MODEL ENGINEER

Vol. 198 No. 4292

2-15 February 2007

MYFORD LATHES PROFILE

MIDLAND 3F LOCOMOTIVE BUILD

SIMPLIFY PLATE WORK

CAN $8.25 | AUS $8.60 | NZ $10.70

RETAILER DISPLAY UNTIL 15 FEBRUARY 2007

£2.50

ChronoS Engineering Supplies

Online Catalogue - www.chronos.ltd.uk

SEE US AT THE LONDON MODEL ENGINEERING SHOW - ALLY PALLY - JAN 19-21 2007

NEW PROFESSIONAL PARTING SYSTEM!!

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

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

CODE	PRICE
PT2005	£22.00 INC VAT!

ELECTRONIC DIGITAL MICROMETER GUARANTEED FOR TWO YEARS!

CODE	RANGE	PRICE
XC234	0-1"/0-25MM	£39.95 £35.00

CLARKE CLM300 VARIABLE SPEED LATHE

HUGE SAVING PLUS FREE STEADY INCLUDED!!!!

CODE XC22 PRICE ~~£682.00~~ £425.00

ACCESSORIES FOR VARIABLE SPEED LATHES

SUCH AS CLARKE, WARCO, CHESTER, ARC ETC

CODE	ITEM	PRICE
XC23	QC TOOLPOST SET	£35.00
XC24	FIXED STEADY	£18.00
XC25	TRAVELLING STEADY	£18.00
XC26	FACEPLATE	£16.00

ER25 COLLET CHUCK FOR CLARKE 300

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

CODE	PRICE
CSC1	£129.95

BRITISH MADE

ER25 COLLET CHUCK FOR BOXFORD

Top quality brand new British product - This collet chuck allows you to use the very flexible ER 25 split collets on your Boxford lathe. ER collets are available seperatly and cover the range from 1mm - 16mm

CODE	PRICE
BFC1	£125.00

BRITISH MADE

ER25 COLLET SYSTEM TO SUIT MYFORD ML7 ETC

CODE	ITEM	PRICE
XC152	CHUCK & SPANNER	£87.00
XC153	SET 15 COLLETS 1 - 16MM	£85.00

SOBA 3" ROTARY TABLE

EXCLUSIVE TO CHRONOS

CODE	PRICE
XC154	~~£79.95~~ £69.00

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

CODE XC68

PRICE £24.95

SET OF FIVE INDEXABLE LATHE TOOLS

CODE	SHANK	PRICE
XC72	1/4	£19.95
XC73	5/16	£19.95
XC74	3/8	£19.95
XC75	1/2	£26.95
XC76	5 X SPARE INSERTS 1/4	£10.00
XC77	5 X SPARE INSERTS 5/16	£10.00
XC78	5 X SPARE INSERTS 3/8	£10.00
XC79	5 X SPARE INSERTS 1/2	£10.00

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

CODE XC69

PRICE £24.95

HSS BORING & THREADING SETS

INC BORING TOOL & MET/IMP INT THREADING TOOLS

CODE	SIZE	PRICE
XC70	6MM DIA/9MM SQ HOLDER	£17.50
XC71	12MM DIA/16MM SQ HOLDER	£26.95

PARTING TOOL WITH HSS BLADE

CODE	SHANK	PRICE
XC80	5/8 HIGH 5/16 BLADE	~~£16.95~~ £12.00
XC81	3/4 HIGH 1/2 BLADE	~~£19.95~~ £15.00

SET OF 3 8MM TOOLHOLDERS WITH HSS BITS

STRAIGHT LH & RH

CODE XC82

PRICE ~~£19.95~~ £14.00

SETS OF 7 INDEXABLE LATHE TOOLS

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

CODE	SHANK	PRICE
XC91	6MM HIGH	~~£39.00~~ £99.00
XC92	8MM HIGH	~~£35.00~~ £31.00
XC93	10MM HIGH	~~£39.95~~ £37.00
XC94	SET 7 INSERTS 6MM	~~£14.00~~ £12.00
XC95	SET 7 INSERT 8MM	~~£14.00~~ £12.00
XC96	SET 7 INSERTS 10MM	~~£14.00~~ £12.00

GLANZE TURNING, MILLING & BORING SET

NEW - PROFESSIONAL QUALITY SET, INCLUDING 3 TURNING TOOLS LH - RH & STRAIGHT, 1 X BORING BAR - PLUS 3 INDEXABLE ENDMILLS

CODE XC88

PRICE ~~£89.95~~ £79.00

INDEXABLE PARTING TOOL WITH 6MM SHANK

CODE		PRICE
XC89		~~£11.95~~ £10.00
XC90	SPARE INSERT	~~£3.50~~ £2.50

SET OF 7 INDEXABLE LATHE TOOLS WITH 12MM HIGH SHANK

COMPLETE WITH 6 DIFFERENT TURNING TOOLS & A THREADING TOOL

CODE		PRICE
XC97		~~£49.00~~ £38.00
XC98	SET 7 INSERTS-	~~£14.00~~ £12.00

ALL PRICES INCLUDE VAT & CARRIAGE (UK MAINLAND)

(Prices are correct at time of going to press and are only available while stocks last)

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IN THIS ISSUE

● Vol. 198 No. 4292 2-15 February 2007 ●

On the cover ...

The next issue of Model Engineer *sees some important new construction series. First is the superb new clock by Dick Stephen pictured on our cover. Also beginning is Tony Weale's description of the build of* Ayesha II, *based on the famous LBSC original, the model which launched the live steam hobby. This issue also sees a re-vamp of the magazine design to make it easier to read, and more appealing to newcomers.*

(Photograph by Dick Stephen)

TURN TO PAGE 168 FOR SUPER SUBSCRIPTION OFFERS

Advertisement Index

MODEL ENGINEER 4293

STUART MODELS

FOUNDED 1906

For the MODEL ENGINEER

SETS OF CASTINGS

We offer Sets of Castings suitable for both those starting out in model engineering as well as those looking for a new and challenging project.

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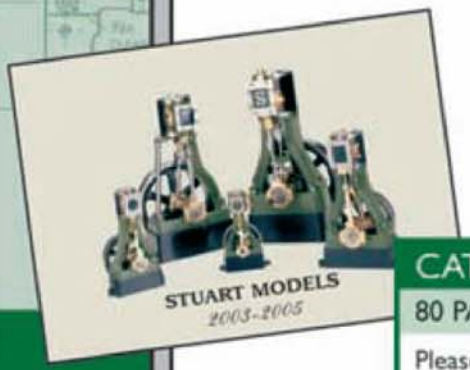

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WARCO

MINI MILL

New

Unique spring loaded plunger to locate column in vertical position

- LONGER, WIDER TABLE
- INCREASED LONGITUDINAL AND CROSS FEED
- MORE POWERFUL MOTOR
- METAL HANDWHEELS
- Table: 460 x 112mm
- Longitudinal travel: 300mm
- Cross travel: 300mm • Motor: 550w

Still only £455 including VAT and delivery

Huge range of tooling available, please see our web site or ask for a brochure

MINI LATHE

New

- LEVER OPERATED CAM LOCKING TAILSTOCK
- DIGITAL SPINDLE REV COUNTER
- PUSH BUTTON CONTROLS
- INDUCTION HARDENED BEDWAYS

Supplied with: 80mm three jaw chuck with inside and outside jaws • Faceplate Four way indexing tool post • Dead centre A choice of metric or imperial threading

- Centre height: 90mm
- Distance between centres: 300mm
- Motor: 400w

Still only £375 including VAT and delivery

- BOTH MACHINES ARE FITTED WITH AMERICAN MADE ELECTRONICS FOR LONG TERM RELIABILITY
- ACCURACY TEST REPORT SUPPLIED WITH EACH MACHINE

Huge range of accessories available, including optional threading kit, four jaw chuck, fixed & travelling steadies, vertical slide, live centre, quick change tool post, tailstock chuck, lathe tools. Please see our web site or ask for a brochure

MINI BENDER

Item No 7073

- Vice Mounting
- Segmented blade
- Folds up to 90°
- Capacity: 12″ x 16 swg

£89.00

Vice not included

MINI SLIP ROLLS

Item No 7072

- Vice mounting
- Roll dia.: 1 3/16″
- Wire grooves
- Rear pinch roll

£89.00

Vice not included

CYLINDER CLAMP

- Ingenious device to clamp cylinder to lathe face plate for machining
- Capacity: 2 3/8″
- Reversible vee clamp for small diameters

£45.00

VICE BRAKE

- Sheet metal bender
- Bends up to 115°
- Segmented knife
- Strong magnets hold die and knife to vice jaws

4″ £15.00 **5″ £16.50**
6″ £18.00

ALL PRICES INCLUDE DELIVERY UK MAINLAND

WM-180 VARIABLE SPEED LATHE

- Centre height 7"
- Distance between centres 12"
- Supplied with 3 and 4 jaw chucks
- Faceplate • Four way tool post
- Fixed and travelling steadies
- Metric/Imperial threadcutting
- Digital rev. counter
- Compound slide

SPECIAL LIMITED OFFER: Free tailstock chuck, indexable lathe tool set, live centre

- LATHE IS SUPPLIED WITH EITHER METRIC OR IMPERIAL LEADSCREWS AND DIALS

£499.00

WM-14 VARIABLE SPEED MILLING MACHINE

New

- Table 16" x 4 1/2"
- Speeds 50-2250
- Back gear for maximum torque in the low speed range
- 3/4 h.p.
- Weight 132lb
- Stand and tray optional

£635.00

WARCO - continuing to respond to customer demand

Prices include VAT • Delivered UK mainland • Please ring for comprehensive sales literature

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Machine Mart

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Where *Quality* Costs Less

Clarke METAL LATHE - CL300M

- 300mm between centres • LH/RH thread screw cutting
- Electronic variable speed • Gear change set
- Self centering 3 jaw chuck & guard • Power feed

ONLY £359.99 EX VAT £422.03 INC VAT

Clarke DRILL PRESSES

- Tables tilt 0-45° left and right
- Depth gauge • Chuck guards

MODEL	WATTS/ SPEEDS	EX VAT	INC VAT
CDP5DD	250/5	£29.98	£35.23
CDP10B	245/5	£49.98	£58.73
CDP15B	300/5	£79.98	£93.98
CDP-10B	370/12	£89.98	£105.73
CDP20B	370/12	£99.98	£117.48
CDP-15F	370/12	£109.98	£129.23
CDP30B	510/12	£134.99	£158.61
CDP35F	510/12	£149.98	£176.23
CDP40B*	510/16	£159.98	£187.98
CDP45F*	510/12	£189.98	£223.23
CDP50F*	980/12	£379.98	£446.48

* Includes wet 'T' slot table & worklight

FROM ONLY £29.99 EX VAT £35.22 INC VAT

B=Bench mounted
F=Floor standing

Clarke 6 SPEED METAL LATHE WITH 12 SPEED MILL DRILL - CL500M

ONLY £649.99 EX VAT £763.23 INC VAT

Full range of accessories available

- 430mm between centres
- Compound slide with 4 way tool post
- Power fed screw cutting facility
- Forward/reverse lathe operation
- Clutch for independent mill/drill operation

Shown with optional floor stand & tray
ONLY £119.98 EX VAT £140.98 INC VAT

ALSO AVAILABLE:
CL430 - As above but without the Mill/Drill head.
£539.98 EX VAT £634.48 INC VAT

Clarke BOLTLESS SHELVING

- Simple bottless slot & pin locking mechanism
- Weight loading per shelf up to 150KGs
- strong 9mm fibreboard shelves
- Quick assembly unit

FROM ONLY £25.99 EX VAT £30.54 INC VAT

CS5150

Available in red, drak grey & blue from only £35.25 Inc VAT £29.98 Ex VAT

MODEL	SHELF DIM(WDH)	CAPACITY	EX VAT	INC VAT
CS5150	800x300x1500mm	150kg	£25.99	£30.54
CS5350	1800x400x900mm	350kg	£44.99	£52.86

Clarke ENGINEERS STEEL WORKBENCHES

NEW RANGE

HEAVY DUTY

FROM ONLY £119.00 EX VAT £140.00 INC VAT

- Sturdy lower shelf
- Durable powder coated finish

INCLUDES SINGLE LOCKABLE DRAWER

Shown fitted with optional 3 drawer unit ONLY £79.98 EX VAT £93.98 INC VAT

MODEL	SIZE (LWH MM)	EX VAT	INC VAT
CWB1000B	1000x650x880	£119.98	£140.98
CWB1500B	1500x650x880	£159.98	£187.98
CWB2000B	2000x650x880	£189.98	£223.23

Clarke AIRBRUSH KITS

FROM ONLY £7.99 EX VAT £9.39 INC VAT

DIY KIT - CAB1H
- Spray pattern adjustable

ONLY £7.99 EX VAT
£9.39 INC VAT

PRO KIT - CAB2P(pictured)
- Double action trigger for accurate air/paint control
- Precision machined nozzle • Special lightweight hose

REDUCED! WAS £28.14 Inc.VAT
NOW ONLY £20.99 EX VAT £24.66 INC VAT

Clarke 12 SPD MILL/DRILL

FROM ONLY £599.00 EX VAT £703.33 INC VAT

CMD1225C

Precision engineered with cast iron head, base & column

- Spindle speeds 100-2150rpm
- ¾ Hp, 230v, 1 Ph motor
- Accessories available
- 63mm milling cutter
- 16mm chuck
- Table size 585x190mm

Clarke MEASURING EQUIPMENT

MODEL	DESCRIPTION	EX VAT	INC VAT
CM100	150mm/6" Vernier Caliper	£8.49	£9.98
CM180	0-25mm Micrometer	£9.98	£11.73
CM145	150mm/6" Digital Vernier	£19.98	£23.48

Clarke ROTARY TOOL SYSTEM

CRT40

ONLY £24.99 EX VAT £29.36 INC VAT

Kit includes:
- Rotary tool • 1m flexible drive • Height adjustable stand with clamp • 40x accessories/consumables

Clarke ARC/TIG INVERTERS

NEW RANGE

- Used for ARC & TIG welding, utilising the latest technology
- Low amp operation - ideal for TIG welding, auto bodywork and thin mild/stainless steel

FROM ONLY £129.00 EX VAT £152.23 INC VAT

MODEL	AMPS	ELECTRODE	EX VAT	INC VAT
85	25/80	2	£129.98	£152.73
110	30/105	2.5	£149.98	£176.23
155	22/140	3.25	£259.98	£305.48

Clarke MICRO MILLING & DRILLING MACHINE

ONLY £239.00 EX VAT £281.98 INC VAT

CMD10

- 150w/230v motor
- Variable speed 1000-2000rpm
- MT2 Spindle Taper
- Face mill capacity 20mm, end mill 10mm
- Table cross travel 90mm, longitudal travel 180mm

Clarke VARIABLE SPEED LATHE

CL250M

ONLY £249.99 EX VAT £293.73 INC VAT

- 150w motor
- Ultra compact precision lathe
- Variable speed control 100-2000rpm

Clarke WIZ MINI AIR COMPRESSOR

FROM ONLY £54.99 EX VAT £64.61 INC VAT

- Compact; Ideal for brush work
- Quiet operation
- Oil-free diaphragm
- 1.58cfm - 2.8bar

Clarke INSPECTION LAMP

SAM100

- Powerful 3 dioptre 120mm precision lens
- Fully adjustable & lockable spring balanced arms for exact positioning
- Universal G-Clamp for quick fixing to desks
- SAM75 only £17.61 Inc.VAT £14.99 Ex.VAT

FROM ONLY £34.99 EX VAT £41.11 INC VAT

Clarke BLAST CABINETS

- Blast away paint, surface rust, scale, burrs, carbon & dirt & revitalise aluminium
- 1,020 ltr/h Max pump rate

ALUMINIUM OXIDE POWDER FROM ONLY £19.98 Ex.VAT £23.48 Inc.VAT

FROM ONLY £89.00 EX VAT £105.72 INC VAT

MODEL	DESC.	TYPE	EX VAT	INC VAT
CS820B	Compact Cabinet	Bench	£89.98	£105.73
SB30	Large Cabinet	Floor	£249.98	£293.73

Clarke TURBO AIR COMPRESSORS

TIGER 8/40

- 7 cfm displacement
- 1.5Hp
- 24Ltr

ONLY £64.99 EX VAT £76.38 INC VAT

FULL RANGE OF AIR TOOLS & SPRAY GUNS AVAILABLE

Clarke 8mm air hose (10m long)
FROM ONLY £9.98 EX VAT £11.73 INC VAT

† Belt Driven

MODEL	MOTOR	CFM	TANK	EX VAT	INC VAT
8/45 o/f	1.5Hp	6.3	24ltr	£84.99	£99.86
Panther 25	2Hp	8.2	24ltr	£129.98	£152.73
Panther 50	2Hp	8.2	50ltr	£169.98	£199.73
10/70†	2.0Hp	9	50ltr	£259.98	£305.48
15/55	3.0Hp	14	50ltr	£259.98	£305.48
15/65†	3.0Hp	14	50ltr	£359.98	£422.98

Clarke POLISHING KITS

- Kit Includes: Tapered spindle, Coloured mop for initial cleaning,pure cotton mop for high polish finish
- 6" & 8" available

FROM ONLY £12.99 EX VAT £15.29 INC VAT

Clarke TAP & DIE SETS

FROM ONLY £12.99 EX VAT £15.29 INC VAT

- High quality tungsten steel
- Supplied in metal storage case, except 16pce

TYPE		EX VAT	INC VAT
16pce	Metric	£12.99	£15.26
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28pce#	Metric	£19.98	£23.48
33pce#	Metric/UNF/BSP	£29.98	£35.23

#28pce Best Budget Buy, 33pce Recommended Practical Classics

Clarke CHESTS & CABINETS

FROM ONLY £56.99 EX VAT £66.96 INC VAT

BALL BEARING

HEAVY DUTY

MAX LOADING 500KG

‡ REDUCED CBB209 was £140.94 Inc.VAT

	MODEL	DESC.	DR.	LOAD	EX VAT	INC VAT
2	CBB203	3 Dr step up		38kg	£56.99	£66.96
1	CBB204	4 Dr chest		38kg	£69.98	£82.23
4	CBB206	6 Dr chest		38kg	£86.99	£102.21
	CBB205	5 Dr chest		38kg	£89.98	£105.73
	CBB209	9 Dr chest		38kg	£99.98	£117.48
	CBB210	10 Dr chest		30kg	£129.98	£152.73
	CBB212	3 Dr cab		43kg	£134.99	£158.61
	CBB213	3 Dr cab		43kg	£159.98	£187.98
3	CBB215	5 Dr cab		43kg	£169.98	£199.73
5	CBB217	7 Dr cab		43kg	£199.98	£234.98

REDUCED

Clarke SOLDERING KIT

FROM ONLY £12.99 EX VAT £14.68 INC VAT

- Instant heat & trigger operated for controlled application
- Hands free magnifier
- De-solder suction tool to remove excess from joints
- Scraper/probe tool • Spare gun tip

Clarke ANGLE GRINDERS

FROM ONLY £12.99 EX VAT £15.29 INC VAT

Inc. disc & handle

MODEL	DISC	MOTOR	EX VAT	INC VAT
CAG121B	115	500w	£12.99	£15.26
CAG115	115	500w	£23.99	£28.19
CON115	115	1010w	£24.99	£29.36
CAG232	230	2000w	£25.99	£30.54

Clarke BENCH GRINDER STAND

BGS1

- Complete with bolt mountings & feet anchor holes

FROM ONLY £24.99 EX VAT £29.36 INC VAT

Clarke BENCH GRINDERS

CBG6W features 8" whetstone & 6" drystone.

FROM ONLY £12.99 EX VAT £15.29 INC VAT

6" & 8" available with light

MODEL	DUTY	WHEEL DIA.	EX VAT	INC VAT
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CBG6RSC	HD	150mm	£24.99	£29.36
CBG6RWC*	HD	150mm	£29.98	£35.23
CBG8RSC	HD	200mm	£33.99	£39.94
CBG8W (wet)	HD	150/200mm	£33.99	£39.94

Clarke MIG WELDERS

Includes: • Gas regulator • Earth clamp • Face mask • Welding torch

FROM ONLY £149.99 EX VAT £176.23 INC VAT

Pro90B-150TEB includes CO_2 gas bottle

MODEL	MIN-MAX AMPS	EX VAT	INC VAT
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135TE	30-130	£159.98	£187.98
151TE	30-150	£189.98	£223.23
165TE Turbo	30-155	£239.98	£281.98
175TE Turbo	30-170	£299.98	£352.48
205TE Turbo	30-185	£329.98	£387.73

Clarke TURBO FAN GAS HEATERS

FROM ONLY £69.99 EX VAT £82.33 INC VAT

- Ideal for low cost, efficient heating in workshops, warehouses etc.

850

MODEL	OUTPUT BTU/Hr	EX VAT	INC VAT
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DEVIL 650	52,000	£99.98	£117.48
DEVIL 850	107,000	£139.98	£164.48
DEVIL 1250	149,000	£169.98	£199.73
DEVIL 1850	200,000	£249.98	£293.73

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DERBY Derwent Street	01332 290931	MANSFIELD 169 Chesterfield Road, South	01623 622160
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EDINBURGH 163-171 Piersfield Terrace	0131 659 5919	NORWICH Heigham Street	01603 766402
		NOTTINGHAM 211 Lower Parliament Street	0115 956 1811
		PETERBOROUGH 417 Lincoln Road, Millfield	01733 311770
		PLYMOUTH 58-64 Embankment Road	01752 254050
		POOLE 137-139 Bournemouth Road, Parkstone	01202 717913
		PORTSMOUTH 277-283 Copnor Road, Copnor	023 9265 4777
		PRESTON 53 Blackpool Road	01772 703263
		SHEFFIELD 453 London Road, Heeley	0114 258 0831
		SOUTHAMPTON 516-518 Portswood Road	023 8055 7788
		SOUTHEND NEW 1139-1141London Rd, Leigh on Sea	01702 483 742
		STOKE-ON-TRENT 382-396 Waterloo Rd, Hanley	01782 287321
		SUNDERLAND 13-15 Ryhope Rd, Grangetown	0191 510 8773
		SWANSEA 7 Samlet Road, Llansamlet	01792 792969
		SWINDON 21 Victoria Road	01793 491717
		TWICKENHAM 83-85 Heath Road	020 8892 9117
		WOLVERHAMPTON Parkfield Road, Bilston	01902 494186
		WORCESTER 48a Upper Tything	01905 723451

SMOKE RINGS
With the Editors

Steam in the air

An acquaintance of ours refuses to take or read a daily newspaper. His reason is that he sees so many of his friends, relatives and workmates become distressed by what they read in the papers that he believes he will probably live a longer and happier life if he avoids subjecting himself to such stress. Well, that is one point of view! However, in our line of work, i.e. editing a periodical like *Model Engineer*, it is not one we can really condone. In any case the diligent reader can usually find something of interest amidst all the gossip columns and comment on the antics of our politicians in Parliament featured in our 'dailies'.

One such example came our way the other day. It seems that the *Daily Mail* features an *Answers to Correspondents* page in most issues and many and varied are the questions asked. A bit like our own *Post Bag*, we suppose. One recent query was: "*Was there ever a steam-powered aeroplane?*" Several people have responded but most would do well to read *Steam in the Air* by Maurice Kelly (published by Pen & Sword, ISBN 1 84415 295 2). Unless we have missed it, the work of people like William and George Besler has passed the bulk of the population by.

However, a recent response to the question mentioned a possibility we were not aware of. The writer, one Tex Waite of Cheshire, relates that during World War II a story did the rounds to the effect that an attempt was made by the British government to develop steam powered heavy bombers. This was, of course, at a time when high-octane fuel was difficult to come by so the story is perhaps not as weird as it might seem at first. The work was allegedly carried out at RAF Marston Moor on Handley-Page Halifax aircraft and involved the use of two Sentinel waggon engines arranged to drive four propellers through a system of gearboxes and drive shafts. The boiler details are not given but it is implied that the fuel was in the form of coal or coke so the standard Sentinel boiler may have been pressed into service. Water was carried in the redundant fuel tanks and fuel in the fuselage and wing roots.

Knowing that some of our readers are well verses in aeronautical history we put this story to you for comment. Did such aircraft ever exist and what was the chance of such a scheme working satisfactorily? Letters to our office in Orpington please, not the *Daily Mail*! Perhaps Mr. Waite himself is a reader, or known to a reader, and might be persuaded to tell us more.

How much?

"How much did you say?"

"*Eighty seven pounds 50 an hour, Sir*," came the echoed reply to a query on the labour charge for the local Volvo dealer to replace a cracked headlamp lens.

Struck us as a bit on the high side, but a quick bite of the tongue stopped a minor tirade about charging anything like that for work that is largely de-skilled, thanks to plug-in diagnostics, replacement units, computers for this that and t'other. Or about jobs that require nothing more demanding than knowing how to use a screw driver.

Decided not to have the lamp done. Just handed over the plastic for best part of £400 for the routine service – fortunately there was no 'extra' work involved. In other words going on for £200 an hour, if you add in materials, for nothing more difficult than changing an oil filter. "*Yes, that does include VAT, Sir.*"

And its not just because it's a Volvo. The little Honda Civic didn't cost much less.

So what should our models be worth? That little steam engine you made for the youngster that passed a pleasant fortnight, and involved more than a little knowledge and skill. What is that worth? According to the local Volvo dealer, if they had the ability to do it, up to £16,000.

That simple 5in. gauge locomotive just finished by the chap at the club. Must be worth £200,000.

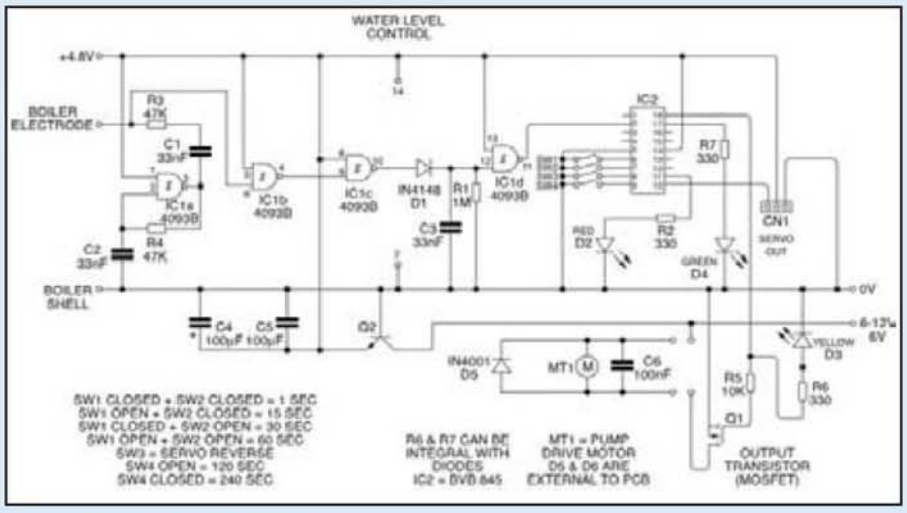
One of Cherry Hill's traction engines? £1.2million plus.

Will any one ever pay those sorts of prices? Of course not.

Will we keep paying £300-odd for a two-hour car service? If it is under guarantee, of course. If we are busy, naturally.

Crazy, isn't it?

However, if anyone out there wants a model built, we know a couple of clever chaps who could be lured away from editing for, oh, as little as £75 an hour.



Bother and corruption

Unfortunately the water level control diagram in Tim Greenwood's article on electronic boiler control became corrupted, as did a couple of adverts, in issue 4290, 5 January 2007. Apologies all round from *M.E.* Above is the diagram in its uncorrupted form.

Another change

Thanks to all those who have changed their address lists to update contact details for *Model Engineer.*

Now, there's another change following Encanta Ltd joining Magicalia Ltd.

Please change emails which end in '.encanta.co.uk' to '.magicalia.com'

So that now our addresses are, for example:
david.carpenter@magicalia.com
And neil.read@magicalia.com
And all other staff addresses follow the same pattern, and general addresses can be found on the contents page.

Meanwhile, don't forget our correct snail mail address is:
Model Engineer
Berwick House
8-10 Knoll Rise
Orpington
Kent
BR6 0EL
Please address all correspondence to 'The Editor'.

New look next issue

The next issue sees a new look and a couple of super new series which we anticipate will be highly popular. First is *Ayesha II*, the recreation of LBSC's original engine by Tony Weale. Working from the Curly original, Tony has produced a design in three versions of the Atlantic: Marsh, Ivatt, and original Ayesha. We also have an article from Tony on the 'Battle of the Boilers' and how Curly's little locomotive changed the course of model engineering.

Anyone who has seen Tony's prototype, cannot fail to have been impressed as it ran for hours on end on a variety of continuous and up-and-down tracks all last year. It has plenty of power, too. Enough to pull a passenger or two, as well as the driver, given good adhesion.

So here's a chance to build what is the most important locomotive in the history of model engineering. It is a good project for beginners and experienced builders alike. In $2^1/2$in. gauge it is a manageable proposition in terms of handling and transportation. All the castings are available from the National 2.5" Gauge Association.

Also in the next issue Dick Stephen will describe a brilliant new clock (see photo on the cover of this issue), Peter Rich pofiles the *Great Bear,* and Neil Read profiles the SMEE.

This next issue also sees a new look to M.E. We are changing to a new, larger, more open, and easy to read typeface for text and headlines. Gone will be the tints over the pages, and headlines will be in bright CAD type colours. The aim is to make 'ours' easier to read, and more attractive to encourage newcomers to take up model engineering.

We also aim to bring you news of the new dates and venue for the Model Engineer Exhibition, which reaches its Centenary this year.

POST BAG

Brazing alloys and copper boilers

SIRS, - I am not quite sticking my head above the parapet, but I am waving my hat on a stick.

I read the recent comments on the above topic out of interest during my normal perusal of the magazine, some days later I had a nagging thought that something was possibly wrong or that I had missed. I re-read the articles and still could not think what it was that was niggling at the back of my mind. I will state right now that I have never built a copper boiler and am unlikely to, but I have done quite a bit of brazing/bronze welding (or 'Sifbronzing'). From time to time this niggle came back to me and now some three months later a form for 'the niggle' took place in my mind.

The thought was: If the test was for zinc content of a braze/weld on a copper boiler and its electro-chemical extraction by the chloride content of water, then the sample used should have been an actual braze/weld, not an unused rod. This because these rods are a eutectic alloy and the zinc content is dramatically reduced when a weld is made because a modicum of the zinc 'boils off'.

This is why it takes a higher heat to re-melt the joint, and the hotter the applied heat in applying the original weld the lower the residual zinc in the resulting joint. So if there is not as much zinc in the joint as the article suggested, there isn't as much to remove as the article prescribed and the joint will not be as weakened as suggested.

My hat is now waving for pundits to shoot at!

Peter King, New Zealand.

Bristol *Hercules* engines

SIRS, -May I refer to the letter from Mr. John Willock of Warwickshire (*M.E.* 4281, 1 September 2006) regarding the Bristol *Hercules* VI and XVI.

