Check the orientation of all the components before soldering them in. An easy one to get the wrong way round is the LED indicator (don't ask!).

My approach is to insert the resistors (which are not so delicate) into the correct places and to solder those first. I then follow this with the other components.

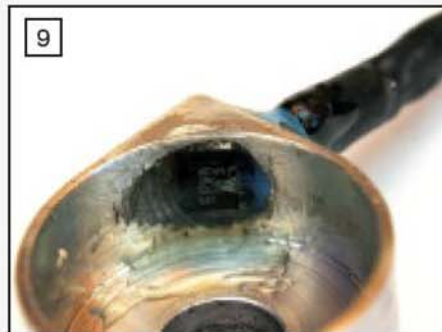
I also fitted a plug into the coil circuit so that I could set the timing with out having the coil connected. To connect the Hall Effect detector, I used a radio control servo extension lead cut in half. These can be bought from any good model shop and have a polarised 3-pin male plug on one end and an equivalent socket on the other, so when cut in half, you have a matching pair of leads. The wires are colour coded, so decide on your convention and solder one cable to the circuit board (photo 7) and the other to the Hall Effect transistor. Some short lengths of thin heat shrink insulating sleeving must be used to insulate the three pins on the transistor. These are slipped over each wire before it is soldered and then slid up over the bare wires.

Once this is done the transistor must be mounted in the hole in the casing with the correct





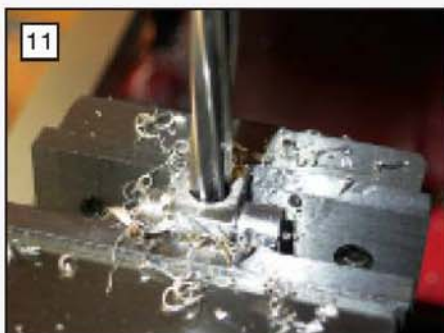
8 Hall Effect sensor soldered to the connecting lead showing the insulation used.



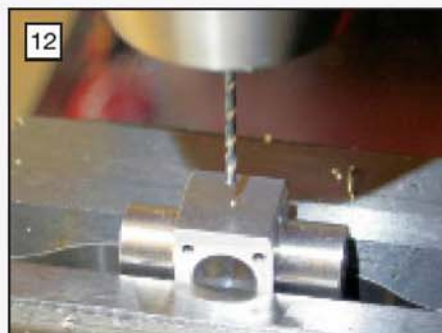
9 Timing case with the sensor installed.



10 Turning the inlet portion of the carburettor body in the self-centring 4-jaw chuck.



11 Reaming the barrel hole in the carburettor body.



12 Drilling the air bleed hole.



13 Turning outer spigot on end cap before parting off.

face (the large face with the chamfer at the top) pointing into the case. To do this, angle the pins slightly (photo 8) so that the acting face is at the correct angle when the wires hang vertically from the case.

I stuck some self-adhesive tape over the inside of the hole and then used epoxy resin to fix the transistor in place. The tape prevents the resin from getting on the inside of the case and helps to locate the transistor. Put a small amount of resin in the hole, insert the transistor and then fill the cavity from the outside to seal everything. Silicone rubber sealant could also be used.

Allow everything to set, then remove the tape from the inside and clean off any stray adhesive if needed. The transistor should have its acting face tangential to and flush with the inside surface of the casing (photo 9) when fixed.

41 Exhaust and inlet flanges

I will cover these simple items now, in preparation for making the carburettor and assembling the engine. The flanges are different because of the spacing of other holes in the cylinder head. Both are made from 3mm thick mild steel (or stainless if you prefer) and are

simple milling and drilling jobs. The fixing holes should be drilled using the jig made for drilling the cylinder head.

I used some $\frac{3}{8}$ in. dia. stainless steel for the inlet stub and exhaust, so I drilled the large holes to suit this and silver-soldered the pipes in place before cleaning up the cylinder head mating faces. The flanges could be turned with built in stubs if preferred.

I angled the inlet stub downwards, but this is not essential. I also threaded the inlet stub and carburettor to fix the carburettor in place, but Loctite could be used without the threads if preferred. Make sure the inlet stub is long enough so that the carburettor is clear of the timing case.

Carburettor

This is a simple barrel type with an adjustable air bleed to set the slow running mixture. It is not difficult to make but care is needed when setting up for drilling the various holes because of the small size.

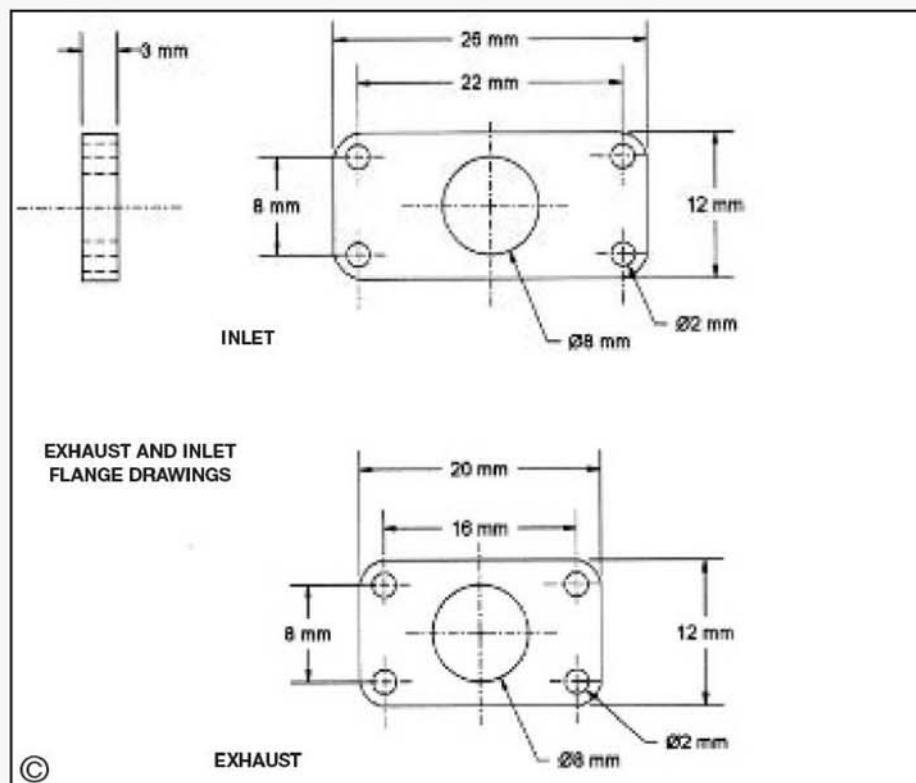
40 Carburettor body

I started with a length of square HE30 bar held in the self-centring 4-jaw chuck. Turn the 12mm diameter on one end (photo 10) and then use this to hold the blank in the 3-jaw chuck, or preferably a collet chuck to turn the other end to the same diameter. This end will be reduced in length later.

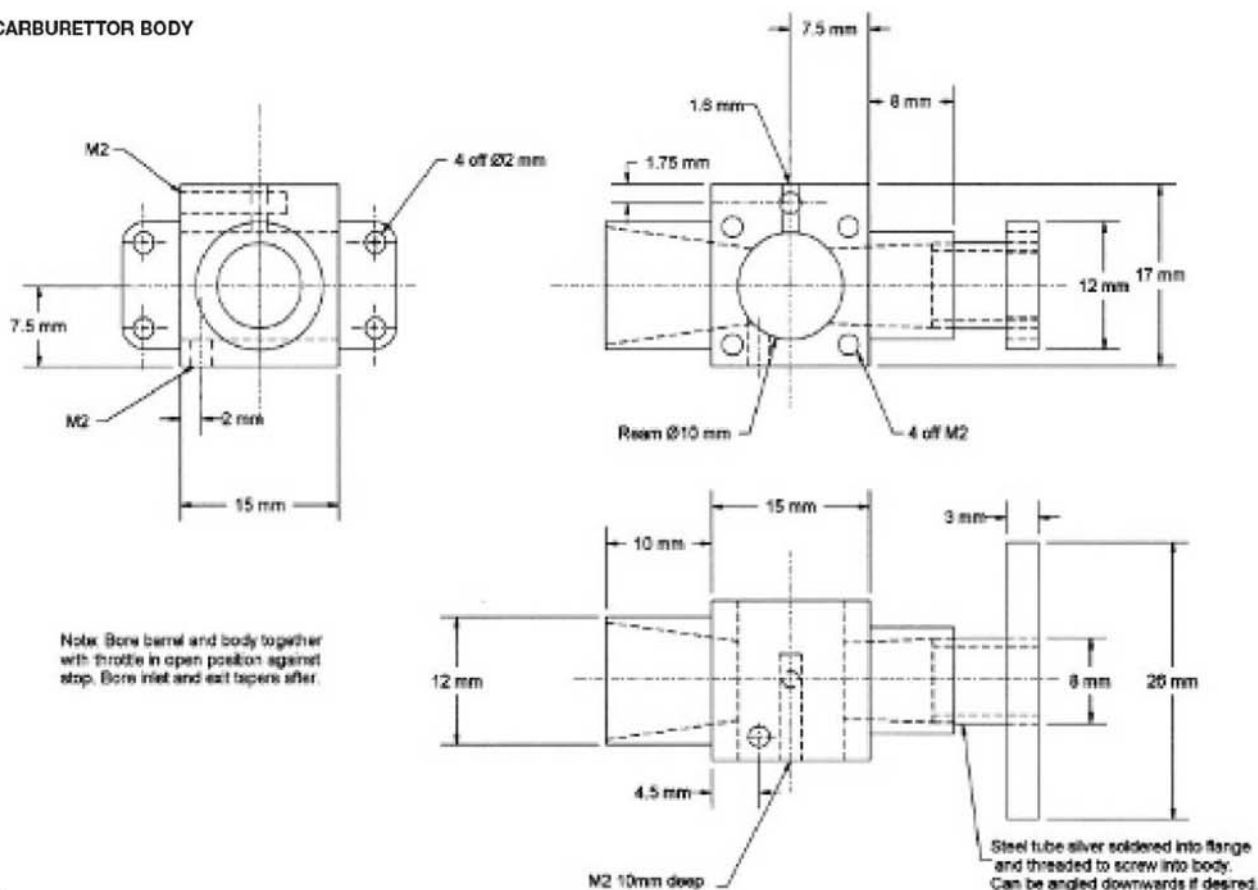
Clean up the edges and set the blank on one side in the milling vice. Centre the quill over the square portion, drill and ream (photo 11) the throttle barrel hole. Machine the same face down to 7.5mm from the centre line. I used the 12mm dia. as a datum for this. The face should end up 1.5mm above the 12mm section.

Reverse in the vice and mill the opposite face to the same dimension. This should result in the body being 15mm across the two faces. Set up in the mill to drill and tap the throttle stop hole M2. Note this hole is close (0.5mm) to the end cap fixing screw so take care with the positioning.

Set up to drill and tap the air bleed adjusting screw hole M2 for a depth of 10mm on the same



CARBURETTOR BODY



end as the throttle stop screw. Drill the air bleed hole (photo 12) to meet this. The body is now put to one side until the end caps are made.

38 and 39 Carburettor end caps

I used a piece of 25mm dia. HE30 bar for these but they can be machined from a piece of suitable square bar if required. Whichever is used set the bar in the chuck to run centrally and turn down the 10 x 0.5mm spigot. For the spray bar end, drill and tap M4. For the lever end, drill and ream 4mm.

Now use a parting tool to turn down and part off the 10mm spigot (on what will be the outer side to length) (photo 13). The throttle lever end is 4mm long whilst the spray bar end is 2mm.

Because I used round stock, I then clamped the end caps to the body in the milling vice and milled the top and bottom edges to match the body. It is quite easy to keep the edges in line when the job is turned over. I used a piece of bar stock as a base for this.

I then clamped the covers to the body with an M4 hole through the throttle arm end into the spray bar

end. This also ensures the spray bar and throttle holes line up correctly. Set the complete assembly upright in the milling vice and centre under the quill.

Drill 1.6mm for the cover bolt holes in one end before reversing in the vice to drill the corresponding holes in the other end. Take care with the positioning of these holes. It is wise to use the lathe indexes for this.

Remove from the mill and remove the covers, marking them so that everything will go back together correctly. Tap the holes in the body M2 from both sides. Enlarge the cover holes to 2mm and assemble the covers using M2 socket screws. Return the assembly to the lathe and skim off the inner faces to clean up. The needle valve end cap will need a small semi-circle cut in the edge to clear the air bleed screw.

46 and 47 Carburettor adjusting screws

I used M2 socket screws for these. I suggest turning a 45deg. point on the air bleed screw and rounding the end of the throttle stop screw.

42 Throttle barrel

This is a simple turning job from brass bar followed by drilling the through passage in situ in the body. Chuck a suitable piece and turn to a good sliding fit in the carburettor body. Turn down 15mm to a diameter of 4mm for the operating shaft.

Now part off the main part, leaving it slightly over 14mm long to allow for accurate finishing to length later. Try the barrel in the body with the throttle end cap fitted. Now we need to set the finished length of the barrel. I checked the amount to be removed by pressing the other end cap tightly against the barrel and using a feeler gauge in the gap between the end cap flange and the barrel. Return the barrel to the lathe and face the end to the correct fit. When fitted with the end caps bolted in place, the barrel should rotate easily but with no slack.

Now set up the barrel in the mill and machine the cutaway at the end (photo 14) for the throttle stop. Clearances are tight here so take care with the set up. Check that when the barrel is



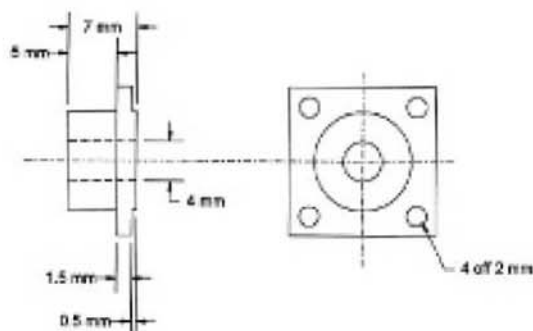
Milling the throttle stop cutaway on the barrel.



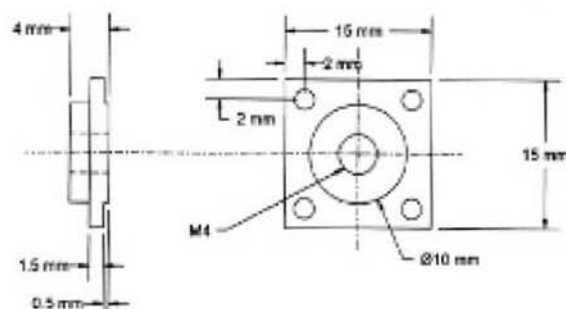
The barrel assembled and locked in the body ready for boring the carburettor air passage.



Turning the inner venturi shape.

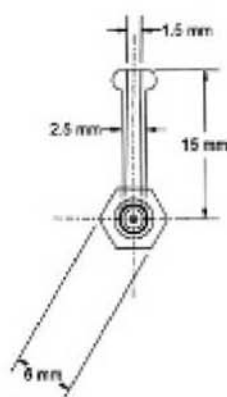


38 - End Cap - throttle arm end

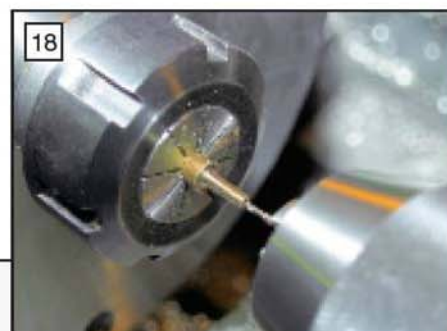
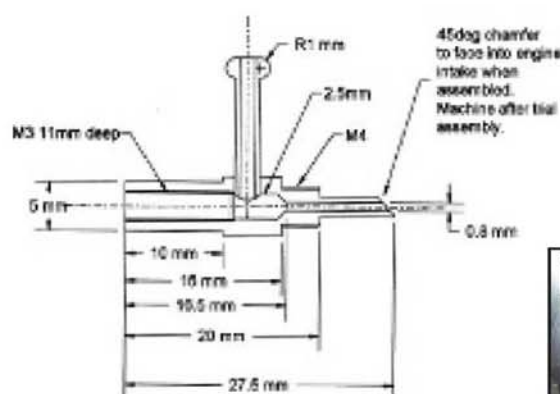


39 - End Cap - spray bar end

CARBURETTOR END CAPS AND SPRAY BAR



45 - spray bar



Drilling the needle hole in the needle body.

assembled and the lever end cap is bolted down the barrel is just clear of the throttle stop screw and can rotate. The throttle will be fully open when the barrel cutaway edge is parallel to the adjusting screw and touching it. As the throttle is closed, the cutaway will eventually come up against the end of the screw. This allows the minimum throttle position to be set by adjustment of the screw.

Boring the carburettor passage

Assemble the carburettor complete with the throttle stop screw and set the throttle barrel in the fully open position. This is with the edge of the cut away parallel with the throttle stop screw and touching it. Looking from the throttle lever end this means turning the barrel clockwise hard against the stop.

With the barrel in this position screw an M4 screw into the spray bar hole and tighten gently to

lock the barrel. Check that the barrel is still hard against the stop before starting to bore the hole.

Set the assembly up in the lathe using the outlet (engine side) spigot (photo 15) and check that the outer (inlet spigot) runs true. Centre, drill and ream 7mm. Start with small drills and increase the size gradually for this for this operation.

Now either use a 10deg. included taper reamer or bore the taper for the venturi (photo 16). Bore until the tool just starts to cut into the barrel edges. Clean up the edges of the venturi and polish with some fine emery held on a cocktail stick.

Reverse in the chuck and taper the engine side of the throat. You will need a taper reamer for this with a maximum diameter of 8.5mm because there is not really room to get a boring tool in this end. Again use the reamer until it just begins to cut the barrel edges. If no suitable reamer is available, make up a taper D-bit from a piece of silver steel.

I then drilled and tapped the passage $\frac{3}{8}$ in. x 40tpi for about 6mm deep so that the carburettor could be screwed onto the inlet flange pipe.

Now dismantle the carburettor. At this stage you will find that the barrel is tight in the body. Using an aluminium drift, and with the body supported, gently tap the barrel free. Don't try to twist it out with the operating shaft; you will almost certainly break the shaft. Once the barrel is out, carefully remove all burrs and run the reamer through the body. I held the barrel by the shaft in the collet chuck in the lathe and used a wide fine diamond file to ease it until it was a free fit in the body. Once it is a free fit,

reassemble and check that things are still free. You may have to do several trials here to get the barrel turning without tight spots. Make a suitable lever to suit your own needs. I used a short lever with a split clamp onto the shaft.

Set the barrel in the chuck to drill the hole for the spray bar (photo 17). I did this after boring the barrel to avoid any chance of the centre hole being deflected. Fit some small springs on the adjusting screws to ensure they stay put and the carburettor body and barrel are finished. Make up a suitable pipe and flange to fit to the engine. I suggest keeping the pipe as short as is sensible and angled down slightly.

45 Spray bar

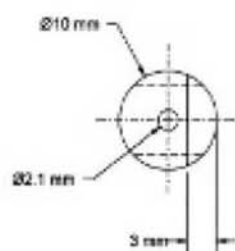
This is a turning and drilling job. Chuck a piece of 6mm (or $\frac{1}{4}$ in.) AF hexagon brass in the lathe and turn the 5mm outer round section down for 10mm long. Drill 2.5mm for 16.5mm deep. I then drilled the jet hole as far as possible with the 0.7mm drill. This helps to ensure the two are concentric.

Tap the hole M3 for about 15mm deep. Take care not to hit the jet hole because this will damage the edge and prevent a good seal when the needle valve is shut. Reverse in the chuck and turn down the outside to 4mm diameter to leave a 6mm hexagon section.

Face off to the correct length to put the end of the spray bar in the centre of the intake. This

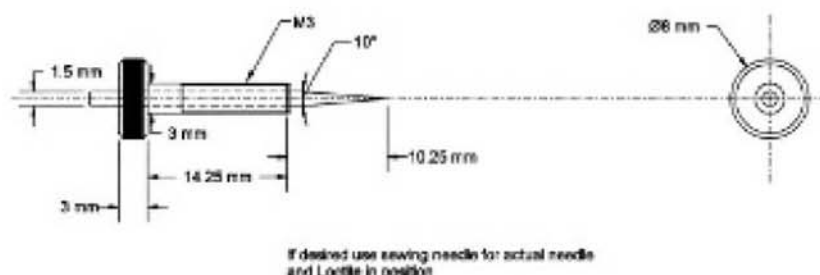
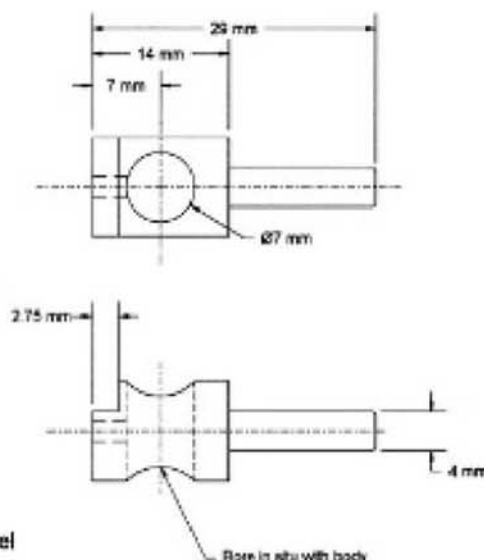


Drilling the spray bar hole in the barrel.

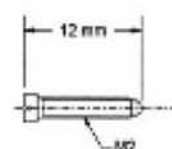


FUEL NEEDLE, CARBURETTOR BARREL AND ADJUSTMENT SCREWS

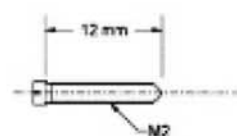
42 - Throttle Barrel



43 - Fuel Needle



47 - Throttle Stop Screw



46 - Idle Screw



A view of the end of the barrel with the throttle turned fully clockwise against the stop in the closed position.

should be 7.5mm but check from the carburettor. Turn down the outer portion to 2mm diameter to leave 4mm at the hexagon end for the M4 thread. Cut the M4 thread.

Centre and drill the 0.8mm jet hole (photo 18) until it meets the previously drilled portion.

Fit to the carburettor and check that the barrel still rotates freely and that the jet is in the centre of the barrel. Mark one of the hexagon flats to position the fuel pipe connection in the desired position. I fitted mine pointing downwards. Turn the fuel pipe connection and then silver solder it in place. I threaded the connection piece and the hole in the spray bar to hold it in place whilst soldering.

43 Fuel needle

Chuck a piece of suitable brass bar and turn down to 3mm for 10mm and thread M3. Centre and then drill to suit the needle to be used for about 20mm. I then drilled a slightly greater diameter for 8mm. This allows the needle to flex slightly and centre in the jet when closed. I turned and knurled the head before parting off to length.

I used a sewing needle for the actual needle. If you are turning your own needle use free cutting stainless steel. Take care turning the 10deg. included taper. Use a collet and try to turn the whole taper in one go, and then polish with a diamond file or fine emery. In either case clean and degrease the needle and roughen the part which will be in the outer body with fine emery.

Screw the outer fully into the spray bar and then back it off two turns. Apply some Loctite to the relevant part of the needle and insert it into the outer with a twisting motion to

spread the Loctite before ensuring the needle is pushed fully into the jet. Leave to cure fully.

The carburettor can now be assembled (photo 19) and after checking to see that everything is in order can be fitted to the engine. I used some threadlock to ensure the body did not come unscrewed from the mounting. The action of the throttle stop can be seen in photo 20 which is with the throttle turned fully clockwise to the closed position. Photograph 21 shows the carburettor broken down into the main units.

Next time I will cover the assembly and running of the engine.

●To be continued.

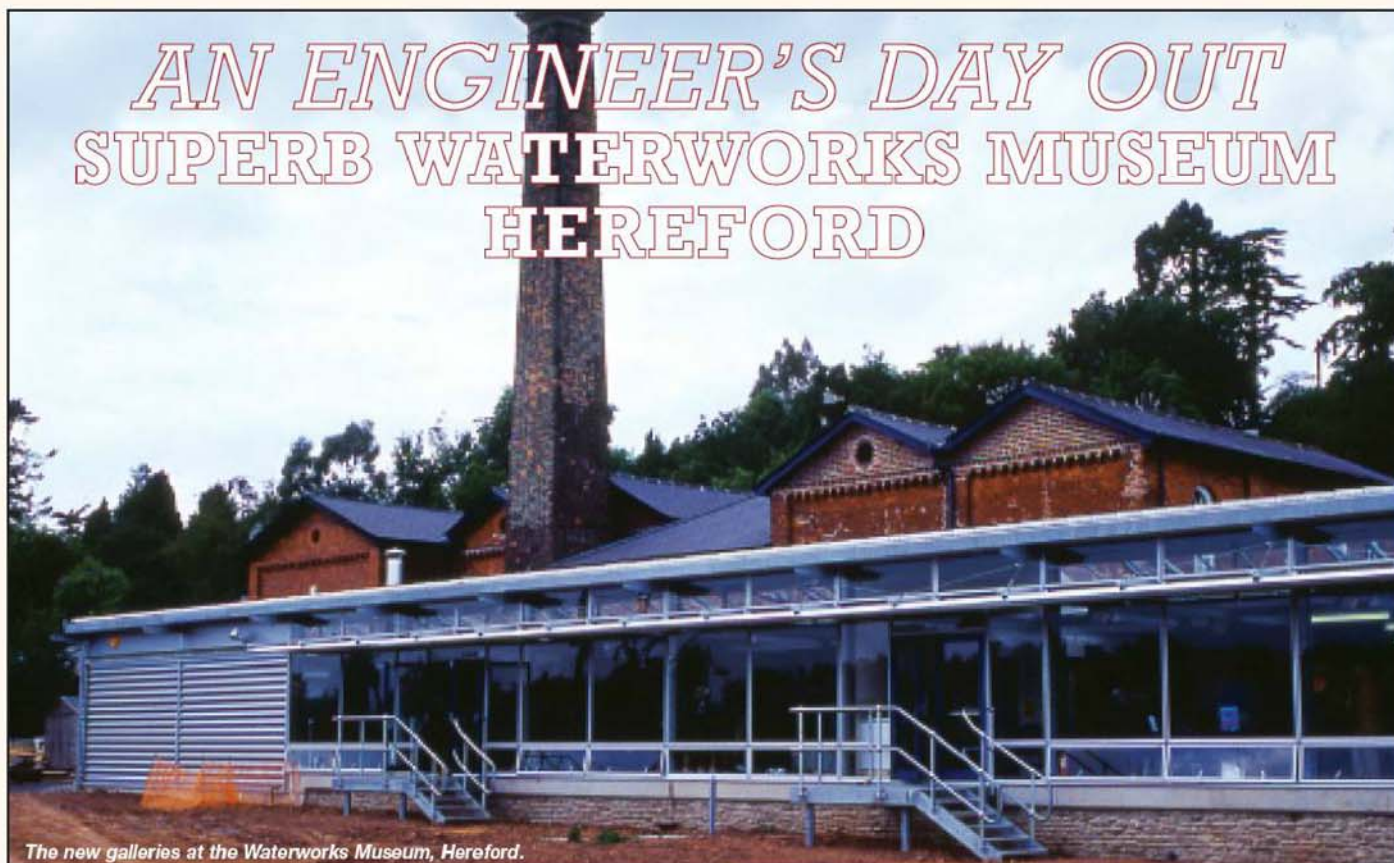
19 The completed carburetor.



21 The carburettor broken down into the main units, left - the spray bar and end cap, centre - the body, right - the barrel and other end cap.



AN ENGINEER'S DAY OUT SUPERB WATERWORKS MUSEUM HEREFORD



The new galleries at the Waterworks Museum, Hereford.

Roger Backhouse

visits a museum by the River Wye in Hereford which will inspire model engineers.

The Hereford Waterworks Museum is one of the best volunteer-run museums I have seen. Although the collection lacks the large engines of Kew Bridge it compares well for the wide-ranging collection, quality of exhibits and excellent presentation. The museum's new galleries were opened in June 2006 by Sir Neil

Cossens, Chairman of English Heritage. The museum's inspiration came in the 1960s from the former Chairman of Herefordshire Water Board, Stephen Southall, and the Board's Chief Engineer, W. H. Austin. The Southall family trust funded some of the work and I am pleased to say Stephen and his family were present at the opening to see the culmination of a vision.

The museum presents the history of water supply from wells and hand pumps through to the latest electric pumps. Much focuses on the 19th century revolution in water supply when growing realisation of the dangers of impure

water led local councils to improve supply. However, the museum is now filling gaps in the collection with a growing range of pumping equipment from the 1930s and 1940s.

Hereford's water supplies came from the River Wye and local wells but in the 1850s the Corporation built a pumping station taking water from the Wye to storage on Broomy Hill for distribution across the city. It used a Simpson beam pumping engine on the site joined by a second in 1862. These engines have not survived though another of Simpson design built by Harveys has been moved here from Cardiff. This



Above left; Unique Worth Mackenzie 2-cylinder compound engine of 1906. Above centre; The man behind the museum, Stephen Southall, with his wife Philippa with their daughter Anna at the new gallery opening. Above right; A boiler feed pump.

engine house is the core of the waterworks buildings forming the museum.

By the 1890s Hereford had grown and additional capacity was needed. A water tower on Broomy Hill was built in 1883 to supply the higher parts of the City. Beam engines were no longer state of the art so a Worth-Mackenzie triple expansion engine was commissioned in 1895 with steam from a Lancashire boiler. Both are key parts of the museum.

As demand grew even this engine was not enough. A 2-cylinder Worthington-Simpson engine was added in 1906. Nothing like it exists anywhere else and it marks the end of an age of small stationary steam pumping engines. Only five years later the Waterworks Committee decided to try electric pumps, much in advance of other places, and followed with more electric pumps in 1914. The museum shows the massive Crompton-Parkinson electric motor and the Pulsometer spindle pump it drove.

Herefordshire's rural water supplies were often poor. In the 1960s the Herefordshire Water Board began co-ordinating piped water to almost all parts of the county. By this time pumps were slim electric affairs like the Pleuger and Hayward-Taylor pumps. Lowered into boreholes they could run totally submerged for years without attention.

Other market towns had different approaches. Ross-on-Wye was one of the first towns in England to have a public supply developed by the

Water wheel from Carmarthenshire.



celebrated benefactor, the 'Man of Ross', John Kyrle, in the early 18th century. It used a water wheel to pump to a cistern on the Prospect. Later, Ross installed a large gas engine in 1912 to drive pumps. This is on display in the museum and is often demonstrated. Similar gas engines supplemented steam or acted as a standby like that at Tees Cottage pumping station in Darlington, complete with producer gas plant.

My home-town of Kington used a Francis type water turbine to drive three reciprocating pumps. A small dam in the Back Brook created

a head of water, an ecologically sound way of pumping water. (Another dam fed the water tower at Kington station). Power output is varied by altering the angle of the guide vanes. The turbine is preserved at the museum as a hands-on exhibit. Other water turbines are on display including a complete Easton, Anderson and Goolden pump set.

Kington also supplemented the turbine with a gas engine though this was unfortunately scrapped. Almost 500ft. higher than the pump house at Crooked Well a windpump once



Tangey diesel of 1932 – one of only two in UK operated at Pembroke Dock.



Water wheel – a very hands-on experience for the younger family members!



A very impressive Lancashire boiler.



Hereford SME's Broomy Hill track is right next door to the Waterworks site.



Alcazar engine in steam.

supplied water to the community on Bradnor Hill. These 'Climax' windpumps were once a common sight in other rural areas but most have now gone. Luckily the museum preserves an example, another reminder of ecological pumping also demonstrated by the water wheel from Carmarthenshire on display.

Old Ordnance Survey maps of Herefordshire show many references to 'ram'. These were hydraulic rams using the principle of a large quantity of water at low pressure raising a small quantity to a height.

The ram was one of the lesser-known inventions of Joseph - Michel Montgolfier of ballooning fame. They could pump water as high as 1000ft. and required minimal maintenance. An example from near Bromyard is preserved here.

Diesels began to replace steam and gas engines from the 1920s. The museum operates a 1932 Tangey diesel, one of only two in the UK, which originally operated at Pembroke Dock. Other models were much more compact like the W. H. Allen diesel of the same year that replaced the Ross gas engine. It drove a centrifugal pump via a speed increasing gearbox.



Godiva wartime civil defence fire pump.



The Climax wind pump was once a common sight.

It is difficult to summarise the wide range of machinery on display. The waterworks has a small railway with a Lister diesel of 1962 once used at Painter Brothers galvanising plant. (The firm made many of the National Grid's pylons as well as the celebrated Skylon for the 1951 Festival of Britain.) Other equipment includes devices to measure water flow, boiler feed pumps, a Thornycroft launch engine, a hand pumped fire engine and a wartime Coventry Climax fire tender.

The new galleries means more space for maintenance and display smaller equipment but the collection is growing fast. The museum's aim is to present a complete picture of water supply from the 1850s to the present day. It is concerned to acquire more exhibits from the 1930s and 1940s, building a new gallery to show this period.

The new galleries also provide an education area and tea bar. The museum takes educational responsibilities seriously. Some exhibits are hands on and appeal to children (and many adults). It houses an archive of water supply - an important part of engineering heritage that can be overlooked. The signage and explanations throughout the museum are excellent.

Teams of volunteers worked hard to raise over £800,000 required for the restoration and new gallery. The fitting out was all done by volunteers and they overcame many obstacles, including a rapidly deteriorating structure, the unexpected need to pile foundations for new galleries and liquidation of a supply contractor. The funders, including Dwr (Welsh Water), National Lottery and English Heritage, can see their money well spent.

Other attractions

Herefordshire remains one of England's most beautiful counties with many lovely villages. Hereford has several museums including the Cider Museum and distillery. To see the best of the border counties I recommend a ride on Sergeant's bus to Kington and on to Llandrindod Wells where there is the National Cycle Museum.

Next to the museum Hereford Society of Model



A rather lovely Thorneycroft launch engine.

Engineers have an extensive track running trains on many weekends and always when the museum is open.

Reaching the museum and opening times

General opening arrangements from Easter to the end of October 2007 are expected to be: Engines working on 2nd and last Sundays in the month plus Easter, Spring and August Holiday Mondays, 14:00 to 17:00, last admission 16:30.

Special openings for educational visits and groups can be arranged. The museum is just over a mile to the west of Hereford. It is reached from a footpath along the Wye or it is signed by road to Broomy Hill engines. Details of opening are on the website www.waterworksmuseum.org.uk or e-mail info@waterworksmuseum.org.uk tel: 01432-361147 What's On - and 01432-344062 general information.

Hereford Society of Model Engineers information can be found at www.hsme.co.uk or contact the chairman, Brian Moorey on 01432-270143.



1962 Lister diesel came from a galvanizing plant.

D.A.G. Brown and Mark Smithers continue their programme of updates on the building of this popular locomotive.

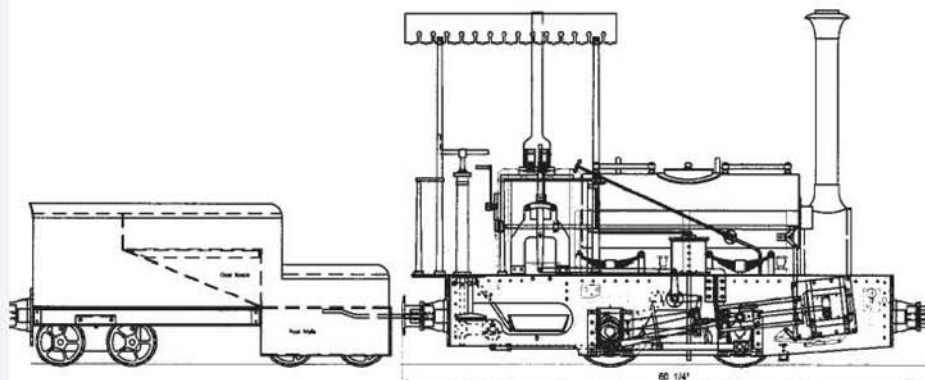
● *Part XXVI continued from page 271 (M.E. 4281, 1 September 2006)*

I realise that this latest series of updates will seem to come in rather an odd order; having done the original design and looking at the large number of pictures from my own construction, it seems good to pick out the items which have the best message to pass on to others.

As I press on with the boiler construction, I am reminded of the marriage of that large lump of copper with the smokebox, of which there are some interesting tales to tell. Going back to *Part X* of the series (*M.E.* 4237, 25 December 2004), you should also refer to the pipework drawing which had appeared in *Part IX* (*M.E.* 4235, 26 November 2004); in the text I had made a recommendation for assembly of the pipework, making use of a "rudimentary baseplate" to make sure that the flanges all landed up in the correct alignment.

Photograph 1 illustrates my execution of this task, from which I should like to make three points: firstly the piece of scrap 6mm plate which I had to hand was just too small for the job. No need to waste a good piece of virgin metal, so I chose to set the axis of the holes at a rakish angle on the plate's surface to get them to fit. Secondly, I only drilled and tapped two diagonally opposed holes to position each of the four pipework flanges, since there was no point in wasting effort on drilling the complementary pairs of holes. Thirdly you will see the central short pillar which raised the base of the blast pipe for silver soldering; its bottom surface was machined at 6.5deg. to the normal, the inclined plane so formed being bolted to the baseplate on its centre line, thus displacing the centre line at its top by 0.107 inch. This offset recognises that the bottom of the blast pipe sits $15/16$ in. above the level of the pipework flanges, and the displacement is calculated as 0.938 tan 6.5 degrees.