Although I flew as engineer in Stirlings for a short while in 1944, I had little knowledge of the *Hercules* engine apart from a general talk at the beginning of a course (possibly six months long) on the Lancaster, with *Merlin* engines. So my knowledge is modest and about 60 years-old, as is my memory. But by reference to my textbooks, I located a drawing of a cylinder head showing the sleeve relief valve in a book dated 1943. I have, since reading the letter, located an expert in the Rolls-Royce Heritage Trust, who informs me that although all cylinders were fitted with relief valves, a subsequent modification introduced shallow grooves in the inner top surface of the sleeves to achieve the same object.

If I might refer now to the Mark numbers, the Hercules Mark VI was fitted with a manual mixture control lever, which could be used to weaken the mixture strength at cruise to economise on fuel; The *Hercules* Mark XVI was fitted with an all-can-do carburettor, which optimised the mixture strength at all throttle positions, and ambient conditions.

It might be of interest to know that one of the Bristol *Hercules* engines, recovered from the crash site of one of 115 Squadron's Mk.II Lancasters in 1995, may be seen at a Display of Memorabilia of RAF Witchford. This is on show in the foyer of the Grovemere Building on the Lancaster Way Business Park (formally Witchford Airfield) off the A142 between Ely and Witchford. For more details readers should telephone Grovemere on 01353-66666.

With reference to the discussion on sleeve valves and the port design thereof or even other aspects of the sleeve valve as related to the Bristol radial engines, it is possible that the Rolls-Royce Heritage Trust might be able to help.

Contact: Brian Whatley, Rolls-Royce Heritage Trust, Bristol Branch E,W. 6-18, PO Box 3, Filton, Bristol BS34 7QE.

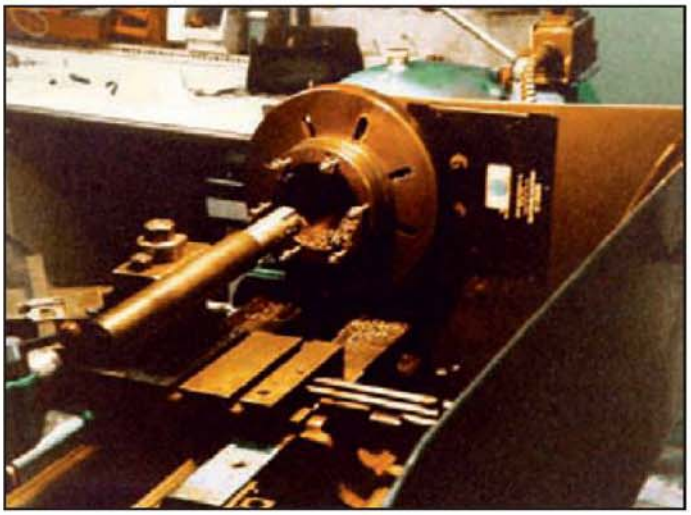
Roy Simmons, Bristol.

Aero engines – last word?

SIRS, - The subject of WW2 aircraft is possibly of only marginal interest to the majority of readers, but without wishing to prolong this correspondence unduly, I would welcome the opportunity of replying to the last letter of Mr. Shilling (*M.E.* 4288, 8 December 2006). So now we have it, his service in the RAF appears to have taken place after the end of hostilities, and therefore he had no opportunity of 'hands-on' experience of these machines, conversely the writer spent close on 2,500 hours doing just that. Armchair book experts abound, but before rushing into print, should endeavour to utilise the best sources, Janes probably the most accurate but expensive, a book entitled *Hurricane* by Edward Shacklady lower priced and covers pre-War developments leading up to the building of this aircraft. Mr. Shilling tells us that 12-cylinder in-line engines did not exist, but the Rolls-Royce FW1A was of this type, developed from the Curtiss Corp. D.12 engine, and fitted to the Hawker Hart bomber and others. All variants and 'specials' are covered, grouped together in the Kestrel family, also the Goshawk, Falcon, Peregrine etc., some specified as steam-cooled.

Regarding the altitudes that Wellingtons could reach, no doubt the early types fitted with Bristol *Pegasus* engines might struggle to reach over 20,000ft., but it is surprising that Mr. Shilling seems unaware that most aircraft with single-speed supercharged engines had a Service Ceiling around this figure, even the training Oxfords and Ansons. So he might reflect why two-speed superchargers were employed, as I previously stated, the 'drill' was to change into high gear at 20,000ft. and start using oxygen. Wellingtons and Lancasters were used for Tiger Force training, the Bristol *Hercules* of the former gave between 1600-1850hp. It is in print that one fitted with Rolls-Royce *Merlins* of only 1350hp was designed to fly at 38,500ft., certainly there was no problem with the aircraft which we used to reach over 30,000 feet. It was during WW2 that 'jet streams' at high altitudes were first discovered, causing some consternation to navigators at times. Mr. Shilling also seems to know more about Tiger Force than myself, modified Lancasters were never mentioned, the designated aircraft Lincolns with much needed ventral turrets and cannon gun armament. The proposed base was Okinawa, so it was certainly a relief when the atom bomb was dropped, but which was to cast such a dark shadow over the world for years to come.

Cyril Cannell, Isle of Man.



Roger Winslade's set up for cutting a screwed nose for his lathe.

Screw nose lathe mandrels

SIRS, - You have featured a series of articles on modern industrial lathes. There is one advantage of older machines with a screwed spindle nose. It is possible to make a pattern of the spindle nose and to screw cut back plates for accessories on the same machine. As the thread was 4tpi, to ensure sufficient rigidity a tool was made from pieces of flat steel welded to a piece of steel bar. This was bolted in place of the standard tool holder. The internal threads were cut easily with this set up. A collar on the faceplate enabled the tool to pass right through the 'new' back plate.

Roger Winslade, Falmouth.

Condenser shoehorn

SIRS, - I enclose herewith a photograph of a shoehorn I made in 1946 while serving as a junior engineer on the *M.V. Columbia Star*.

A piece of 18g condenser tube 9in. long by 3/4in. diameter was used. A 4in. slit was made at one end and the tube opened out and shaped.

The shoehorn is in daily use, but the ship has long since been scrapped.

The second engineer at the time

Mr. McMillan's shoehorn made from condenser tube.

was very displeased to find that one tube of the spare set of condenser tubes was shorter than the others!
P. S. McMillan, Devon.

Colchester lathe accuracy

SIRS, - I noticed with interest in *M.E.* 4282 15 September 2006 the article by Tony Griffiths about Colchester lathes. These lathes are very familiar to me, when at Technical College before WW2 I worked on the belted versions of a Colchester Triumph, a Master and a Harrison, all of which I enjoyed using and which were much better than my Dad's treadle Relmac!

After the war when in the scientific industry, my job over the years involved setting up several workshops and I arranged for the purchase of a number of lathes from the Colchester range, Marks 1 and 2 Triumphs, Masters, Students, Bantams and Chipmasters. All, except possibly the Chipmaster, gave excellent service and were probably the best value for money lathes. However, the feature that was probably their greatest asset was the *Gamet* (French, pronounced 'Gamay') precision bearings fitted to the headstock.

In the early 1960s we were working on the development of what was to become the world's first commercial scanning electron microscope and the electron optics required very precise turned components of soft iron. To enable us to measure the roundness and flatness of these my MD had already authorised me to obtain a Taylor Hobson Talyrond capable of measuring circularity and flatness to the order of millionths of an inch. Before purchasing any lathe for this work we insisted that our engineer should turn, under carefully controlled conditions, a circular and faced test piece which we would check on the Talyrond.

Not only were we choosing the research workshop machine but also the machines for the ultimate production departments. Cam action, i.e. endways movement of the mandrel affecting flatness was as important as circularity. When the manufacturer was asked the errors of their lathe turning some said *"Oh negligible error"* to which we replied *"That is for us to decide"*. Many lathes in the 6in. to 8in. centres range from the cheapest to the most expensive were tested and surprisingly no lathe came anyway near the Colchester Masters or Triumphs! Admittedly some of the expensive machines were better built but no headstock was as good as the Colchester and we were able to live with the lathe build to get the headstock performance we needed.

The MD of one reputable lathe manufacturer was so insulted when we rejected his machine that was twice as expensive as the Master, he obtained and fitted a pair of *Gamet* bearings from Colchester but he didn't know the tricks of adjusting them and Colchester were not telling!

Incidentally, the Colchesters we installed were used for many years and their performance did not deteriorate throughout their production life. Headstock bearing trouble was unknown.

Cylindrical grinders were also tested and for interest we tested a Myford Super 7 which was remarkably good.

While we were doing this investigation I was invited to the Colchester plant at The Hythe and found it using some very interesting production techniques and well organised.
Donald Unwin, Cambridge.

Gorgon bearings

SIRS, - Regarding the query of Mr. A. H. Middleton (*M.E.* 4287, 24 November 2006). The bearings he requires for the Gorgon can be obtained from **www.technobot.co.uk** or **www.arceurotrade.co.uk**

As for the square section brass tube for the condenser box, I have not been able to source any, and have resorted to fabricating them from brass sheet and silver soldering them. Hope this helps Mr. Middleton.
L. Hutchinson, Nottinghamshire.

Railway litter?

SIRS, - The following tip may be useful to your readers. I recently built a static model for a friend and to finish it I needed some track ballast. Being the sort that likes to work from scratch, I used Happy Shopper cat litter. You have to sieve it twice, once to remove any dust and secondly to get the size you need. Also, at £1.75 for 10 litres it's very economical or free if you've got a cat.
David Sterling, by e-mail.

Cancelled course

SIRS, - North Yorkshire County Council, via its Adult Learning Manager has cancelled the Model Engineering Course based at Yorkshire Coast College, the course ran for more than 30 years. The County Council hired the workshop and provided the teacher. Yorkshire Coast College will consider running a course in the future, from September 2007. The lecturer in charge of the workshops is new in the job and has asked us to be helpful and obtain details from other Colleges. We need to know the course fee, hours per week, number of weeks, syllabus, exams if applicable etc., to build up a case for the course to run.

If any readers are attending a Model Engineering course then would they please contact me? Being retired, and available almost any time, a phone call would be appreciated. 01723-362537. Just leave your number and I will phone you back.
John Fletcher, by e-mail.

Another cancelled course

SIRS, - I am sadly writing to advise you of the demise of the practical engineering course at Newbury College. This was a very successful course running on three evenings per week in 2005/6.

Initially the students were warned of impending closure at the end of March 2006 but thanks to our local MP and several of his neighbouring colleagues, the class was allowed to continue for the autumn term at the current course fee rates *"to enable completion of projects!"*

Various reasons were offered to justify the closure:

Public funding had been reduced by 10% - presumably course fees could not be increased to make good this shortfall!

The local authority (West Berkshire Council) states that *"all courses should be a learning environment where students learn a clear set of skills and then progress to appropriate higher level courses. We do not fund* 'clubs' *where the same learners work on a project term after term over a number of years."*

Surely making models using large lathes, milling machines and other industrial workshop equipment constitutes learning?

Many students (approximately 40%) are retired and so would not expect to progress to higher courses. Also has anyone ever completed a major project inside a year when relying on a college workshop?

The college has offered to let the course continue on a *"self funding basis"* for £199 per 10-week term (£6.60 per hour). This is a four fold increase for pensioners and double the original fee for the under 60s.

On a more cheerful note, West Wiltshire College at Chippenham is running a similar course starting in January 2007 at £4.30 per hour over a 10-week term.

Newbury College moved to a new site a few years ago having sold off all its old machines at giveaway prices. At the new site it was re-equipped with Chinese machines – maybe we complained too much!

Whatever happened to education, education, education?

Incidentally, Malcolm Stride was once a member of the Newbury College course.
Malcolm Hynes, Berkshire.

I was indeed a member of the Newbury course for several years and even managed to complete some projects. I am saddened to learn that it has been axed. I think the narrow view that one must progress to "an appropriate higher level course" *shows a lack of understanding of such things because all model engineers learn by moving on to more advanced projects as the years go by – Malcolm Stride.*

Sentinel Sirena

SIRS, - I was reading some old (early 1960s) *Model Engineers* and came across a Sentinel locomotive construction called *Sirena*. Does anyone know if castings were ever made available for this locomotive, other than the Stuart ones, and if they are still available?
Derek Jones, Coventry.

3F TO 3F
AN AMBITIOUS CONVERSION

Geoff Dowden

describes how an LMS Jinty 3F became an ex-Midland Railway 3F, a class introduced in 1903, the last year that Samuel W. Johnson was locomotivemotive superintendent, although the design is credited to his assistant and successor R.M. Deeley.

Part I

It all began following my decision to attend the Martin Evans Rally at Brighouse and where by co-incidence, I had a completely unexpected meeting with the gentleman from whom the rally took its name. At some point during our conversation I was invited by Martin to submit an article to *Model Engineer* relating to the building of my locomotivemotive to his '*William*' design. The experience was my first sojourn into the realms of 'proper' railway modelling, having until 1983 concerned myself for 30+ years with the delights of '00' gauge, plus a very brief flirtation with its big brother '0'. Shortly afterwards, my appetite now whetted for the larger scale, I was in the local library browsing through the pages of a copy of the *M.E.*, the issue which by sheer chance contained part X of Martin's series on '*William - A Locomotivemotive for Beginners*'.

As it turned out that incident proved to be a life-changing event, as from that moment onwards it was ' William or Bust' as far as I was concerned. The rest is history as the expression goes. In the final paragraph of my article, which was published in September of 1994, I mentioned that I was building a 5in. gauge tender version of an ex-Midland Johnson 3F utilising Martin's Jinty notes for the construction of the chassis and it was impossible for me to have foreseen in 1987, after completion of '*William*', that it would take almost twenty years to accomplish this second challenge as I naively thought that having built '*William*' in four years, I now knew what I was doing and could build this new locomotivemotive in half the time.

How wrong can you be? What happened to the splendour of middle age? It must have passed me by as I could have had a bus pass six years ago if I had so wished! However, it is only fair to say, that in the meantime, and for the reasons outlined in the July 2000 edition of *M.E.*, I have completed 5in. gauge versions of a bogie riding truck; a 20 ton LMS brake van; a seven-plank private owner mineral wagon; a narrow gauge slate wagon, slightly amended to couple up with the standard gauge stock and more recently, a 12 ton NE covered van. In addition, there was also a period of 15 months or so when I made no progress whatsoever following a house move.

As some degree of encouragement to other pseudo modellers like myself, maybe lacking in technical or practical experience but making up for this shortfall ten times over in sheer commitment and enthusiasm, I thought that a description of some of the problems and solutions that I encountered dabbling in the realms of the unknown may serve as a prompt, or perhaps be of some assistance, to anyone a little hesitant about 'taking the plunge' to construct a complex piece of machinery with frequently little to refer to and without the benefit of someone else's knowledge and expertise in the form of plans or working drawings.

What I failed to mention in my earlier article was the reason why I decided to convert to the 3F in the first place instead of completing the straightforward Jinty tank. However, with the benefit of hindsight many of us would be brain surgeons or rocket scientists and on reflection, in some ways, I wish that I had stuck with the Jinty, as well before now, I may have been in the position to enjoy balmy summer steaming sessions at the track and thenceforth into the enviable position of being able to build more freight rolling stock! Nevertheless, I have been reminded by several of my fellow club colleagues that a 5in. gauge 3F could perhaps create a little interest around the club tracks and be something of a rarity if and when it ever hits the road! My following comments, therefore, generally follow the chronological order in which events unfolded with the tender being built to virtual completion after producing the locomotivemotivemotive's rolling chassis and before fabricating the locomotive firebox wrapper and erecting the cab assembly.

Construction begins

At one of our club meetings shortly after '*William*' was completed, a fellow member was inviting offers of good homes for three sets of Jinty frames which an acquaintance of his was anxious to dispose of following unfortunate difficulties being experienced on the domestic front. I was well aware of Martin's series in *M.E.* of course, and with a strong leaning towards all things LMS, I thought that I could do worse than volunteer my services and consequently became the proud owner of one of the sets of frames. Incidentally, to this day I never did learn the fate of the other two sets.

With stretcher, crosshead pump, cylinder block, horn block and wheel castings duly purchased, construction followed the printed page and was uneventful until just prior to wheel turning stage when I asked myself "Did I really want another tank engine?" This self-examination was prompted by my still vivid re-collection of the trauma I suffered in my attempts to construct the left-hand side water tank of '*William*', a complication necessary to allow the passage of the reach rod to the weigh shaft. Subsequent deliberation eventually provided a negative response together with visualisations of some other exciting and attractive alternative. Further progress was, therefore, abandoned and I set about the task of identifying a substitute.

It would be fair to say that I then spent literally hours searching through railway magazines and books etc., even my old copies of Ian Allan ABC of LMS Locomotivemotives of 1946 and 1948 were scrutinised, in my attempts to identify a prototype that would fit my criteria, namely similar shaped frames with identical axle centres. I had almost given up hope when a copy of the June 1964 edition of the *Railway Modeller* revealed a 4mm drawing of the Johnson 3F locomotivemotive, but without any tender detail. After a little study, I realised that a few compromises would have to be made, i.e. larger diameter wheels, shortened frames, different boiler design and brake gear, but never mind, the wheelbase appeared to be correct and I concluded that I would worry about such trivialities later. Bad decision!

First things first. Who supplies scale 5ft 3in. diameter wheel castings for a Midland 3F? Answer? Nobody. So I had to review the options. Making my own patterns, or asking someone else to oblige, were both considered to be non - starters, which left me with the only other alternative, i.e., an existing pattern for some other design would have to fit the bill. Was there another prototype therefore that had the correct wheel diameter and number of spokes, identical boss shape and balance weight arrangements and most importantly, if so, were the necessary castings available through our normal retail suppliers? More hours of scanning the trade catalogues without success until I discovered that the LNER J39 wheels appeared to be reasonably similar, not exactly identical but with correct boss, sixteen spokes and albeit cast for a locomotive with slightly smaller driving wheels than the 3F, I realised that this was as near as I was ever going to get with an 'off the shelf' product and the anomalies could be addressed later. Fortunately my friendly casting supplier exchanged my Jinty wheels for a set of J39 castings and the point of no return had been reached. Construction could now begin again in earnest but progress was soon interrupted, as the need to make the changes to the rear end of the frames now became the priority.

The Frames

Having exchanged the wheels, the appropriate alterations now had to be made to the frames and, as my chosen prototype was a tender version, the rear extension of the frames to support the bunker superstructure was superfluous. Reference to the 4mm drawing revealed the position of cut and the additional slight amendments required. Consequently, the rear buffer beam was detached from the chassis and $1^3/8$ inches of frame material was squarely amputated from each side with the hacksaw. This was followed by attention to the other modifications required, which included transfer of the reverser stand from the left to the right hand side of the cab, the details of the whole operation being shown in **figure 1**. The buffer beam then had its buffers and stocks removed and transferred into storage for re-use on the tender in due course. Next the coupling hook slot was opened out, extended transversely and the additional triangular gussets fitted to the inside in order to accommodate the tender coupling pin. After cleaning up the ends of the frames the old beam was refitted as a new drawbar and wheel turning could commence at last.

To say that I am entirely satisfied with the end result of the wheel turning exercise would be perhaps something of an untruth. In spite of very careful machining to achieve the maximum of 5ft 3in. diameter equivalent for the class 3, the outcome is that I have finished up with wheels whose rims maybe look a little 'heavier' than those depicted in photographs of the 3F's. To correct the situation would have meant the removal of more metal from the inside of the rim, a procedure where every thou machined away would contribute towards the creation of an unprototypical and unsightly step at the base of the spokes. I therefore adopted the good old British compromise by considering the former situation to be the lesser of two evils, reluctantly accepting that this was the price I had to pay for not having the correctly dimensioned castings in the first place and moved on with Martin's notes for erection of the cylinder assembly, crosshead pump and valve gear, etc. However, a club colleague recommended that I should take the opportunity to fit balanced slide valves and after an explanation as to what that meant, I made the small deviation from the published drawings and altered the valve arrangement to that shown as **figure 1a**.

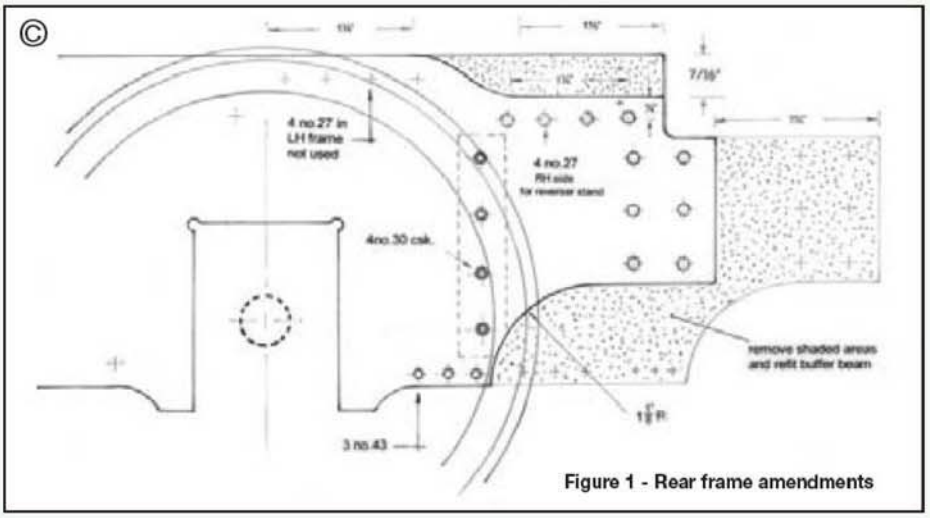


Figure 1 - Rear frame amendments

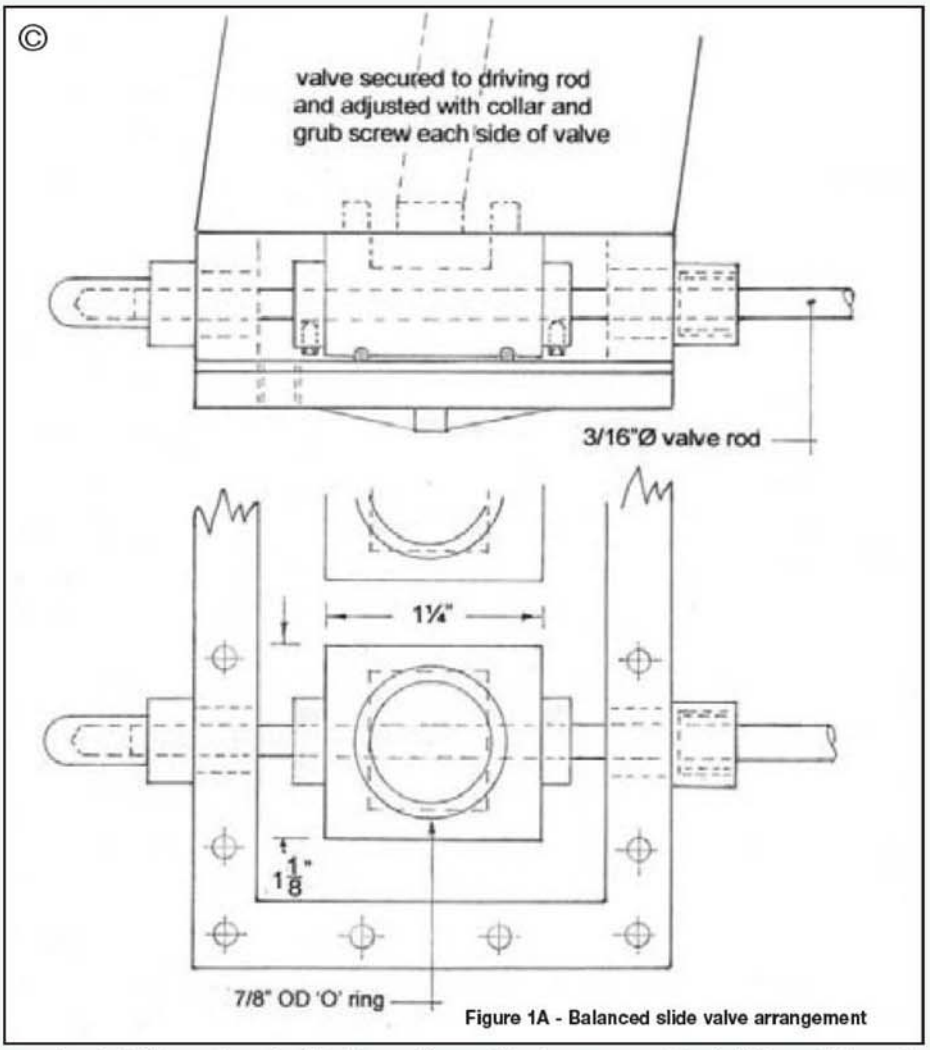


Figure 1A - Balanced slide valve arrangement

Air test

Chassis construction continued to air test stage when the same club member mentioned above offered me appropriate facilities at his works premises. Subsequently, well oiled up and with the weigh shaft clamped in full forward gear, (the notches in the reverser stand sector plate not yet having been cut), the air hose was connected and the compressor activated. As the wheels began to rotate and I watched the almost hypnotic effect of the valve gear motion, I felt an enormous glow of satisfaction, perhaps second only to the ultimate thrill of being in control of the regulator when a locomotivemotive that you have built takes to the track for the first time under its own steam. Suffice to say the chassis performed equally well in reverse gear and ticked over on a quite small level of psi like the 'proverbial sewing machine'.

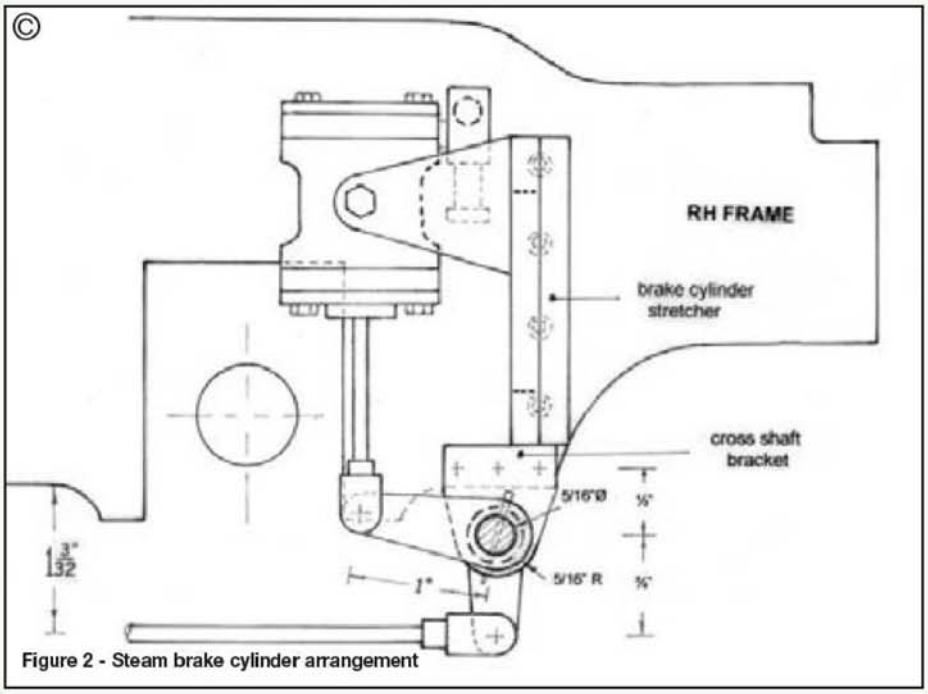


Figure 2 - Steam brake cylinder arrangement

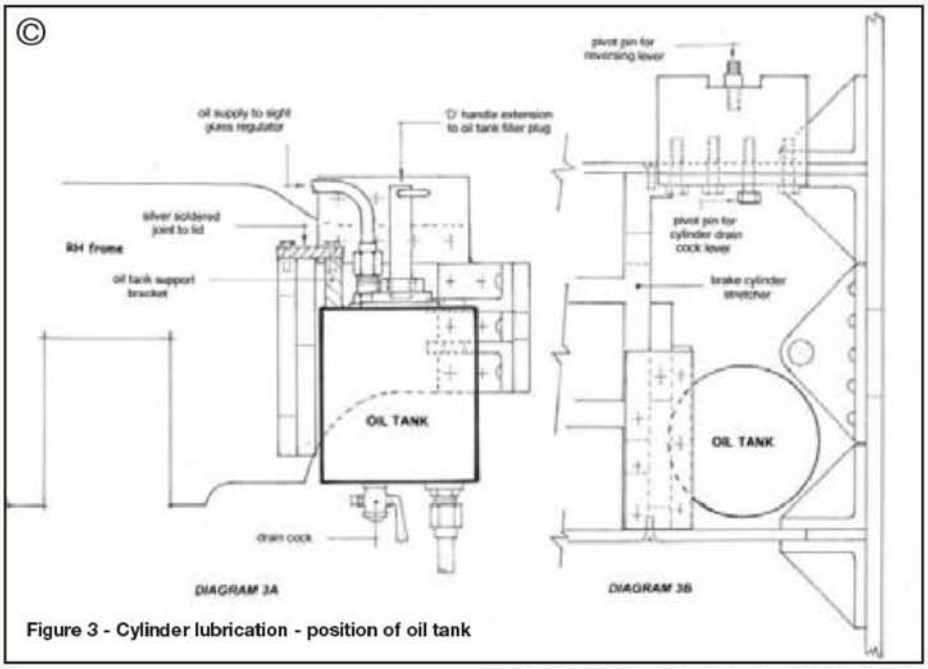


Figure 3 - Cylinder lubrication - position of oil tank

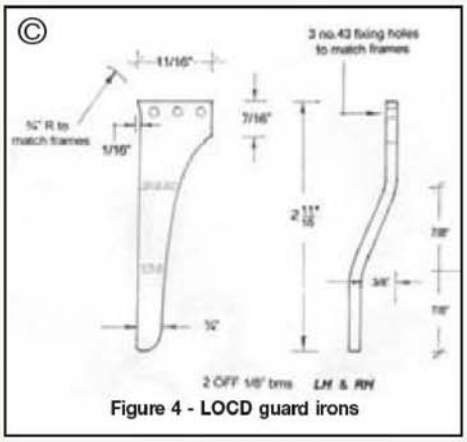


Figure 4 - LOCD guard irons

The brake gear

Jinty's brake gear arrangement is quite unsuitable for the class 3 version, but where were the necessary details that I required? More reference to photographs and perusal of previously published *M.E.* designs ultimately enabled me to make some assumptions with regard to the shape, proportions and arrangement of the main components that I required. Brake beams, pull rods, and fork joints etc., were duly produced and then Jinty hanger pin castings machined ready for fitting. I then produced a series of cardboard hangers to calculate the appropriate dimensions and then by trial and error I was able to determine the location of the six new brake hanger pin fixing positions in the frames, the originals for Jinty's smaller wheels of course, being quite unsuitable.