Having bolted the exhaust flanges and the blast pipe to the baseplate, it was then easy to assemble



ANNA

A MANNING WARDLE LOCOMOTIVE FOR 7 $\frac{1}{4}$ in. GAUGE

the short straight pieces of 22mm copper pipe and four 135deg. bends dry, making the necessary adjustments to their lengths. At this stage the live steam pipe was also assembled to drawing, enabling me to check that the two sets of pipework did not conflict before making the joints.

Bearing in mind the relatively large mass of the baseplate and its capacity for absorbing heat, the first joints to be soldered off the baseplate were those between the flanges and the first pipe sections. The rest, all done *in situ* as shewn, completed the shapes of the pipe runs. They are pictured here as put together, before pickling.

On offering up the flanges within the smokebox, I found that they fitted like a glove, albeit a brand new one, i.e. needing a slight amount of stretching to perfect the alignment. Soft copper is easy to drift and no doubt any small error was due to the difference in gasket thickness between my drawing and the actual materials used.

Photograph 2 is a view from the back of the smokebox, which illustrates the neat appearance of the assemblies, after pickling. Also to be seen in this view are twelve blind nuts forming a ring

around the boiler, for its eventual fixing; and you will notice the green gasket on the steam pipe flange, also awaiting the final connection. How is that for an act of faith?

Photograph 3 looks up into the front of the smokebox with the strongback lifted out, and catches the blower pipe on the left of the picture and the vacuum brake ejector exhaust on the right. These items were also visible in the previous photograph, which also indicates how they lead from the fabricated elbows at waist level on each side of the smokebox.

In **photo 4** the strongback has been replaced into its pockets; the slightly higher vantage point of this view gives a glimpse of the lower pocket and accentuates the offset position of the strongback to line up with the smokebox left-side door. Also apparent are the deeply counter bored holes for the handles to enter. With the clearances as drawn on the door gear, closing and locking them in place is a real pleasure.

Blast pipe modification

I made a modification to the blast pipe, merely to allow hand access to the main steam pipe



The improvised assembly fixture for the smokebox pipework made from a scrap of 6mm thick plate.



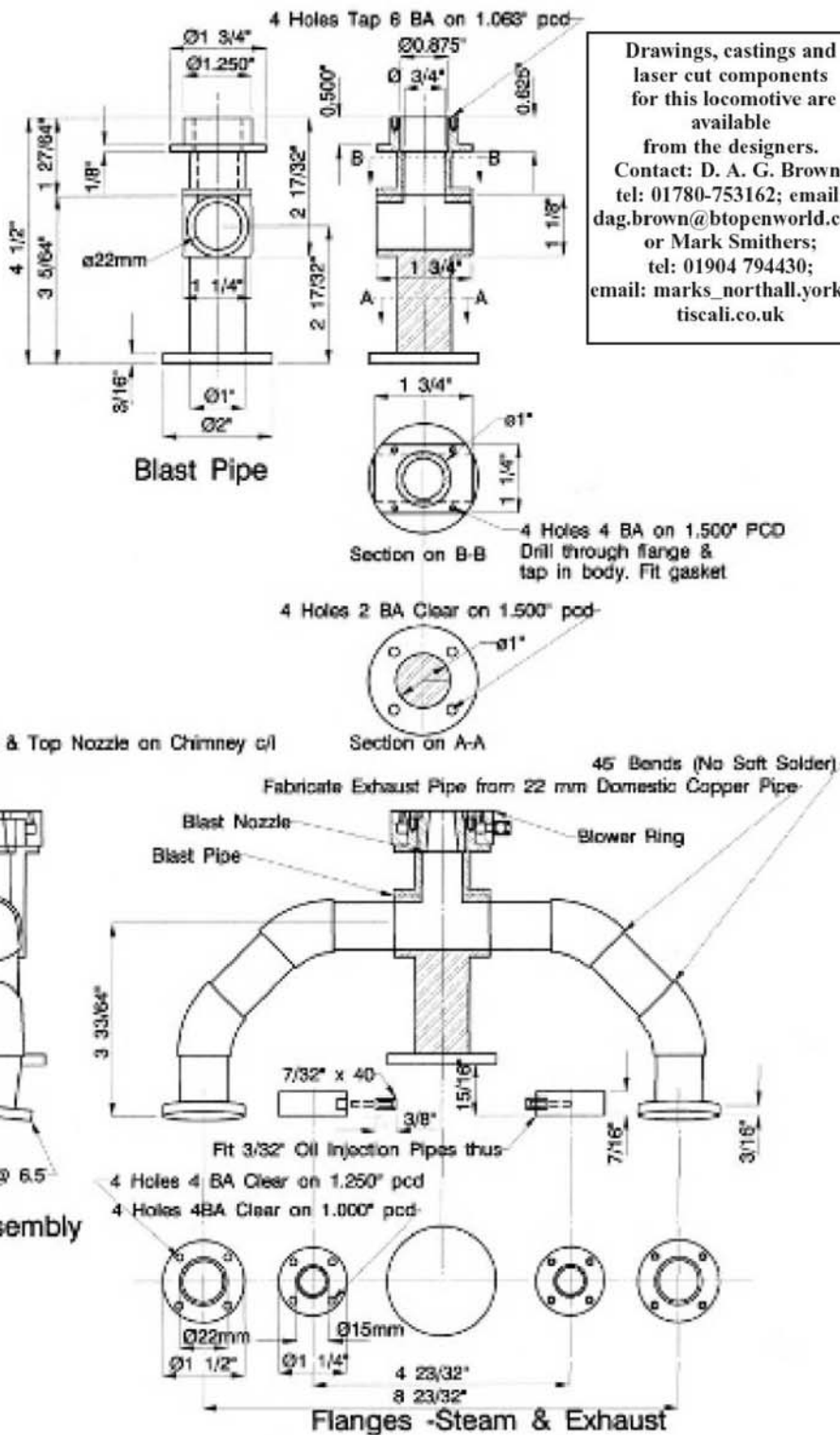
Looking into the back of the smokebox. Note blower and vacuum brake pipework and twelve blind nuts for connecting the boiler.

connection with the boiler. Whilst there is space to connect the blower and vacuum brake ejector pipes through the door aperture, there is not enough room for access to the steam flange. So I have split the blast pipe assembly and the revised arrangement, with its gasket fitted, is pictured in the photographs. I would strongly advise the assembly by means of hexagon headed set screws, rather than studs and washers, to avoid wrestling with a porcupine in the top of the blast pipe stump!

Looking at the revised drawing, I have simplified the blast pipe base, so that it can be machined from a piece of 2in. dia. brass bar. The cross piece at its top is machined on four sides to form a rectangle, the two holes for the exhaust pipes being positioned as before. The top surface of the base allows four 4BA holes to be positioned for mating with the upper unit. By machining the shape shown in section B-B, enough metal is left to accommodate the four fixing holes, while thinning down the assembly to make access as good as possible. Do not forget to install a gasket in the joint, since it would otherwise lead to an escape of exhaust steam and consequential loss of smokebox vacuum.

Gasket cutting

To make gaskets, the method I use is to scribe two circles on a sheet of CAF (compressed asbestos fibre), using a pair of dividers. The outer circle must be done before the inner one otherwise you land up *avec les pantalons descendu* and nowhere to place the point of the dividers! One learns from one's mistakes. Practice teaches us how generous to be with the hole sizes; it is also worthwhile to turn over the sheet and scribe from the other side. With sharp dividers, it does not take long to cut right through $1/32$ in. or $1/16$ in. material. The cutting of rings of bolting holes is also an easy job, if you make up a simple core drill from silver steel. Take as an example the drilling of holes for 4BA fixing screws: turn down a 3in. length of $5/32$ in. (or 4mm) silver steel to a diameter of 0.140in. for a length of $1/4$ in. Then centre drill the end to a sharp edge and



Drawings, castings and laser cut components for this locomotive are available from the designers.
Contact: D. A. G. Brown;
tel: 01780-753162; email: dag.brown@bopenworld.com
or Mark Smithers;
tel: 01904 794430;
email: marks_northall.yorks@tiscali.co.uk

enlarge the centre hole to $1/8$ in. dia. for $3/16$ inch.

The core drill so formed should be run at say 200rpm into the CAF material, with some MDF as backing and using the clearance holes in the upper flange itself as a drill guide. Such a simple core drill will form a dozen or two holes in gasket material before it needs re-sharpening by means of the centre drill. There is admittedly no ejection mechanism for the slugs of gasket, but they tend to curl up and lodge inside the hole in the silver steel. After each two or three holes, pick them out with a sharp scriber, rather like picking out the flesh from a crab's claw.

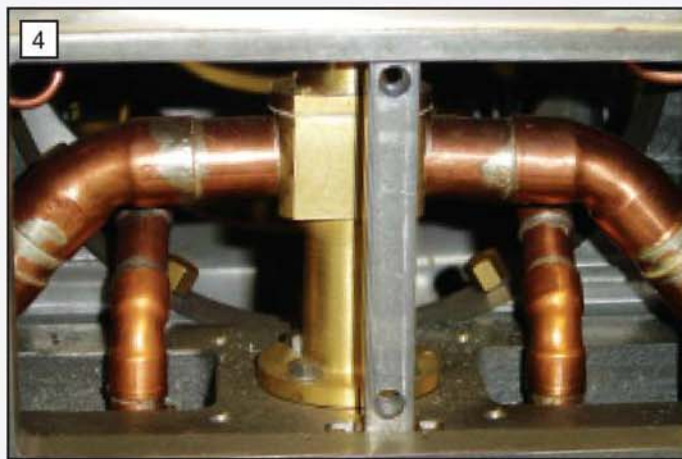
I have a collection of various sizes of these core drills and they are certainly worth saving for posterity. I have successfully run them in the drilling machine and in a power drill, making sure that the speed does not run away to destruction. With the need to mate the gasket with both the top flange and the holes in the bottom flange, the importance of accurate spacing of holes on the correct p.c.d. becomes obvious, so that the gasket can fit any way round.

Oil injection pipes

In the original description of the live steam pipework I specified a couple of sparge pipes



3
The smokebox front view with the strongback removed to show the pipework.



4
The smokebox front view with the strongback replaced. Note its lower pocket just visible.



5
Machining the crosshead top and bottom surfaces. Note the parallels to fix the height.



6
Machining the crosshead grooves, using the same parallels to help support the work.

sticking into the middle of the steam passage leading to the valve chest. The ends were left dangling, ready for later connection to the lubricator with 'site run' pipework. In the event, it looked messy and well nigh impossible to drop between the valve chest and the smokebox base casting. So I decided to fit a short nipple threaded 7/32in. x 40, with the sparge pipe attached by silver solder. This is detailed on the drawing, and like the rest of my modifications, is included among my original master computer drawings. It is easy for the short stub of screwed nipple to fit in the space available and becomes just visible between the frames for connecting to a 3/32in. pipe by means of a union nut of generous length.

Last word on the smokebox

The eagle eyed will have noticed from the photographs that I have not yet fitted the blanking plates in the bottom of the smokebox. I have decided to delay this operation until I strip down for painting, and at that stage to enlarge the clearance around the rectangular openings in the base, so as to give a generous land on which the blanking plates can seal. I know that at least two of those constructing the model have spotted this minor ink before finally assembling the smokebox body.

Back to the motion work - crossheads

When the motion work was described, back in part VI (M.E. 4229, 3 September 2004), I made the point that the piston rod should be centred in the crosshead casting. Some may find this

difficult to achieve, so may I offer some evidence of what I believe is a successful method. In photo 5 you can discern that the casting has been faced both sides and brought to finished thickness, before boring the hole for the piston



7
Rear cylinder cover set up for machining the rear surface area.

rod. The area around the boss of the piston rod socket has also been cleaned up, using a cranked (or Heineken) tool, after its ability to reach parts other tools cannot.

As an aside, mention of this type of operation reminds me of a visit we made to our daughter a few years ago, then living in Amsterdam. We were enjoying a splendid piano recital in the beautiful Concertgebouw hall, just around the corner from her house; in the interval she pointed out that the chap sitting in front of me was none other than Freddie Heineken, head of the brewing family. It put new meaning for me in the flavour of a certain lager. Sadly the great man, well known on Dutch television, died a few months later.

These preliminaries having been accomplished, the important next stage is to get the sliding surfaces top and bottom to be equidistant from the rod axis. A piece of 7/16in. dia. silver steel is shoved into the reamed hole in the casting and that rod is supported on a couple of V-blocks, made up to a convenient height with parallels. With this height definition, the casting is gripped in the machine vice for milling to the required height. This can be judged by inserting slip gauges or other pieces of known thickness between a cutter tooth and the piston rod dummy. When the casting is turned through 180deg., the other face will be machined to the same dimension as the first one. The point I am making here is that we are making use of a natural axis of symmetry to obtain the desired result.

Now change the tooling, establish the centre line of the metal, midway between the vice jaws,



A similar set-up to that shown in photo 7 for machining the piston rod glands.



Finishing the end arcs of the piston rod glands on the BCA milling machine. Note the MDF packing under the work.

and use a slot-drill on this centre line to form the rebate for a guide bar. Again, turning the casting 180deg. about the piston rod dummy, enables the second slot to be cut to the same depth as the first one. See **photo 6**.

Incidentally, the 'parallels' that you see pictured here were salvaged from the race of an old roller bearing of rather large size. The tolerances to which such items are made are far finer than anything we do in normal model making, so they provide a ready source of cheap parallels; I keep several sets of different sizes. Note that for other operations, the inner and outer races of conventional ball bearings, stripped out, are also of great accuracy and can be used as parallels.

The principal remaining operation is the boring of the stepped hole for the gudgeon pin in the side of each casting, a job for the 4-jaw chuck. Examination of this set-up reveals that three of the jaws will be pushing against nicely machined surfaces, whilst the fourth jaw bears against two short unmachined areas on the curved part of the rearward facing casting surface. This is a recipe for upsetting the alignment of the casting in the chuck, preventing it from snuggling up to the back surfaces of all four jaws. The solution is first to assess the way the casting lies under pressure from the jaws, and then to insert a soft packing between the jaw and the rough surface. It also helps to encourage the seating of the castings against the jaw surfaces by judicious use of a soft mallet.

Rear cylinder cover

In *Part V* of the series (*M.E.* 4227, 6 August 2004), the cylinders appeared, and as part of their description the machining of the rear end cover was detailed. In **photo 7** the casting is held on the rotary table to enable first the holes to be drilled and tapped and then the slots to be machined and curved about the central axis. If you look carefully at the surface of the casting, in the already machined area between the cover and the slide bar support, you will see some evidence of roughness, which actually indicates porosity in the casting just at the point where the change of section occurs. I just got away with my two examples, but in others supplied to constructors, this porosity has left a leakage path to the outside from the bore of



Using a dial indicator mounted on the catchplate to set the tailstock barrel in line with the mandrel.

the stuffing chamber, a casting fault which is unacceptable.

Discussion with the foundry has led to the incorporation of a chromate sand into the core mould, which has cured the problem by improving the heat transfer in this small critical area. This phenomenon is recognised in areas of sudden major change of section such as that which occurs in this casting. I carried out a rough machining operation on a recent batch of castings to make sure that there was no remaining porosity in the affected areas. Who said that model engineering is all predictable?

Before we leave the cylinder cover area, it is worth taking a look at the piston rod gland, which is carved from a slice of 2in. dia. brass bar. The stuffing box end of the job is a straightforward turning operation, leaving a $\frac{5}{16}$ in. thick flange, which has to be finished to a lozenge shape. This can best be roughed out by sawing away most of the unwanted material before mounting for milling. In **photo 8** the job is held concentrically in a chuck on a rotary table. Having established a datum on the chuck centre line, the two jacking holes have been drilled at the correct (1.5in.) pitch circle diameter and the index reading on the rotary table noted for the following operation. By rotating ± 17 deg. from the origin, the four flanks of the lozenge could be generated without marking off, the sweep from -17 to $+17$ deg. forming the smooth transition between flanks. The cutter used for this operation was one of the

small throwaway slot-drills which appear on the market cheaply from time to time. Many of these cutters are 'seconds', which probably means that they are out of spec. on size - not acceptable for industrial production, but ideal for our purposes.

Stating precisely the order of operations after drilling the holes: the job was offset in the X-axis by an amount (radius of the cutter + 0.469in.). The table was moved down say 1 in. from the centre datum in the Y-axis and the rotary table turned -17 degrees. The cut along the Y-axis formed the first side of the lozenge, stopping the cut at 0.000. The rotary table was turned 34deg. to $+17$ deg., which formed the root radius, then the second flank of the lozenge was cut by again moving in the Y-direction. The job was rotated 146deg., and the above procedure repeated for the third and fourth sides of the lozenge.

The remaining operation was the formation of the two end arc segments, each joining two of the flats just mentioned. The part was transferred to a stub on the rotary table, which locates in the jacking holes, drilled as the first of the previous operations above. In **photo 9** this operation is being completed. As I have already stated, my BCA milling machine is normally set up to perform such 'running round' operations and this is no exception. Careful examination will reveal that the finish obtained by these methods leaves very little hand finishing to be done. Note the regulation piece of MDF as 'a packing'. It must be emphasised that a good fit is essential between the hole in the component and the stub mandrel in the table centre.

Tailstock centring

When dealing with taper turning the canopy pillars in *Part XV* (*M.E.* 4247, 13 May 2005), I mentioned the performance for truing the tailstock. **Photograph 10** illustrates this taking place. I have mounted a dial gauge in such a way that its face can be read, on a magnetic base and (by chance) on the catchplate. Pulling the lathe round by hand, any difference in gauge reading between back and front of the barrel can soon be compensated for by turning the adjusting screws at the base of the casting. This is a very sensitive test, as a 0.001in. difference represents a positional error of only half that amount.

● *To be continued*

LIFTING AND SHIFTING LONG AGO

John Ditchfield

discusses the technical features of some early Victorian factory cranes.

●Part II continued from page 517
(M.E. 4285, 27 October 2006)

In Part I, I gave a detailed description of an overhead travelling crane built by Craven Brothers, which obtained its power from a stationary engine by means of an endless rope running the length of the building.

Let us now step back into the Victorian era, and rather than just look at some other examples of early factory cranes, let us imagine that you are a factory owner in, say, 1875. You are building a new works to make machinery, and need a means of transferring heavy parts between carts or railway wagons and machine tools, assembly beds, etc.

What about opting for a steam railway crane with a jib? It would be versatile, and could even haul its own wagons, but it would demand a clear avenue through the shop, together with room to swing round in close proximity to all those expensive new machine tools. It would also fill your newly whitewashed shop with smoke.

You could choose cranes attached to the wall, having a horizontal jib, braced from above or below by struts or tie bars, and hinged from the wall so that they could swing through a useful angle. These were often called foundry or smithy cranes, and usually had a small crab that travelled along the horizontal jib. They could lift the work off the appropriate conveyance and deposit it where required. You'd need quite a few of them, though. The cranes would most likely be hand-worked, with a cluster of gears conveniently situated for crimping the workmen's waistcoats. These gears usually operated chains to traverse the crab, although this movement might be achieved simply by towing it along by the hoist chain. Incidentally, in much earlier times the equivalent of the crab may have been wheel-less, being prized along the beam by means of a long bar. The bar would be pivoted on a convenient peg, a series of which protruded from the side of the beam. You may not be familiar with the expression 'a much-prized crab', since I have only just thought of it.

An overhead crane is obviously preferable in the factory, but it needs strong walls or columns to take the main tracks. There is more than just the weight of the crane and its load to consider. There are also the dynamic forces applied to the building when the crane and its burden are accelerated and decelerated. Therefore the building will need bracing to prevent its rectangular shape turning into another form of parallelogram. So, overhead cranes obviously add to the cost of the building. Then there are the rails. How do you set up two rails, dead straight, horizontal and parallel rails, perhaps 50 or 100 feet apart. Well, that is someone else's problem. After all what do you pay these people for? But

how do you check what they have done? You also want the crane to run smoothly on the rails, without shaking the works and introducing interesting patterns on the surfaces of the components being finish machined in the lathes and planing machines. Not recommended with the big wall-mounted planing and drilling machines used by the likes of Boulton & Watt.

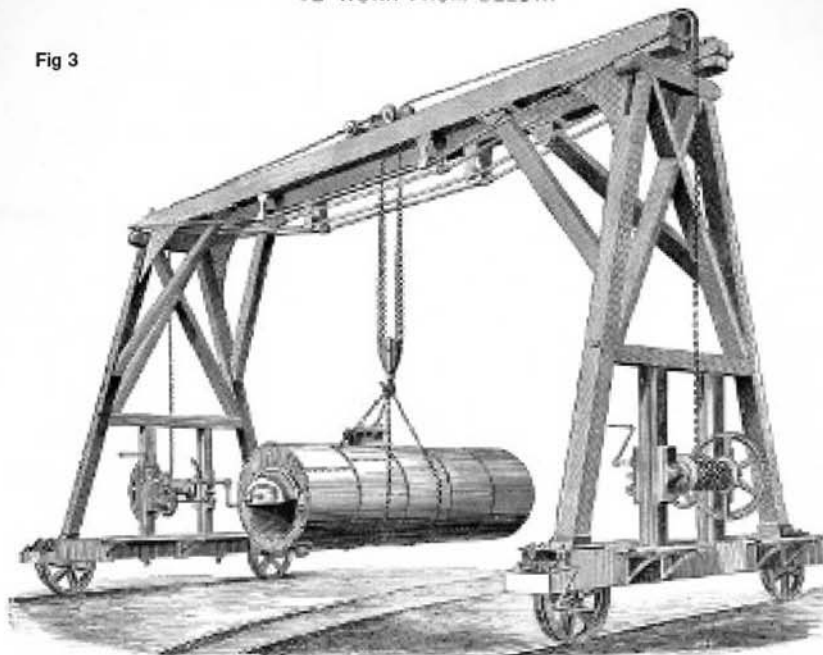
As an alternative, what about a gantry crane? Like a trestle, but running on rails (see fig 3). Incidentally, Ransome & Rapier's catalogue of 1888 refers to these as "Gantry" cranes. Posh, eh? Gantry cranes would make for a cheaper building, but bear in mind that the legs would have to run behind the machine tools. So? Well, they would take up space, and let us not forget that, backstage, there would be a plethora of line shafts, belts, pipes for the gaslights, etc. Tangye Bros. & Holman offered a wooden, hand-operated 'Goliath' crane of the gantry type at

£175 in their 1876 catalogue, but you could save £50 by just buying the ironwork and an engineering drawing to allow you to make and assemble your own timber work! Of course timber was timber in those days. Usually. For anything other than the standard size, you would pay £3 extra per foot in gantry height, and £5 per foot of span. As well as DIY gantry kits, they also offered crabs and shafts, etc., for customers to make their own overhead cranes. Alternatively, they would supply a complete overhead crane, cautioning tropical residents that wrought iron was recommended in preference to wood for the main beams. The apparatus was designed with typical Victorian elegance, including a fluted iron column for the hand trundling gear. This was obviously a sales point in the catalogue, as the short descriptive text mentions the fluting along with the "bevil" gears and the powerful "break".

There is a further option alternative, involving

GOLIATH HAND TRAVELLER, TO WORK FROM BELOW.

Fig 3



These Travellers are extensively adopted in Timber and Stone Yards, Railway Goods Stations, Foundry Yards, &c., and are preferred in many cases to those worked from above. They are very compact, and easily managed, the operations of lifting or lowering, and traversing the weight either longitudinally or transversely, being carried on from below.

PRICE OF 10 TON TRAVELLER as illustrated, with single and double purchase Winch on each side, carriage on top, also longitudinal traversing motion, travelling wheels, and all timber and iron work, including chain and block, but exclusive of rails. Height under tension rods 16 feet 6 inches, gauge of rails or span 20 feet. £175

PRICE PER FOOT EXTRA IN HEIGHT... .. £1

" " " IN SPAN £5

PRICE OF IRON WORK ONLY, but inclusive of a drawing to enable purchaser to construct and erect timber work £225

NOTE—The framing can be constructed of wrought-iron if preferred, any height and span, at an extra charge.

lateral thinking. If you have a narrow central aisle between machines, then upend the overhead crane so that one end of the bridge beam (now a column) runs on a single rail set in the floor down the middle of the shop, with a pair of guide rails up in the roof space. Then attach a swinging jib to the beam column. Such 'mono-rail' cranes were found in railway works, for example, but they demanded a clear space through which to pass. The crane consists of a vertical column, a jib and a trolley. Bear in mind too, that the tipping force applied by the column to the sky rails must be accommodated by tie bars attached to the walls at high level.

So, we'll settle on an overhead crane. Set sufficiently high for the suspended load to clear all the obstructions. If the load is suspended from two slings in inverted V-formation, then the angle of the 'V' needs to be kept reasonably small (in order to minimise the tension in the slings). This affects the required height of the hook. Of course, the higher the crane, the higher the building costs, and the more rope or chain to be wound onto the drum, preferably without overlapping. And don't forget, you might have to leave headroom for the crane's chimney. What? This leads to the next question.

Next question: What do we use for motive power? Manpower was one option, but steam was the obvious candidate in 1875. A complete steam plant could be mounted on the crane itself. Alternatively the steam engine could be located elsewhere, as for the Craven rope-driven crane, for example. When I first heard of overhead cranes surmounted by a boiler and steam engine, for use indoors, I thought the idea bizarre. On reflection, I still do. What a sight to behold! Belching steam and smoke, dropping ash and dripping water and oil. Little wonder that rope drive found favour.

The page extract from Alex Wilson Ltd's 1875 catalogue (fig 4) shows the attraction of manual motive power. A 40 foot span, 10 ton hand-wound wooden-beamed crane cost £220, compared with £420 for its steam-engined counterpart. For the sake of up-to-date comparison, arbitrarily add a couple of noughts to those figures, and the man-powered option needs thinking about. Not for a busy factory, but worth considering if the crane was only to be used infrequently.

Interesting to note that Wilson's 10 ton steam crane could be had with wrought iron beams instead of trussed timber, for £500. Is it worth the extra £80? Well your view might be coloured by the thoughts of warping or fire or wood-worm (or termites or galloping rot for those in less temperate zones), or by knowledge of spectacular failure of a wooden crane. Anyone with access to a book called *Crewe Works in the Age of Steam* (ref 2) will find an interesting photograph of a rope-driven overhead crane in an awkward predicament. It was one of a pair engaged in attempting to lift a locomotive, and the beams snapped. The main structure was made from wooden beams reinforced by wrought iron tie bars in conjunction with cast iron brackets, similar to the arrangement seen on the 'Hand Traveller' in fig 4. Did it creak-before-break, I wonder, or did it go suddenly with an explosive crack of doom, heard miles away?

An account of a Brown & Wilson's overhead steam crane in *The Engineer* in 1866 gives a good idea of the excitement attending the use of such a machine, although this was for an outdoor construction site rather than our orderly factory. The crane in question was working on the construction of the Blackfriars Bridge in London, and ran on a wooden gantry no less than 70 feet high. The article pointed out the difficulty of getting "ordinary" steam travellers to keep on the line at moderately high speeds, or to prevent the movements of the engine from endangering the entire structure. Now, young man, still want that driving job? The boiler, engine and winch were fixed at one end of the crane, and the crab was a small item propelled towards or away from the engine by chains. This had the advantage of avoiding the transverse forces, which would arise if the whole mass of machinery were sitting on the moving crab. When a powered crab accelerates with its load, there is a reaction force between the driven wheels and the cross rails which in turn acts upon the gantry. A very similar crane is shown in fig 4.

The crane's bridge beams were thoughtfully extended outwards beyond the 55-foot gauge of the tracks, the aim being that if the crane was derailed, then it would drop a few inches rather than many feet. Derailment must have been a real possibility, since the gauge was said to vary by as much as plus or minus 12 inches. The track also undulated considerably, due to the effect of excavations on the gantry's foundations. The "proper" longitudinal speed was 1 mph, and the article expressed wonder that such a speed could be safely obtained. The supporting wooden gantry at the "boiler end" was made stiffer than the opposite gantry, this being "free to adjust itself" to the moving crane! The main wheels were driven by a shaft extending across the bridge beam. At the "non-boiler end" of this shaft was what appears to be a hand wheel. In fact it is a flywheel, which served to "carry the further end of the machine over any bad joints or inequalities or obstructions on the line of rails". Good. Various friction clutches were apparently able to slip to prevent undue strains leading to breaking or accident.

OVERHEAD STEAM TRAVELLER.

FIG. 41.

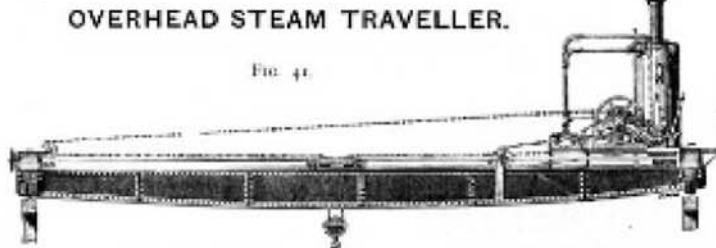


Fig. 41 represents an Overhead Steam Traveller, from which pattern the Cranes were made for removing the old and rebuilding the new Blackfriars Bridge, London. Five Cranes were used in this important work; and similar Cranes were also used at Victoria Railway Bridge, Finsley; East Bait Dock, Cardiff; Limehouse Dock; and two can now be seen at work daily at the Stone Pier of the London and North-Western Railway, Nine Elms, close to the Vauxhall Iron-works. The advantage of this Steam Traveller over all others is that the Boiler, Engine, and Gearing are all fixed at one end, so that the Girders have only to carry the weights that are lifted, while the strain on the Gantry caused by the whole Engine travelling with the suspended load is entirely obviated.

Price of a Crane, with wrought-iron Girders, 40 feet Span and to lift 10 tons	£500
Price of ditto, with trussed wooden Beams, 40 feet Span and to lift 10 tons	£420

Prices of different Spans and Capacities on application.

HAND TRAVELLER.

FIG. 42.

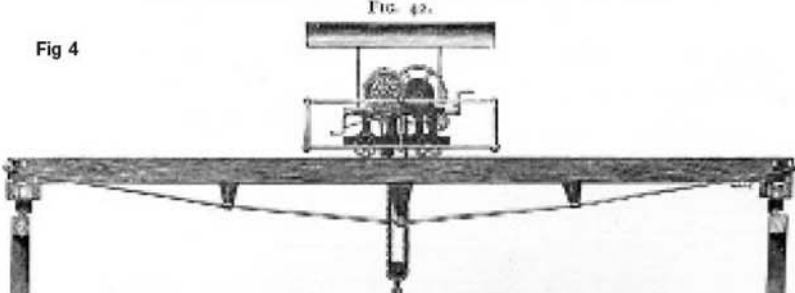


Fig 42 represents a Hand Travelling Crane which is too well known to need description. Price of a Hand Crane, with trussed wood Beams, 40 feet Span and to lift 10 tons, £220.

Prices of different Spans and Capacities on application.

TRADE MARK FOR THE ABOVE CRANES

We also manufacture every description of Crane, Hoist, and Lift, worked by Steam, Hydraulic, or Hand Power.

ALEX. WILSON AND CO.,
ENGINEERS, VAUXHALL IRON-WORKS, NINE ELMS, LONDON, S.W.

More about overhead cranes and their makers

In the first exciting instalment, I described a Craven overhead crane that received its power through an endless cotton rope running on wall-mounted pulleys. The crab up on the crane's bridge beam was driven by a square-section shaft supported at intervals on 'drop' bearings that descended out of the way to let the crab pass unimpeded. I will now describe some features on other overhead cranes.

It may be of interest to note that John Fowler Ltd. entrusted the design and manufacture of their overhead cranes, for use in their Leeds works, to themselves. These used a wire rope for power transmission, rather than the more common natural fibre. This is not surprising, given Fowler's early adoption of wire ropes for ploughing engines. It appears from photographs that both the main drive pulley, and also the main pulley on the crane, utilised Fowler's 'gripper' arrangement on the rim. This increases the contact pressure on the rope according to the rope tension. Fowler's cranes will reappear later in this article. Wire ropes were also adopted by the Fairfield Shipbuilding & Engineering Co. in Govan to drive cranes made for their own works.

Belts (presumably leather) were sometimes used instead of cotton or wire ropes to take the power to the crane. In the 1880s, the main gun machine shop of *Forges et Chantiers* in Le Havre had 60-ton and a 30-ton belt-powered cranes which could be worked in unison to lift 90 tons. They also had an interesting crane at their gun-testing site. This was of the conventional gantry type, but the operators were required to wind the crane manually, noting that it had a capacity of no less than 80 tons. As a reward, they could watch big guns being fired. More excitement came when making use of the crane's unusual feature. The whole gantry could be run onto a traversing carriage and moved along to other bays.

As an alternative to a rope drive running along the wall, why not have a shaft running along the wall instead? The shaft needed to be supported at intervals by some sort of 'drop bearings' as used on a small scale on the Craven crane. I do not know whether there was a definite limit to the length of shaft that could be supplied, or whether lengths could be joined on site by hammer-welding and then fettled to produce a nice straight shaft. Such shaft-driven cranes were offered by a number of firms, such as including, Sampson, Moore & Co of Liverpool, Smith, Beacock & Tannett of Leeds, Ransomes & Rapier of Ipswich and Thomas Smith of Rodley, Leeds. Ransomes' 1888 catalogue offered shaft drive as an optional extra at £1 5s 0d per foot of shafting, including the necessary "shunting bearings". Smith, Beacock & Tannett made cranes powered by a 2 1/2 in. square shaft running along the wall, the shaft's section being made circular at the intermittent support bearings, which were spaced at intervals of 10 feet. These support bearings were of the 'rise and fall' type, actuated by two series of ramps fixed to the crane. The lower of the two ramps tripped a trigger, permitting the bearing to drop, while the upper ramp let it down gently, and then pushed it back up so that it could re-latch. Each bearing

strut had a roller which to help it ride up and down the ramp.

It must have been quite satisfying to feel the smooth activation of the mechanism as the crane travelled. Even more satisfying to know that once again the complicated apparatus had worked properly and not brought the crane to a clattering halt. No such complication was adopted for the round, key-wayed shafts on the crane itself. The supports for the round shaft were simple L-shaped tumbling brackets. It may be of interest to note that an 1882 description of such a crane in *The Engineer* gives us its view of the status of the crane's driver with the words "The attendant is placed in a cage".

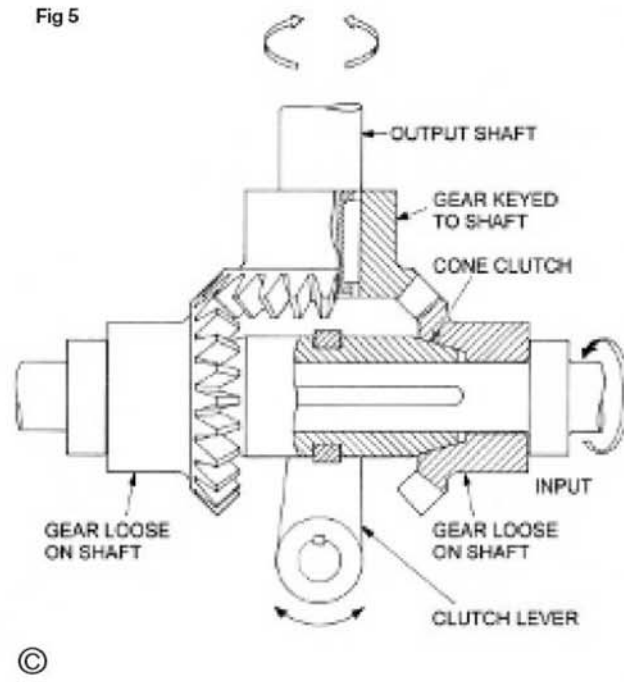
Sampson, Moore & Co supplied some 60-ton capacity overhead cranes to the Gun Factory at Woolwich Arsenal in 1876. The main drive was supplied by a square shaft. In one shop, the one-piece shaft was no less than 250 feet long. I can only assume that lengths were joined on site by hammer welding, but the production of such a long, straight shaft would be challenging, to say the least. The shaft section was made circular at the support positions. Simple counter weighted tumbling bearing supports were used for both the main (square) shaft and for the round cross shafts on the crane itself. These supports stayed vertical until pushed out of the way by the crab, after which they would swing back into position. The same firm had supplied rope-driven cranes to Crewe locomotive works in 1860, and these will be mentioned later.

On those cranes that used a wall-mounted shaft, rather than rope drive, power was usually taken from the main shaft to the crane by a pair of bevel gears, one being keyed to the main shaft. The hoisting and traversing motions were then transmitted by "double friction cones". These three words manage to convey little, but the term usually refers to an arrangement of three bevel gears and two friction clutches, commonly used on cranes and other machinery to provide a simple, compact way of selecting and engaging forward and reverse action. The basic layout is shown in fig. 5.

The central clutch sleeve was keyed or splined to the shaft, and was slid left or right to engage with one or neither of the large bevel gears, giving forward, reverse or neutral output. On manual cranes, where the input shaft could be stopped easily - and with a sigh of relief - a simple dog clutch might be used instead of friction cones. Instead of a cone friction clutch, some makers used expanding shoes like those in a car's drum brakes.

Another big maker of overhead cranes was Vaughan & Co. Their factory was in Reddish, near Manchester. Reddish was something of a

Fig 5



hot spot, being home to Craven Bros. and to at least one other crane-maker, S. H. Heywood. In 1889 *The Engineer* gave a detailed description of a 25-ton Vaughan crane supplied to the ground breaking power station at Deptford, London. This crane was rope-driven, and the driver was able to start and stop the rope from his cab using a cord, which ran along the wall. Not to be confused, it is hoped, with the main driving cords. Like the Craven crane described earlier, each cross-shaft transmitted its power to the crab via a worm and wheels. However, the shaft in this case was circular, with two key-ways. The rise and fall support bearing system was particularly complicated. An iron wedge slid horizontally under the bearing to make it rise and fall. The approaching crab carried a 'plough' which engaged with a roller-equipped peg on the sliding wedge. The plough slid the wedge out and then pushed it back as it passed. Vaughan used an arrangement of leather belts, much like that on the Craven cranes, to convert the rope-driven input power to crane motion. Other makers used different methods, and I will briefly mention three examples below.