I also considered that my Jinty brake block castings were too small and as I was unable to locate any suitable replacements through the trade outlets, there was no alternative but to take steps to machine my own set. A chunk of $^{5}/_{16}$in. thick mild steel sheet was therefore mounted on the faceplate and machined to an internal radius of 2$^{1}/_{2}$in. after which it was a simple marking out job, sawing, drilling and filing to shape and then into the vertical slide for slotting. The resulting set of blocks was fine, but for operational purposes Jinty's cab positioned brake column standard would need to be changed. The 3F required a steam brake arrangement, so it was back again to previously published *M.E.* designs in the hope that I would be able to glean sufficient information to enable me to design a system that would be appropriate for this occasion. Careful calculations followed which resulted in the fitting of a new cast brake cylinder stretcher at the point where the final top curve of the frame begins. Gunmetal bushed, cross shaft brackets were attached at the bottom and rear end of the frames together with all the various bits and pieces to complete the assembly in keeping with accepted practice. Fortunately, there was just sufficient space for the stretcher and cylinder assembly to drop into position behind the rear axle and 1$^{1}/_{2}$in. forward of the front of the coupling pin gusset as shown in **figure 2**.

Lubrication

In the early days of William's service I had experienced some difficulty with the mechanical lubrication system, either too little or too much oil, but eventually I got it right. By comparison, I had envied the apparent reliability and ease of control of a friend's hydrostatic system fitted to his 5in. gauge '*Pansy*' and thought that if ever the occasion arose, I would adopt a similar arrangement and this was just such an opportunity! I was further encouraged when this same '*Pansy*' owner gifted me a ready made cylindrical oil tank 1$^{1}/_{2}$in. diameter and 2in. deep, and which quite incredibly fitted perfectly into the only possible available space to the left of the coupling pin gussets and to the rear of the newly fitted brake cylinder stretcher. The latter component was used to mount a small rectangular plate, the rear edge of which provided a 90deg. fixing point for a similar plate silver soldered in a vertical position to the top of the tank as shown in **figures 3A** and **3B**. A note was made not to forget to provide an additional valve position on the backhead for a water supply to the bottom of the oil tank and in due course to locate a suitable drawing for the manufacture of a sight glass and oil regulator arrangement when, ultimately, I utilised the detail design produced for '*Torquay Manor*'. At the opposite end of the locomotive a small bracket was then fitted to the rear of the lower plate of the steam chest in readiness for the final fitting of the connecting union of the cylinder oil feed line from the sight glass in the cab.

Guard irons

Drawings for the guard irons were not included in the Jinty series and as these fittings present a prominent feature and important purpose on most locomotive front ends, it was considered imperative that my class 3 should be no different. I therefore prepared my own drawings, figure 4, and manufactured a pair from $^{1}/_{8}$in. thick mild steel, bolting two plates together for drilling, sawing and filing before separating to finish the top and bottom edges and final bending to left and right handed shape. The irons are secured to the frames utilising the three holes shown on the Jinty frame drawing, the two rearward holes

using shortened 8BA hexagon head bolts, and in order to avoid breaking through, screwed into very carefully tapped holes in the cylinder block. For the sake of safety, I seem to remember that I may well have removed the cylinder block from the frames in order to carry out this operation, a little tedious but worth the trouble to avoid any possible disaster. A conventional nut can retain the forward bolt as the hole is clear of the front edge of the cylinder block.

Springing arrangements

It must have been about this stage in the chassis development that I became fully aware that the prototype springing arrangement behind the driving wheels is quite noticeable and I was very annoyed with myself for not registering this fact much earlier. It was, therefore, paramount that this issue should be addressed before moving on to anything else. Reference to the trade catalogues enabled me to purchase a set of aluminium leaf spring castings of the correct dimensions and complete with shackle and buckle detail. However, as supplied, the casting would not fit into the restricted space behind the driving wheel but by judicious milling and filing to reduce the thickness of the metal at the rear of the shackle by 50% to 9/32in. and similarly, the creation of two U-shaped slots centrally, to accommodate the real springs and pins beneath the hornstays, the castings eventually fitted into the space quite nicely. One small leap of faith for me or 'where there's a will there's a way', as I recall being frequently encouraged as a child by my WW 1 ex-Royal Marine paternal grandfather! The dummy units are retained in position by suspending each end of the leaves by small links, but unfortunately, not all of the twelve links can be attached in identical fashion because of other bits and pieces already in position. See **figures 5A** and **5B**.

The centre axle is the most straightforward, the 1in. long links being tapped 8BA each end. The lower end fits into a generous 1/8in. rebate at the rear of the spring shackle end, drilled No. 43 and the upper end positioned behind No. 43 holes drilled close to the bottom edge of the frames and just to the left and right of the horn plates, both top and bottom of the links being secured with 8BA hexagon head bolts. However, the forward end of one pair of leaf spring units is not rebated out as they are treated slightly differently as described a little later for the front axle.

The rear axle again uses 1in. links, which are secured to the shackles as before, but the top fixings require special attention. The lower of the two circular frame stretchers is located exactly where the forward link has to be secured, so I removed the stretcher, mounted it in the lathe chuck and milled out 1/2in. diameter to a depth of 5/32in. from each of the thickened ends. A slot was then filed in the end allowing the link to be dropped in when the stretcher can be replaced ready for securing by sharing the same fixing bolt as the stretcher. See **figure 5C**. The slot at each end should, of course, be in identical alignment. The top end of the rear link is drilled for 8BA clearance and is secured with a nut at the back of the frames to the most forward of the three bolts holding the brake cross shaft brackets to the bottom of the frames.

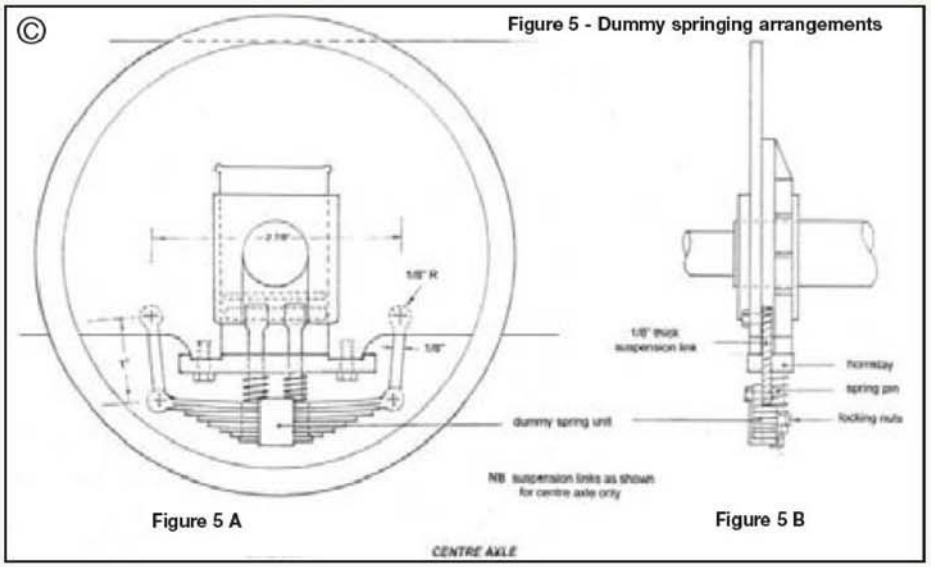


Figure 5 - Dummy springing arrangements

Figure 5 A

Figure 5 B

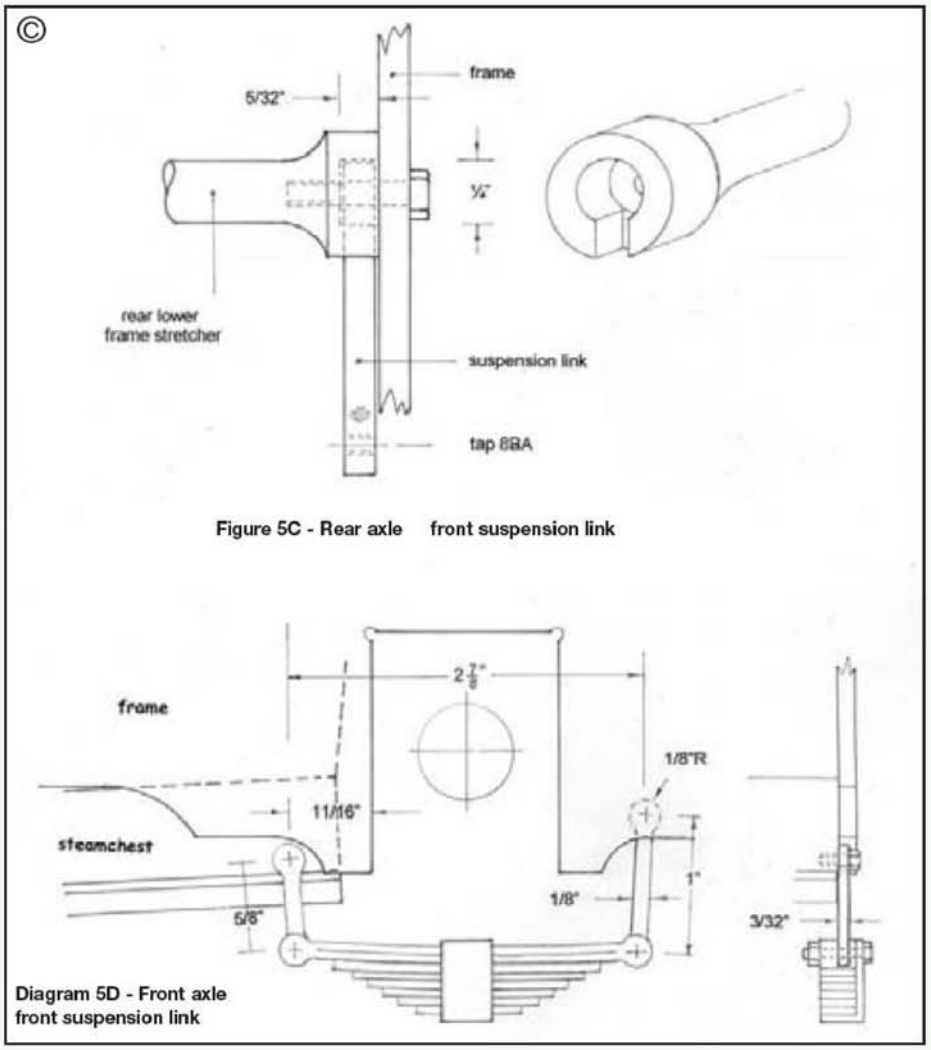


Figure 5C - Rear axle front suspension link

Diagram 5D - Front axle front suspension link

The rear link of the front axle can fortunately be dealt with as the centre pair. However, it is not possible to secure the forward link behind the frames as the cylinder block fills the entire space. After a great deal of thought, I resolved the problem by producing a link shortened to 5/8in. and thinned down to 3/32in. thick.

A slot a few thou' wider was then milled in the front end of the shackle slightly to the outside of its longitudinal centre line, in order to create a mini 'mortice and tenon' arrangement that allows the lower end of the link to be inserted and then secured with an 8BA hexagon head nut and bolt. The top end of the link is fixed in position by a suitably shortened 8BA hexagon headed bolt screwed into a tapped blind hole in the side of the steam chest and located just below the bottom edge of the frame. **Figure 5D** illustrates the principle. The task was quite fiddly and time consuming but I am convinced that it was well worth the effort as the spring units do look the part and as a bonus, conceal a good proportion of the real axle springing arrangements.

●*To be continued*

A COMPACT RATCHET BRACE

Bill Steer

continues the construction of a precision version of this simple tool with the centres.

●*Part III continued from page 22 (M.E. 4290, 5 January 2007)*

Two interchangeable centres are provided; male and female. Their purpose is to abut against a suitable supporting structure which in turn provides the reaction for the brace to thrust against. For many applications the male centre will be the obvious choice; its shape enabling it to be readily located in existing holes etc. For other applications, particularly where space is at a premium, the female centre will prove to be more appropriate. Both are hardened and are a tight push-fit in the thrust transfer sleeve. To help with their withdrawal from the latter, each centre is equipped with a pair of tapped holes for use with jacking screws. **Figure 7** gives the details of the centres.

The shape of both centres is such that when making them, we are faced with maintaining a reasonable degree of concentricity on the machined surfaces either side of the flange. Ideally we might use collet chucks to hold the work, but, since a slight loss of accuracy here is unlikely to have serious consequences, a 3-jaw chuck, *in good condition*, will probably suffice. If, however, yours runs out of true by more than a couple of thou-or-so, on the diameters involved, you may prefer to use an independent 4-jaw chuck in conjunction with a dial test indicator.

Since silver steel is a fairly tough metal to work and we need a surplus of material to provide an adequate grip during certain stages of manufacture, I suggest rough turning the piece to begin with. We can then re-sharpen the tool and take lighter cuts to get a good overall finish. For best results I recommend working at a speed of about 200rpm and using plenty of cutting fluid.

Grip a length of 1/2in. dia. silver steel in a suitable chuck (see above), leaving about 1in. protruding. Face and turn down to about 0.260in. dia. for a length of 11/32in. Part off to 23/32in. long (this is a little longer than finally needed, but it allows extra material for holding during subsequent operations). Next, reverse in the chuck, gripping by the smaller diameter portion. Turn down the exposed end, again to about 0.260in. dia., leaving the 1/2in. dia. shoulder about 7/64in. long. Again, reverse in the chuck, re-sharpen the tool and finish turning the end to 0.250in. dia., at the same time take a fine cut off the face of the flange. Set the top-slide over to 30deg. and carefully turn the point. Reset the top-slide to 45deg. and chamfer the edge of the flange.

Yet again, reverse the work in the chuck making sure that the flange is hard against the jaws (use only a light grip, so as not to spoil the freshly turned surface). Carefully face the side of the flange, bringing it to its final thickness of 3/32in. and likewise, reduce the length of the smaller diameter section to 3/16 inch. The diameter of this part can now be skimmed down to 0.251 inch. We ultimately require this to be a tightish push-fit in the thrust transfer sleeve (requiring a diameter somewhere between 0.2501 and 0.2505in.), but hardening and tempering will cause a dimensional change which needs an allowance. In the absence of a cylindrical grinding facility, a little polishing, with emery paper, will soon bring the hardened item to the required size.

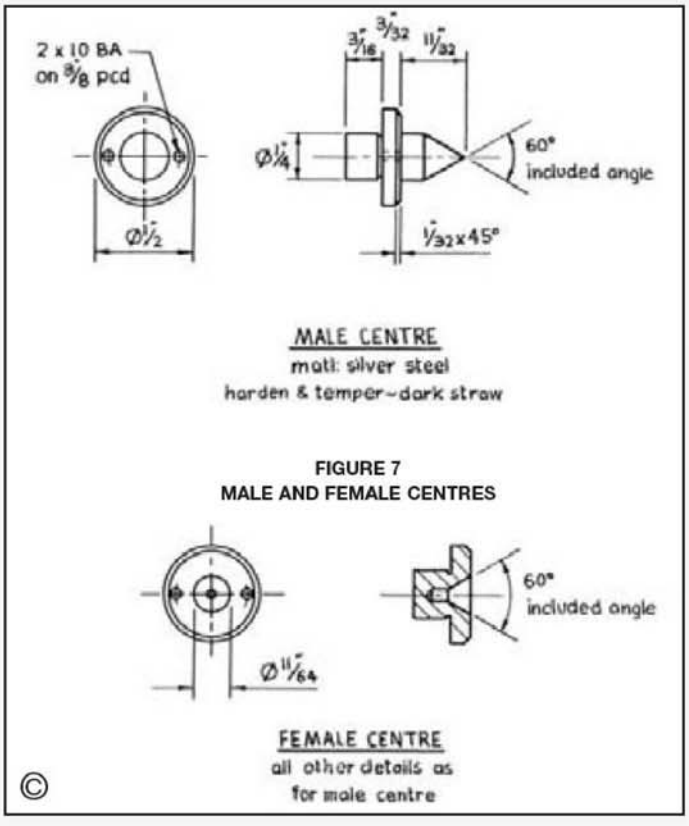


FIGURE 7
MALE AND FEMALE CENTRES

Tapping the 10BA jacking screw holes in one of the centres, using a guiding attachment set up in the drilling machine.

Before removing the workpiece from the chuck, don't forget to put in the small recess at the inner corner of the flange, and break the other sharp edges.

The two holes for the jacking screws can now be drilled and tapped 10BA. I used my dividing head, in conjunction with the lathe, to locate and drill the holes, and a simple attachment (as described many times before in these pages), set up in my drilling machine, to tap the holes (**photo 18**). Before hardening, it is worth making the female centre as they can then both be heat treated together. This centre is made in much the same way as the first, only this time the end with the spigot can be finished turned (0.251in. dia.) before parting from the parent material. The other side of the flange can then be faced and chamfered. A 3/16in. dia. Slocomb drill (taking it almost to full depth) is used to put in the female recess.

Hardening the centres

Although we might get away with direct heating in a flame there is a risk of overheating the sharp tip of the male centre. I therefore made up a simple muffle furnace to heat mine. The main body or container of this consisted of a piece of steel pipe, about 1 1/4in. inside diameter and

Improvised muffle furnace used for heat treating the centres.

1 1/4in. long; both ends having been trued up in the lathe. This was stood on one end, on a fire brick. The other end was closed with a loose cap made from a disk of 1/4in. thick steel plate. Other fire bricks were positioned around to form a tunnel. A few small pieces of charcoal were placed in the bottom of the container, to maintain a reducing atmosphere, and the centre, to be hardened, suspended by means of a length of soft iron wire, pinched under the cap. Care was taken to ensure that the centre didn't touch the sides. When all was ready, heat was applied using a fairly large burner (Sievert type 2943). This soon brought the container to red heat and shortly after, the centre itself (the lid had to be lifted slightly to see this). The gas flow to the torch was then regulated to maintain this state. **Photograph 19** shows my improvised furnace in use.

Whatever form of heating you decide to use, the work should be held at cherry-red temperature for a few minutes and then plunged into a container of cold cooking oil. The use of oil, instead of water (as is normally recommended for silver steel) will reduce the risk of these particular shaped components from distorting or cracking. Any reduction in the maximum attainable hardness, through using oil, will be of no consequence to us.

Incidentally, sperm oil was the traditionally favoured quenching medium, but with a ban on whaling this is no longer available. Cooking oil makes a good substitute, but don't use motor oil as this gives off dangerous fumes when hot and, owing to its lower flash point, it can pose a serious fire risk.

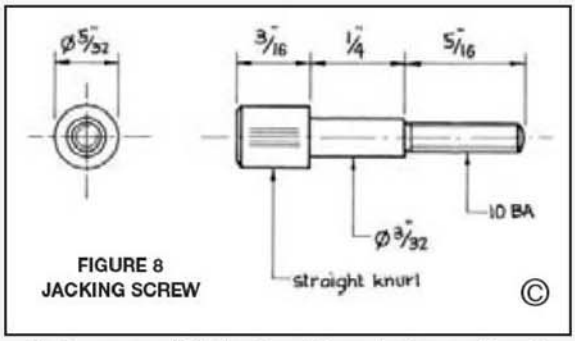


FIGURE 8
JACKING SCREW

Above: The completed centres together with jacking screws.

Having successfully hardened the part, clean up all surfaces with fine emery paper and then temper to dark straw colour. Again clean and polish. While doing this, check the diameter of the end that is to engage with the thrust transfer sleeve and continue to polish this, with the work held in the lathe (cover the ways first with paper to prevent the ingress of abrasive dust) till a reasonable fit is obtained. An emery stick (a small strip of wood with fine emery paper stuck to it) is a useful tool for this kind of work. The spigot should be finished very slightly tapered so that its end just begins to enter the hole freely — beyond this a modest amount of pressure should be needed.

To hold the female centre in the lathe, in order to polish its spigot, attach it to the faced end of a brass rod, (gripped by the 3-jaw chuck) using double-sided sticky tape.

Finally, for the sake of completeness, make up the two jacking screws (**fig 8**) used to assist in the removal of the centres. I made mine from drawn phosphor bronze (to prevent marking the thrust transfer sleeve) but, from an aesthetic point of view, they would look more attractive if made in blued steel, with a small bronze cushion inserted in the end. **Photograph 20** shows the completed centres together with these screws.

Thrust race

Although there is no difficulty in procuring commercially produced thrust races, those seen on the trade stands of modelling exhibitions are often surplus stock of unknown specification and indeterminate availability. It is for these reasons that they are generally offered at bargain prices. On the other hand, items with a pedigree and an assured supply are normally only obtainable directly from the manufacturer or an approved agent. The guaranteed quality of the product is reflected by a much higher price, added to which there may be a minimum order charge.

For our application, the rotation speed is low, the axial loading (for a typical race) is not excessive and most of the other effects that bearing manufacturers take great care to overcome, such as rumble, noise and poor sensitivity etc. are of little concern to us. Giving these all due consideration, I decided to make my own race; it also meant that I would not be restricted to the size limitations imposed by the use of standard components. This had a number of advantages. For example, by making the race a little smaller than its nearest commercial equivalent, the brace itself could be made significantly more compact, thus increasing its versatility in restricted spaces. At the same time, and perhaps more importantly, by keeping the diameter of the feed applicator (housing the race) within the smaller limits now afforded, the amount of braking torque applied to this component could be better optimised. This in turn would help to improve the handling characteristics of the tool by restricting the feed rate to a level just below that likely to cause drill bits to stall. (The alternative solution to this particular problem was to use a feedscrew with coarser pitch, but this had other disadvantages.)

To me, the exercise of making the thrust race was both interesting and rewarding and although some careful workmanship is called for this should not be beyond the ability of most readers.

The race consists of three main parts detailed in **fig 9**. These are the ball retainer (containing eight 1/8in. dia. hardened steel balls) and the two hardened steel raceways. Note that only one raceway is drawn; the second is identical apart from being 0.005in. larger in both its outside and inside diameters. This is normal practice since it allows one raceway to be located by the shaft whilst clearing the wall of the cavity, and the other to be located by the wall whilst clearing the shaft.

The ball retainer

We begin with the ball retainer, but since this is to ride freely on the thrust transfer sleeve, together with one of the raceways, it is worth ▶

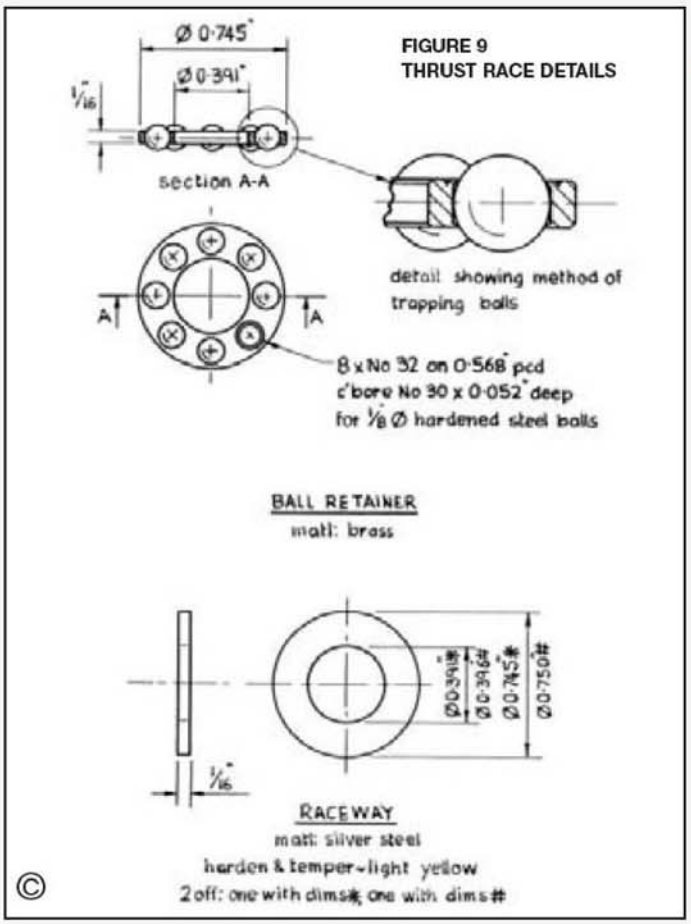


FIGURE 9
THRUST RACE DETAILS

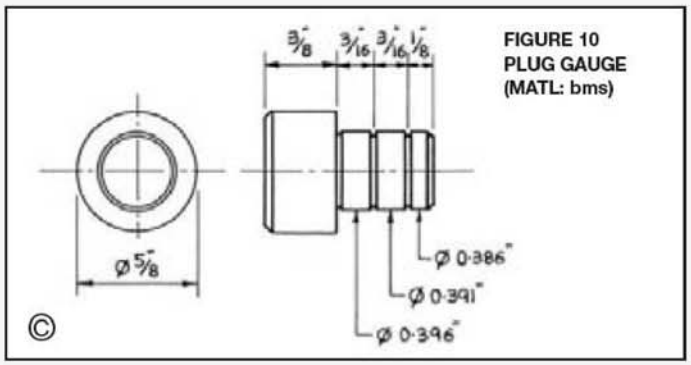


FIGURE 10
PLUG GAUGE
(MATL: bms)

Plug gauge and split rings.

Facing the second surface of the ball retainer. Note the use of the split holding ring.

making up a simple plug gauge to ensure the right fit is obtained when boring the hole through the middle. To save time we can combine this gauge with one that will be needed for the second, slightly larger, raceway; it is depicted in **fig 10**. The first region from the end, with a diameter of 0.386in., is simply to provide a 0.005in. warning of the approach to the finished size. A prior indication can be obtained from the penetration depth of the lightly chamfered end. The plug gauge is made from mild steel, and apart from taking the usual care with dimensions it is worth aiming for a finely turned, smooth finish over the reference zones.

To make the ball retainer, take a length of 3/4in. dia. brass rod and grip it in the 3-jaw chuck with about 1/2in. protruding; true up the end by facing. Since the drilling of the holes for the balls could cause some distortion in an otherwise finished retainer, we will make this the next operation, leaving the rest of the machining till later.

Drilling the holes

The easiest way of locating these holes, set on a 0.568in. pcd, is again with the aid of a dividing head. Whether you use this method, or simply mark out and use a drilling machine, it is best to keep the workpiece in the chuck. Start each hole with a Slocomb drill and follow up with a No. 32 for a full depth of 1/8 inch. Now open up these holes with a No. 30 drill aiming for a full depth of about 0.060 inch. The exact depth is not too important at this stage, but whatever you make it, it should be the same for each hole.

If you are struggling to complete this operation without a dividing head and the convenience of co-ordinate methods, I suggest fitting the drill with its own depth stop. This need be no more than a piece of 3/16in. dia. steel or brass rod, 3/8in. long, with a hole running centrally through its length. This should be put in by the drill itself. Another hole, tapped 8BA, at right angles to the first and about half way along will take a fixing screw for attachment to the drill.

Having completed the drilling, transfer the chuck, complete with the workpiece, back to the lathe.

We can now bore the hole through which the thrust transfer sleeve will pass. Start by centring and then drill 23/64in. to a depth of about 3/8 inch, (remember to use a drill that has had the face of its flutes stoned to produce a rake angle of 15deg. or less, as this will reduce the chance of snatching).

When this has been completed, set up a small boring tool and continue to open up the hole carefully until the second zone of your plug gauge (diameter, 0.391in.) just enters fully. The next operation is to turn down the outside to 0.745in. dia. for a length of about 3/16 inch.

Facing the first surface

We are now ready to take a further facing cut over the surface. This will remove any burrs thrown up during the drilling stages and also ensure that the balls are trapped in a cavity of the required depth. First though, we must determine just how much needs to be taken off. To do this, pop a 1/8in. dia. steel ball into one of the holes and then measure how much it protrudes from the surface of the retainer. This can easily be done with the aid of a dial test indicator (DTI) mounted on the cross-slide of the lathe. Alternatively, simply bring a pointed lathe tool into contact with the ball at its point of maximum projection (use a cigarette paper as a feeler), and note the reading on the top-slide micrometer dial. Move the cross-slide a little and then repeat with the tool, now free of the ball, just touching the surface of the retainer (take due consideration of any backlash within the top-slide feedscrew). The difference in the two readings gives the projection. Whichever method is used the lathe saddle should be locked during the determination. Once you have finished making measurements, the ball can be removed from the hole with the aid of a small magnet.

Ideally, the ball should protrude by about 0.030in. from the surface of the finished retainer and so by subtracting your measured value from this you will obtain a figure for the amount of material that needs to be removed. Take care with the facing operation, it is better to take several fine cuts rather than one heavy one and regret it later! Finally, very lightly chamfer the outside corner, together with the entrance to the large hole and part off to a little over 1/16in. thick.

Facing the second surface

We are now confronted with a problem common to all makers of precision washers; how to hold the workpiece in order to face the second side. It obviously can't be held directly in the 3-jaw chuck. One of the best ways is to use a stepped internal collet if you have one the right size — my impression though, is that these are not very common among model engineers. We could use the old watchmakers' technique of sticking the disc to a wax chuck (a miniature faceplate onto which the workpiece is traditionally attached using shellac), but it can be tricky to locate the work properly and the final thickness may be a little indeterminate.

Use of split rings

Since we will encounter the same problem when we come to the raceways I suggest making up a pair of split rings that will enable all these items to be held readily in the 3-jaw chuck (**fig 11**). Used with care, and providing your chuck is in good condition, they will hold the work reliably and with a degree of accuracy more than adequate for our needs. Of course, the use of such a fixture does mean holding the work by the extremities of the jaws — never a good practice — however we will only be taking very light finishing cuts and so the grip need not, and indeed should not, be excessive.

The drawing shows only a single ring since the pair are identical apart from one being bored 0.005in. larger than the other (thus providing one for each size of disc). Since this small difference only changes the circumference by 0.016in. (less than the width of the saw cut) it may seem hardly worth making a second ring but as I didn't want to use any more closing force than was absolutely necessary I decided to make a pair.

They are quite easy to manufacture. Working from the outside first, face a short length of 1in. diameter mild steel rod, centre and drill to 1/2in. diameter. Turn down the 7/8in. dia. shoulder, the length of which is 5/64in. Part off to 1/8 inch. long and reverse in the chuck, gripping it by the shoulder. Make sure that the side of the flange buts right up against the face of each jaw and that no swarf has been trapped. The chuck should be tightened with the key in the No. 1 hole (the one between Nos. 1 and 3 jaws). Face, bore and counter-bore to size. Before removing from the chuck make a small mark on the flange, mid way between jaws Nos. 1 and 3. Holding the work in the bench vice, make a fine radial saw cut at this point. Remove any burrs with a small Swiss file, and, as usual, wash thoroughly, dry and cover with a thin film of oil. **Photograph 21** shows the split rings together with the plug gauge made as an aid to the boring of the holes in the raceways and ball retainer.

Now that we have a means of holding the work, the second side of the retainer can be faced, bringing it to its final thickness of 1/16in., (**photo 22**). For greatest accuracy, make sure that the split, in the ring, comes midway between Nos. 1 and 3 jaws of the chuck, and tighten up using the No. 1 key position. While doing this, apply finger pressure to the centre of the workpiece, thus ensuring that it sits properly inside the ring and that the flange of the ring, itself, abuts with the face of each jaw.