In the 1860s, Appleby Brothers of Leicester made rope-driven cranes with features similar to those installed in the LNWR Crewe works, which used another form of nearly-forgotten power transmission. This eschewed belts and bevel gears in favour of 'friction pulleys'. I do not have clear details of the equipment, but will offer my understanding of the arrangement, see fig 6. The pulley rims were grooved to maximise contact area. The rope ran across the span of the crane's beam, and in doing so it turned three separate pairs of pulleys. These pulleys were horizontal, and rotated freely on vertical spindles. The rope was threaded such that the pulleys in each pair rotated in opposite directions. Each pair of pulleys had its vertical spindle fixed to something resembling a lathe cross-slide. Turning the 'cross-slide' hand wheel caused one or other pulley to be pressed against a third wheel. The third wheel sat between the two belt-driven pulleys. In this way the third wheel could be made to rotate either clockwise or anti-clockwise, torque being transmitted by friction.

Contact pressure could be varied, using the hand wheel, to control slippage. This third wheel drove a worm, which engaged with a worm-wheel to perform the relevant function (hoisting, traversing, or moving the crane). The three hand wheels were mounted on the crab. However, only two of the pulley clusters were attached to the crab, the third being located on the end of the crane (to drive a pair of main wheels). This third cluster was worked from the remote hand wheel by means of our old friend, the square shaft. The hand wheel itself was attached to the crab and slid along the square shaft.

The friction pulleys on the Appleby crane are described as being grooved, but the form of the grooving was not specified. Neither was the material of the pulleys identified. 'Direct' friction drives in the Victorian era took a variety of forms, mainly involving either plane surfaces or V-shaped circumferential grooves in wheel rims. V-grooved rims had the advantage of requiring less contact pressure, and hence offering lower bearing loading, compared with cylindrical surfaces. Metal-to-metal V-grooved pulleys, sometimes referred to as wedge gearing, were adopted for high speed applications such as engine-dynamo drives, while many applications used non-metallic facings such as wood or leather. Whatever the combination, there is obviously real potential for even or uneven wear of the friction faces when engagement took place. It follows that detail design and execution of the engaging mechanism were key influences in the reliability of factory cranes, and any downtime due to crane failure could have a serious impact on production. Nearly all powered cranes in the pre-electric days incorporated some form of friction drive, whether in the form of friction pulleys, clutches or belts, so there was no escape from the problems of wear.

Fielding & Platt Ltd. of Gloucester were, until recently, makers of hydraulic presses. In the 19th century they also made steam and gas engines, and were big in rivetting machines, which ranged in size from portable to immense. They also made the odd overhead crane. One such was described in *Engineering* in 1884. You may recall that from the previous instalment that the Craven crane derived all its movements using just six belts. The Fielding & Platt crane managed with just two. Now having two of something rather than six does not necessarily equate to simplicity, and I will spare you any descriptions or diagrams of the arrangement. Suffice to say that the tortuous route followed by those two belts would be the envy of any dodgy taxi driver. The crane's cross-shafts had a drop bearing, similar in concept to the early Craven arrangement (fig 2 in *Part I*), but using scimitar-shaped bell cranks which served to make it look more complicated than it really was. A shaft ran along the crane's bridge beam to drive a worm and wheel on the crab for hoisting, but the crab itself was hauled along the beam by a pair of chains. About half of this chain length was of the pinned-link type (broadly similar to bicycle chains, but without rollers), driven by sprockets. The other half, which had no contact with the sprocket, was of the ordinary and presumably cheaper forged link variety.

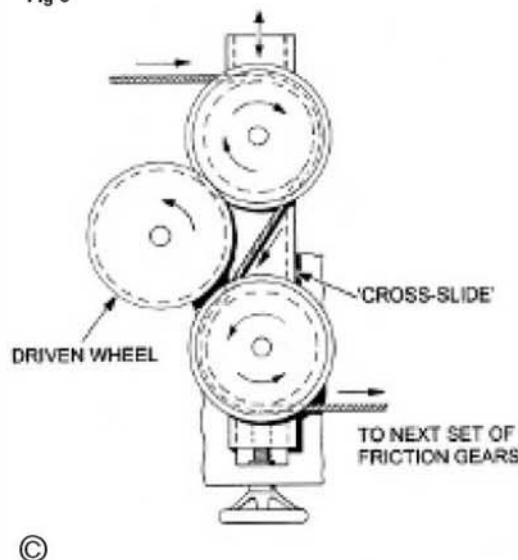
Some Continental makers of overhead cranes opted not to use wide hoist drums, and favoured

chains driven by narrow sprockets or notched wheels instead. The unused length of chain piled up in a sort of bucket on the crane. Stuckenholtz of Germany were using pinned link chains in this way in the 1870s.

Eglinton Engine Works in Glasgow had a home-made 15-ton overhead crane. This was rope-driven, but managed with just a single rope pulley on the crane instead of the three or four used by Craven and Vaughan. This pulley turned a shaft supported on tumbler bearings. Power was taken from the shaft to a cross-shaft on the crab by bevel gears. This cross-shaft was host to a variety of pinions, which drove the hoist, as well as three of those 'double friction cones' (sets of bevel gears with built-in friction clutches, as in fig 5). The friction cones controlled forward and reverse traversing, longitudinal movement, and hoisting and lowering. The friction cones were operated by levers, but the levers were not welded directly by the driver. Instead, at the end of each lever was a geared sector, and this was turned by a worm attached to a hand wheel, giving the driver more precise control. This arrangement represents a different approach for providing smooth engagement, compared with the friction pulleys used on the Appleby crane and the belts and pulleys found on the Craven and Vaughan cranes. Nothing could possibly go wrong, but when it did, hand cranks could be fitted to the ends of the cross-shaft. In fact, manual override was quite common on Victorian mechanical cranes. The Eglinton crane's rope drive tension was adjusted by a leadscrew and hand wheel. Adjustment was required to compensate for stretching, whether permanent or due to the weather. A more common arrangement used weights in order to maintain a reasonably constant tension.

An occasional maker of overhead cranes was Davy Bros. of Sheffield. In designing a 10-ton

Fig 6

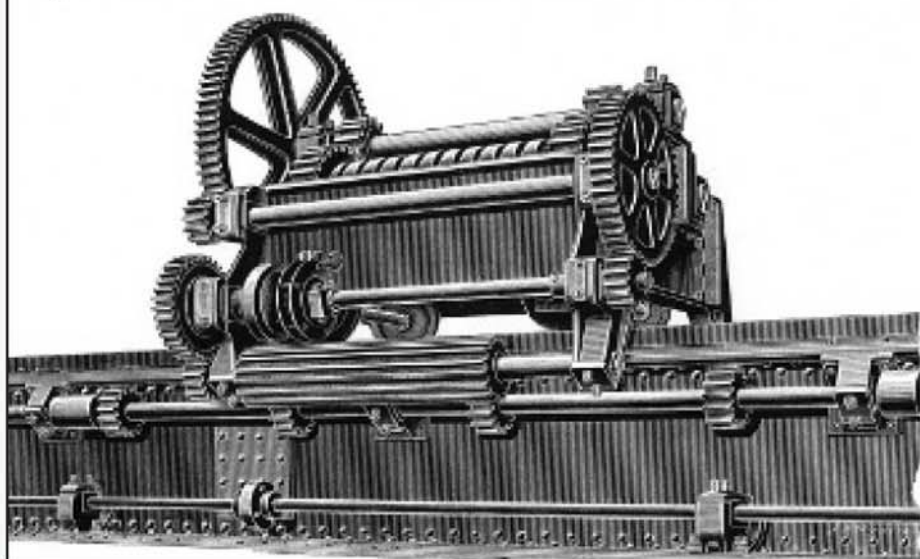


machine for his own works, Charles Davy rejected the idea of potentially troublesome tumbler or drop bearings for the cross shafts, and instead patented an interesting alternative (fig 7). Instead of having a square cross-shaft, or a round one with key-ways, he provided his cross-shaft with a series of equally spaced gear pinions. The cross shaft was well supported by conventional closed bearings. Power was transmitted by a very wide gear, fixed to the crab, which was wide enough to span two of the small pinions in any position of the crab. This arrangement allowed the main shaft to have conventional bearings with a good lubrication regime. It was argued that this allowed a higher shaft speed and therefore a smaller shaft diameter (power transmitted being a function of torque and speed).

Davy's idea of using intermittent pinions and a wide gear was unusual, but the principle seems quite sound. A much odder arrangement was used on an overhead crane illustrated in Adrian Jarvis's booklet *Victorian Engineering* (Shire Books). Power was transmitted to the crane using the principle of a shaft running along the wall. I say 'principle' because instead of using a round or square shaft, the designer opted for an elongated

Fig 7

DRIVING GEAR FOR TRAVELLING CRANES.
CONSTRUCTED BY MESSRS. DAVY BROTHERS, LIMITED, SHEFFIELD.





4
An example of a reversing bevel cone clutch assembly photographed on a steam jib crane.

gear! In effect it was a single pinion running the length of the shop, but in practice it was made up of a number of very wide gears separated by joints and short bearing journals. These must surely have had the largest width/diameter ratio of any gears ever made. Power was transmitted from this elongated pinion to the crane by a relatively narrow gear attached to the crane.

A number of questions arise in connection with this arrangement, but at least the use of tumbling-type bearings was avoided. The use of such bearings was probably quite an issue for wall-mounted shafts, which had to run for long periods. In the absence of a good lubrication regime, tumbler-bearing journals would be prone to wear. Wear that resulted in the formation of steps could cause problems when the crane came along to push the tumbling bearing away. Not to mention the headaches associated with rectifying a badly worn journal on a shaft several hundred feet long. So perhaps the grand pinion concept wasn't such a weird idea after all. Expensive, though.

The increased size of forgings, mainly for naval guns, led to a demand for 150 ton overhead cranes in the 1890s. Woolwich Arsenal had a steam-driven one in 1891, and its maker, Easton & Anderson, may be better known to some readers in connection with stationary steam engines. The crane must have looked impressive, with sixteen main wheels running on rails 65 feet apart, while the large steam-powered crab and its corrugated iron house had 10 wheels. The boiler was of the horizontal marine type, 5ft. 6in. diameter, and working at a pressure of 80 psi. The boiler shell thickness was only $\frac{5}{16}$ in. (8mm) - when new.

Also in the 1890s, Vickers' River Don Works in Sheffield had a 150 ton overhead crane to serve its 8000 ton hydraulic forging press. Now, some of the cranes described above were driven by a square shaft mounted on the wall, and mention has been made of the complications associated with this arrangement. Well, the Vickers crane was served by no less than four of these shafts, one above the other, each driven by its own steam engine located at one end of the building. Power was transmitted to the crane by bevel gears, but not crude, noisy straight-toothed ones. No, these were of the herringbone type. Four shafts then traversed the crane's bridge, and three of these were supported on drop bearings. The shafts were arranged in pairs either side of the bridge beam, one above the other. This complicated the provision of drop bearings, but the solution was neat. Counter weighted rocking

arms supported the bearings, and each arm was linked to its partner by their counterweight.

Wait a minute. Four shafts crossing the beam, when other cranes managed with three? Yes, things were more complicated, because not only did the crane have to carry its incandescent burden of steel, it also had to manipulate it at the press. Some readers may have seen photos of hot ingots with one end in the jaws of a big press, and the other supported by a huge bike chain. Well, in this case it was the crane's job to turn the chain, which it did using turning gear suspended from the hoisting chains. The gear was powered by a vertical, square shaft coming down from the crane's crab.

Vickers' River Don works was described in *Engineering* in 1897. In the following year the magazine gave a detailed account of a competitor's works in France, the huge Schneider plant, and described their 150 ton crane. This crane was more advanced than the Vickers equivalent, being electrically driven, reflecting Schneider's early entry into the electrical engineering business. Initially, Schneider relied on electrical technology from Ganz of Hungary. Ganz also made cranes, and in fact they still do. Surprisingly, a 100 ton electric crane installed at Vickers' Sheffield works in 1900 was built in the USA, by Wellman-Seaver. That does not imply that the capability was lacking in Britain, because in the same year, Armstrong-Whitworth's armour plate works treated itself to a 135 ton electric crane built just down the road by Vaughan. A few years later, Craven exported a 120 ton capacity ladle crane to a Japanese armaments factory.

A number of methods of getting power to overhead travelling cranes have been described, but this is not an exhaustive account. There were other methods of power production and transmission, and some of these were no doubt applied to overhead cranes. Hydraulic jiggers were used in the USA to activate ropes which were connected to overhead cranes, the jiggers being fixed to the building rather than to the crane itself. I have not encountered any examples of overhead cranes powered by air or by internal combustion engines in the Victorian era, but perhaps they existed. Pneumatic cranes of other types were certainly used, one US factory in the 1880s reporting that "the volume of pure cool air exhausted is of value in assisting ventilation and increasing the general health of the workmen".

One of the problems with overhead cranes

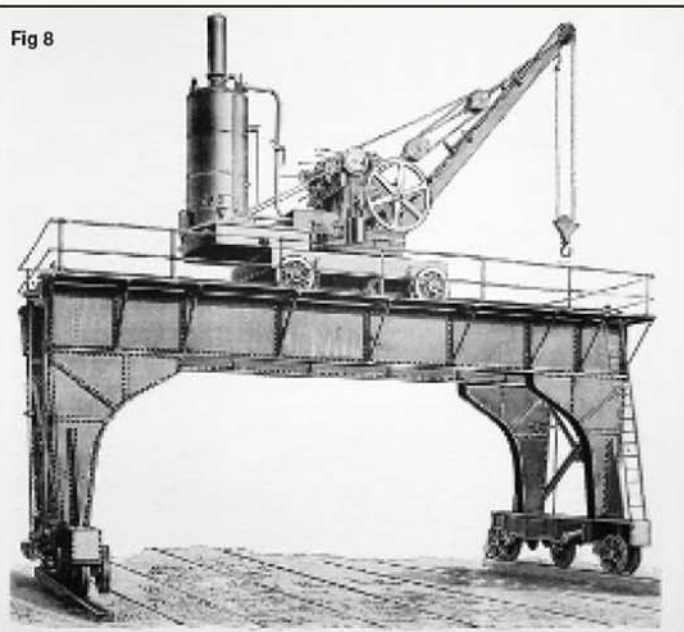


Fig 8

was communication between the driver and the ground crew. Imagine the difficulties in a locomotive boiler shop, where long boilers were suspended vertically for rivetting. The crane driver was particularly high above the ground, and would need good eyesight for lip-reading, given the prevailing nerve-shattering cacophony of rivetting and caulking. Modern cranes often have remote control. So did some Victorian cranes. Nothing very sophisticated, just a pair of chains hanging from each double-ended lever that engaged the forward or reverse friction cone.

Having brought up friction cones again, I will mention some more methods of applying greater force with finer control than could be obtained with a simple lever. The Eglinton crane discussed earlier used a hand wheel-operated worm that engaged with a sector on the end of the clutch lever. Another method used a spur gear sector on the end of the clutch lever, and this engaged with a similar sector on the end of a much longer hand lever. A further method, shown on a steam jib crane in **photo 4**, is self-explanatory.

Thomas Smith of Rodley supplied a 10 ton capacity gantry steam crane to Sydney in 1886 (**fig 8**). This was unusual in having a conventional travelling jib crane perched on top, which trundled back and forth along the gantry's beam. Suspicion that this was a standard railway crane is enhanced by the gauge of its bogie - 4ft. 8 1/2 inches. Not quite standard, though, because of the complication of having to make the jib crane drive its great supporting gantry along the rails. This was achieved by having a shaft taking power from beneath the crane to bevel gears on each end of the gantry. From here, further shafts and gears drove the gantry's wheels. Not only that, but also this: each of the gantry's bogies incorporated a winch for hauling (warping) railway wagons unto itself.

Coming up in the next instalment: some history, and a trip to the dockside, where we will learn what was used in 1856 to lift a 70 ton boiler into a ship.

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2: *Crewe Works in the Age of Steam* by Edward Talbot. Oxford Publishing Co. ISBN 0-86093-177-3.

●To be continued.

FOREIGNERS, AND OTHER ASSORTED ITEMS

Mike Zanker

gets nostalgic about a time when his father's ingenious projects stimulated an interest to find out 'how things worked'.

Most people who have worked in the engineering industry will know what 'foreigners' are. They are unofficial jobs done for oneself, usually during tea or lunch breaks. However, they seldom seem to have an adverse effect on productivity, and during slack periods, at least help to defer the onset of boredom and enable one to 'keep one's hand in'. Management has been known to turn a blind eye in such circumstances.

My father, who was a tool room fitter in a long defunct manufacturing concern, was very adept at this and produced several articles in the post-war years and afterwards. During this period, many items other than the basic necessities of life were either difficult to obtain, and/or very expensive. One example, which gave my brother and myself hours of amusement, was an inclined railway, on a frame about 2ft. long and the same in height, with the rails at about

3in. gauge and sloping at roughly 45 degrees. At the top was mounted a large hopper with a flap at its base, spring loaded or weighted to keep it closed. A small tipping hopper wagon on four flanged wheels ran on the rails with a cord attached, which passed over a pulley at the top of the incline, with a weight attached to the end. Figure 1 shows the general arrangement.

To commence operation, the wagon was held at the bottom and the hopper at the top was filled with sand. The wagon was then released and ran to the top, pulled by the falling weight. At the top a striker on the wagon struck the hopper flap, which opened and allowed a quantity of sand to run into the wagon hopper; the weight was sized so that as soon as the wagon hopper was almost full, this overcame the pull of the weight and the wagon ran to the bottom. Here the wagon hopper tilted and emptied the sand, either due to inertia throwing it forward, or by means of a roller on the hopper striking a tilting plate at the bottom of the track. I have to admit my memory is a little vague on this part of the mechanism. The weight now pulled the wagon to the top again and the operation was repeated automatically until the large hopper was empty and all the sand piled at the bottom. The whole apparatus was built in brass, nicely finished and a source of endless

fascination and instruction to children, and not a few adults. Obviously, it would require a fair amount of trial and error to get it working properly, but this is part of the enjoyment of projects such as this.

Amongst his other creations was a stationary steam engine, built mainly from scrap materials. Again, this was nicely built and finished on a polished wooden base, complete with a full set of fittings including a lineshaft. The boiler was heated by an electric iron element, which would no doubt be frowned upon today, and I suppose was not very efficient in energy terms but was, of course, a very clean method of raising steam. My father always took the time to explain to us how things worked, and we learned quite a bit about mechanical principals in this way.