●*To be continued.*

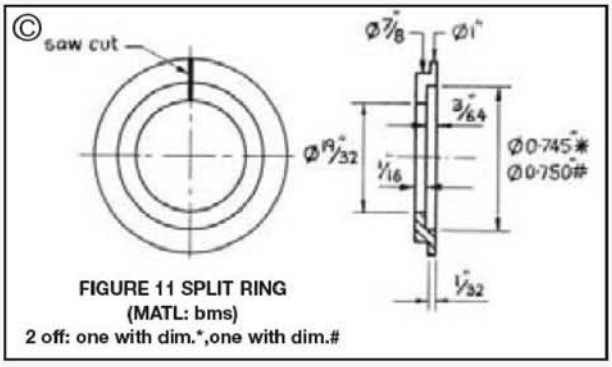
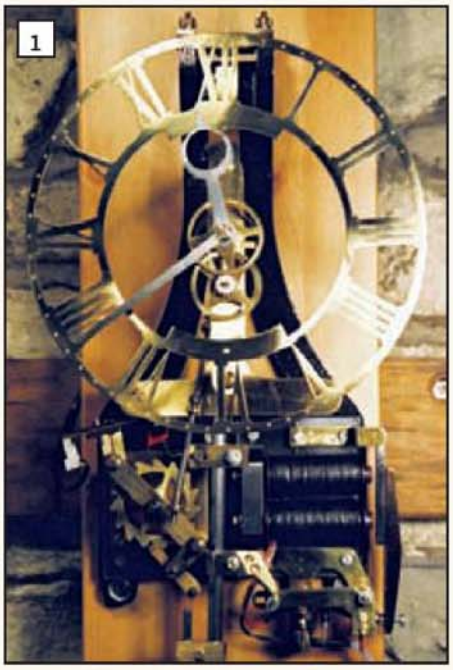


FIGURE 11 SPLIT RING
(MATL: bms)
2 off: one with dim.*,one with dim.#



The author's Jubilee clock featuring the improvements described in the text.

MODIFICATIONS TO THE *M.E.* JUBILEE CLOCK

Daniel and William Henderson

describe some interesting modifications to this popular design.

John Wilding's excellent series of articles between October 1992 and June 1993 entitled *The* M.E. *Jubilee Clock* (ref 1) describes an update to E. T. Westbury's clock originally published in *M.E.* during 1958. The present authors built the clock in accordance with John Wilding's design but experienced difficulties in getting it to work reliably. The trouble was eventually tracked down to inaccuracy in the machining of the count wheel. This is a critical component in this design of clock since the wheel not only counts pendulum strokes via a gathering pawl attached to the pendulum that drives the motion but also generates an impulse to the pendulum as its oscillation decays.

John Wilding's design employs a modification of the well-known Hipp Toggle. The German clock maker Matthias Hipp invented this technique of detecting clock pendulum oscillation decay to deliver a periodic impulse to a pendulum to sustain its motion; the method has been widely used since its invention in about 1834, both in its original form and with many variations. The variation adopted in the Jubilee design is that invented by Herbert Scott. Instead of the usual Hipp notched block and trailing trigger, a toothed count wheel with notches at the apex of each tooth is employed to trigger pendulum impulses.

In the Jubilee design, depicted in **fig 1**, a gathering pawl attached to the pendulum engages teeth of a 15-toothed count wheel and advances the escapement on every pendulum oscillation. As the pendulum arc decays over a period of perhaps 90 seconds, the gathering pawl, rather than gathering a further tooth, settles in a notch cut in its apex. This raises the vertical height of the gathering pawl on this pendulum stroke and makes an electrical contact to energise a solenoid. The solenoid causes a roller to deliver an impulse via an inclined blade attached to the pendulum. It is best that the impulse is delivered as infrequently as possible to least disturb the motion of the pendulum. The Hipp/Scott mechanism is automatic in that impulses are delivered as required to maintain oscillation.

This elegant arrangement relies on rather high precision machining of the count wheel and a nice adjustment of the contacts. Our adjustment of the contact position to start the impulse at the correct time and to sustain it for precisely the required duration during an impulse proved rather difficult in practice. An efficient electrical contact, and thus reliable solenoid action, depends on a precise vertical positioning of the contacts; this proved problematic since our count wheel teeth varied a little in height by just a few thousandths of an inch.

The impulse solenoid circuit is closed by the pawl, when in its raised position, by depressing a flexible contact strip. Thus, the duration of an impulse depends on the shape and length of the upper surface of the pawl. This cannot conveniently be adjusted to optimise the duration of the impulse period. We observed a further problem concerning the quality of the electrical contact made by the gathering pawl. When the solenoid is activated, the pendulum mechanism is in sliding contact at two places at the electrical contacts and at the impulse arm. Electrical contact is required for the full period of the impulse via the solenoid. Small vibrations induced by the impulse and the sliding pawl contact appeared to disturb the electrical contact and occasionally cause the solenoid to chatter. We therefore sought a method of detecting the decay of the pendulum to deliver a precise impulse whilst avoiding the use of mechanical switch contacts.

The modification to the Jubilee clock described here concerns the method used to detect the periodic decay of the pendulum and the precise delivery of the impulse - both its starting time and its duration. Although the modification makes use of an infrared light source and detector and a microprocessor, we feel we have not strayed too far from the spirit of the original Wilding design. The 'free' pendulum remains the primary timekeeping component of the design and the Jubilee clock is, after all, an electric clock! The necessary electronic components are readily obtainable and the electronic construction is within reach of model engineers possessing some circuit construction experience. The authors can provide a

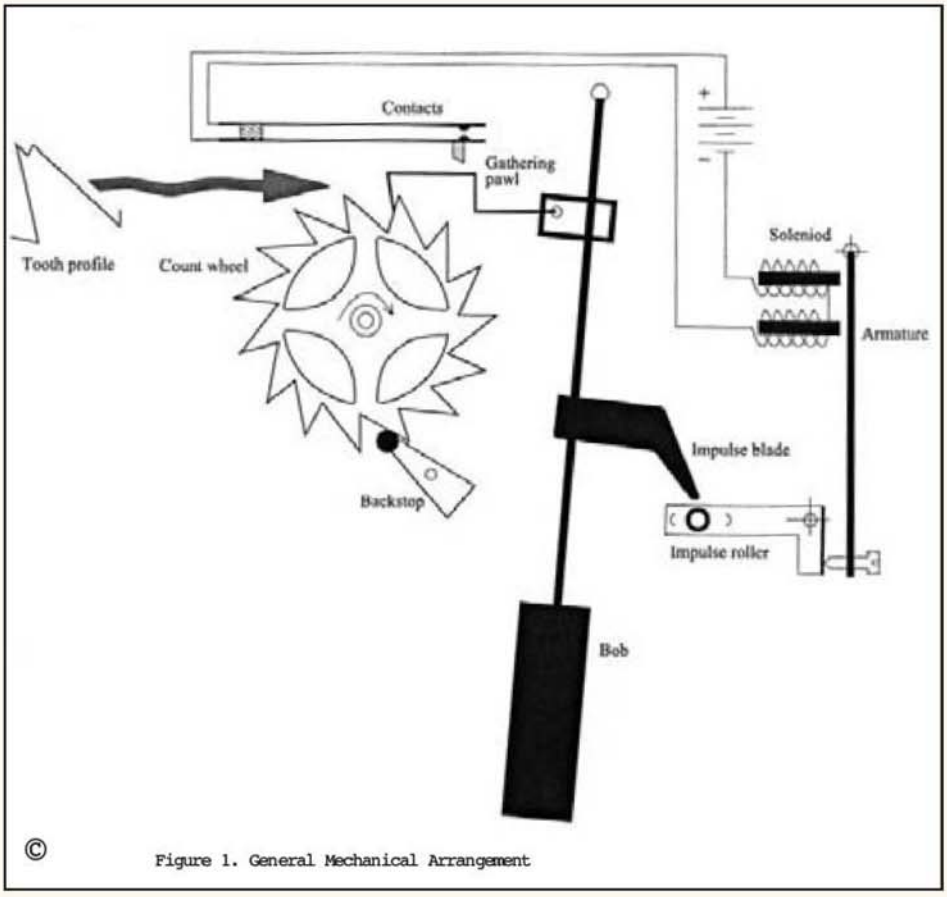


Figure 1. General Mechanical Arrangement

programmed microprocessor for model engineers who feel that they would rather avoid the necessary software development.

Change to the design

We removed the mechanical contacts activated by the gathering pawl and instead detected the decay of the pendulum using an infrared (IR) light source and sensor mounted above the gathering pawl. The infrared beam is aligned perpendicular to the plane of oscillation. The general arrangement of the pawl, detector and infrared light source is illustrated in **fig 2a**.

A light, aluminium 'flag' is attached to the upper surface of the gathering pawl. This obscures the IR sensor when the pawl rises to clear the apex of each tooth. Importantly, the flag remains in its raised position for a longer period when the pawl rests in one of the count wheel notches. Thus, the sensor is activated for longer when the clock requires an impulse. A simple controller measures the time during which the flag is raised and generates an impulse only when the duration exceeds a certain limit. This time delay can be accurately adjusted via the controller as can the duration of the impulse. **Figure 2b** illustrates the approximate loci of the tip of the pawl on pendulum oscillations requiring no impulse and on cycles when an impulse is generated. Also shown is the motion of the pawl flag in relation to the IR beam. Note that on the impulse cycle the IR beam is obscured for a longer interval than on normal cycles.

There are several benefits obtained using this method of detecting pendulum oscillation decay, namely:

1: The IR detector robs the pendulum of no energy - the mechanical switch was found to disturb the motion of the pendulum in the Wilding design. To make a reliable electrical contact, the gathering pawl must compress the spring contacts, absorbing some of the energy of the pendulum and disturbing its motion.

2: The start of the impulse can be readily adjusting by varying the time limit employed in the controller. The impulse should begin after the pendulum begins its rightward motion and the impulse roller is below the start of the impulse blade.

3: The duration of the impulse is now no longer dictated by the profile of the gathering pawl. The impulse interval may be varied by the controller to optimise its duration.

4: The impulse is independent of small variations in the radii and profile of the count-wheel teeth;

5: Feedback between the impulse and the detector, described earlier, is avoided.

Infrared source and detector assembly

The infrared light source is a transmitting diode and the detector is a phototransistor, these are commonly available devices; for example, Maplin components CH10L and CH11M work well. The emitter and detector may be mounted directly on a small piece of copper-clad circuit or Vero board. We employed a slotted opto-coupler assembly to mount the devices and Vero board tracks to take the electrical connections away from the sensor and emitter. The mounting flanges on the housing allow it to be rigidly secured to the contact platform - the attachment intended for the contact assembly. A suitable slotted polycarbonate opto-coupler may be purchased using order code 724-110 from **ESR Electronic Components, Cullercoats NE30 4PQ; tel: 0191 2514363**. The device has a sensitive region of about 1 square millimetre. The coupler is sold with a visible light diode and detector; these should be discarded and infrared devices substituted to reduce interference from sunlight or artificial light sources. The sensor should be mounted in the front of the flag and the source to the rear to minimise light interference. **Figure 3** illustrates the opto-coupler and mounting assembly used in the prototype.

The 'flag' attached to the gathering pawl was made from scrap aluminium alloy sheet, salvaged from a beer can. This was fixed in position using epoxy resin adhesive. The dimension of the flag are not particularly critical since the start time and duration of the impulse can be accurately adjusted by manual inputs to the controller. A mounting plate was cut from copper-clad fibreglass board of the type used to make printed circuit boards; this was glued to the lower circuit board to make a 'sandwich'. A longitudinal slot allows some adjustment of the plate; it is secured to the contact platform by a 6BA screw.

Controller

The control system is depicted in **fig 4**. The microprocessor controller samples the signal from the infrared sensor and generates the impulse via the solenoid at precisely the right time to restore the pendulum swing. Additional

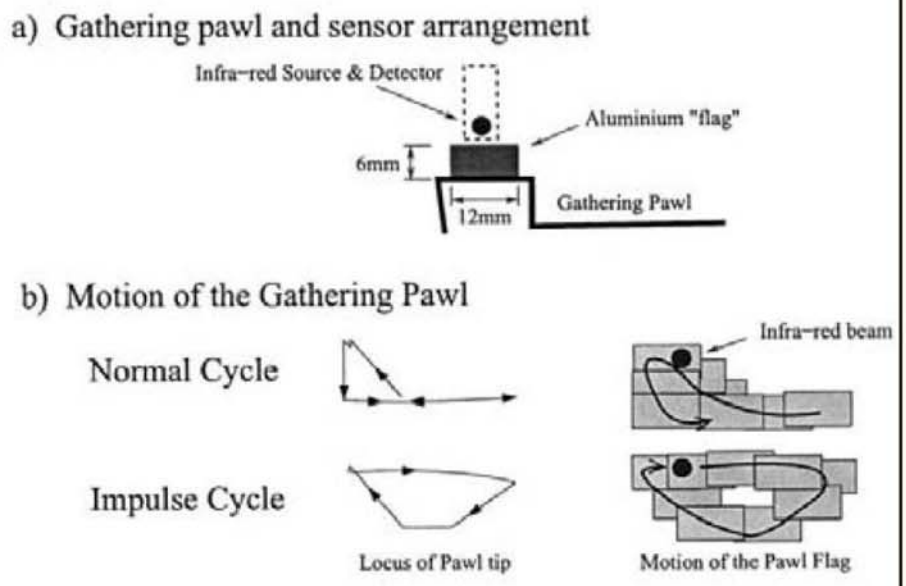


Figure 2. Gathering Pawl, Infra-red Source and Detector

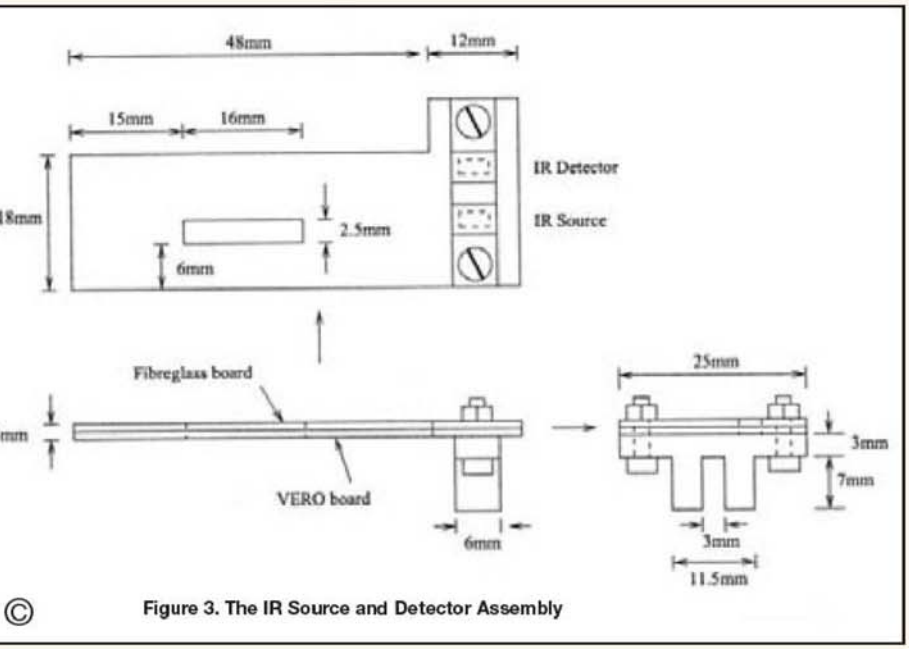


Figure 3. The IR Source and Detector Assembly

inputs to the controller allow manual adjustments to be made to the timing of the impulse.

The microprocessor is the PIC 12F675, a device manufactured by Microchip Technology Inc. This is an inexpensive eight-pin, low-end device with limited memory capacity for storing programs and just six input/output ports (only four of which are required here). Advantages of this device are that it possesses an internal clock, reducing the number of external components required, and analogue to digital converters allowing the time interval values to be input. Devices of this type are widely used in modern domestic goods such as washing machines, toasters and ovens.

A schematic diagram of the controller electronics is depicted in **fig 5**. The infrared light emitting diode is permanently powered from the controller; the series resistor limits current through the device. The controller senses the infrared light signal and detects the motion of the gathering pawl. The analogue signal from the infrared photo-diode controls the state of a switching transistor; this signal is cleaned up using a NAND gate before input to the microprocessor via port GP3. The control software reads this input to determine if the pawl flag is obscured. The visible light LED on the transistor collector indicates the state of the sensor and is useful during set-up. The controller generates an impulse by activating a relay to switch the higher current solenoid circuit. The small signal output at pin GP2 switches a transistor, required to provide sufficient current to drive the solenoid relay coil. The two diodes protect the circuit from the inductive load presented by the relay and the solenoid. The impulse start time and duration are input using potentiometers, the positions of which vary analogue signals presented at ports GP0 and GP I between 0 and 5 Volts. The analogue voltages are converted to digital values by the microprocessor. The microprocessor reads these each pendulum oscillation and uses the latest values for controlling the impulse point.

In our prototype, both the microprocessor and the solenoid were supplied from a small mains power supply. The solenoid circuit is powered separately from the microprocessor and relay to avoid the quite heavy currents drawn by the solenoid from generating noise in the microprocessor supply. The solenoid supply voltage is not critical; we have tried voltages between 5 and 12V to investigate the variation in impulse strength. A 9V supply provides an impulse sufficient to keep the clock operating for at least 2 minutes. In any event, the power supply must be capable of delivering about 500mA during an impulse.

The prototype was constructed on a 2 x 4in. piece of 0.1in. pitch Vero board and fitted inside an aluminium alloy enclosure The total cost of the electronic components should be about £10 or £20 depending on their source; we obtained most of the parts from Maplin.

Software

The PIC microprocessor endlessly executes the following algorithm:

```
loop
read impulse start value - delay1;
read impulse duration value - delay2;
wait until gathering pawl sensor obscured;
delay before start of impulse - delay1;
if ( sensor obscured ) {
      turn on solenoid;
      delay for impulse duration - delay2;
turn off solenoid;
}
goto loop
```

At the start of each cycle, the time delay values are input from the potentiometers by performing

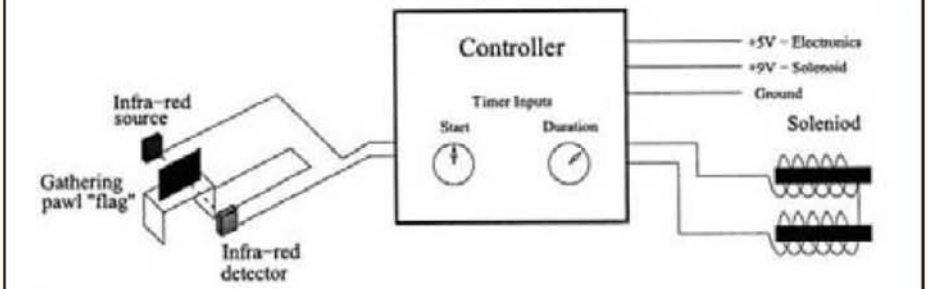


Figure 4. The Control System

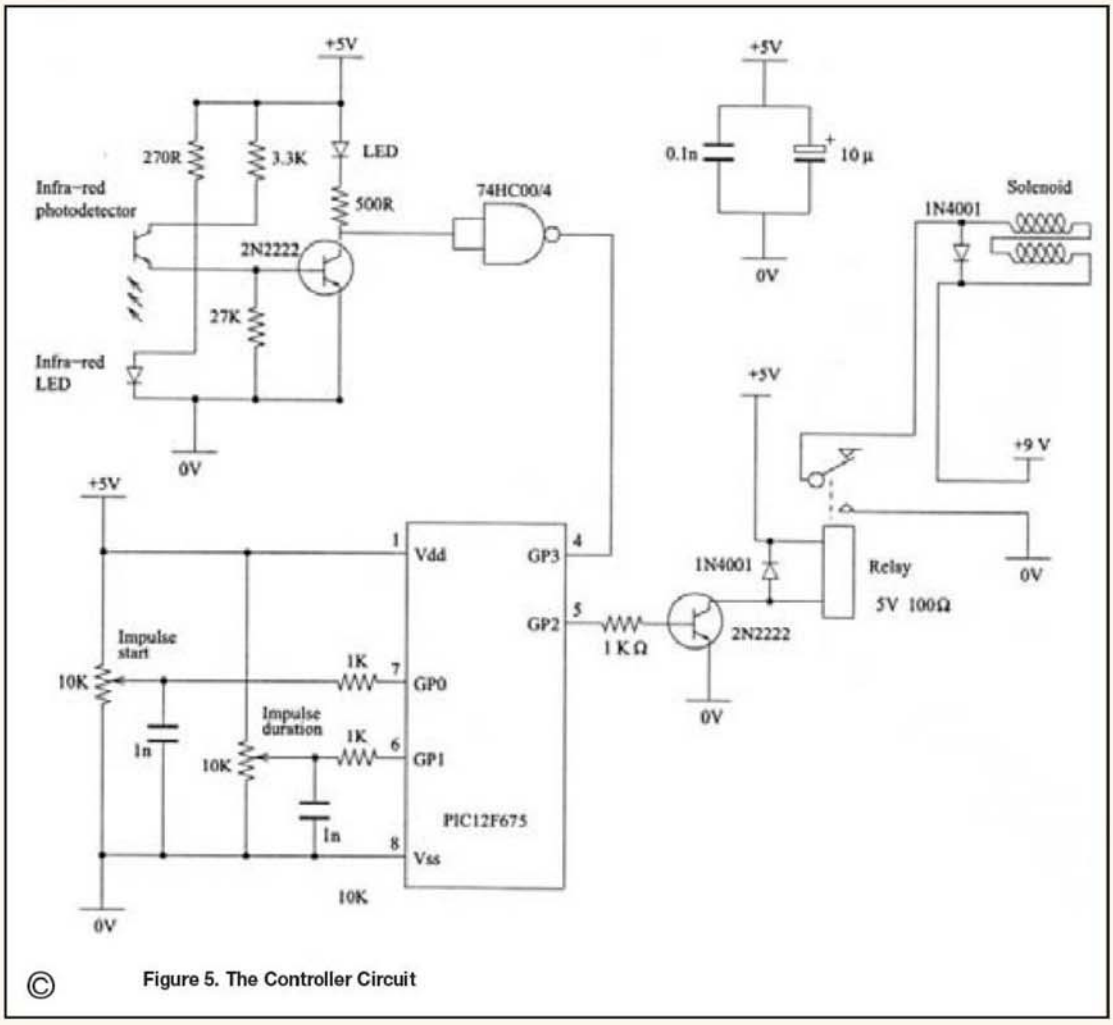


Figure 5. The Controller Circuit

two analogue to digital conversions. The program then waits for the gather pawl sensor to be obscured and starts a delay for a duration, 'delayl', input on one of the potentiometers. Following this delay the sensor is inspected to determine if the gather pawl flag is still obscuring the IR beam. On most oscillations the flag will have fallen over a count wheel tooth and flag will not be obscuring the sensor. If the gather pawl rests on a count wheel tooth notch the flag will still be obscuring the IR beam after the delay. In this event an impulse is delivered to the pendulum by turning on the solenoid for a duration, 'delay2', entered on the second potentiometer.

The delay 'delayl' is adjusted such that it terminates when the pendulum begins its leftward motion to start the impulse. The delay 'delay2' is adjusted such that the solenoid roller makes contact with the impulse blade for its full length during the impulse. Together these two delays are sufficient to obtain good control over the start and duration of each impulse. As with the Wilding design, impulses are delivered with a frequency required to keep the clock in motion. In practice, impulses are delivered every 60 or so oscillations of the pendulum, corresponding to a period of 2 minutes.

Controller software was developed in PIC Assembly Language and assembled using MPLAB, a development environment freely available from Microchip at **www.microchip.com**. The PIC microprocessor software is written into the permanent memory (Flash memory) of the device using the programming board. Once programmed, the microprocessor may then be transferred to the control hardware. Programming devices for the PIC family of microprocessors are readily available from retailers such as Maplin **(http://www.maplin.com)** or Olimex **(http://www.olimex.com)**. An inexpensive development board and programming tool is the PICKit 1 Flash Starter Kit manufactured by Microchip. Both the source (assembly language) and assembled software is available here:
http://www.unn.ac.uk/Thill/jubilee/index.html

For those wishing to try building the controller but have no access to PIC programming hardware or download tools, we can provide a programmed 12F675 microprocessor at a modest charge.

Operation

Photograph 2 illustrates the positions of the sensor components and the gathering pawl in the prototype. It will be necessary to adjust the positions of the backstop, pawl mounting position and infrared source/ sensor assembly to achieve a smooth action of the escapement, John Wilding (ref 1) discusses this procedure at some length.

The backstop position is quite critical since it fixes the count wheel teeth at the point the pawl gathers a tooth. Too far to the right and the pawl may not travel sufficiently far to gather the count wheel. If too far to the left, the pawl may not successfully gather the count wheel when an impulse occurs. The impulse arm position may also require some adjustment such that the impulse roller is below the start of the impulse blade at the extreme end of the pendulum arc. The pendulum should have started its leftward traverse prior to the impulse. Some further adjustments to the positions of the sensor assembly and backstop may be required after the minimum pendulum arc has been determined. The impulse start time and impulse duration may be adjusted manually to optimise the action using the inputs on the controller.

Some final thoughts

The infrared detector is a little susceptible to interference from extraneous light sources. Early after developing the controller, we were disappointed to find the clock had stopped at about 06:30 in the morning on a number of occasions. After suspecting and testing various components we eventually realised that the time of failure corresponded to the appearance of the morning sun and that the IR radiation in the sunlight was swamping the detector and preventing an impulse. A temporary cardboard shield was installed to protect the detector from the sunlight and the clock suffered no further failures. The detector is suitably shielded within its final cabinet.

Some design details of the Jubilee clock limit its accuracy, namely:

1: Hope-Jones strongly advises in his book (ref 2) that impulses should be delivered as the pendulum passes the neutral point at the centre of its oscillation, an observation echoed by Bishop (ref 3). At this point the bob is travelling at its fastest and least disturbance to its motion is made by the impulse. Impulses are delivered near to an extreme of the pendulum oscillation in the Jubilee design at a point where the pendulum is moving slowly. It is particularly important to deliver the impulse after the pendulum has begun its leftward traverse and not whilst it is still travelling rightward or is stationary. This is easily controlled in the current design by adjusting the initial impulse delay.

2: Changes in ambient temperature will cause the length of the pendulum to change and its period to vary a little. For a mild steel pendulum rod, a 2 deg. Celsius increase in temperature will slow the clock by about 1 s/day. For those wishing to try Invar (an alloy with a very low expansion coefficient), Meadows & Passmore; tel: 01273 421321 can supply the material in rod form.

3: The impulse mechanism is electromagnetic. Small changes in supply voltage (and thereby current through the solenoid) will affect the energy delivered by the impulse. Any variations in impulse strength should be avoided if possible (ref 3) since the period of a pendulum clock is lengthened a little as its arc is increased (so called 'circular error'). The gravity impulse mechanism or remontoire delivers precisely the same energy to the pendulum on every impulse so is the preferred method of impulsing (ref3).

Notwithstanding these deficiencies, the modified Jubilee clock is an excellent timekeeper; it appears quite possible to regulate it to achieve a drift of less than ±20 s/week. The simple optical sensor and controller might be adapted to improve the performance of any pendulum clock using the Hipp mechanism.

References

1: J. Wilding, *The ME. Jubilee Clock, Model Engineer*, vol. 169, Nos. 3930, 3932, 3934, vol. 170, Nos. 3936, 3938, 3940, 3942, 3944, 3946, October 1992 to June 1993.

2: F. Hope-Jones, *Electrical Timekeeping*, N.A.G. Press, London, 1940.

3:Bishop, J. F. W., T*he physics of clocks and watches*, *Journal of Scientific Instruments*, vol. 32, August 1955.

A close up view of the sensor components and the gathering pawl. Care is needed in setting up the parts to give good performance.

Undergoing tests for forty years, the backhead valve fitted with a dummy hand wheel.

STEAM OPERATED CYLINDER DRAIN COCKS AND RELIEF VALVES

Ivan Law

passes on details of a design made and tested many years ago but starts with some insight into how he stores engineering drawings.

I have been a model engineer for most of my life. It not surprising therefore, that over the years I have collected a large number of drawings and designs, some of my own creation many others copies of other peoples work. As I have so many drawings and related documents a filing system had to be devised in order that I could access them as and when required. My system is very simple. When I have finished with a drawing, I fold it or roll it up and put it in a drawer or cabinet. It does not matter which as long as it will go in without others falling out.

The system has worked well although, from time to time, further drawers or boxes have had to be added. Recently I was asked if I could supply a reader in America with some prints of a dividing head that I designed and made a few years ago. I knew that these drawings were filed in the system somewhere, so set about finding them. Now, locating a particular drawing is a very simple exercise. I get out each drawer or box in turn, empty the contents on the floor and look at each drawing or document in sequence until the one required is found.

In this particular case it took the best part of a day, for as that famous gentleman's law prophesied, the required drawings were in the last box. However, I did find them, which was gratifying as it proves that my system works. However, one drawback in the system was highlighted; it did take a long time to find what I was looking for. This was due to some drawings re-awakening an interest and time was spent looking at them rather than getting on with the task in hand. One such drawing has resulted in me writing this article.

Follow on

Just prior to starting the search for the drawings, I had been reading the interesting article by Bob Thomas on the subject of automatic cylinder drain cocks (*M.E.* 4286, 10 November 2006). One of the drawings that turned up in my search was a design for steam operated, combined cylinder drain cocks and automatic relief valves. This I thought may make an interesting follow on from Mr. Thomas's article. I designed, made, and fitted these valves to a locomotive about forty years ago at a time when I was experimenting with O-rings. O-rings are now a standard item in the model engineer's armoury against leakage, but they were little used by model engineers at that time. The locomotive to which they were fitted is still in regular use. The drain cocks are still *in situ*, they have never been touched nor have they given any trouble during the whole of that time, so I think that I can call the experiment a success and can offer the design for publishing with confidence.

The usual types of drain cocks fitted to model locomotives are, in the main, taper plug cocks operated by linkage from the footplate. The necessary rods and linkage, which has to both push and pull can, on occasions, get complex and often they have to follow a tortuous route. Nevertheless the system does work reasonably well. However, I have had an occasional failure with them owing to seizure of the plugs or breakages in the linkage. In no way can this type of cock be automatic or operate as a relief valve.

Relief valves are usually separate valves and are fitted in the cylinder covers to provide an escape route for any water trapped in the cylinders. They are not essential in slide valve cylinders because any excessive pressure in the cylinder caused by trapped water lifts the valve off its face allowing the trapped water back into the steam chest, and via the exhaust port, out through the chimney. With piston valve cylinders the situation can become serious. Should any water be carried over into the steam chest, which can happen on the run due to priming, then that water will pass the valve and get into the cylinder where it will become trapped between the moving piston and the cylinder end cover. This will result in a hydraulic lock in the cylinder and enormous pressure as all the moving parts come to a sudden stop. The most likely result would be that the cylinder will fracture around the end cover stud holes resulting in a major breakdown.

Dennis Monk (a respected friend and an oracle on all things 'Midland') informs me that this actually happened to the 0-10-0 banking engine *Big Emma*. The cylinders were all cast in one ▶

The two pressure relief valves fitted to the author's locomotive. They have required no attention since being fitted.

A close up view of one of the neat cylinder pressure relief valves. The author apologises for not cleaning the locomotive before taking the

piece, a very complicated and difficult item to make and replace. The engine would have had to be prematurely scrapped had it not been for the fact that the original order was for two engines, and before the second order had been cancelled two sets of cylinders were produced, and so a replacement set was available and fitted.

Relief valves are spring loaded valves somewhat similar to small safety valves, these provide an escape route for any trapped water. Relief valves were of course fitted to *Emma*, but the water carried over was much more than the valves could handle.

Design

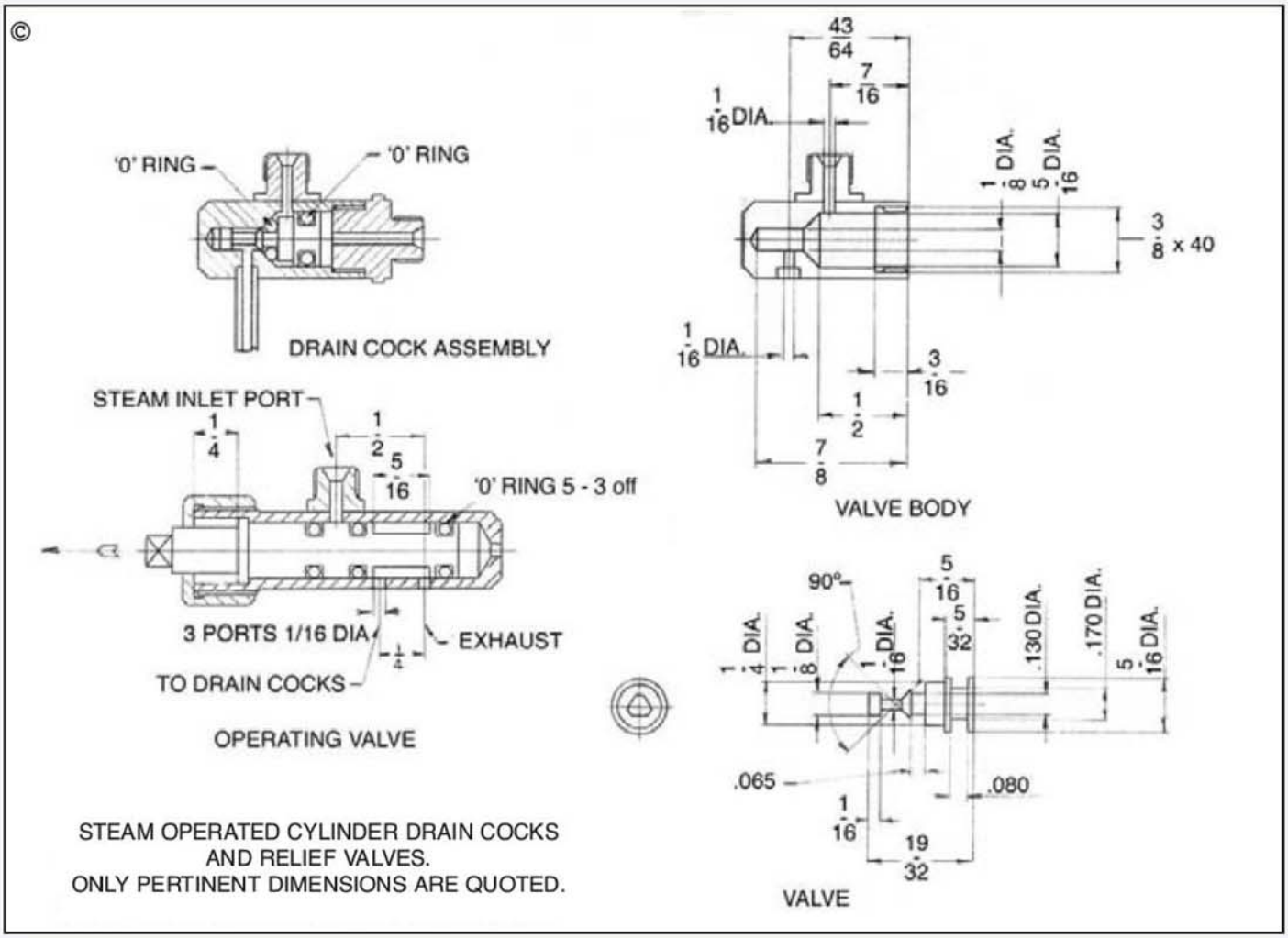
The design suggested here is for a dual purpose valve that can operate as either a drain cock or automatic relief valve. The actual valve is a combination of a piston head, and mitre valve, between the two is the connection from the cylinder - the valve body screws into the cylinder in the usual way. When starting from rest the backhead operating valve is pushed into the open position, that is the position shown on the drawing. Therefore no steam or pressure is passing the operating valve. When the regulator is opened and steam enters the locomotive's cylinder, it also enters the valve body between the valve piston and the mitre valve. The pressure of the steam pushes on the backside of the piston and moves it backwards thus opening the mitre valve. Steam and any condensate can then exhaust to atmosphere. As soon as the driver considers the cylinders are clear of water, the operating valve can be closed by pulling it in the direction of the arrow. Boiler pressure steam now pushes on the valve piston and closes the mitre valve thus shutting the valve.

In normal running, the pressure closing the mitre valve will always be greater than the pressure trying to open it Should any water get past the regulator, due to priming or some other reason, and get into the cylinder the result would be a hydraulic lock or abnormally high pressure. This high pressure will automatically overcome the boiler pressure acting on the valve and the valve will open thus, as the name of the valve indicates, relieving the excess pressure. As soon as conditions get stable the valve will automatically close and normal running will be resumed.

The backhead valve is a simple device, when pushed inwards there is no pressure acting on the drain cock's piston, but when the valve is pulled outwards steam is admitted, and the drain cock closes. It may be noticed from the photographs that a hand wheel was fitted to the operating valve. This is for the sake of appearance and to match the other control wheels, it only acts as a knob. The connection between the backhead valve and the drain cock is by a pipe, as this is only transmitting a pressure this pipe may follow any path available. It does not matter how many twists and bends are required. At the drain cock end the pipe terminates into a distribution block with pipes going to each individual valve

I have not completely detailed the drawings as the shape of the valve bodies may be varied to suit the whim of the constructor. The mitre valve is completely dimensioned, and so are the innards of the valve bodies as these are important. The sizes quoted are for the valves that were produced for a small 7 1/4in. gauge locomotive , but at this size they would also be suitable for a 5in. gauge engine. The O-rings are 5/16in. O.D. x 3/16in. I.D. for the piston valve and operating valve, and 1/4in. O.D. x 1/8in. I.D. for the mitre valve. Once the principle is understood dimensions could be determined to suit any size of cylinder.

The valve bodies for both drain cocks and operating valve were made from gunmetal. I am not quite sure of the material I used for the actual valves as it is forty years since they were assembled, but gunmetal could also be used for these items as well, as the movement between the mating components is minimal.



STEAM OPERATED CYLINDER DRAIN COCKS AND RELIEF VALVES.
ONLY PERTINENT DIMENSIONS ARE QUOTED.

Stowe - drawing by Simon Bowditch

STOWE
SOUTHERN RAILWAY 'SCHOOLS' CLASS LOCOMOTIVE

Neville Evans
discusses the slide bar brackets.

●*Part VIII continued from page 32 (M.E. 4290, 5 January 2007)*

It would be nice to be able to say that these particular artefacts gave me more trouble than the rest of the locomotive put together, however, a glance at the complexity of the valve gear arrangements, no doubt the brain child of Harry Holcroft, will suffice to dispel any notions of that sort.

Inspection of the various photographs that I have published of the three preserved 'Schools' class locomotives, will show that at least three different sets of patterns were used in the original manufacture of the slide bar brackets of these engines. It is also probable that the left and right hand brackets of some engines were of different shape. Some were bowed out further than others probably due to the fact that they were all 'handed' because they served a dual purpose in that they not only acted as bearers for the slide bars but also formed the front part of the plate structure that carried the outside expansion links.

It is hoped that the brackets will be available as lost wax castings in steel by the time this screed is published. My remarks as to the necessity for the utmost accuracy in the fitting of slide bars generally, apply just as much to three bar as they do to the more normal two bar slide bars. In fact I have just aligned both inside and outside brackets of 'Jeannie Deans'. I first split the frames, so that I could spot through the existing bracket mounting holes. I have always made a simple jig to help in the alignment of the rubbing surfaces. I generally use a piece of scrap aluminium round bar, turning one end to a push fit in the cylinder bore and the other to fit closely under the slide bar. The complete bracket/ upper ▶

Detail of the rear valve chest cover on a full size example of this class of locomotive (photo: Derek Tulley).

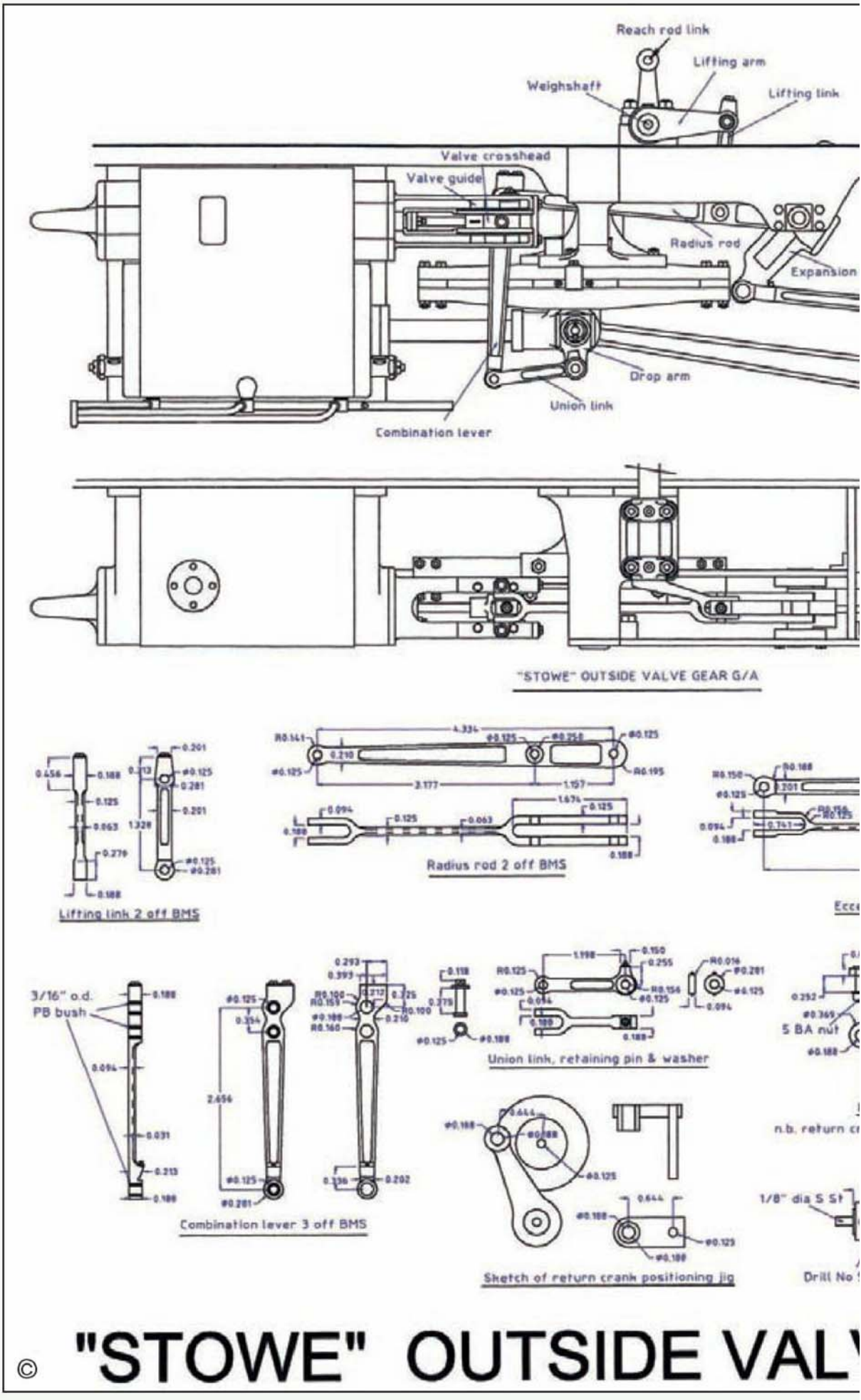
Moving along a little we can see a front view of the slide bar bracket (photo: Derek Tulley).

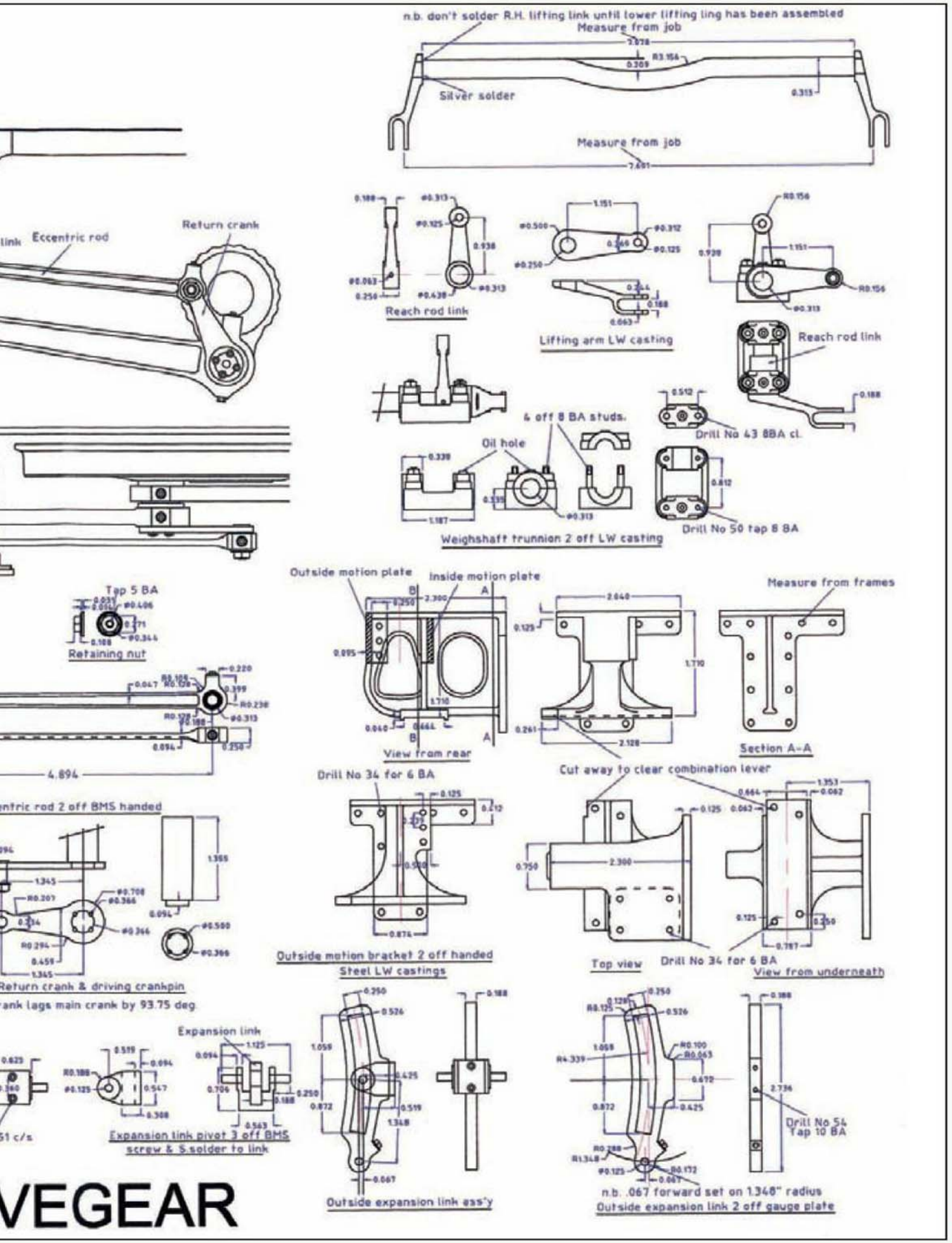
slide bar assembly is then pushed down onto the jig, clamped onto the frame and drilled for the 6BA mounting screws. The piston back cover and crosshead assembly is assembled and the lower slide bar fitted, with appropriate shims, so the the whole lot slides freely. This is but one method which works for me, I'm sure that builders will work out procedures that suit themselves.

Valve gear

Much late night oil has been burned in the preparation of this valve gear. Simon Bowditch has written an article *(scheduled for* M.E. *4294, 2 March 2007 - Ed.)* describing the various problems and their solutions, which should make things much clearer. The complexity arises from the provision of two weighshafts, one for each set of valve gear. These are positioned one above and one below the centre line. The upper weighshaft is the master bar. It is set from the cab by a normal reach-rod and controls the two outside valve gears. The lower bar is coupled to the upper by the proverbial system of cranks and levers. In passing, I must say that I took a good look at LBSC's famous 'Schools' design, that he called *Roedean*. Curly Lawrence managed to fit the whole bag of tricks into a 3½in. gauge engine, without the benefit of computers or any of our modern knick-knacks, and came up with a little gem of a locomotive that not only runs very well, but looks the part too. I have been looking for a nice *Roedean* as well as an LBSC Webb compound (Curly also called his compound *Jeannie Deans*), for a long time now. They seem to be as common as hen's teeth. The man was a genius.

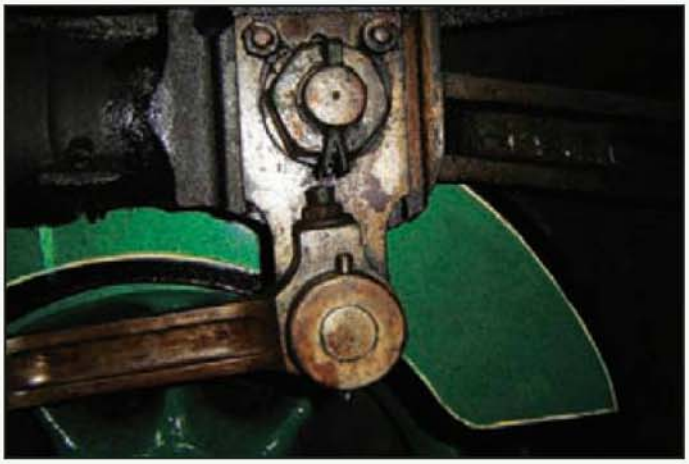
I have detailed the outside motion this month, together with the trunnions and the top weighshaft. Please note that the weighshaft cannot yet be assembled, until the lower weighshaft, that is the inside valve gear weighshaft, lifting link has been put on. The weighshaft in full size has perforce to be made in three




n.b. don't solder R.H. lifting link until lower lifting ling has been assembled
Measure from job
Silver solder
Measure from job
Return crank
Eccentric rod
Reach rod link
Lifting arm LW casting
Reach rod link
4 off 8 BA studs.
Oil hole
Drill No 43 8BA cl.
Drill No 50 tap 8 BA
Weighshaft trunnion 2 off LW casting
Tap 5 BA
Retaining nut
Outside motion plate
Inside motion plate
View from rear
Measure from frames
Section A-A
4.894
Drill No 34 for 6 BA
Cut away to clear combination lever
Outside motion bracket 2 off handed
Steel LW castings
Top view
Drill No 34 for 6 BA
View from underneath
Return crank & driving crankpin
Expansion link
Expansion link pivot 3 off BMS
screw & S solder to link
Outside expansion link ass'y
n.b. .067 forward set on 1.348" radius
Outside expansion link 2 off gauge plate
VEGEAR

Note the angle iron brackets fitted to hold the rear of the expansion link plate (photo: Derek Tulley).

The union link fitted to the full size version of Stowe *and photographed at the Bluebell Line (photo: Derek Tulley).*



Stowe's crosshead and union link fastening. Note the use of the split pin (photo: Derek Tulley)

The left hand expansion link. Note the wrap around suspension bracket (photo: Derek Tulley).

pieces. This is because of the compactness built into the engine, due to its having to thread its way through the tiny tunnel at Mountfield near Battle on the Hastings line, and also the fact that the outside diameter of the boiler is about three inches greater than that of the 'King Arthurs'. This means limited clearances under the boiler.

In full size of course, provision had to made so that the the whole thing could be dismantled without removing the boiler, in pieces small enough that heavy lifting tackle was unnecessary. In our smaller size however, we can always wangle it out from its position without further disassembly. The bend in the middle is not too much of a pain if the middle portion is brought up to a really high temperature and bent over a former. The outer parts can then be straightened into a jig.

One of the minor headaches lay in the fact that, whoever worked out the motion details, fixed the return crank onto the end of the driving crank pin by means of four studs with a tongue and groove to take the driving forces. Stanier locomotives on the LMS used the same fixing method. I'm not sure that this method is appropriate for a small(ish) model so I'm pressing the return crank onto a round boss and scattering the four studs around the diameter of the boss, so that they act as four fixing pins to prevent movement. The crank will have to be set with the aid of a simple jig as illustrated, so as to ensure accuracy. A point that I should have mentioned earlier is that the driving axle must be drilled 1/8in. at least 1/2in. deep so that the jig can be plugged into the axle, and fitted over the arm of the return crank. The full size drawings have been amended to include the jig.

The expansion links and die blocks, will be available from Practical Scale as hot wire cut items. I have just seen the links for the GWR 2-cylinder locomotives and am truly astounded at the accuracy and finish that this process achieves. They seem a little expensive but when you consider the amount of time saved, and the perfection of the finished product, it seems to be money well spent. I am having the expansion links, and in fact all of the valve gear for 'Jeannie Deans', cut on a 3D Laser machine. I am hoping that such time consuming items as the union links will arrive with the fork ends formed and the holes ready drilled to precision limits. I have just redrawn the expansion link pivots in accordance with a new set of photographs taken by Derek Tulley, of *Stowe* on shed at the Bluebell Line. I have enclosed some of the more important ones for your 'hedification'. For the record, this is an excellent example of how to take photographs. Close up, so that all the detail can be seen, and taken as close to right angles as possible, where possible, as can be seen on the union link photo. Well done mate.

The underneath weighshaft, the inside valve gear and the reverser will have to wait until later. The whole bag of tricks looks quite reasonable from here and Derek Tulley reports that he's getting on very well with no unexpected glitches up to now. This is called tempting providence.

Churchward Counties and County tanks

There has been a lot of interest shown in the last few months, in the smaller Churchward express locomotive, the little 4-4-0 'County' class, together with its stable mate, the 'County tanks', so much so that at least one of each is being made even as I write. I intend to devote a couple of issues, in the not too distant, to the tender engines and to include the drawings of the smaller No.2 boiler, as fitted to the tankers, together with the larger No.4 boilers which were carried by the tender engines. In fact one of the tanks, No.2230 was tried with a No.4 boiler for a short time, but it turned out to be too heavy, and a No.2 was substituted after a while.

I did in fact draw a 22 (the official title of what we, the proles, call a 'County tank') as 2230 with the big boiler, and a most striking engine it turned out to be. The larger boiler gives it a greater air of symmetry than the smaller boilered engines. You therefore have the excuse to chose between the two boilers. I would certainly opt for the larger of the two. Incidentally, these two classes never sported outside steam pipes, and so Pete Thomas is slightly modifying the cylinder patterns to accommodate both inside and outside pipes. This obviously is to the advantage of those people who are building the earlier 29s as well the larger and older 2-6-2 and 2-8-0 tanks.

●*To be continued.*

ROAD STEAM

SAVAGE'S *UNIVERSAL CARRIER*

The late Stan Nipper and Martin Wallis

continue their description of the gears.

●*Part XXVIII continued from p. 37 (M.E. 4290, 5 January 2007)*

In common with most undertype wagons, where the engine/ gearbox is a self-contained unit mounted under the chassis, the Savage *Universal Carrier* was provided with two speeds. Undertype engine designs usually (but not always) had a relatively short stroke, and were invariably much more carefully balanced than their overtype brothers so the motion could achieve much higher rotational speeds without undue distress. Since the range of available revolutions per minute was much greater than might be safely achieved on conventional overtype wagons there was no need for a third gear ratio to attain the higher road speeds.

It is a while since the engine general arrangement has been reproduced so, in reduced format, I have included it again. I suspect some of the detail may be lost but the three shaft arrangement and gear layout ought to be clear enough. Note the engine is devoid of a flywheel, an indication of high speed running. The individual drive gears are shown in **photo 290**, and are laid out in their correct orientation in **photo 291**. The differential unit is nearest the camera.

Importance of neutral

A pair of reduction gears transfers the power from the engine to the second shaft, here the drive for the mechanical boiler feed pump and mechanical lubricator are taken and the sliding change speed bobbin provides the two road speeds, with a neutral position in between. The neutral position allows the drive to the back wheels to be disengaged without the loss of the reduction drive to the boiler feed pump, this is most helpful on a model as miniature injectors are not as dependable as their full size counterparts.

The well-known, and much respected, Sentinel lorries made examples where the boiler feed pump could only be used when the lorry was in motion. Unfortunately, even full size injectors have their moments; during a rally this summer I noticed a small crowd collecting around a Sentinel indicating something of interest. On wandering over I saw that a back wheel had been jacked off the ground and was spinning energetically. The injector was having a bad day and the owner was using his boiler feed pump to fill the boiler before the drive home. The adjective 'energetically' was chosen with good reason. Remember that since the drive is through the differential (sometimes called compensating gear) and with one of the back wheels firmly stationary the other wheel was rotating via the 'diff' at double speed.

Primary reduction gears

I believe a detailed description of machining this pair of gears is unnecessary, save for a reminder to take care to ensure the concentricity of the teeth with regard to the bore. If your 3-jaw chuck closes to with a 'thou or two' that would be fine except for the fact that the number of teeth on the 47 tooth gear is not divisible by three. The normal jaws will miss the teeth, and beware of the reverse jaws as they will only hold the gear accurately if the mating radius on the jaw closely approximates to the associated radius of the job. The preferred method of holding the gears is illustrated in **photo 293**.

The 27 tooth gear locates on the 0.625in. ▶

The Savage Universal Carrier *gear train laid out neatly in 'exploded' form to show all the various components (photo: Stan Nipper).*

The vehicle's gear train fully assembled and all ready to be fitted into the crankcase (photo: Stan Nipper).

The 27 tooth wheel may be held in a 3-jaw chuck for roughing purposes (photo: J. Thomson).

A bronze sleeve is bored to a push fit on the gear to ensure concentricity (photo: Stan Nipper).

The four 5/32in. holes being reamed for the bolts, indexing on a rotary table (photo: Stan Nipper).

The 47 tooth gear is hollowed out to save weight and accept the bearing (photo: Stan Nipper).

The second shaft set up for turning mounted between the lathe chuck and a tailstock centre (photo: Stan Nipper).

diameter on the crankshaft and is secured to the crank web with four 5/32in. fitted bolts. If there is enough room over the table on the builder's milling machine this is a convenient way to drill and ream for the bolts, see **photo 294**.

I notice Stan has not specified the method of fitting the 47 tooth gear to the second shaft, but he is in good company as neither did the Savage works drawings. I suggest a medium press fit and a single small taper pin through the boss and shaft together to lock it solid. As disassembly is very unlikely some builders may wish to lightly peen over the end of the taper pin to make certain it cannot come out. A tight press fit would be a satisfactory alternative, as would a medium press fit with a Woodruff or rectangular key. My interpretation of fits is: push fit - assembled by hand or perhaps with a rubber mallet; medium press fit - assembly with a vice or hammer and tight press fit - where the job fights back requiring rather more than average force. Perhaps one of our readers can be more scientific.

Change speed bobbin

The full size change speed bobbin was made from a one piece forging, but in our case we will fabricate. Both gears will be pressed on to the bobbin centre, the larger of the gears being additionally held with 1/8in. steel rivets. Loctite is an alternative for the small gear as there is sufficient contact area for a strong bond.

The change speed bobbin slides on a square on the second shaft. Happily this is not at all difficult to achieve in model form, and is arguably easier than manufacturing splines. I read with interest the clever method of drilling square holes by Jacques Maurel (*M.E.* 4285, 27 October 2007) but it seems the internal holes thus cut have a noticeable internal radius in the corners which does not make it suitable for our purposes.

I suggest it is easier to make the male or external square first and then the internal square to fit it, remember there is a degree of 'chicken and egg' here, no doubt some of us could debate which one ought to come first. True, if a square 0.562in. broach was available naturally the hole would come first, but very few model engineers will have access to such tools, especially in such odd sizes. Where the builder starts is up to him/ her to decide.

Second shaft

In the absence of any 0.562in. square bar the builder will need to make his/ her own. Start with a piece of 0.750in. dia. bar and carefully turn to make the 0.562in. diameters on both ends, see **photo 296**. The shaft may then either be transferred to a dividing head/ tailstock set up on the table of the milling machine or completed in the lathe. If dividing by rotary table, the sort that may be mounted 'on edge', will do the job very well if tailstock support may be contrived.

If the square is to be cut on the lathe the shaft needs to be mounted crossways in the 4-jaw chuck, see **photo 298**. Set up by picking up the two 0.562in. diameter ends with a clock, aiming for identical readings, at which point the shaft should be exactly orthogonal to the lathe axis. With any luck the shaft may then be faced back until the 0.562in. diameters at each end are simultaneously picked up. The shaft is then loosened and rotated 90deg. ready for the next flat to be machined.