Items that were difficult to obtain at the time were Christmas tree ornaments, so he produced some of these himself; one item, which I still have, is a bell, machined from aluminium. This was all right for the rather stiff artificial trees of the time, but hanging it from a modern tree causes it to bend over as if in a force nine gale!

My father was also friendly with some neighbours who ran a toy and model shop and produced several items for exhibitions and publicity purposes. One of these was a roadway to display Dinky Toys, mounted in the middle of a Hornby-Dublo exhibition layout. This consisted of a baseboard about 5ft. long with a motor and gearbox, which I think may have been from a motorcycle, mounted underneath at one end, driving a bicycle chainwheel. Several bicycle chains were joined together and passed round this wheel and another chainwheel at the other end. A narrow slot was cut in the baseboard above the chain and pins pushed through this slot and fixed in the chain at about 6in. intervals, so that they projected above the baseboard. The ends of the roadway, where the chain passed round the chainwheels, were covered over and scenic items added to create the impression of a dual carriageway. Dinky Toys could be dropped over the pins and driven along to create the impression of a busy road. Figure 2 shows the general arrangement. All of this was done with the blessing of Meccano Ltd., though I can never remember my father making much money out of it, if any.

At the time, Meccano were facing competition, both for model railways and construction sets, from Trix, and the Trix Company approached the model shop for a publicity photograph of a finished model built from Trix construction sets. The most elaborate model in the manual was chosen, a grandfather clock, and my father was supplied with all the parts necessary to build it. When complete, it was about 6ft. high, and self-winding. It was weight driven, the 'weight' consisting of a cage suspended on a chain that drove the clock mechanism. This cage contained a battery-driven electric motor, driving a gear train and sprocket, which engaged a second chain. When the cage

Figure 1

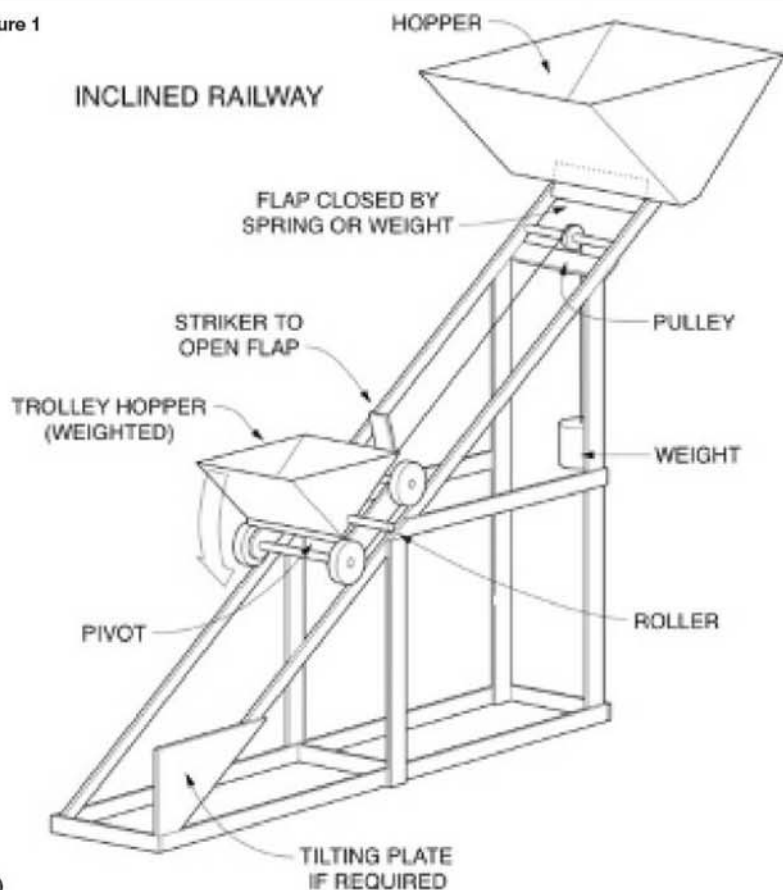
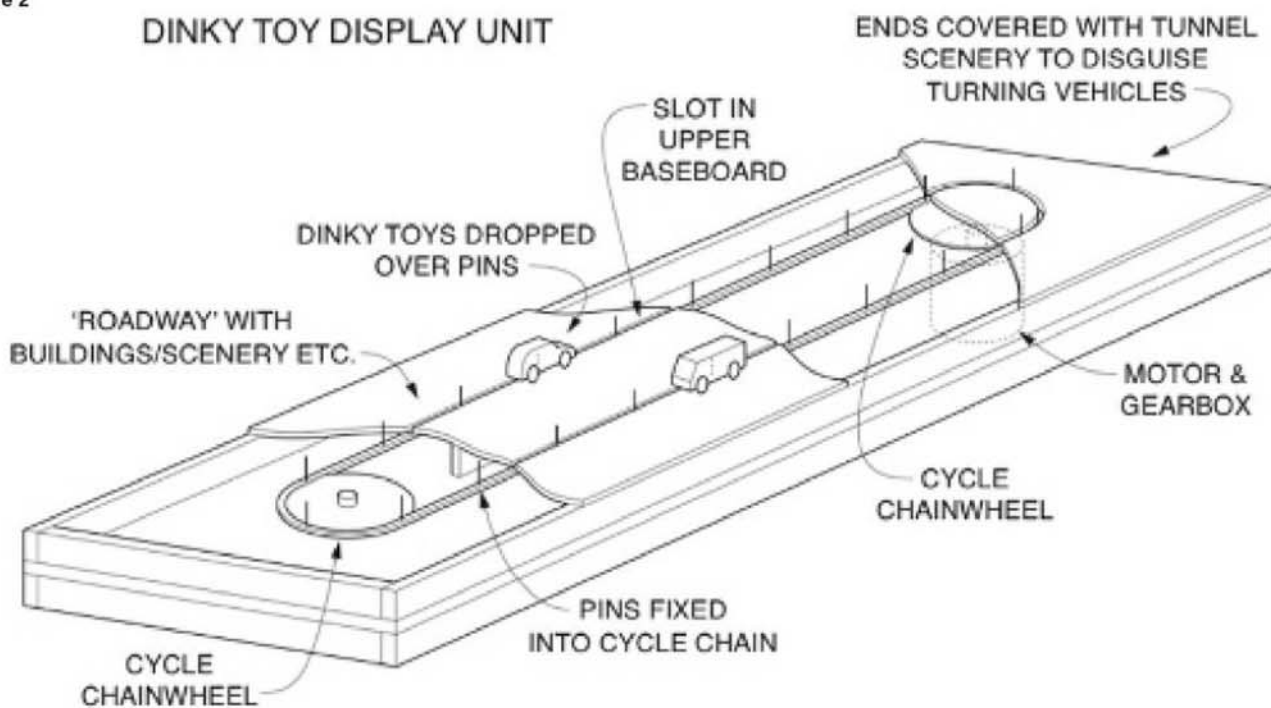


Figure 2



reached the bottom of the case, a switch was closed which started the motor, driving the cage back to the top, where the motor was switched off. I can remember the clock face, made from Perspex with the numerals engraved and filled with red wax or something similar, and the hands made from spanners. For this my father received

the princely sum of £5, which I suppose in those days was not to be sneezed at.

All of these projects gave my father and ourselves a great deal of pleasure, and stimulated in us an interest in finding out 'how things worked'. I count myself lucky to have been brought up in those times; many youngsters

today, although they seem to get almost anything they want, do not seem to have their innate curiosity aroused, and thought processes stimulated, in the same way. Perhaps, although I am not too sure, this is an inevitable result of our decline as a manufacturing nation, but whatever the cause, it is to be regretted. 

IN THE NEXT ISSUE

- NEW SERIES - RATCHET DRILL
- RADIAL AERO ENGINE
- BOXFORD LATHES
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- ROAD STEAM RALLIES 2006
- ONCE I BUILT A RAILROAD
- OHV STEAM ENGINES

Plus all your usual favourites

ON SALE 8 DECEMBER 2006

contents subject to change

Tony Mackay
describes construction of a South
African 19D, across continents.

The South African 19D class was, in my view, a handsome and a well-designed locomotive. These 4-8-2s were prolific in number and served most parts of the SAR network at some time or other. The 19Ds were built by various European and British manufacturers from 1937 onwards, the final batch of 50 (Nos. 3321-70) seeing construction in 1948 at North British's Hyde Park works, Glasgow. These 50 locomotives were equipped with very long Vanderbilt cylindrical tenders, running on a pair of six wheel 'buckeye' bogies, and were, because of their high water capacity, suited to serving the more arid regions, such as between Klipplaat and Oudtshoorn, where a number of them worked for more than 30 years. Locomotive No.3324 which is the subject of my 5in. gauge live steam model was relegated to the scrap dump some years ago, and sometime afterwards I was fortunate enough to be able to purchase one of her cabside number plates, which now adorns my study wall. However, not long after receiving this plate, I did read somewhere that 3324 had been retrieved from the dump and earmarked for preservation. I am unsure of her final fate.

When these 3ft. 6in. Cape gauge engines are scaled to 5in. gauge, they make for a large model, in fact engine and tender measure around 10ft. 5in. over couplers. It is difficult to say with any degree of accuracy how many hours have gone into its construction, but would estimate around 4,000 hours, over a stop start 20 year period. I did for a number of years manage to keep a meticulous log of time spent on each part but this proved to be tedious and fell by the wayside. The time includes the scaling of drawings and the manufacture of the wooden foundry patterns



South African Class 19D 4-8-2s make an impressive and large model in 5in. gauge with a length in excess of 10ft, and taking around 4,000 hours to complete.

WELL TRAVELLED BUT SELDOM STEAMED!

required for the various castings.

Work started on the project shortly before emigrating to South Africa in the late 1970s. I realised that I did not possess the necessary workshop equipment to deal with the locomotive bar frames, but could probably cope with everything else, by joining evening classes at a nearby grammar school.

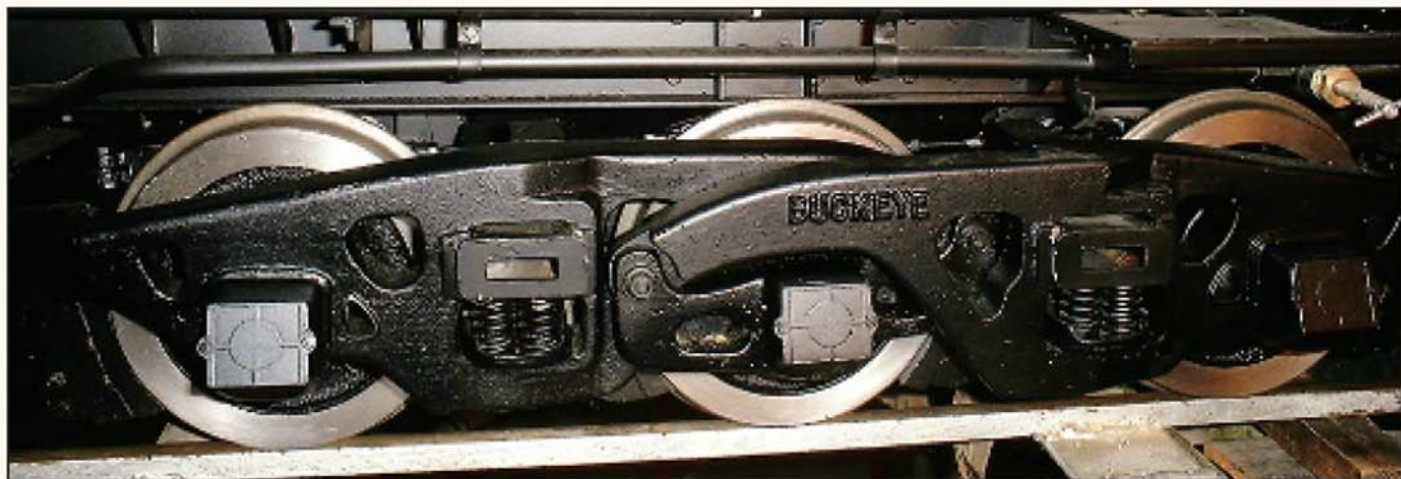
I was able to have the use of a suitably large milling machine. The two frames, each 1/2in. thick, were fastened together and through a combination of drilling, sawing and milling were brought to their elaborate shape. Due to their length, the frames overhung the milling machine quite considerably at times and it was not unknown to receive the occasional quip from the comedian on the adjacent machine "aren't you satisfied with your own machine or are you trying to take over mine as well."

During our five year stay in Johannesburg work on the model continued with enthusiasm, although living in rented houses over this period, my workshop was always makeshift, a bench-top (an old door) propped up on wooden packing cases, located in a hot uninsulated garage. My business life required me to visit Pretoria for a day every couple of weeks or so, and I very swiftly discovered that my working day could be made a whole lot more enjoyable by taking a slightly extended lunchtime visiting Pretoria's Capital Park steam shed to photograph the many different classes of visiting steam locos or examining 19Ds at close quarters, which helped enormously to interpret some of the more complex drawings. It was also on one of these visits I was able to purchase the remainder of the full complement of drawings from the Railway Authorities. My enthusiasm was further buoyed one weekend by being able to spend the best part of a day on the foot-plate of a 19D, although I'm not sure that my wife Christine and two kids were that thrilled passing the equivalent time sat in the caboose at the rear of the train, lurching about on a not too well maintained branch line.

On return to our home near Wakefield in Yorkshire, progress continued once more with



The 19D was started by the author in England, continued in South Africa, returned to Yorkshire, before settling in New Zealand.



Tender Buckeye components were mostly cast in aluminium. Cylinder blocks were fabricated.

one or two interruptions, when finally towards the end of 1997, both engine and tender were about complete, but unpainted.

I had previously run the chassis a number of times on compressed air and was more than pleased by its performance, but it was now time for steaming, and a test run on a short stretch of track in the garden, which highlighted a few small problems, soon to be corrected. Both engine and tender were stripped down for painting, which proved to be a far bigger task than anticipated. The engine was steamed again after re-assembly to ensure that everything had been put back correctly.

The model features working vacuum brakes, steam reversing mechanism, electric headlight, fully equalised suspension. The cylinder blocks are fabricated instead of cast to cut down on weight,

while the tender buckeye bogie components are mostly cast in aluminium. The knuckle couplers are machined from solid.

To prevent corrosion, the tender water is contained in a fabricated plastic tank within the cylinder. The engine is heavy, so it was necessary to fabricate a lifting platform that was both easy and quick to dismantle, and was based on a design featured in *Model Engineer*.

Further steaming operations were curtailed, as it was now time to set to work making two large wooden crates, each with its own length of track and holding down brackets to accommodate engine and tender, enabling them to be loaded along with our furniture and house hold goods into a shipping container to reach us here at our new home in Auckland, New Zealand.

I must confess that I have not joined a model engineering club here as yet, but have enjoyed visiting many of the societies in the North Island, where I have been impressed by the high standard of model engineering and the imaginative and extensive track layouts. It surely must be an indicator that the hobby is in quite good health, when a quick tally reveals there are around 20 club tracks within a country with a population of little more than three and a half million.

Like most model engineers, I have no formal training in metalwork, but gained most of the necessary skills during the construction of my first locomotive, a 3 1/2 in. gauge LMS Class 5 LBSC design. I still have this engine, and like its big brother is well travelled, but seldom steamed. 

LETTERS TO A GRANDSON

M. J. H. Ellis

on how the metre was evaluated in wavelength terms.

● Number 95

Dear Adrian, After so much preparation, we have at last come to the procedure by which the length of the International Prototype Metre was evaluated in wavelength terms; actually, in terms of the wavelength of the red cadmium radiation. I shall divide the subject into three sections, and for the sake of brevity it will be in the form of notes, rather than that of a narrative.

1). The Determination of the Number of Wavelengths between the Planes of the Two Plates of the Shortest *Étalon*. (fig A)

1.1. The distance is comparatively small, approximately 0.39 millimetre.

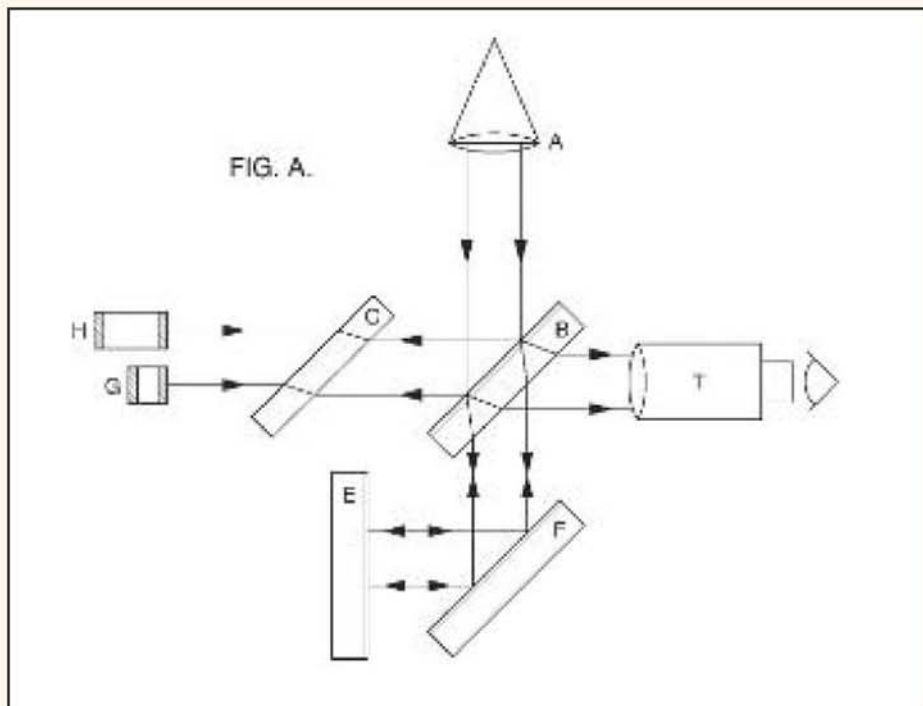
1.2. Shortest *étalon* is arranged side-by-side with the next longer one H.

These take the place of mirror D in my last letter. Lower plates aligned.

1.3. *Étalon* G skewed slightly to produce vertical fringes in conjunction with mirror E. (Explained in my last letter).

1.4. *Étalon* H adjusted to be parallel with E, thus leading to production of circular fringes on lower plate. (Explained in last letter).