A wise precaution would be to machine the square a little oversize first and then re-visit the faces with a small finishing cut. The reason is that bright drawn steel, by virtue of being cold worked in manufacture, has internal stresses locked away inside. If one side is machined the stresses released will send it banana shaped. 'Inspector meticulous' may wish to add that a good quality lathe is set to face very slightly concave, and this, too, might impact when facing across the shaft. I understand the reason for

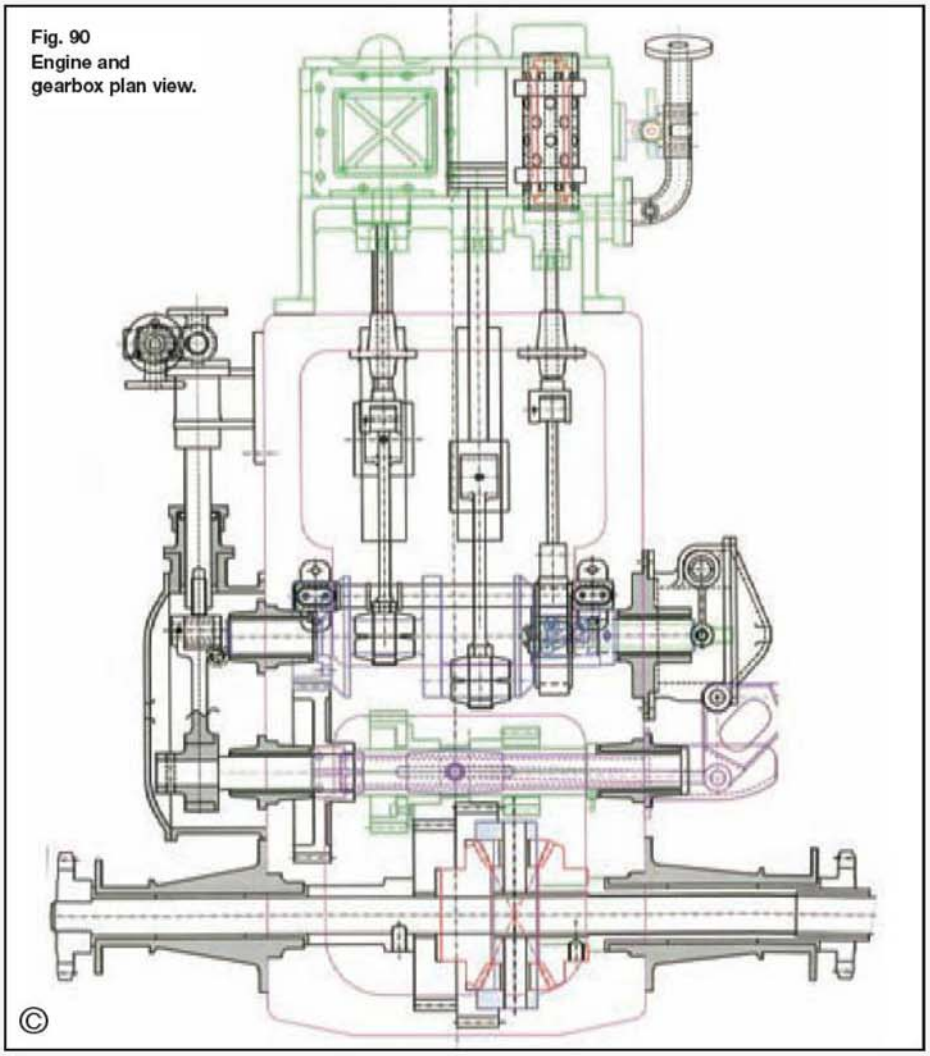


Fig. 90
Engine and gearbox plan view.

The register for the 47 tooth gear being carefully turned (photo: Stan Nipper).

The lathe being employed to machine the square section on the second shaft (photo: Stan Nipper).

The completed second shaft and drive gear (photo: Stan Nipper).

generating a concave surface when facing is to make sure machined surfaces, when mated, cannot rock - as they would if machined convex. The amount of concavity is very small, so if your square measures 0.001in. smaller in the middle that may be the reason.

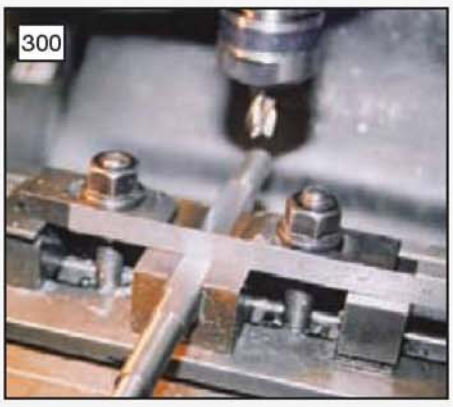
A note on the second shaft drawing references a modification needed if using HPC gear number YG16-47 for the primary drive. This is because the HPC gear has a 0.625in. bore rather than the 0.562in. diameter called for.

Square hole

The method of making the square hole is illustrated in **photos 300** to **303** inclusive. Start with either round or rectangular bar, probably rectangular is best as round bar will be more difficult to hold when machining the slot. The slot is then milled in the bar and the second shaft used as a gauge to finalise the width of the slot, the depth is gauged in the same manner, see photo 300. If the second shaft fits in the slot one way but not the other do not widen it, a little careful drawing filing after soldering will soon fix it. The cap is no more than a slice of bright bar.

The slot and cap are then cleaned with emery cloth or wet-and-dry paper, fluxed, and silver-soldered together. The silver solder should be placed in the joint before heating so when hot it flashes around the mating surfaces. Do not be tempted to feed in further solder as, if there is too much, it may run around the inside faces and spoil the square hole. The zig-zag bent into the solder, see photo 301, is necessary to avoid the lengths of solder acting as rollers causing the cap to slide around when hot.

Allow to cool, de-flux, and emery cloth the hole as best you can to restore a bright finish. The slot ought to be a good sliding fit on the second shaft, but with reality being what it is that is probably unlikely. If resistance is experienced the first check is to make sure it is not caused by any internal fillet of silver solder in one of the ▶



The slot in the bobbin being matched to the second shaft (photo: Stan Nipper).

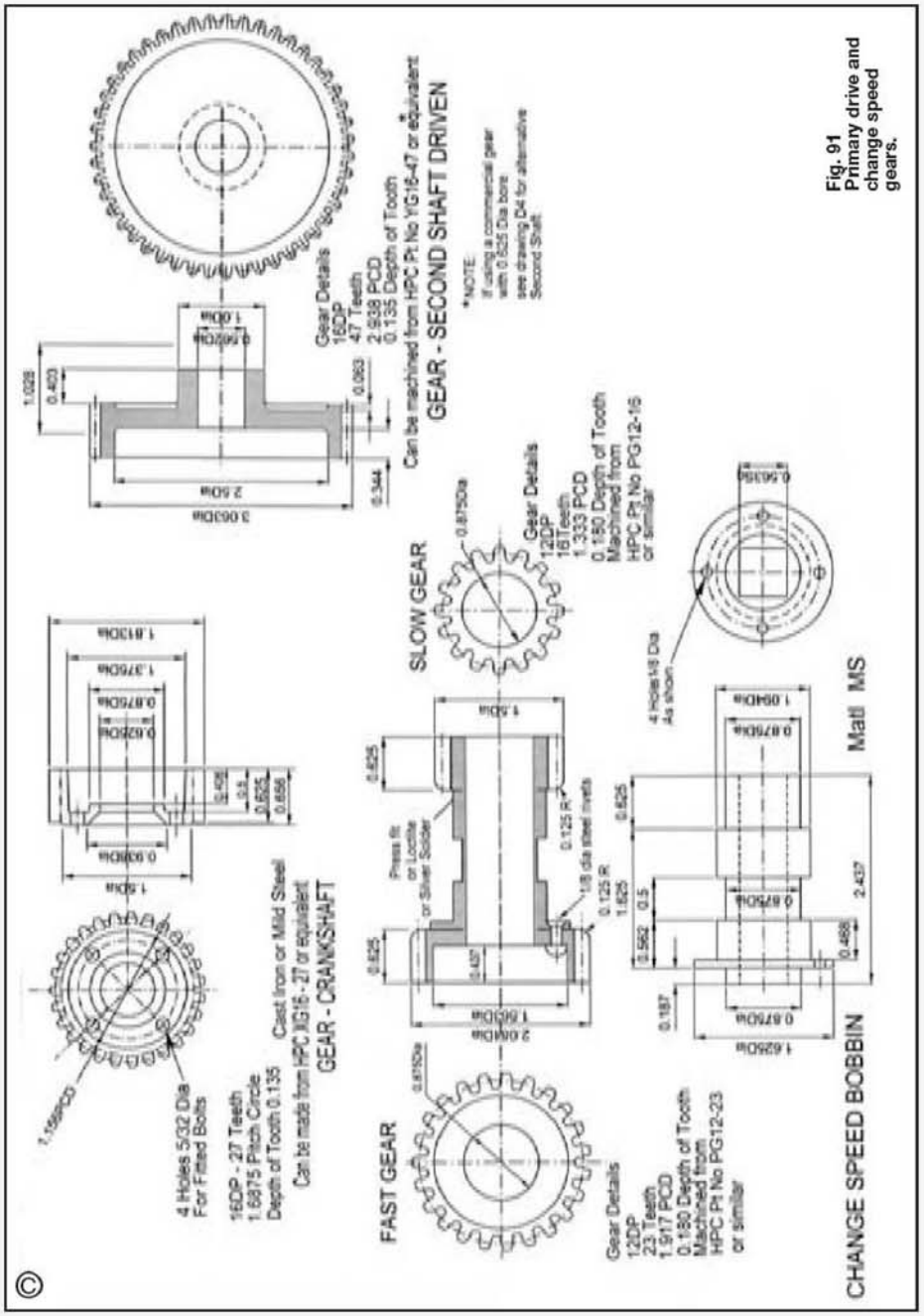
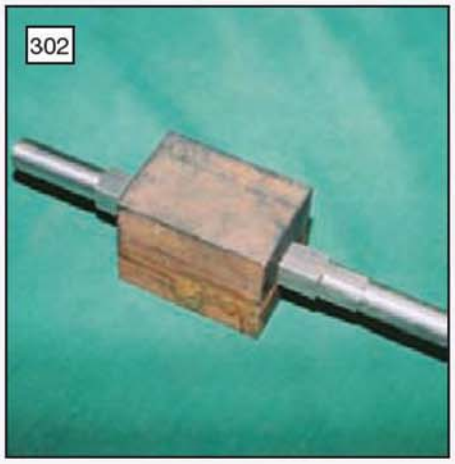
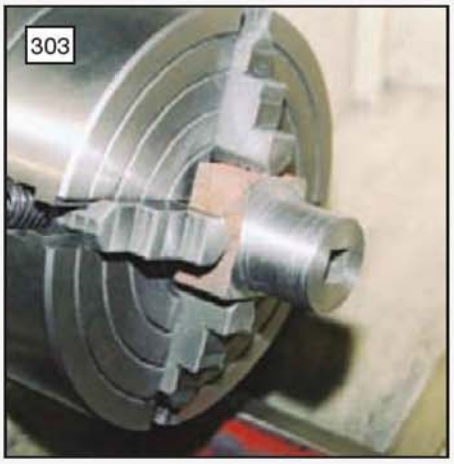


Fig. 91
Primary drive and change speed gears.

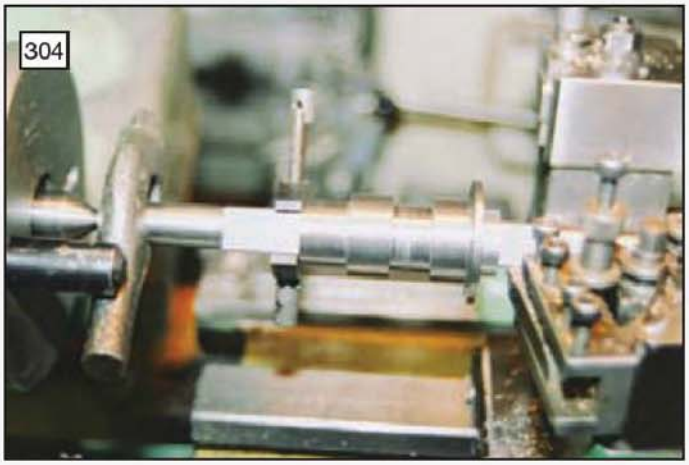
Silver solder and flux were added prior to heating (photo: Stan Nipper).



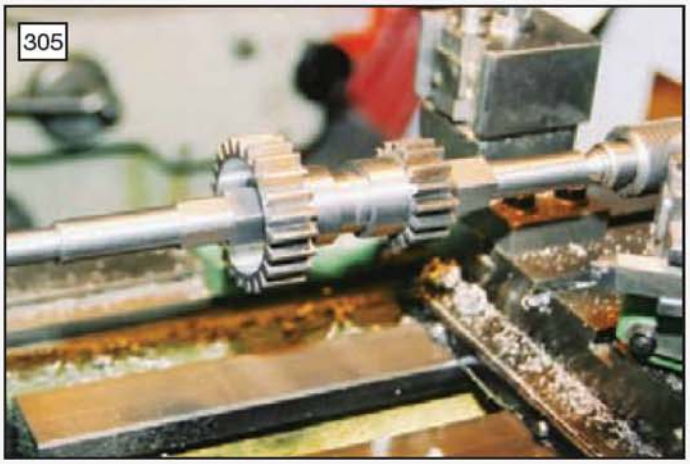
With a little cleaning the soldered bobbin slides on to the shaft (photo: Stan Nipper).



The excess metal is shown being removed on the lathe (photo: Stan Nipper).



The gear registers were turned with the bobbin and shaft mounted between centres (photo: Stan Nipper).



The gears could then be pressed on to the bobbin and the assembly again tested for fit on the shaft (photo: Stan Nipper).

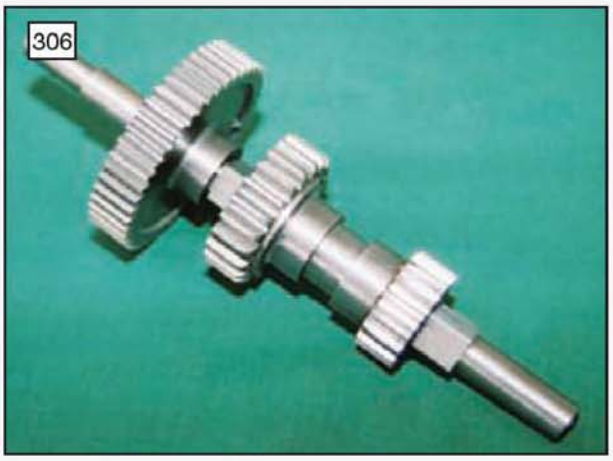
corners. A small square file ought to quickly remove any stray solder from the hole.

Secondly, if necessary, carefully draw-file the flats on the shaft. Remember that neither the square shaft nor the square hole are necessarily going to be perfect so keep trying it 'every which way' and select the most promising combination. Dot punch both the shaft and bobbin to clarify the chosen orientation and proceed until the bobbin slides sweetly along the shaft. A little engineer's blue may help identify any high spots.

The assembled bobbin is then rough turned, photo 303, until it is some 1/16in. or so over size on all dimensions. It is then mounted on its shaft for final machining between centres. It may be wise to substitute the dot punch on the shaft and the corresponding dot punch on the bobbin with a letter or number stamp to formalise the information. This will hopefully guarantee assembly the same way around on all future occasions. The registers for two change speed gears are turned *in situ*, see **photo 304**, on the second shaft ensuring concentricity of the gear teeth.

A steel spacer detailed at 0.156in. wide is slid over the right hand end of the second shaft before assembly in the crankcase. This serves two purposes, firstly it limits the sliding movement of the bobbin but equally importantly it provides a larger bearing area against the bearing flange than the squared off end of the second shaft. An end float of 0.001 to 0.003in. should be maintained, a slightly thicker or thinner spacer may be required.

●*To be continued.*



The completed second shaft is now ready to fit into the crankcase. Photo: Stan Nipper).

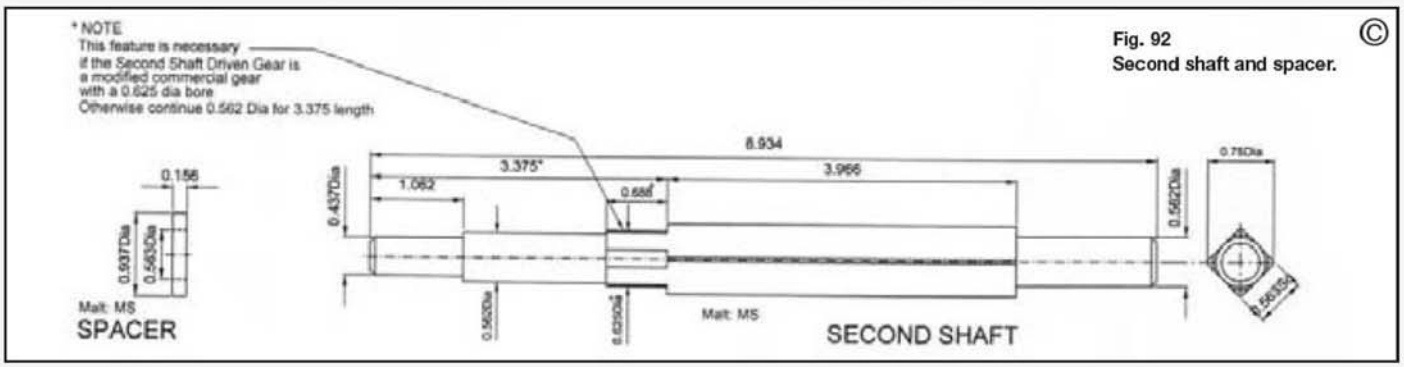


Fig. 92
Second shaft and spacer.

PETE'S PAGE

TOOLPOST GRINDERS

Peter Spenlove-Spenlove discusses these lathe attachments and how to drive them.

A short time ago a reader was seeking a drive belt for his Duplex Co. MYS7 Myford Super 7B toolpost grinder. While I do not know if anybody holds stocks for this machine, the Duplex name was well known 50 years ago. A long defunct Midlands tool factor was a stockist but their list quotes toolpost grinders of 12in. up to 36in. wheel diameter. No smaller Duplex grinders were listed. I suspect that the smaller tools were no longer made. Wolf tools made a small machine for 7in. and 8in. centre height lathes.

Progressive motor mechanics used them when making new parts such as king pins. This work died away and the lathes, clogged with oily grinding grit, died too in the scrap yards. Grinding on the lathe is not really recommended unless you take adequate precautions to keep the grit and debris out of the machine's slides; though sometimes, in industry, the end justified the means and the machine wearing out was the price paid for the profits earned. Since the quoted number includes the word 'Myford' did this firm sell the grinder? If so, have they got any belts in the darker corners of their obsolete parts store?

With computerisation of stocks most tool merchants cleared slow moving items. However, there are several ways to restore a beltless, toolpost grinder. Almost all small toolpost grinders have interchangeable pulleys. One set-up drives the grinding wheel at a speed suitable for an external grinding job whilst the other provides a very much faster speed for bore grinding operations. The latter application requires the use of very small pulleys on the wheel spindle and the linear speed of the drive belt can be very high. The bending of the belt over the small pulley causes heat build up in round or V-belts and centrifugal force tends to reduce the area of contact with the pulley. Consequent friction adds heat to the drive and extra belt tension does not really help.

An answer to this problem was found years ago in the cotton industry where spinning processes involved long lines of tiny pulleys running all day at high speed. The belts, hundreds of them, were continuously woven cotton tape bands with no joint. The belts were supplied pre-stretched ready for use. The pulley was well crowned to stop the belt from slipping off. About 1990 I visited Wigan Pier where, in Trencherfield Mill, a bank of cotton spinning machines was being demonstrated.

Noticing the white cotton belts, I asked if supplies were easily obtained. The answer was that, despite extensive enquiries, no factory appeared to make cotton belts and those in use were made to special order by a retired person who came in to do one more batch.

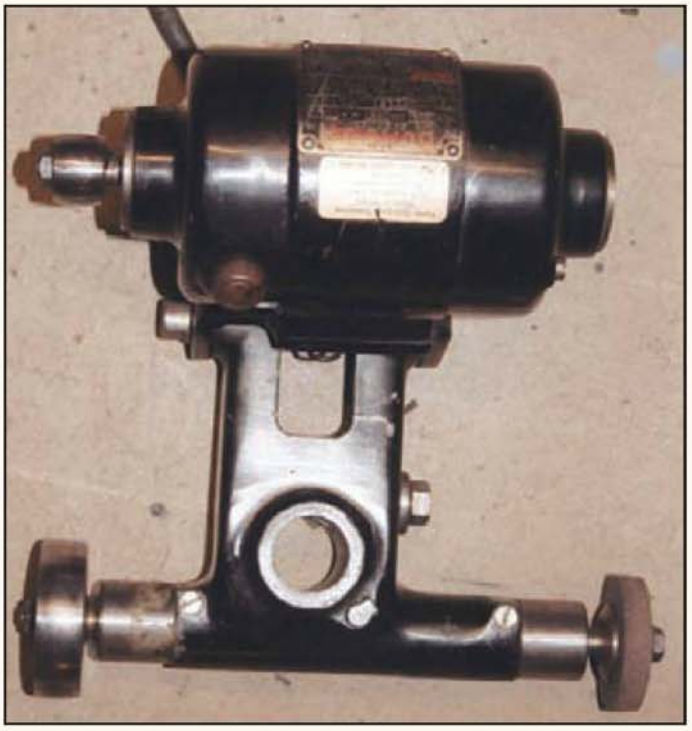
Quarry Bank Mill at Styal has similar, working cotton mill machines. I wonder where they get their belts from?

If proper, cool running cotton belts cannot be found then one could try one or two suppliers of transmission equipment. Some hold stocks of a very thin plastic belting in rolls. A length is then cut-off and 'scarfed' at each end. The joint is then glued or welded under heat and pressure to form a joint no thicker than the belt itself. I had some made up for a very high-speed 0-1/16in. drill press many years ago. The material is about 0.02in. thick but is less flexible than cotton and appears to absorb more power. Some scarf welded belts can only be run in one direction so, if appropriate, ask the supplier to mark the direction with an arrow.

Places of interest

Wigan Pier, Wigan, Greater Manchester; tel: 01942 323666, website: **www.wiganpier.net**

Quarry Bank Mill, Styal, Wilmslow, Cheshire; tel: 01625 527468



A Dumore toolpost grinder of a size suitable for 3 1/2in. centre height lathes. The pulleys can be swapped for bore grinding operations.

On the left can be seen an endless, woven cotton belt whilst that on the right is of plastic. Both are black in colour and 0.02in. thick x 5/8in. wide.

FREDK. POLLARD & CO. LTD. · CORONA WORKS · LEICESTER
SMALL TOOLS DIVISION

"WOLF" 3 in. PRECISION LATHE GRINDER

Type GL3

For use with any normal 6–8 in. centre lathe for grinding to precision limits.

SPECIFICATION

Spindle Speed for external grinding		8000 r.p.m.
Spindle Speed for internal grinding		20000 r.p.m.
Input on full load		495 watts
Diameter of Motor Pulley for external grinding	1"	25·4 mm.
Diameter of Motor Pulley for internal grinding	2 3/8"	74·6 mm.
Diameter of Spindle Pulley	1 3/4"	44·5 mm.
Overlap of 3" grinding wheel beyond spindle	1/2"	13 mm.
Nett Weight	18 lbs.	8·1 kgs.
Gross Weight	21 lbs.	9·5 kgs.

Motor, 0·4 H.P. Standard voltages: 100/110, 110/130, 150/160, 200/220, 220/250 volts D.C. and single phase A.C. 25/60 cycles. Also 50 volts to special order. Supplied with 5 ft. (1·53 m.) 3-core T.R.S. cable, driving belt, belt guard, grinding wheel guard, grinding wheel 3" × 1/2" × 14 mm. and one diamond grinding wheel dresser.

For internal grinding a large pulley is fitted to the motor.

IMPORTANT. Type GL3 is supplied with an aluminous oxide wheel grade A60M 5VBE for high-tensile materials such as alloy, carbon and high grade steels. For low-tensile materials—cast iron, brass, soft bronze and cemented carbides—use a silicon carbide wheel.

A small toolpost grinder found listed in post World War II tool merchant's catalogues. This one dates from the 1960s.

OVERHEAD VALVE ENGINES

Colin Pape

continues the description of his V-6 engine and starts by discussing the valve rotors.

●*Part VII continued from page 18 (M.E. 4290, 5 January 2007)*

The V-6 is a very interesting engine to watch and it runs well. I don't know of any existing engine of this type but the engineers of the 19th century were very inventive and there could well have been V-6 engines that worked in a similar fashion.

Valve rotors

The high-pressure rotor is basically the same as in Step 3. The low-pressure bank is designed to be a slave to the high-pressure bank. The low-pressure rotor does not need any inlet slots but it does need to provide control over the exhaust. The exhaust openings are at different times depending on the engine rotation so a pair of exhaust slots is provided for each cylinder and a switching arrangement is provided. The two rotors are shown in **photo 36**.

I decided not to provide a reverser plug since there was no need to provide any translation between four slots and three ports and instead I decided to move the low-pressure rotor lengthwise to provide the switching function. In order to move the low-pressure rotor I provided it with an extension that protrudes through the rear frame. The extension is held captive in the end if the rotor but is free to rotate. In fact the rotor rotates and the extension remains still so that a simple O-ring provides an end seal.

I made a first version of the engine with two reverser handles but it seemed more convenient to have a single handle so I developed one and it is visible in some of the photographs. The drawings show the single handle version.

The design of the single handle mechanism provides for the fact that the high-pressure reverser plug moves 5mm and the low-pressure rotor moves 6mm. The extra movement for the rotor is required because the width of the exhaust slots in the low-pressure head is 3.5 mm and I wanted to maintain a separation of 2.5mm between slots. The drive shaft for the low-pressure rotor has deep holes to accept the long drive pins on the rotor.

Belt guides

As in the previous engines, a tensioner is not required if a good centre to centre distance has been maintained but the run-off characteristic seems to be unavoidable. I ran this engine initially without any guides but mis-alignment did occur in one direction. I have never had a belt actually come off a pulley but a badly aligned belt is unacceptable so I installed the same type of roller guides as before.

Notes on building this engine

This engine uses similar materials to the previous engines and many of its parts are quite similar. I have included the drawings of the Step 4 engine components in the following figures *(more next time - Ed.)* and some photos showing the important parts. In several cases there are three or even six examples of a part to be made so it's now even more interesting to think about making some of the parts in batches.

For this engine I used a timing belt with the part number 140MP025 from Davall and three pulleys with the part number P48MP025MI also from Davall. With the three pulleys arranged in an equilateral triangle, the centre-to-centre distance of the shafts is 86.03mm if the same formula is used as before. Since the result for the two pulley arrangement was not good I factored down the centre distance taking into account the longer belt and came to a value of 85.7 millimetres. The drawings show this distance. In practice my distances varied a little bit but gave a mean distance in the finished engine of 85.8mm and this has proved entirely satisfactory.

The two valve rotors of the V-6 engine shown with their drive shafts and timing belt pulleys.

Basic dimensions:

Bore of HP cylinder: 13mm

Bore of LP cylinder: 19.8mm *

Stroke of HP and LP pistons: 22mm

* Nominally 20mm but this small reduction allows 20mm stock to be used for the pistons.

Cylinder heads

The high-pressure head is not identical to that used in the Step 3 engine. The reason is that there are two pistons operating on each crank and two big ends on each crank. These require some extra space. I made the big ends thinner than in all the previous engines and reduced the thickness of the intermediate bearings but even so the cylinder spacing has risen from 25mm to 27 millimetres.

The cylinder head in Step 3 was 83mm long. It was about as long as I could handle. These two heads are 84mm long. The heads could actually be 6mm longer but I avoided this by introducing spacers for the cylinder heads. It would be possible to have two-part front and rear frames that provided this spacer function but I preferred a one-piece design.