1.5. The face of mirror E is engraved with a graticule of equidistant vertical and horizontal lines.



1.6. E now adjusted by micrometer screw in white light until vertical fringes appear on lower face of G.

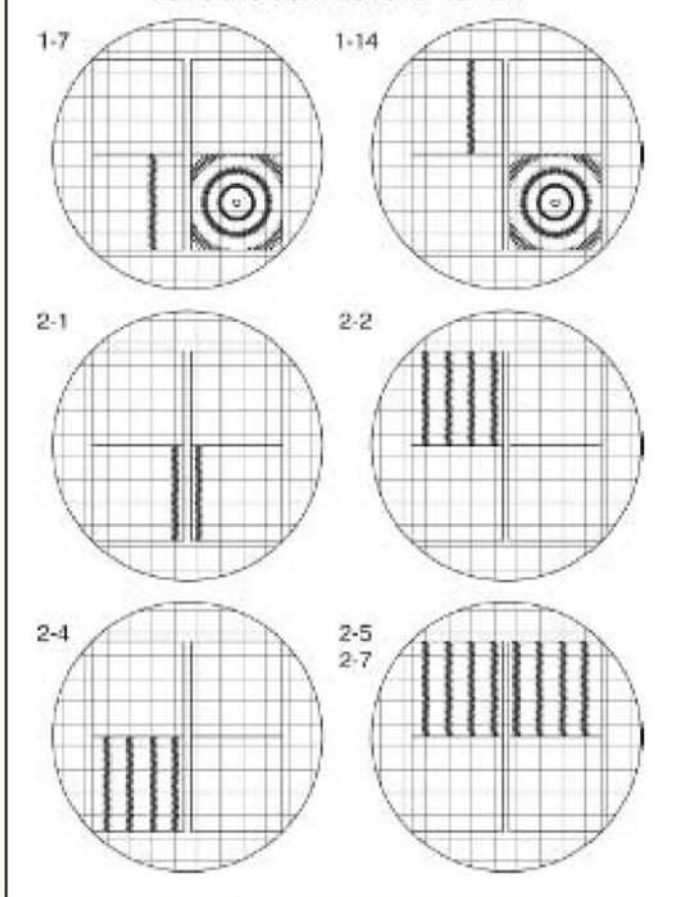
1.7. Central (most prominent) black band brought with micrometer screw into coincidence

with one of the vertical lines of graticule (fig 1 - 7).

1.8. Change to monochromatic Cadmium red light.

1.9. Adjust *étalon* H to produce dark spot at

FIGS. 1-7 TO 2-7
NUMBERS CORRESPOND TO TEXT



centre of circular fringe system.

1.10. Move E slowly backwards with micrometer screw. On H fringes emerge from centre and expand outwards.

1.11 These fringes are carefully counted.

1.12. (White light). E and upper plate of G approach coincidence. (Coincidence being as if between E and a fictional G, - see last letter).

1.13. (Still in white light) vertical fringes now seen to move sideways across upper plate of G.

1.14. Black central fringe brought to coincide with same vertical line of graticule on E as in 1.7. Count of (red) circular fringes maintained.

1.15. The foregoing apparently required continual alternation between white and red light. No provision for both red and white light at the same time.

1.16. The tally of circular fringes now gives number of wavelengths between two plates of G.

1.17. For greatest possible accuracy fraction of a circular ring estimated by slight swivelling of plate C. (This alters length of path in glass, where wavelength is shorter than in air).

2). Determination of Exact Ratio Between Lengths of Consecutive Étalons.

2.1. The two étalons arranged side-by-side (fig 2-1), slightly inclined to E, with a prominent black fringe in white light on both lower plates.

2.2. E is moved backwards by micrometer screw until black fringe appears in same position as it was in 2.1, but now on G's upper plate.

2.3. E has now moved the exact distance between the planes of G's two plates.

2.4. G is now moved backwards until the central black band again appears in the same position as in 2.1. (On lower plate of G).

2.5. E is now moved backwards again, to bring central black fringe to the same position again, but in upper plate of G.

2.6. E has now moved backwards twice the distance between plates of G. Let this = d.

2.7. If the distance between the plates of H had been exactly 2d, black fringes would have overlapped as in fig 2-7.

2.8. But in practice this will not be so, but the black band will be displaced by two or three fringes from the correct position.

2.9. The discrepancy is estimated from the number of fringes produced in monochromatic light. Sodium yellow light was actually used.

2.10. This process was repeated in succession until the longest (100mm) étalon was dealt with.

3). Determination of Length of Metre in Terms of Wavelength.

3.1. The longest (100mm) étalon was provided with a short arm projecting sideways, on the end of which was engraved a line parallel to the faces of the mirrors.

3.2. The étalon was secured, to the carriage of the interferometer alongside a brass metre sub-standard, engraved with two lines, nominally one metre apart. The étalon could be moved along the instrument, maintaining the same distance away from the brass bar.

3.3. Two microscopes were set up, one over each of the index-lines on the bar. The distance was measured by means of the appropriate microscope, between the index line on one end of the bar and the line on the arm of the étalon. (Evidently, the arm overhung the bar, and initially the index-line at the end of the bar and the one on the arm were not far apart).

3.4. The étalon was then moved along the bed of the instrument by its own length (between the two mirrors) using the same interferometric means as before.

3.5. This process could then be repeated, without any further reference to lines on the bar until the length of the étalon had been measured out ten times over.

3.6. Now, using the other microscope, the distance between the line on the echelon-arm and the other end line on the bar could be ascertained.

3.7. In this way, the distance between the lines on the bar was determined as $10 \times \text{length of '100mm' étalon} + 27.56\pi$ (average of three measurements)

3.8. Finally, by purely mechanical means (e.g., using a comparator), the error in the length of the bar with respect to the International Prototype Metre could be found, and the figure of 27.56π adjusted accordingly.

3.9. The length of the International Prototype in

terms of the Cadmium Red wavelength could now be arrived at by simple calculation.

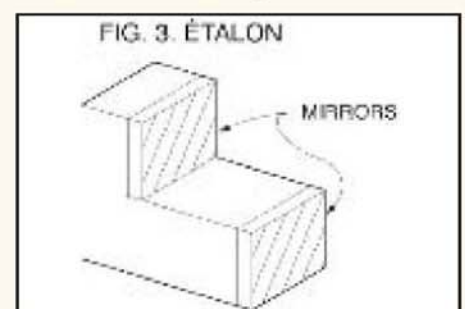
Comment on the foregoing

I realise that I have fallen into error. Let me warn you against doing the same. The object was not to up-date the length of the standard metre, for the International Prototype Metre remained inviolate. Nor was it to arrive at a value for the wavelength of the Cadmium red radiation, although that was obtained as a by-product. All that was required was a *pure number*; the number of wavelengths which went to make a metre, and which would enable it to be replaced precisely if ever the International Prototype standard bar were destroyed or lost.

I have done all I could to make this rather esoteric subject understandable, and I encountered a number of knotty points which I had to ponder over before I could unravel what the author was driving at. In particular, I was long perplexed by the diagrams from which my figs 1-7 and 1-14 were taken. I could not make sense of them, as they seemed to be inconsistent with the text and the other illustrations. At last it dawned on me that they must somehow have been transformed into the mirror images of what they were meant to be. I can only suppose that at some stage in the processing of the original drawings they were in the form of transparencies which were inadvertently reproduced back to front, and that the mistake was not spotted in the proof-reading. Even that was made all the more difficult by the fact that the numerals which formed part of the illustrations were not Arabic, but Roman, and therefore looked the same either way.

I have corrected these presumed errors in the diagrams which I have sent you, in the belief that all is now in order. So I don't expect you to find anything wrong; but if you do, please tell me. We can all make mistakes. I think that it says something about a person's character if they admit a mistake readily, or even relate it as a humorous anecdote. Travelling on the train, one day, I got into conversation with a young soldier, who observed that like himself, I was wearing a Green Signals beret, "We are told never to admit a mistake" he said, "it is a sign of weakness of character". I did not agree with him, remembering a much older and wiser man than he, who observed "There are people who think that readiness to admit a mistake indicates weakness of character. I don't think so. On the contrary, I think that it requires real strength of character". I might add, that if you try to excuse yourself with a lie in which you are caught out, it will do you much more harm than admitting the mistake in the first place. Ask your dad if he agrees.

Your affectionate Grandpa.



Keith Wilson

discusses Kings, *Lillian's* overhang and different types of valve gear before visiting an old acquaintance.

●Part XXVII continued from page 521 (M.E. 4285, 27 October 2006)

I am glad to learn that my first model engineering club is still going strong and improving its headquarters; I refer to the Harlington Locomotive Society, not far from Heathrow. If my memory is correct, it was founded in 1947, and has prospered well ever since. It did some early experimenting with water troughs, and got quite well known as specialising in steam locomotives of 3½in. and 5in. gauges.

They accepted me as a member about 1954; I hope they have not regretted it too much! It was whilst I was a member that I built one of the first 5in. gauge Kings, I reckon I got several hundred miles out of that locomotive including two five-mile nonstop runs.

It was there on its first day operating that I first learnt that there were no full-size Kings built exactly as the Swindon drawings shewed: the very first bogie that was built was different from the drawings in that it was built with increased vertical movement. The drawings were not altered to show this, so there are quite a few King miniatures 'built from Swindon drawings' that are technically wrong. The horns on the bogie were made deeper than shewn, and of slightly different design. On my first run, no way (except too fast!) would she (he?) go round the top curve into the station.

I discovered that due to the long wheelbase compared to the other locomotives some minor 'twist' in the track caused the front left bogie wheel to lift completely clear of the track. I found that removing the horn keeps on the front wheels cured the problem. So I made and fitted keeps more like the letter 'omega' and also milled a slot

Wilson's Words of Wisdom:

*Either we are alone (in the universe)
or we are not, either way is
mind-boggling.*

across the bottom of each of the axleboxes. I must emphasise that this was on the original track; the present one is greatly improved.

I recall one amusing (afterwards) occurrence when driving the King one open day. I found it often easier to sit sidesaddle for driving, for it was quite a reach forwards into the cab whilst waiting at the station, one of the station staff accidentally stepped backwards onto my foot; it was extremely painful for I was wearing sandals. I let out a scream of pain, and (perhaps naturally) screamed: "Get off me (pause while I thought very fast!) engine driver's toe!". I learnt that most if not all club members present had visibly cringed as I got to the pause, and gave sighs of relief at what I actually said - as distinct from what they feared. Understandably!

A few issues ago I mentioned the Fink valve gear, and I am glad to pass on some details kindly provided by D.A.G. Brown. Incidentally, it was not Hermann Finke that wrote the 'glow-worm idyll' but Paul Linke. A very easy mistake to make, but as so often happens (curses!) I only noticed the error after forwarding all copy and accepting the proofs. Allo! What a mistake-a to make-a!

Anyway, herewith pictures from D.A.G. illustrating the gear. Unfortunately, it is in the ideal form for understanding how it works but a form that some computers do not like; it is an 'exe' file and loads and runs perfectly well in

Windows XP at least, but does not seem to be happy with Applemacs. So to try and explain I

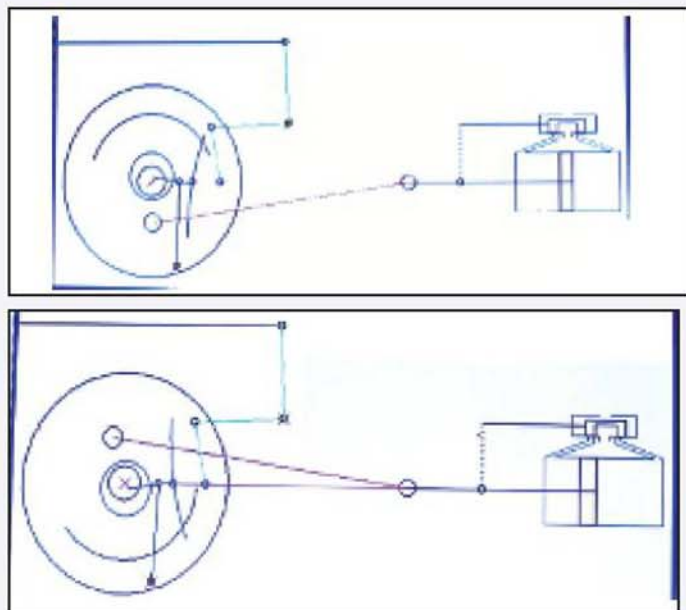
LILLIAN A NARROW GAUGE LOCOMOTIVE for 7¼in. gauge

took 2 pix of the screen, stopping the motion at two points for safety. The lines in dark green are the reversing control, the pivot point with the cross is the weighshaft, and the long dark red line with circles on each end is the connecting rod; the big complete circle is the wheel, and at the centre is an eccentric which rocks the expansion link, which is the sector of large radius. This is pivoted by the top of the straight link just behind it. The radius rod is shown on the centre line (gear shown in mid-gear) and has a rigid drive to the valve. Piston and valve are to the right.

I am aware that this description is sketchy, but if any curious person sends me an e-mail I will be happy to forward a copy of the working layout. keithgwrloco@blueyonder.co.uk will find me, but due to the problem with some computers I cannot promise success.

I mentioned recently that *Anna's* tender could be used for *Lillian*; D.A.G. Brown (the designer) tells me that he is making *Anna's* tender available in 'flat-pack' form. Best of luck, why not make things easier for builders?

Oddly enough, the large 'overhang' behind the rearmost driving wheels of *Lillian* does not seem to make any difference to the stability despite appearances. I recently witnessed Larry Barker's tender, it had a wheelbase just like the engine, albeit 'back to front'. This immediately looks like 'forward tilt' because of the driver's weight, but it doesn't. Coupled to the engine, it goes just right. There might just be trouble on severe reverse curves, but it performs well on the WDMES track at Baggeridge Country Park, just south of Wolverhampton. The main weight of the driver is just about vertically over the front tender wheels, and up to about 14 gallons of water (140lb) nearer the back helps too. At a rough guess, the tender would be about 350lb plus driver. Incidentally, the long overhang at the front enables a big foot-well, more comfortable for the driver.



A view of the full size Tornado's boiler. The visitors give a good idea of the size of the thing.



Another view of the full size boiler. Seen below are some of the other parts made for the Tornado project.



The full size connecting and coupling rods - and you thought your 7 1/4in. gauge locomotive parts gave you problems.



Two nicely machined and polished return cranks carefully laid out for inspection.



The crank pin on the drive centre shown together with some detail of the wheel casting.

Just had an e-mail from a friend building a King. He was worried about the fact that in mid-gear, steam was still fed into the cylinders. He had run the gear through a computer program which showed this apparent fault.

This is a characteristic of Walschaerts-type gears (Baker gear is one) and they all have constant lead. It therefore follows that since the lead is constant, it must open at the same point in each revolution of the wheels, therefore even in mid-gear some port opening is present. Some good folk used to advise against this on the grounds that 'kick-back' might occur. Rather impossible, because the cylinder concerned would be on or very near dead centre, whereas the other side would be about 90deg. round its travel and therefore in the strongest possible position.

Valve gears with non-constant lead (Stephenson's, Allen's, Gooch's etc) should not admit steam in mid-gear, for the advance of the valve openings would give very big opening on dead centre when the valve gear is notched up. If too much this can be a problem, so the lead in full gear is negative leading to a fair amount when notched up. In other words, on dead centre in full gear, the valve is closed, opening shortly afterwards. This, according to some authorities makes the engine better at 'slogging' at fairly low speeds, thus for passenger stopping trains, Stephenson's was best. If going for fast trains, then Walschaerts was best; at least with Swindon settings. I have read somewhere that the 'change-over' point was about 48 miles per hour. Also, due to the advance characteristics, the exhaust point was affected, so you couldn't notch up with effect beyond about the 20-22% point, whereas

Walschaerts could be run at up to 12% cut-off without the choking effect of late exhaust.

It is just about impossible nowadays to get pictures of a full-size locomotive under construction, but there is a main-line locomotive being built 'from scratch' and I took the opportunity of popping off a few shots.

The locomotive is a Pacific of Gresley design, not GWR but you can't have everything. A large amount of work has been done, and I thought a few pix of the boiler would be of unusual interest. I understand that it was made in Germany, and recently delivered in Darlington. I think the photos speak for themselves.

Note that some firetubes are placed between superheater tubes, it would be near impossible

for us, because no way can we scale the boiler exactly. Flue tubes should not be of 'scale sizes', for no way can ashes and grit be scaled. There is a simple formula for getting ideal tube sizes based on the length thereof:

$$d = \text{sq.root}(L/65) \text{ is recommended.}$$

d = internal diameter, L = length.

To get to a standard size of tube the 65 part can be anywhere between 60 and 70. It has a steel rather than copper firebox; the pix show the inside as well as the outside.

The three pistons are standing on end, almost certainly machined as solid with the rods, crossheads resting on the tops. The apparent blackness of some bits is a trick of the lighting. Note the fixing of crossheads to piston rods. A bit difficult for us, unless someone has an idea for cutting a suitable slot. Without going into calculations, they would probably need a slot-drill some 1/32in. diameter and something like 1in. long - all cutting length. Any questions?

I must confess that I managed it on the two 47xx in 10 1/4in. gauge using LBSC's little Wolff-Jahn milling machine. If a crosshead pin comes out, (rare) you might be able to bid farewell to the front cylinder cover. The strange thing here is that if you actually want to get the pin out, you'll have quite a job!

A point to note is that if you decide to use two or three taper pins (the round variety) do one first, ream it taper and put in a pin. Then do the next one and repeat for the third one if you want three. The reason for this is, if you do it this way, the holes are more likely to match up perfectly;



The smokebox end of the boiler - difficult to scale accurately in our gauges.



The pistons and rods for the Tornado Project. Looks as if they were turned from the solid.

whereas doing all three at once pretty certainly means that only one pin will take the load. Somewhat counterproductive!

Under the boiler is a stack of connecting and coupling rods, note nice bronze bushes. A pair of return cranks can be seen, note the fact that they can be most rigidly fixed on the drive centre crank pins. I am trying to work out a jig system to pre-set these crank pins in our sizes, the calculations are quite simple. The frames were laser-cut. A friendly firm had installed a nice new high capacity laser machine, and to test it they cut out the frames at minimal cost.

It is an unfortunate case that the group making the engine applied for a grant (about £30,000 from a big fund and it was refused; whereas the same fund gave about £2,000,000 to place some bricks in a pile to look like an A4 pacific emerging from a tunnel. Such is the spirit of adventure.

Blast from the past

Visiting a locomotive repair shop recently I was intrigued to learn that one of my past-made locomotives had been sent back to this country for overhaul after some 25 years of hard work, including some very long runs.



The chassis of the 7 1/2 in. gauge King stripped and undergoing overhaul after twenty-five years or so of hard work

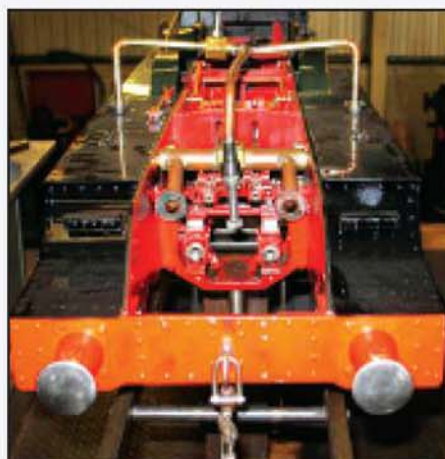
It has been run on Train Mountain track, where as I recall there are 4 main circuits, taking respectively half an hour, 1 hour, 2 hours, and 3 or more hours to complete. There cannot be many miniature railways where you can be completely out of sight of your starting point due to sheer distance. The gauge is 7 1/2 in., so it is somewhat limited as far as the rest of the world is concerned. I remember the fun I had converting this locomotive from its original 7 1/4 in. gauge, inwardly debating whether it was better to push out the frames by 1/8 in. each side or keep the frames as they were and put 1/8 in. spacers behind each wheel. It was found easier to take the latter course and tender wheels plus front bogie wheels (twas a King) left very little clearance betwixt

them and the frames. Another fault came to light later. I had been particularly asked to use 'scale' wheel widths instead of 'standard' ones; this making the tyres 11/16 in. wide instead of 13/16 in., and I agreed. This would not normally matter, but then (in 1979) we took him (not 'her' for Kings) to the Goleta Valley railway about 90 miles west of Los Angeles, and as its name implies, it is on a mountain.