●*To be continued*

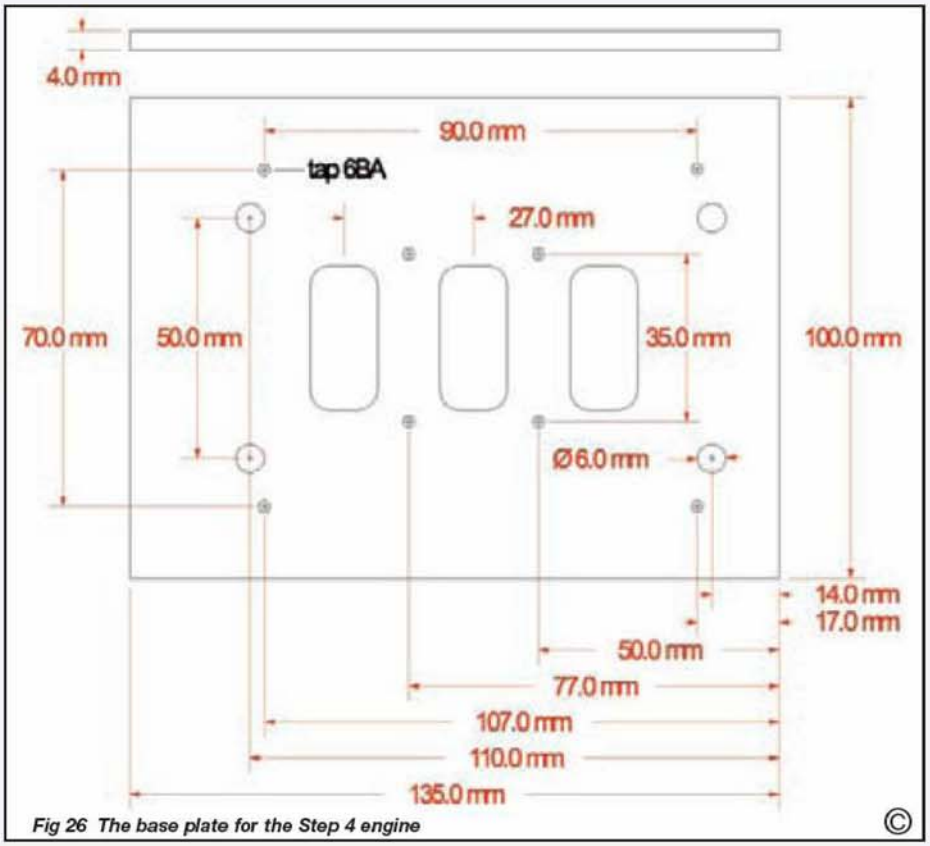


Fig 26 The base plate for the Step 4 engine

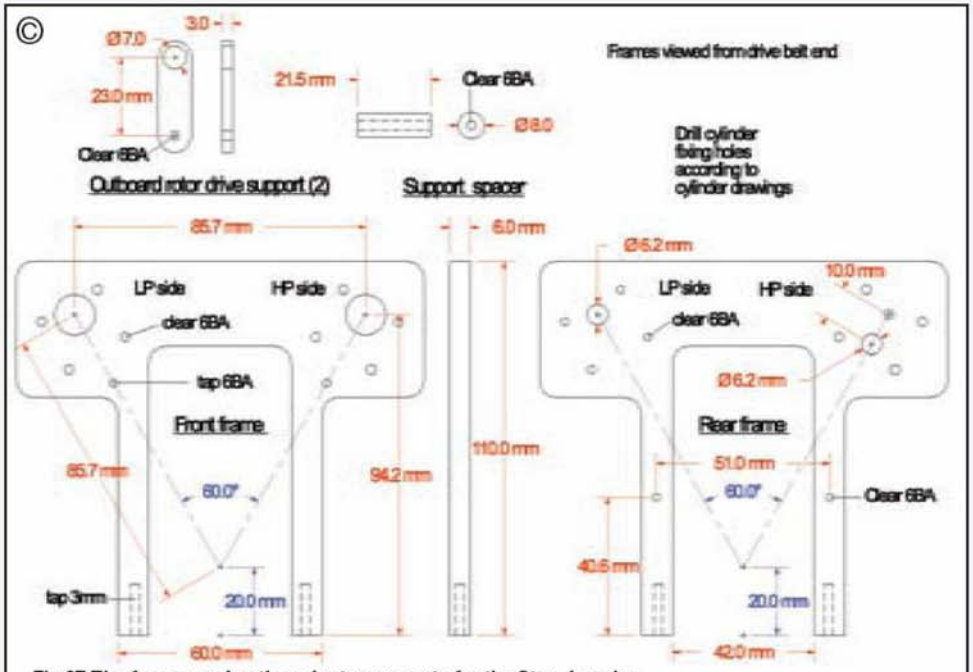


Fig 27 The frames and outboard rotor supports for the Step 4 engine

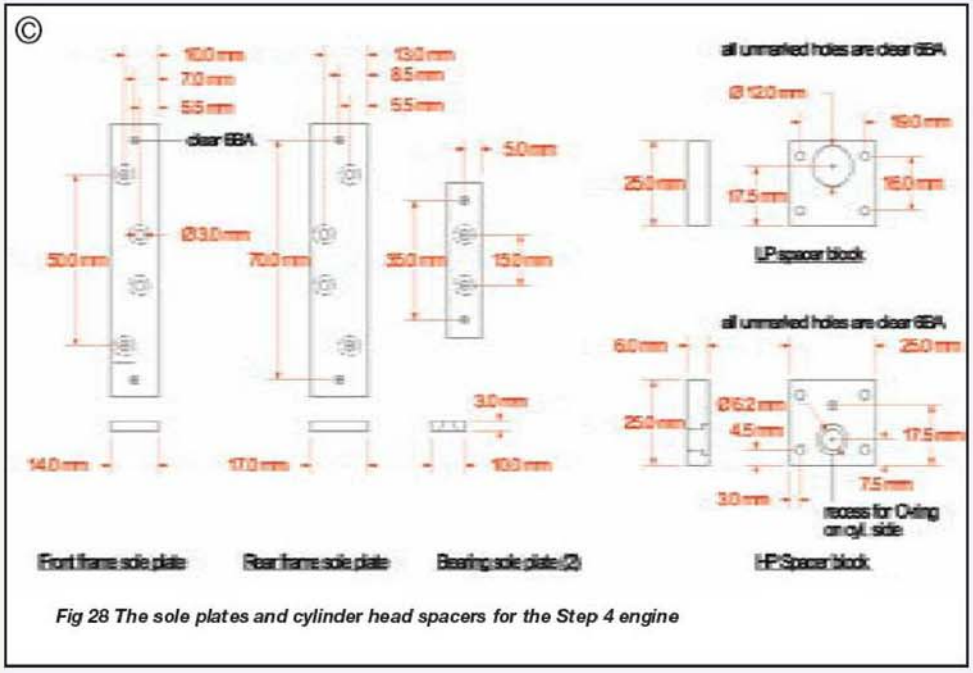


Fig 28 The sole plates and cylinder head spacers for the Step 4 engine

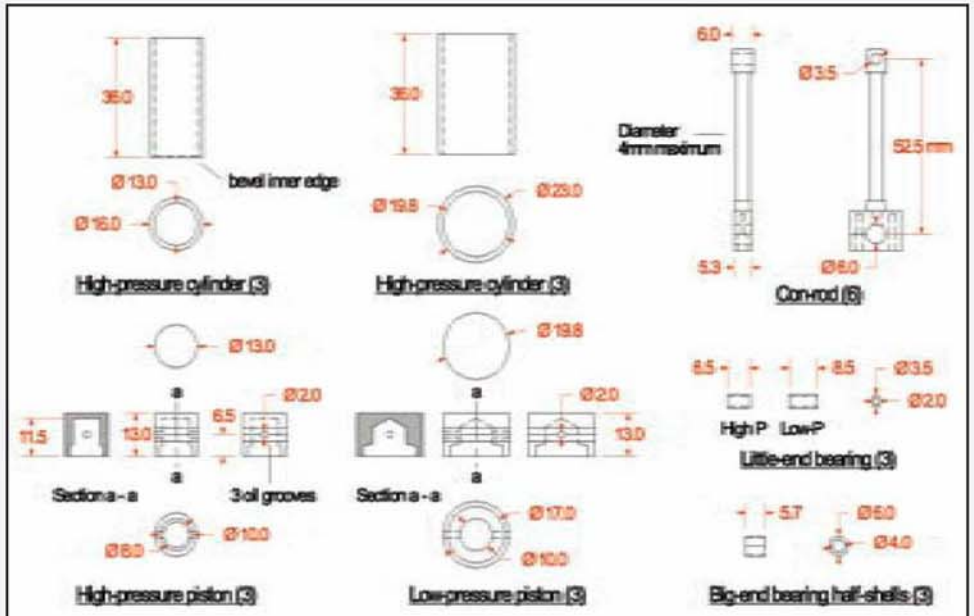


Fig 29 The cylinder parts for the Step 4 engine

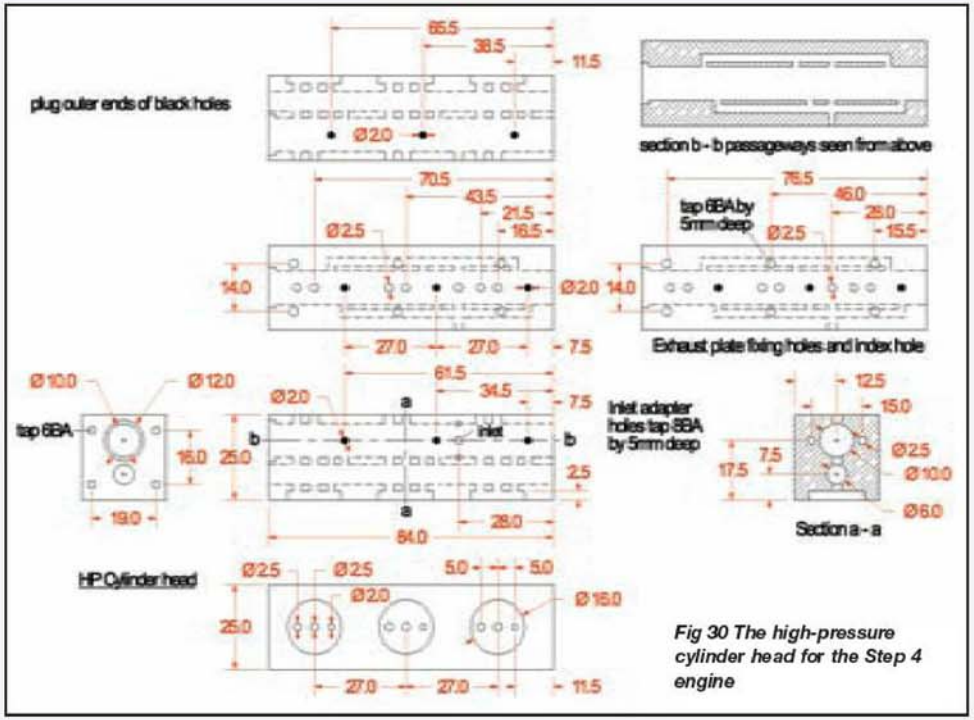


Fig 30 The high-pressure cylinder head for the Step 4 engine

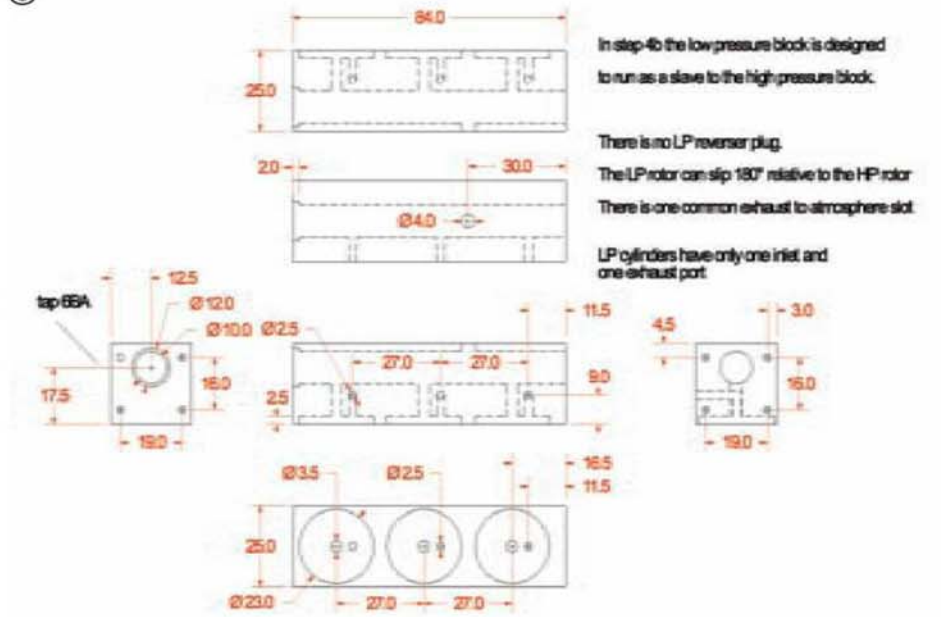


Fig 31 The low-pressure cylinder head for the Step 4 engine

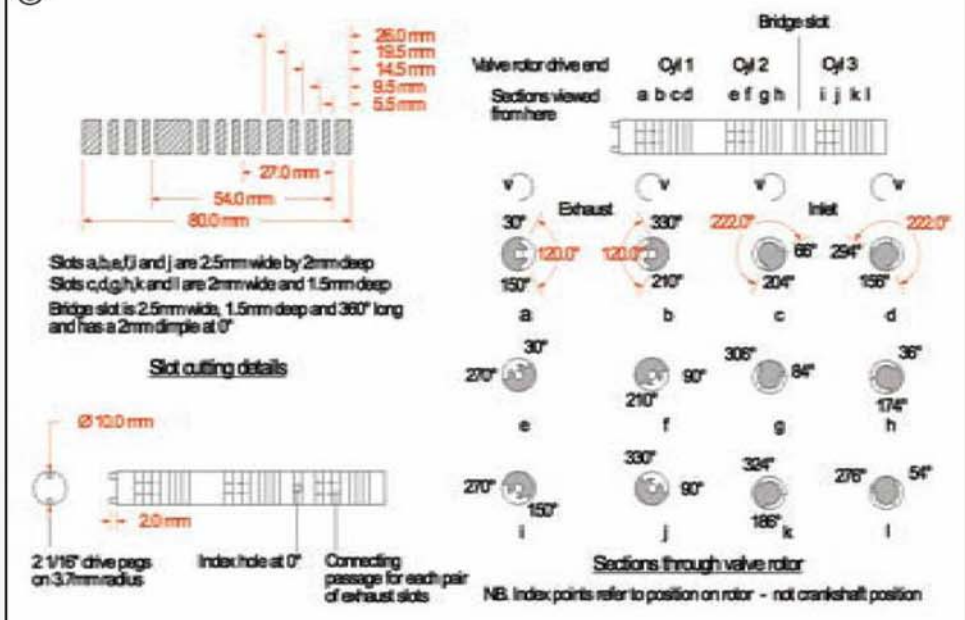


Fig 33 The high-pressure rotor for the Step 4 engine

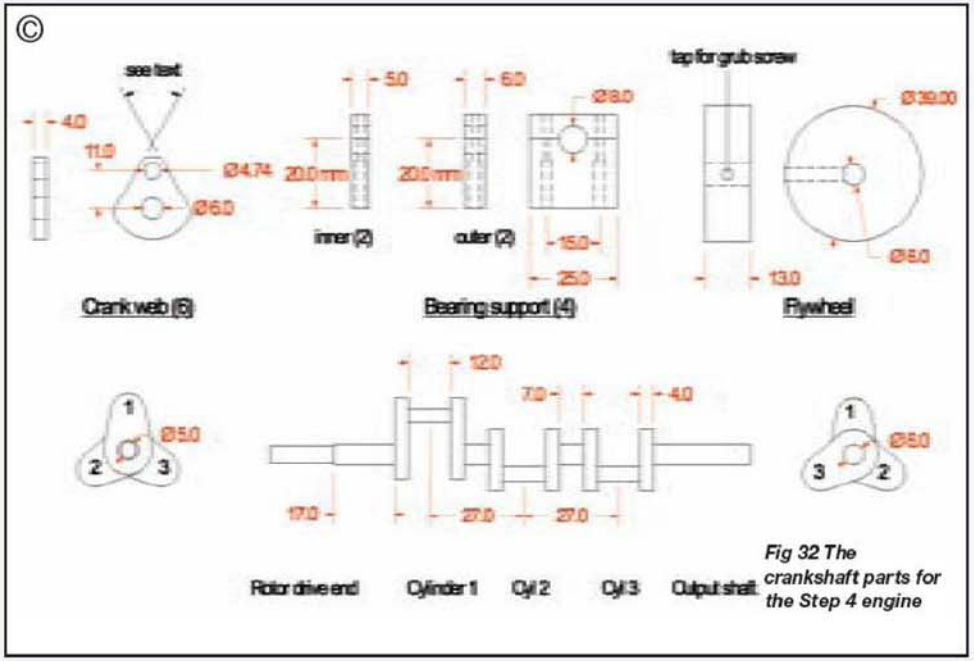


Fig 32 The crankshaft parts for the Step 4 engine

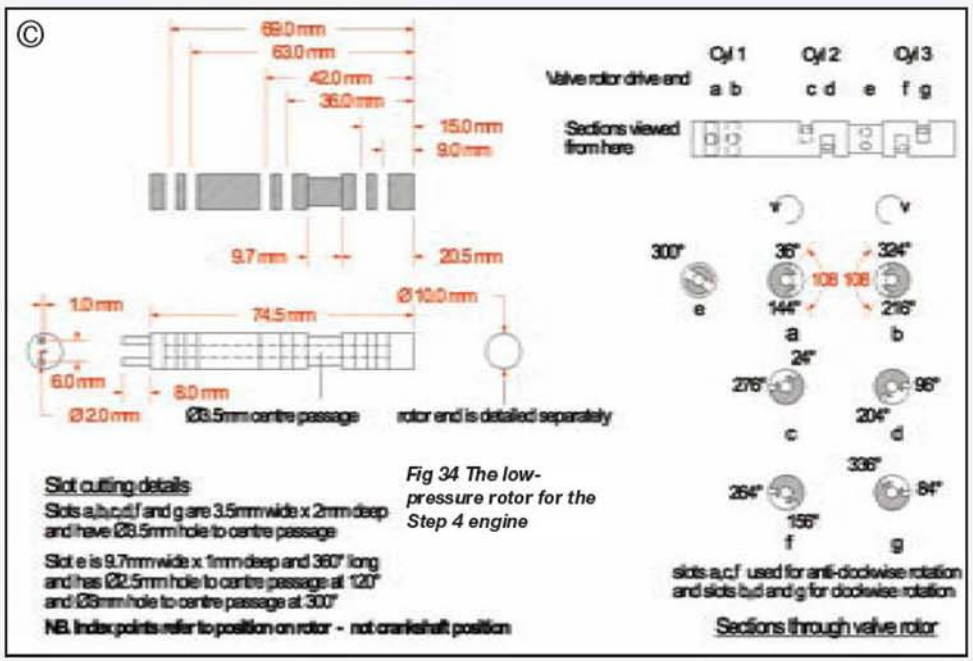


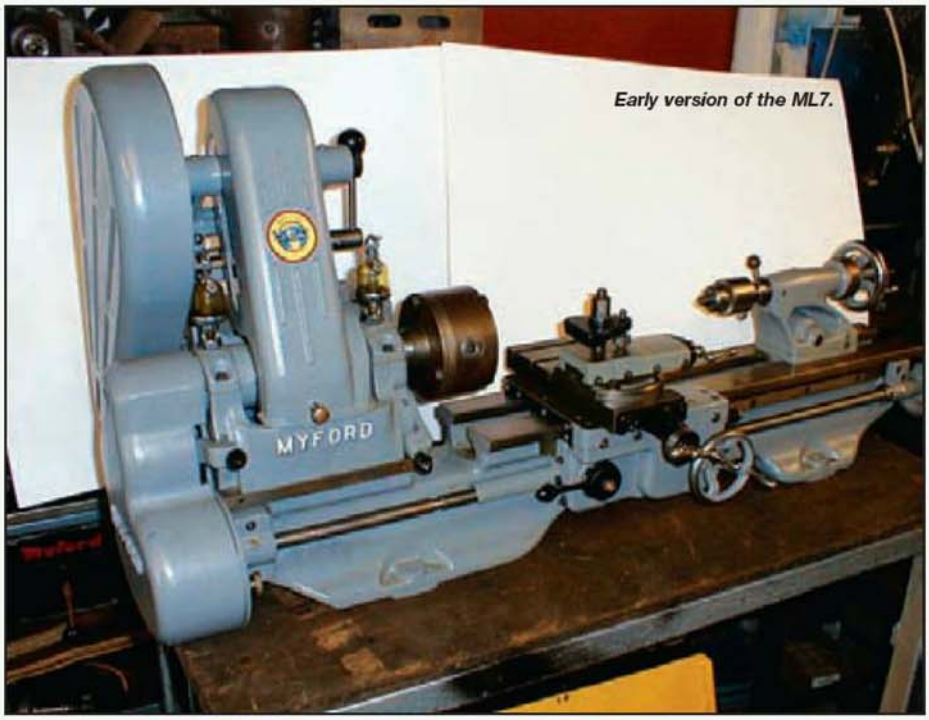
Fig 34 The low-pressure rotor for the Step 4 engine

MACHINE TOOLS

Tony Griffiths

Looks at the most successful lathes developed specifically for model engineers, starting with the ML7.

●*Part I*



Early version of the ML7.

MYFORD LATHES

When, in the early 1930s, the embryonic Myford company started business in a spare room in a 5-storey lace mill in Beeston, Nottinghamshire, few could have foreseen the day when, 10 years later, they were to occupy all but a fraction of the same building and rise to pre-eminence among the then many competing makers of small lathes. The foundation of this success was a range of just four lathes, the ML1, ML2, ML3 and ML4, designed and priced to appeal to the model engineer.

However, even the most enthusiastic of owners would have been unable to claim that these were state-of-the-art designs and, by the close of the decade the 1937 American Atlas 6-inch - with its all-V-belt drive countershaft, roller-bearing headstock, fully-guarded changewheels and a host of user-friends details - was setting the bench-mark for hobby lathe design. In response, by the end of World War II, Myford were ready with what was to become the most popular and sought after small lathe in the UK, the ML7.

Undoubtedly drawing some design influence from Atlas, the 7 was announced in early 1946 with the first catalogue stamped "*Provisional*" and printed in the same A5 landscape format used for the ML2 and ML4; the cover was dark-blue with the single word "*Myford*", in the traditional script, picked out in gold. The pages were typed, reproduced on a Gestetner, and contained just one photograph showing the lathe mounted on its special octagonal-form braced sheet-steel cabinet stand.

From the start of production the ML7 was designed to accept a variety of profitable accessories (all listed and illustrated in the first full catalogue dated November, 1947). Very soon, with such an expandable and properly-engineered English small lathe on offer for the first time, many ex-service men (with gratuities burning a hole in their pocket) caused a lengthy waiting list to develop.

By the late 1940s, with only one model of lathe in production, it was decided that the market could stand the introduction of a significantly altered and more highly developed machine (yet able to use exactly the same accessory range) and in late 1952 the Super 7 was launched - with the provisional catalogue dated November of that year.

Although popular, neither the ML7 or Super 7 have ever been cheap, but have always been excellent investments being well made from top-quality materials, assembled with care and finished to a high standard - even to the extensive use of fully-machined and chemically blackened nuts, bolts and other fasteners. Both lathes are now firmly in the 'classic' category and two versions of the Super 7 remain in production, the large-spindle bore, power cross feed Super 7 Plus (in various forms including one with variable-speed drive) and a version much more like the original model and without power cross feed, the Sigma 7.

Capacity

Both lathes can turn a maximum diameter of 7in. over the bed and 10in. by 1.5in. thick in the gap; between centres the ML7 can handle material up to 20in. in length and the Super 7 19in. - or both a little more if you allow the tailstock to overhang the end of the bed. An ML7 is around 42in. long and occupies a space about 22in. front to back while a Super 7 is approximately 46in. long and a little deeper than the ML7 at around 27in.

Surprisingly, a bench as little as 16in. deep from the wall will accommodate an ML7.

There are long-bed versions of both lathes: these admit 31in. between centres and are constructed with a very much deeper bed wall. Interestingly, the long-bed ML7 was fitted, as standard, with a Super 7 apron, leadscrew, saddle and cross and top-slide units - although oddly, despite its appeal, this improved specification was never mentioned in contemporary catalogues. As an aside, although the cross-slide on the long-bed ML7 appears to be a standard Super 7 unit, its end bracket and the method of assembling the cross-feed screw to it, are different.

ML7 - general specification

Of ribbed box-section, the bed was constructed with a flat top of typically English design, with narrow vertical shears, the nearer vertical element of the gap between the front and back ways being shared by the saddle and tailstock.

This is not an ideal situation but, in practice, causes no problems until the bed wears badly when, as the tailstock is brought close to the headstock, its central locating tenon becomes loose. One advantage of the bed design is the relative ease of regrinding with all the main surfaces at either the same level or at a right-angle to each other. The back face of the bed is machined flat and equipped with tapped holes ready to accept a taper-turning attachment.

The design of the saddle is interesting, with shimmed plates at front and rear by which means a very close vertical fit can be obtained; at the front, instead of a full length inner lip, just a short one is employed, no wider than the cross-slide, and it is on this surface that tool thrust is taken. A consequence of this design quirk is that the four gib-strip adjustment screws along the front edge of the saddle take some skill to set correctly with only two bearing against a firm surface; to get the setting correct the maker's instructions have to be followed to the letter. Towards the end of ML7 production a New Zealand engineer pointed out that if the tool thrust was to be taken along the full length of the saddle's inner rear face – and so utilising an otherwise unused already-machined surface - a much longer and more stable contact could be obtained. Unfortunately the New Zealander's proposed method, while possible in an experimental situation, was not suited for production and so Myford - probably following the appearance of an article in *Model Engineer* proposing a similar but rather more straightforward modification - came up with a system (from K107657) that involved machining away the original short contact at the front and using a modified casting to keep the relative position of apron and leadscrew the same.

The apron is die-cast in a form of ZAMAK, fastened to the saddle with 3 cap-head screws and with the leadscrew clasp nuts guided in adjustable gibbed ways. On early machines the reduction gearing between carriage traverse handwheel and rack was exposed (and quickly collect swarf and dirt) but this fault was soon corrected and a close-fitting cover provided.

While the Super 7 was fitted from the start of production with a long slide as standard that on the ML7 was always shorter (with 5-inches of travel and four 3/8in. T-slots) but with the option, at extra cost, of a longer 10.75-inch slide (and matching longer feed screw) with five T-slots. ▶

Later Myford ML7.

Even so, the standard slide has a generous 30 square inches of clamping surface and, with the top-slide removed, is ready to be used as a miniature boring table or to mount a milling slide or rear toolpost. Until Machine K108718, slotted BA screws and locknuts were used for the gib-strip adjustment but after that easier-to-set self-locking 5mm pitch hexagon-socket screws were substituted.

The 2.5-inch travel top-slide can be swivelled 63-degrees either side of zero and both it and the cross-slide are fitted with 10 t.p.i. Acme-form feed screws and micrometer dials die-cast in ZAMAK which, while a 'character' part of the machine, are not as easy to read as the properly-engraved units fitted to very late models. The toolpost clamp post is surrounded by three little tapped holes, intended to accept the mounting screws for the indexing plate used on the 4-way toolpost; as supplied from the factory each hole was sealed with a small grub screw to prevent swarf working its way through to the feed screw and wearing it out.

In comparison with almost every other contemporary small (British) lathe the headstock of the ML7 is a rugged affair and bolted to the bed by 4 high-tensile cap-head Allen screws and aligned by a ground rectangular locating tongue fitted into the gap between the bed ways. Two pusher screws entering from the rear press against the tongue and so hold the headstock hard against the inner vertical bed way.

The spindle is in 40-50 tons high-tensile steel and runs in plain, parallel Glacier TI Alloy 'half-step' bearings with laminated (0.002in.) shims between the upper and lower bearing halves to allow a degree of adjustment. Strong bearing caps are used, each bolted down by two socket-head cap screws, and a ball-thrust bearing fitted in a shielded position at the left-hand end. The spindle is offset from the bed centre line towards its rear - a feature the makers ingeniously claimed in their first publicity sheet: *"The distinct advantage of the offset is paramount when turning large diameters, the degree of rigidity being equal to that of a bed 5-inches wide with the headstock centrally disposed."*

The spindle on early machines was fitted with a pair of simple little No. 2 size wick oilers (easily neglected) while later models have proper drip-feed lubricators where the supply of oil can be adjusted (according to the spindle speed) and its level easily inspected. The dimensions of the original spindle - 1.125in. diameter, bored through 19/32in., No. 2 Morse taper, front bearing section 1.25in. diameter, rear bearing section 1in., bull gear section 1.125in., 12 threads per inch nose backed by a plain register 1.25in. in diameter and 0.4375in. long. - were carried over to the Super 7 and only changed with the advent of the new-for-2001 Super 7 Plus.

The drive from countershaft to spindle is by 3-step aluminium alloy pulleys with a proper, full-sized A-section V-belt that allows full use to be made of the motor's power (generally 0.33 h.p. on early lathes and 0.5 h.p. on later) while the robust backgear assembly (clustered at the front under the spindle line) means that speeds down to around 35 rpm can be achieved with greatly increased torque - and no risk of belt slippage – ideal for both screwcutting and turning large blocks of metal held in a four-jaw chuck or on a faceplate. The part of the backgear carried on the headstock spindle is in the form of a sleeve pinion - that is, the gear is extended to form a long bush on which the pulley rotates when backgear is engaged - a design that does much to enhance the lathe's ability to run reliably at slow speeds for long periods. For quiet running the makers recommend a resilient-mounted motor (with rubber rings isolating the main housing from the foot) and, so equipped, an ML7 will run almost silently. While all Super 7s have a clutch fitted as standard, on the ML7 this was an optional extra - but one well worth having. The ML7 unit economised by utilising the brake shoes from the front wheel of a Nottingham-made Raleigh moped the Gadabout.

In place of the crude assembly used in pre-war years, with plain-bore changewheels running directly on studs and retained by split-pins and washers, the changewheel drive on the ML7 is properly engineered with hardened steel pins carrying bushes keyed into the gears with neat, quick-release washers retained by slot-head screws. Unfortunately the nuts holding the changewheel are still behind the banjo, making any alteration in position a fiddly, time-consuming business. The changewheels, like the belts, are enclosed inside a neat, thin-walled cast-aluminium cover. Tumble reverse is fitted as standard, allowing quick reversal of the saddle drive - and so speeding up the boring of deep holes, etc. Setting the tumble-reverse lever to 'neutral' means that high speeds can be used without having to drive the changewheel set and this makes an already very-quiet lathe even more acceptable in a domestic situation - many being used in attics and even spare bedrooms.

The 8 t.p.i. left-hand thread leadscrew is of Acme form, 5/8-inch diameter and runs in Oilite bushes. On the original ML7 both the tumble-reverse and backgear levers were tipped with lovely little 'acorn-shaped' plastic knobs - in what must have been a subtle reference to Nottinghamshire's woodland heritage.

The tailstock can be off-set and its 1-inch diameter barrel, threaded 8 t.p.i., carries a No. 2 Morse taper - so allowing heavy-duty drilling. The barrel is bored clear and passes through the handwheel – an arrangement that does have some advantages, notably when the lathe is used for long-hole boring when woodturning.

Although the ML7 changed very little during its production life some improvements were made. By 1950 the countershaft had been given more substantial uprights and the back made solid instead of having three open panels: the original ball-spring Bennet oilers were replaced by proper nipples to which a pressure oil gun could be applied to blast out dirt and drive oil to where it would do some good, and by 1960, the tailstock casting was filled in and its 'off-set' guide moved to a thicker part of the casting. In 1969, from machine K90494, a cast lug was added to the headstock to provide a location point for the lever-action collet closer- this had previously been supported by a bronze bracket, clamped by two Allen screws to one of the cast-in strengthening ribs behind and immediately below the front headstock bearing.

During 1973, from machine K111727, production was rationalised around just one 7-series bed, that for the newly-introduced, power cross feed Super 7 - the change of bed also forced the use of the superior cast-iron apron and 3/4in. diameter leadscrew from the Super 7 - improvements which mean that these late ML7s have the very best specification of all. The last ML7 (K140848) left the assembly line on the 31 January 1979.

ML7: Speed Range

As supplied to the UK market (with a 50 Hz 1425rpm motor) the ML7 has a speed range of: 35, 62, 110 in the 5.78:1 ratio backgear, and, 200, 357 and 640 rpm in open drive. Although it is perfectly possible to raise the top speed by increasing the size of the pulley on its motor, it is wise to bear in mind that the maximum recommended speed of the original white-metal bearing model is 1000rpm. I have known machines to be run at much higher speeds, without apparent ill effect, but these were in good condition, carefully set up and with an increased flow of top-quality lubricant from their oilers. A worn machine treated like this might not take at all kindly to the treatment.

At one time, in order to permit higher speeds to be reached with reliability, the option of a kit containing bronze headstock bearings and a hardened spindle was available at extra cost - and these parts are now supplied as standard when replacements are required. Because the oil

feed to the bearings is 'constant loss' it is important to make sure that both oilers are topped up and opened to give a generous rate of feed every time the machine is run. I have seen countless ML7 lathes that, despite having given more than fifty years of service, still have bearings that are 'spot on'.

ML7: Electric Motors

One of the most frequent problems with any small lathe is the 1-phase motor. These are best run near their rated capacity all the time (i.e. worked nearly flat out); if the motor is switched on and off frequently against 'no load' the windings will be damaged and, if run through a cycle where it is started, worked briefly, stopped and started again, the capacitor will fail prematurely.

It is very important not to 'over-motor' a Myford (or indeed any other lathe); any accident or dig in will have far more serious consequences - and if the machine is worked beyond its capacity excessive wear will quickly become evident. Early ML7s were fitted with 1/3hp motors and later ones with 1/2hp - a figure that should not be exceeded.

The Super 7 has always been fitted with a 0.75 hp motor (necessary to pull the top speed of over 2000 rpm) and this too should be respected as an absolute maximum. The original Brook-Crompton motors are very expensive; however, direct replacements, of exactly the same specification but more economically priced, are now available.

Buying a Used ML7 - and value for money

When contemplating a used Series 7 Myford its age is irrelevant (unless you require a particular specification); mechanical condition is everything and I have seen many machines over 50 years old that have either had so little use, or been so carefully taken care of, that they appear to be only a year or two old. While late machines have their serial numbers stamped into the front of the bed, just to the right of the gap, earlier versions had theirs in a difficult-to-find location punched into the vertical way at the back of the bed at its tailstock end. If you can find a good-condition ML7, especially one with the original bed machining marks intact and wearing its original paint, it will represent tremendous value for money. In addition, even if the machine shows signs of careless use, every mechanical spare is available direct from the factory to restore it to 'as-new' condition.