The line was double track, winding its way up the side thereof to a loop around the house on the top and back down. There were two big 'trestle' viaducts en route, and the builder had widened the gauge on them to allow for the radius of curvature. Unfortunately for us, this widening was just too much for the King and it frequently dropped through! With standard wheels it would not have mattered, but so much for scale sizes.

This locomotive is (technically) one of the only two miniature locomotives to have pulled a Royal train, as far as I know. The other one was a nice narrow-gauge locomotive at Echills Wood in 1984 when Princess Anne had a ride. In the case of my King it was in Los Angeles in 1980 or '81, it took the British Ambassador round the railway; later I understand that his son(s) had a drive. At that time, I noted that the main line was about 2 miles long, I believe it is now more like 3 miles - quite a run. It was in the form of two circuits - one inside the other - with a crossing. This of course needs very stringent signaling rules, in fact if a train does a 'SPAD' then a big exploding rocket is fired off and not only has the offender to 'face the music' of shame but has to pay for a new rocket. It works!

●To be continued.



A view of the model King chassis assembly looking from the front end.



A view of the boiler of the model King. The locomotive has seen service on the Train Mountain track in the USA.



The other end of the boiler showing the neat backhead.



The newsletter of the Southern Federation contains a note regarding forged boiler certificates. This was one of the old-style certificates and had entries made after 1 January 2006. It was also apparent that some of the earlier entries on the certificate were also doubtful. If you come across any suspicious boiler certificates, I am sure that any of the federations would be pleased to hear from you.

The newsletter also carries a reminder of the size limitations covered by the federation insurance policy. The limits are, locomotives up to 15in. gauge, and for road vehicles and boats, up to 1:2 (6in.) scale. These limits apply even if the boiler bar-litre capacity falls inside the relevant boundary. This means that small steam boats for carrying passengers are not covered and those testing such boilers will not be covered for any liability arising from the tests.

UK News

The junior member driver training day at Bradford MES was very busy with 15 junior drivers getting to know the variety of steam and battery electric locomotives on offer. Four of the junior members also join in on the Wednesday working days on a regular basis.

The newsletter for Canterbury DMES has undergone a redesign

and is now a very impressive A5 colour publication. I look forward to receiving

regular copies in the future and congratulate Editor Barry Loraine on his efforts. The redesign was prompted in part by the new Royal Mail pricing rules which mean that it is cheaper to send A5 size documents than A4. The club hosted the two main public events of the year recently, the first being the open day which was followed by the traction engine rally.

East Somerset SMEE has made excellent progress in the 20 months since work on the new track was started and is now up to if not ahead of the schedule set originally. So far the grand total of passengers hauled in 2006 has reached 8,441. Membership is also growing with six new members joining since June. The society exhibited at the Bristol Exhibition this year.

The new riding trolleys at High Wycombe MEC have had a successful test and were used for public running in July. The trolleys incorporate over-run brakes which have proved successful apart from some fine-tuning to make the application and release as smooth as possible. Brian Turnbull masterminded the project and the work was carried out by members with some parts purchased. An interesting point was that the price for a professionally square tube welded chassis was only about 20% more than buying the small quantities of material from the local DIY store.



One of the new track pedestals being installed at the Steam Locomotive Society of Victoria track site.

Members of the Melton Mowbray DMES were entertained by a talk on professional steel boiler making by Terry Statherns. The talk covered the range from miniature to full-size boilers and members were impressed by Terry's technical knowledge and craftsmanship. The society is celebrating a successful 21st Whissendene Rally again this year. The weather was kind and the event had a "record turnout of models and visitors". The summer evening steam-up in August was also host to a large number of members and guests with 10 steam and two electric locomotives on the track. The locomotives were complemented by two traction engines in the field.

A contingent from Northampton SME braved the motorway network to attend IMLEC this year to support member Bernard Clark who entered for the third time. Members had another outing in the summer, this time to John Robert's ground level track. This is situated in a large garden on the side of a hill and takes the form of a figure of eight. A feature of this line is the severe gradients including a 1 in 60 climb on the curve out of the station. The only part of the track that is level is the station area and drivers have to concentrate, not only on the uphill stretches but also when running down the equally steep downhill runs.

Members of the National 2 1/2" Gauge Association have attended many rallies this year. The well attended South East Area summer rally was held at the Staines SME. Tony Weale was driving *Ayesha II* which was running well this time. Des Adeley ran John Cook's *Uranus* and after being held up by other locomotives, got in several trouble free laps. The Northern Area summer rally was held at the Nantwich track of the South Cheshire MES and had a rather limited entry because several regulars could not attend. A group of members ventured to the Antwerp club for a weekend in

April and report a very enjoyable trip. A major item of news in *Steam Chest* is the announcement of a new locomotive design for 2 1/2in. gauge by Martin Barker. This is the well-known Horwich Crab and is based on the original *Dyak* design. It is hoped that drawings and castings will be available by Christmas and the new locomotive will be the focus of the society stand at the Model Engineer Exhibition. Doug Randle describes his method of soft-soldering small items using a single ring hot plate. This has the advantage of keeping both hands free for holding parts and applying solder. The hot plate Doug uses is the Micromark MM9861 solid hot plate and is 7 1/2in. diameter.

Some of you reading this column will have visited the open weekend at Reading SME in August and will know that it was a very successful event in spite of the rain over that particular weekend. Several locomotives ran on the track including John Tierney's vintage Stirling Single which he describes as a "do nothing engine" because of the minimal effort needed to drive it. There was a model display set up and several regulars from the now defunct Knowle Hill Rally brought models, including Phil Abbot and his collection of high-speed flash steam boats. Reading member Robert Manley had his part finished *Nemett NE155* I/C engine on display. This is the water-cooled version and is progressing well. The '0' gauge group are busy with the remaining carpentry work for the new layout which is based on a Scottish branch line. Good news from the club is that it has now got about eight junior members who it is hoped will be involved in the new small '00' gauge layout.

Work continues at the Saffron Walden DSME with the container entrance now concreted and work started on an upgrade of the access between the steaming bays and ground level track. The new power supply to the club hut has



Peter Chappell driving Peter de Salis-Johnston's *Fayette* at the National 2 1/2in. Gauge Association Northern Area Rally at Nantwich. Photo by Peter de Salis-Johnston.

been connected and tested and passed okay.

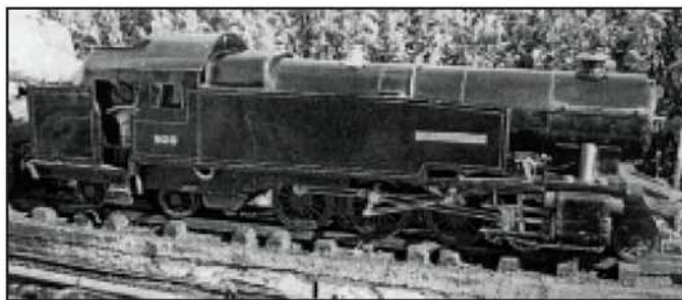
Peter Brewster of the St. Albans DMES has acquired an interesting freelance 4-6-4 tank locomotive which is named *William Thrale* after its first owner. William Thrale once owned a bakery and two teashops in St. Albans and Peter is keen to find out more about the locomotive's history. If any readers can provide further information, we will gladly pass it on.

World News

Australia

Work has started at the Steam Locomotive Society of Victoria on the replacement of the track support pedestals. The work is necessary to counter some subsidence which has occurred.

Under the heading "Zen for Model Engineers", the newsletter contains the following words of wisdom: "Do not walk behind me, for I may not lead. Do not walk ahead of me, for I may not follow."



The interesting freelance 4-6-4 tank engine William Thrale owned by Peter Brewster from the St. Albans DMES.

Do not walk beside me either. Just pretty much leave me alone." and "If you lend someone \$20 and never see that person again it was probably worth it." There are others which I will include in the future.

Canada

The annual Train Fest at British Columbia SME was a great success with plenty of visiting locomotives and lots of passengers for them to haul. More than 1,400 passengers were hauled on each day

and the Saturday evening dinner was also well attended. The Tuesday evening working group has completed the new east interchange crossover. This needed three diamond crossings and two switches (points).

New Zealand

Members of Hutt Valley MES are obviously a brave lot because they held a meeting where they recounted tales of misfortune in their workshop engineering activities. I will not name the names but the disasters included two tales of unintentional left-hand threads due to deciding to cut away from a shoulder, one case of a boat builder forgetting to allow for framing when making a water tank for his boat, making a funnel for a tug which was too heavy and tended to capsize the boat and a couple of tales of metric conversions going wrong. All those tempted to snigger should probably examine their own workshop history!

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.

Bob Dimmock
Dave Moore
Ron Pocknell
John Pool
Peter Stroud

High Wycombe MEC
Canvey Railway and MEC
Crawley Model Engineers
North Norfolk MEC
National 2 1/2" Gauge Association

CLUB DIARY

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.

November

- 24 Malden DSME. Rummage Sale. Contact John Mottram: 01483-473786.
- 25 Chesterfield MES. Public Running Day. Contact Mike Rhodes: 01623-648676.
- 25 Oxford (City of) SME. AGM. Contact Chris Kelland: 01235-770836.
- 25/26 South Lakeland MES. Ulverston Dickensian Festival (Portable Track).
Contact Adrian Dixon: 01229-869915.
- 26 MELSA. Sunday in the Park. Contact Graham Chadbone: 07-4121-4341.
- 26 Westland & Yeovil DMES. Track Running Day.
Contact Gerald Martyn: 01935-434126.
- 27 Bedford MES. Tool and wear care. Contact Ted Jolliffe: 01234-327791.
- 27 Canterbury DMES (UK). Bits & Pieces. Contact Mrs P. Barker: 01227-273357.
- 28 Chelmsford SME. Club Auction. Contact D. Blake: 01376-324205.
- 29 Chingford DMEC. Noel Shelley: The small scale Foundry.
Contact Ron Manning: 020-8360-6144.
- 30 Cardiff MES. Club Chat. Contact Don Norman: 01656-784530.

December

- 1 Canvey R&MEC. AGM. Contact Brian Baker: 01702-512752.
- 1 Maidstone MES (UK). Members' Old Slides Show.
Contact Martin Parham: 01622-630298.
- 1 North London SME. A Pre-Christmas Social Evening.
Contact David Harris: 01707-326518.
- 1 Portsmouth MES. Any Questions. Contact John Warren: 023-9259-5354.
- 1 Rochdale SMEE. Work in Progress. Contact Mike Foster: 01706-360849.
- 1 Romford MEC. Competition Night & Millennium & Rusty Titford Cup.
Contact Colin Hunt: 01708-709302.
- 2 Bradford MES. BMES Annual Competition & Display.
Contact John Mills: 01943-467844.
- 2 Canvey R&MEC. Members' Running Day. Contact Brian Baker: 01702-512752.
- 2 Ickenham DSME. Public Running. Contact David Sexton: 01895-630125.
- 2 New Jersey Live Steamers, Inc. Work Day.
Contact Karl Pickles: 718-494-7263.
- 2 SM&EE. Competition Day. Contact David Boote: 01202-745862.
- 2 Sunderland (City of) MES. Meeting.
Contact Albert Stephenson: 01429-299649.
- 2 York City & DSME. Paul Butler: Four Decades on NYMR.
Contact Pat Martindale: 01262-676291.
- 3 Basingstoke DMES. Public Running. Contact Guy Harding: 01256-844861.
- 3 Bristol SMEE. Santa Special. Contact Trevor Chambers: 0145-441-5085.
- 3 Cardiff MES. Santa Special Day. Contact Don Norman: 01656-784530.
- 3 Ellenroad Engine House. Christmas Fair. Enquiries: 01706-881952.
- 4 Peterborough SME. Bits & Pieces. Contact Ted Smith: 01775-640719.
- 5 Basingstoke DMES. Meeting. Contact Guy Harding: 01256-844861.
- 5 Stamford MES. Malcolm High: Laser Cutting & Model Engineering.
Contact Derek Brown: 01780-753162.
- 5 Taunton ME. Tim Taschmowitz. Boiler Making.
Contact Don Martin: 01460-63162.

- 6 Bristol SMEE. Ladies Night. Contact Trevor Chambers: 0145-441-5085.
- 6 Chingford DMEC. Bits & Pieces. Contact Ron Manning: 020-8360-6144.
- 6 Guildford MES. White Elephant Sale.
Contact Dave Longhurst: 01428-605424.
- 6 Leeds SMEE. Christmas Dinner. Contact Colin Abrey: 01132-649630.
- 6 Staines SME. General Chat. Contact Stan Bishop: 01784-241891.
- 7 Cardiff MES. Carl Pickstone. Contact Don Norman: 01656-784530.
- 7 Leyland SME. Project Night. Contact A. P. Bibby: 01254-812049.
- 7 Westland & Yeovil DMES. Video Evening.
Contact Gerald Martyn: 01935-434126.
- 9 Glasgow & S.W. Rly Ass'n. G&SWR Miscellany.
Contact Bruce Steven: 0141-810-3871.
- 9/10 Nottingham SMEE. Santa Specials. Contact Gerry Chester: 0115-9259096.
- 9 SM&EE. Seminar. Contact David Boote: 01202-745862.
- 10 Canvey R&MEC. Santa Specials. Contact Brian Baker: 01702-512752.
- 10 Chichester DSME. Santa Specials. Contact Brian Bird: 01243-536468.
- 10 Frimley & Ascot LC. Santa Run. Contact Bob Dowman: 01252-835042.
- 10 Harrow & Wembley SME. Santa Run.
Contact Roy Goddard: e-mail RSGwaford@aol.com
- 10 Malden DSME. Contact John Mottram: 01483-473786.
- 10 York City & DSME. Running Day. Contact Pat Martindale: 01262-676291.
- 11 Bedford MES. Quiz Night. Contact Ted Jolliffe: 01234-327791.
- 11 Melton Mowbray DMES. Richard Smith: Tales of a Permanent Way Inspector. Contact Phil Tansley: 0116-2673646.
- 12 Chelmsford SME. Monthly Social Evening. Contact D. Blake: 01376-324205.
- 12 Dockland & E. London MES. Christmas Get-Together.
Contact P. M. Jonas: 01708-228510.
- 13 Chingford DMEC. Tim's Ramblings. Contact Ron Manning: 020-8360-6144.
- 13 High Wycombe MEC. Dr. Peter Brandham: Steam on Indian Railways.
Contact Eric Stevens: 01494-438761.
- 13 St. Albans DMES. Club Night. Contact Roy Verden: 01923-220590.
- 14 Canterbury DMES (UK). Annual Society Dinner.
Contact Mrs P. Barker: 01227-273357.
- 14 Cardiff MES. Quiz Night. Contact Don Norman: 01656-784530.
- 14 Worthing DSME. Christmas Social. Contact Bob Phillips: 01903-243018.
- 14 Canvey R&MEC. Christmas Party. Contact Brian Baker: 01702-512752.
- 15 Rochdale SMEE. Meeting. Contact Mike Foster: 01706-360849.
- 15 Romford MEC. Bring & Buy Sale. Contact Colin Hunt: 01708-709302.
- 16 Guildford MES. Christmas American Supper.
Contact Dave Longhurst: 01428-605424.
- 16/17 Nottingham SMEE. Santa Specials. Contact Gerry Chester: 0115-9259096.
- 16 York City & DSME. AGM. Contact Pat Martindale: 01262-676291.
- 17 Canvey R&MEC. Santa Specials. Contact Brian Baker: 01702-512752.
- 17 Chichester DSME. Santa Specials. Contact Brian Bird: 01243-536468.
- 17 Harlington LS. Mince Pie Run. Contact Peter Tarrant: 01895-851168.
- 18 Model Steam Road Vehicle Soc. Christmas Bring & Eat Supper.
Contact Geoff Miles: 01869-247602.

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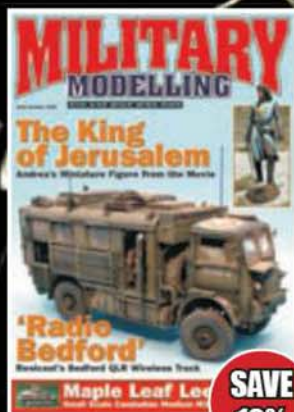
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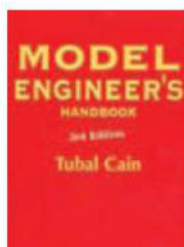
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Due to circumstances beyond our control The Model Engineer Exhibition, due in December 2006 at Olympia 2 is being rescheduled into the New Year, 2007.

Revised event details will be published shortly.

Please note competition entry forms may be carried forward, as well as tickets already purchased.

The organisers apologise for any inconvenience this change causes, and look forward to bringing you an outstanding event in 2007 - our 100th year!



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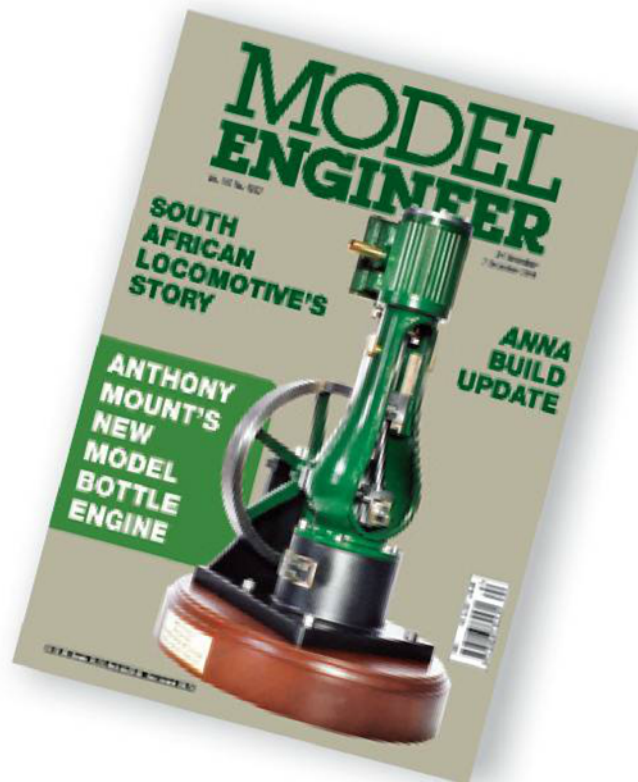
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