With the removal from the spares-counter of the teenage girl, it's even possible to talk to somebody who knows the lathe intimately. Don't be tempted to make or modify parts yourself - use original components and preserve the authentic look and feel of the machine - this will not only enhance its value, but also make using it a much more secure and successful activity.

It is much more difficult to find a good Super 7; competition for them is strong, which raises prices well above those of the ML7 - often twice as much, model for model; the ML7 really is the bargain version.

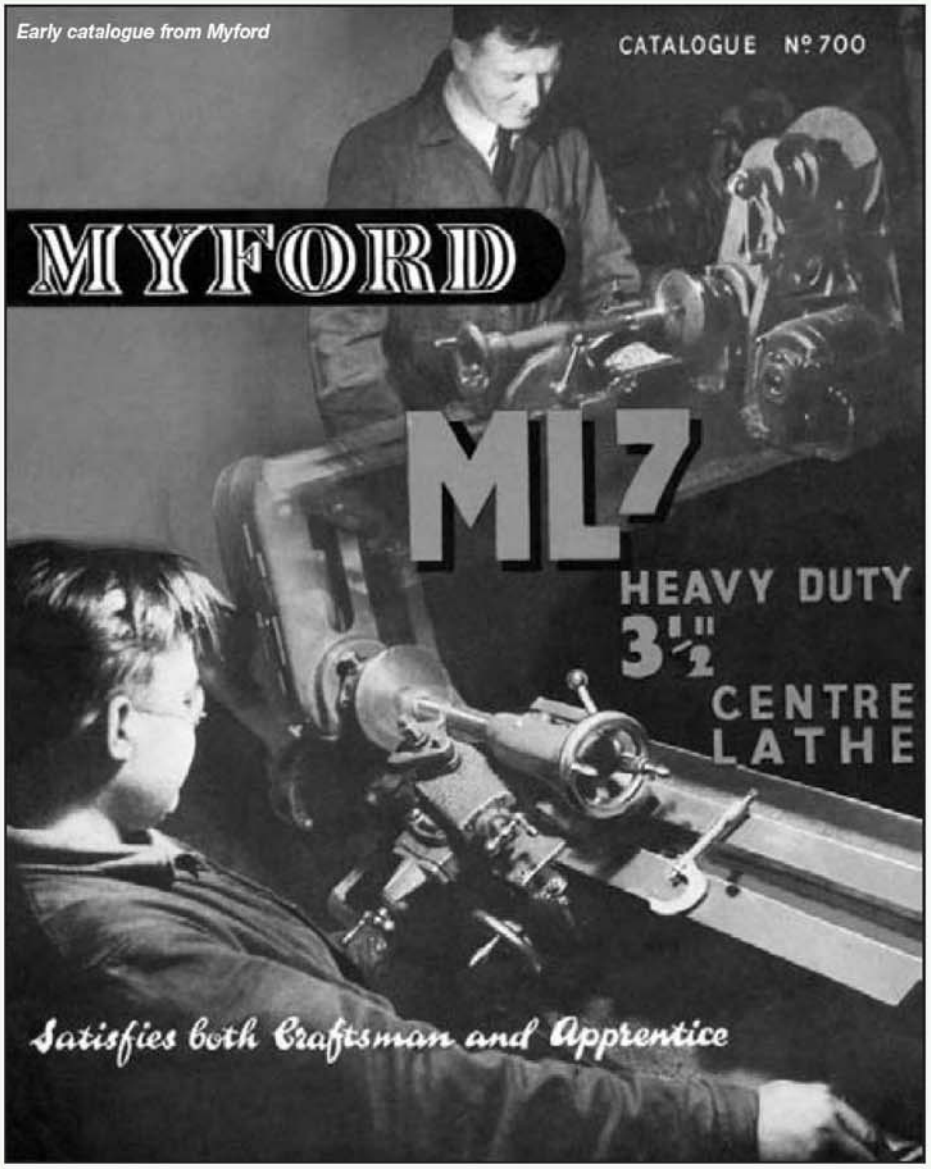
Super 7: General Specification and comparison with the ML7

When it appeared in late 1952 it was immediately obvious that the Super 7, although built with the same bed-way dimensions as the ML7, was a thoroughly re-engineered design, with many significant improvements. Super 7s of all years are well finished, but early models appear to have enjoyed especially fine detailing with fully-machined and chemically-blacked nuts and bolts – and to have been very carefully painted. Until 1959 the lathe had a distinctive drip-feed oiler built into the front of the headstock casting, the circular window of which was just to the left of the chuck, and the countershaft assembly ran on needle roller bearings with the (standard-fit) clutch contained within the countershaft's central 4-step cast-iron pulley.

Surprisingly, the needle roller bearings gave rise to noise and vibrations - and the clutch was also prone to rattle unless correctly adjusted - reference to the maker's instructions on this point is vital. In June 1958, from lathe SK 8128, the clutch was moved to its current position inside the large countershaft pulley and the countershaft bearings changed to plain Oilite bushes. This significant re-engineering of the drive (which also involved new belt-guard covers) made a huge difference to the smooth running of the lathe. In May 1959, from machine No. SK 9167, the expensive-to-produce drip-feed oiler was abandoned and a sump provided beneath the bearing with feed by a wick - a change that did at least have the advantage that it was no longer possible for foreign matter to find its way into the bearing. It is useful, though not official, to refer to these plain-bearing countershaft machines as the Super 7 Mk. 2.

The headstock drive system (powered by a 0.75 hp, 1425 r.p.m. motor and with a clutch fitted as standard) has 16 speeds; however, allowing for the fact that the two fastest backgear speeds in high range are not recommend for use this gives 14 useable speeds of: 27, 39, 54, 77, 95, 135, 210, 300, 420, 600, 740, 1050,1480 and 2105 rpm - an especially 'deep' speed range that goes a long way towards making the Super 7 such a versatile and adaptable machine. In the USA, with 60 Hz motors running at 1700 rpm, the speed range is correspondingly faster.

The drive from the motor to the countershaft is arranged with 2-step pulleys (rather than the single of the ML7) - while the headstock spindle carries four speeds instead of three. Both countershaft pulleys, and the headstock cone pulley, are made in cast iron (a much better material for belt-drive than aluminium alloy) and the rotating masses of which assist a single-phase motor by providing a useful 'flywheel' effect. For many years the rather fragile and easily distorted two-step motor pulley was in aluminium alloy but this was changed to cast iron (so matching its countershaft equivalent) at some point in the 1980s.



Early catalogue from Myford

In place of the ML7's plain white-metal bearings the Super 7 spindle runs in a tapered bronze bush at the chuck end and a pair of angular-contact ball bearings at the rear. The ball-races are housed between screwed rings - which are used, by moving the spindle backwards and forwards, to provide a precision method of adjusting the front-bearing clearance. The spindle is immensely rigid and known for long, trouble-free life; the backgear assembly is similarly beefed-up, uses stronger gears and is fitted with a very handy 'flick-over' quick-release mechanism.

The tailstock has a longer travel than the ML7, is fitted with a ball-bearing thrust race, a quick-feed, multi-start thread, self-eject for the centres and a longer barrel and housing. On both lathes the tailstock is improved immeasurably by the use of the optional lever-operated attachment; the increased sensitivity when drilling, especially on very small diameters, is well worth the expense.

The Super 7 cross-slide is longer, with an extra T-slot and, rather than a loose gib strip, is fitted with a pair of rigid gib blocks screwed into the roof of the slide. The top-slide is able to rotate through 360 degrees and employs a tapered spigot mounting instead of a clamp. The micrometer dials are engraved (not cast), have much larger (adjustable) thrust pads and can be 'zeroed' – when correctly set-up the 'feel' of a Super 7 slide can be almost equal to that of a Schaublin precision bench lathe.

The tumble-reverse mechanism is stronger, uses larger, quieter-running fibre gears and the changewheels run on much improved, 'quick-set' studs where, to adjust the relative position of a gearwheel, it is necessary only to slacken a nut on the outer end of each stud instead of having to release one hidden behind the banjo arm. The gear and belt-guard covers are much more convenient, being arranged to hinge open instead of having to be slid or removed.

The leadscrew, 0.75-inches in diameter, was matched with suitably larger and longer-lasting clasp nuts and the right-hand leadscrew bearing hanger more stiffly mounted by being doweled as well as bolted to the bed. The apron is more robustly constructed and made from cast iron.

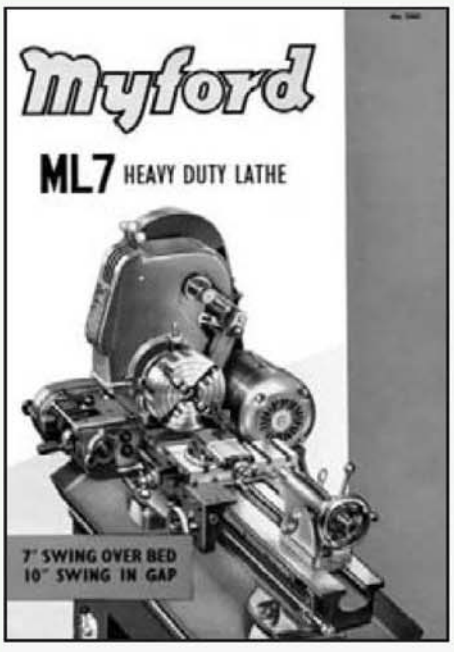
The power feed Super 7 apron was first advertised in 1974, from machine SK 115830, with two minor changes occurring on this model shortly after production started with the substitution, in June 1975, of the original bronze cross-slide feed by one made from hardened steel (from lathe SK 122657) and in December 1975, (from SK 126004), with the power cross-slide feedscrew modified resulting in a larger counter-bore in its micrometer dial. Even today any type of power-cross-feed Super 7 is relatively rare on the used market, especially one owner, carefully-used examples. It would seem that, once you have one of these machines, you simply don't want to part with it.

Colour seems to play an important part in people's perception of a machine's vintage so it is sobering to know that the first green Super 7 was produced as long ago as April 1977, from machine number SK 142981. Later in the same year, in November: from machine SK 136311 the power cross feed apron was partially redesigned with an adjustable cam provided to correctly set the engagement of the leadscrew clasp nuts.

Surprisingly, while many other makers have been content to allow their lathes to be re-branded for overseas markets, Myford were never tempted down this road - the only known exception being the application, in the USA, of badges proclaiming: "*Allied AMMO 7in. x 30in. G*" to some long-bed, screwcutting-gearbox equipped Super 7s of the 1960s.

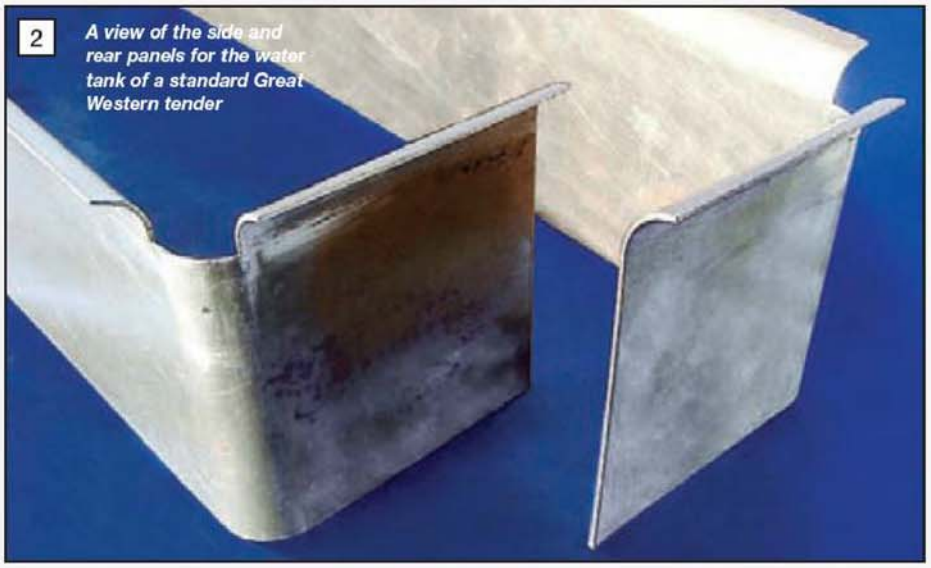
At least two Chinese copies of the Super 7 were manufactured and distributed as the Whitecote, Whitecolt 720 with other clones, presumably by other makers, being badged Tiger Turn. These imitation Myfords are easily recognised by their crude appearance and look quite at odds with the superb finish of the genuine article.

●*To be continued.*



Tri-leva version of the ML7 with gearbox remains popular with model engineers.

The 5in. gauge Stirling Single tender built by the author many years ago.



A view of the side and rear panels for the water tank of a standard Great Western tender

CUTTING CORNERS

Alan Crossfield

explains how he constructed some tricky period features for a model GWR tender.

Locomotive tenders of the Victorian and Edwardian era often had the side-panels of their water-tanks flared outwards at their upper edges. This feature, whilst being aesthetically pleasing has created problems for generations of model locomotive builders.

In scales up to 1/2in. to 1ft., the tools and the procedures required to create the curved flare have not been too demanding of either the builder's muscle or his wallet. Once we go up to and beyond 3/4in. to 1ft. scale however, considerable force and some form of bending fixture will be needed if the builder is to obtain an even curve, free from ripples or evidence of hammering.

Many years ago I was faced with the problem of creating the curved flare on the rear and side-panels of a tender for a 5in. gauge Stirling Single. Made from brass, the length of each water tank side panel was approximately 23 inches. My workshop equipment and building experience at the time being somewhat limited, I was anxious to find a solution requiring minimal skill. Various options were considered before settling for a slightly unorthodox solution.

Photograph 1 shows the rear corners of the eventually completed tender. The shaping of the upper portions of the side panels has been achieved by adding separate lengths of curved-section steel. These were obtained by sawing a length of 1 1/2in. diameter tube longitudinally with a hacksaw. I do remember the tube being easy to saw but difficult to grip. I was thankful that the rear corners of the tender were straight and that the curved upper portions only required to be mitred at 45 degrees. The real headache came several years later when I was confronted by the requirements of a tender having flared panels plus curved corners at the rear.

Photograph 2 is the rear view of the side and rear panels for the water tank of a standard Great Western tender. The tender is the 3,500 gallon type and like most GWR tenders, it features the dreaded rounded corners at the rear of its water tank. Progress of construction had been swift up to this stage, due to the fact that, at the time, I was enrolled onto a model engineering course at a local technical college. The college had a comprehensive workshop where students had the use of many types of sheet metalworking tools.

A large guillotine had been used to cut the two pieces of brass plate to the required dimensions. As each side-panel also included half of the rear-panel, the total length of each flat plate was around 27 inches.

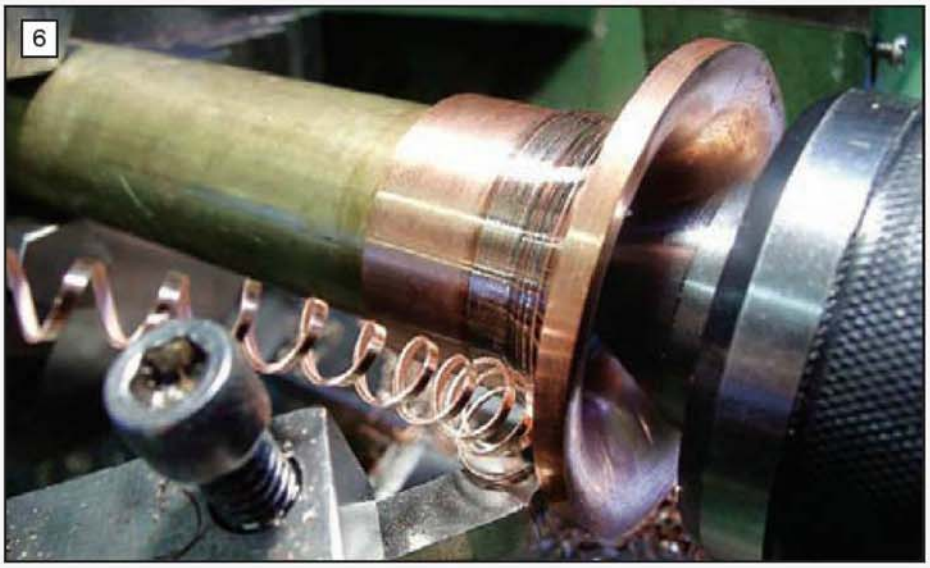
Rectangles were marked at the points that would later become the rear corners. Metal was cut away as required (see photo 2); this proved to be a straightforward job using a combination of hacksaw and chain drilling.

A robust bending brake was used to produce the curved profile of the flare: the trick had been to secure the flat plate onto the fixed table of the bending brake whilst a length of 1in. diameter ▶

A template was made out of thin brass material carefully filed to the correct profile. It is seen here testing the radius in one of the panels.

One of the first operations on the copper 'bell mouth' was to open up the bore with a suitable drill.

Using the template to check the radius formed in the bore of the 'bell mouth'.



Turning the outer shape of the 'bell mouth' on the lathe. The work has been soft soldered to a brass mandrel for this operation.

bar was trapped between the brass plate and the clamping plate. The action of the hand-operated bending brake guaranteed that the same profile was applied to both the side and the rear panels of the tender water tank.

A similar procedure was then used to form the rear corners. The same piece of 1in. dia. bar was used, the only difference being that the panels needed to be supported on spacing blocks which would allow the previously created curves to stand off the fixed table of the bending brake.

At this point the swift progress came to an end for I was now faced with a problem familiar to many model locomotive builders - how to complete the upper flared portions of the corners. This is the main subject of the article and the accompanying pictures will hopefully complement the description of the various stages in the procedure.

My preferred method of producing this type of corner is to first of all reproduce the profile of the curved panel onto a circular blank of suitable metal. The machining procedures to achieve this are similar to those of machining a locomotive petticoat pipe: one ends up with lots of swarf and an object shaped like the mouth of a bell. Quadrants are then removed from the bell shaped blank and inserted into the relevant gaps in the plate work.

Stage 1 involves the production of a simple template replicating the profile of the side and rear panels. **Photograph 3** shows the finished template. This was made from thin brass plate using a selection of small files. The lower portion of the template (stem) looks longer than necessary, but was actually provided as a positive means of checking the fidelity of the curve during the production of the template itself. The upper portion of the template (crossbar) has also been extended and checked to be at ninety degrees to the stem; the purpose of this will become clear as further procedures are revealed.

A circular blank of copper was gripped in the 3-jaw lathe chuck: brass would have been equally suitable but the copper blank was found first and at 2in. O/D, required no adjustment to the outside diameter. **Photograph 4** shows an early operation in the creation of the 'bell mouth'.

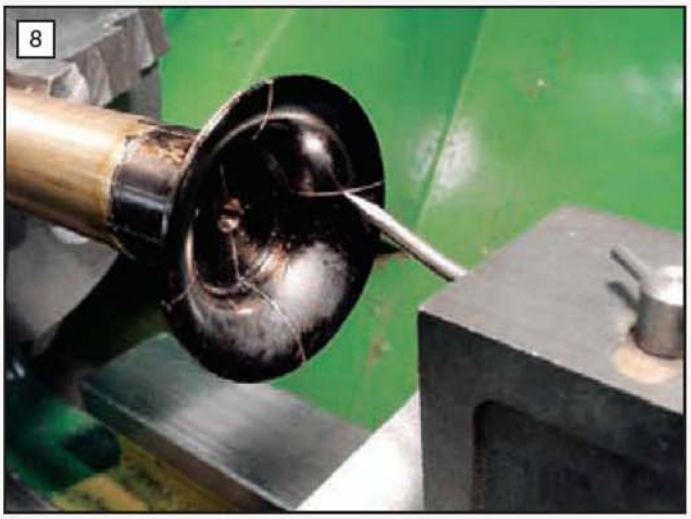
The next procedure will be to bore the inside to a diameter equivalent to the diameter of the inner rear-corners of the panels, minus 0.050 inch. The minus 0.050in. dimension will allow for a stepped inset. The stepped inset will eventually provide the means of locating and securing the individual quadrants in their final position (see later picture).

Creating the curved profile or 'bell mouth' was achieved using a round-nose cutting tool of around 1/8in. radius. The tool had top-rake and was thus compatible with the machining of copper; had the choice been brass then the top-rake would have deemed the tool unsuitable due to the dangerous tendency for the tool to 'dig in'. The actual procedure was carried out with some care, and required frequent reference to the template. Any mismatch of the profile would be highly visible on the completed model and would be almost impossible to rectify.

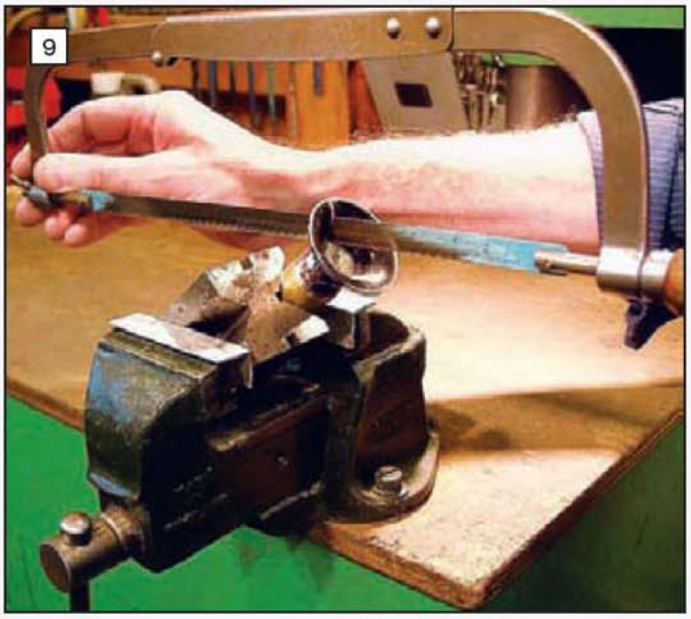
Photograph 5 shows the template in action. The stem has been shortened so as not to foul the inset step in the bore. The purpose of the template's crossbar should now be clear as it provides a positive means of referencing the template against the face of the 'bell mouth'.

On completion of the inner surface of the 'bell mouth', attention was then focused onto the outer surface. The blank was removed from the lathe chuck and soft-soldered onto a brass mandrel.

Checking the thickness of the 'bell mouth' with a suitable gauge. It was made slightly thicker than the side panels at this stage.



Marking the bell with quadrant lines. The surface gauge has been set to the centre height of the lathe.



The bell provided two quadrants obtained by sawing outside the scribed lines of two opposing quadrants.

A close up view of one of the finished quadrants after tidying up with a file. The stepped in lower portion is clearly discernable.

Photograph 6 shows the mandrel repositioned between the chuck and a supporting centre. More swarf is being produced as the same round-nose tool is used to generate the outer profile of the 'bell mouth'. The operation required the job to be positioned well clear of the chuck in order to provide space in which to angle and manoeuvre the tool post. The tool is being manipulated using the saddle hand wheel and the cross-slide hand wheel simultaneously.

In **photo 7**, a thickness indicator is being used to check the profile of the outer surface against the finished and hopefully correct profile of the inner surface of the 'bell mouth'. The aim at this stage was to maintain a thickness slightly greater than that of the tender side panels (0.048in.). The additional thickness could prove useful if, at a later stage, a slight mismatch required that the outer surface should be dressed.

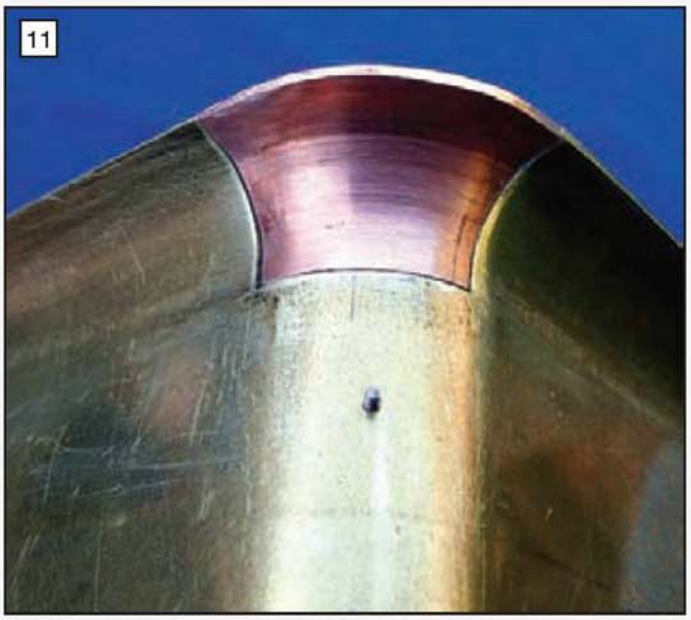
Photograph 8 shows that the centre support has been withdrawn whilst the job is marked into quadrants. The stylus of the scribing block was set to the lathe centre height. In order to mark accurate quarter divisions, an indexing device was used to engage the bull wheel of the Myford. A hacksaw was used to make the actual cuts, these being on the outer sides of the marked lines of two opposing quadrants. **Photograph 9** once again records the procedure (I'm not really left handed but holding the hacksaw correctly made the scene difficult to photograph).

De-soldering and separation of the individual quadrants from the mandrel was a simple operation. The business end of the mandrel was held in a moderate flame whilst the individual pieces were allowed to drop free as heat from the propane blowtorch melted the solder.

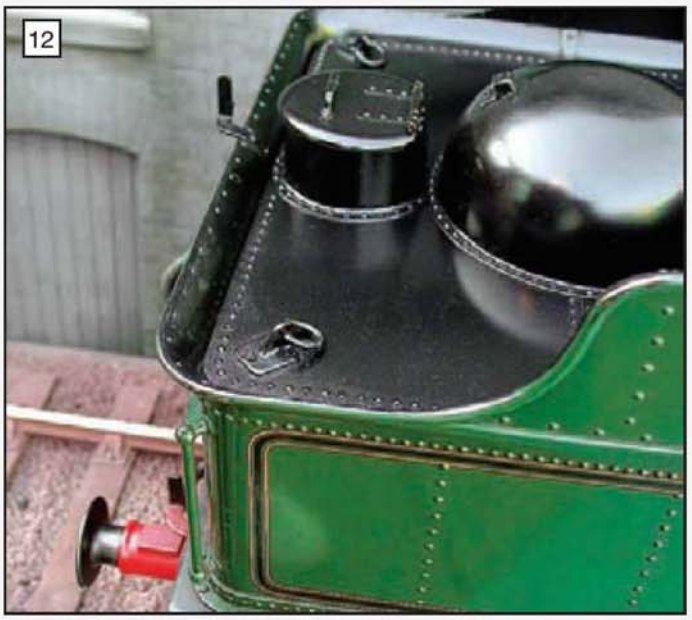
Photograph 10 shows one of the two segments. A file has been used to tidy up the edges and to complete the 'fit' into the allocated gap in the structure of the water tank. The 'stepped in' lower portion of the quadrant will be secured to the inside corner of the water tank by a single brass setscrew.

In **photo 11** the quadrant has been temporarily secured in position. The small protrusion on the corner is the stem of a 12BA setscrew. Prior to its final fixing, the edges of the quadrant will be tinned with soft solder, along with the interior areas of the panels. The final completion of the corners will require the soldering of the joints and the addition of beading around the edges. However, these procedures will be incorporated into the general construction and completion of the tender itself.

Photograph 12 shows the finished result. Rivet detail and paint have made the final contribution to the overall authenticity of the completed model. The tender is currently paired up with a 78xx (Manor) class locomotive.



Here a quadrant has been fitted to the tender using a 12BA setscrew. Final fitting will be done using soft solder.



The finished tender after the rivet details and paint have been added. The tender lives with a 78xx (Manor) class locomotive.

CLUB CHAT
With Malcolm Stride

President Ken Whittaker followed by son Steve double-heading on the last day of running at Stockport DSME.

Notices

As no new secretary was forthcoming at **Leeds SMEE** all correspondence should be directed to the Chairman, John Hunt, 10 Mill Lane, Camblesforth, Selby YO8 8HW, tel: 01757-618605 until further notice.

We have also received details of a change of Secretary at **Welling DMES.** The new man in the post is Robert Underwood who can be contacted at 60 Archery Road, Eltham, London SE9 1HG.

Georges Droulon has provided advance warning of the 15th annual 'Steam Fair of Normandy' at Athis de L'Orne which takes place this year on 16/17 June. Further details can be obtained from Georges at 16 Rue de la Garenne, 61.100 Saint Georges des Groselliers, France. Tel/fax: 00-33-2-33-96-19-73 or e-mail at **g.dsteam@wanadoo.fr** This event is popular with many readers in the UK and anyone wishing to attend is asked to send details before 23 May 2007.

Another event we have details of is the Third Model Engineering and Hobbies Exhibition to be held on 17/18 March at the Michael Herbert Hall, South Street, Wilton, Salisbury. Further details can be obtained from Organiser P. J. Parrish at The Burrells, 33 Tidworth Road, Porton, Salisbury, Wilts SP4 0NS, tel: 01980-610346. All proceeds from the event will be going to the local hospice.

Yet another event is a new one at the **Harlington Locomotive Society** entitled 'Maunsell In Miniature' To be held on 28 April 2007. This will be a day out with a difference for model engineers and anyone else who may be interested. It is planned to have a 'Maunsell in Miniature' day at their track on Harlington High Street, north of the A4 and close to Heathrow Airport.

All locomotives up to 7¼in. gauge, part-built or completed, will be most welcome, although only 3½ and 5in. gauge will be able to run on the Harlington raised track. If prior notice is given, a portable track in 7¼in. gauge can be made available. For those of a smaller persuasion, there is a garden railway catering for Gauge 1 etc.

For further details, contact Les Pritchard (01932-761582 after 6pm) or Ivan Hurst (01252-510340 any time), both of who are members of the Harlington Society and also members of Maunsell LS.

On a more general note, many clubs have reported increases in membership in the past few months which must bode well for the future of our hobby. Long may the trend continue!

UK News

Following the cancellation of the National Locomotive Rally at short notice in 2005, members of Birmingham SME were concerned that visitors might be put off attending in 2006. They need not have worried, visitors attended the 2006 rally *"in droves"* with model engineers and locomotives from over 20 societies. A total of 47 visiting locomotives ran on the tracks during the weekend with 10 BSME members running on the Sunday, bringing the total up to 57. The visitors included one group calling themselves *"Steam Itinerants"* who reportedly had steam flowing in their veins. Model engineers from the London and North Western Railway Society visited the track in September and brought a fine selection of motive power based on prototypes from that railway.

At **Bradford MES**, President Jim Jennings has been busy. He has made a new crank axle for his 4-F locomotive. As he says, this involved dismantling the engine almost completely so Jim took the opportunity to carry out some other improvements such as new O-ring clacks. Jim made the effort to drag himself away from the Wednesday track painting efforts to steam the locomotive and sort out the minor niggles which inevitably results from such major work and, as a result, the locomotive is now back in action again.

The annual charity day this year at the **Hereford SME** is to be on 17 July and will be in aid of the Acorns and is a joint venture with the Waterworks Museum. The 2006 charity day raised £150 for the local Crime Prevention Panel. This year also sees the introduction of a *"member's day"* once a month on a Saturday. Newsletter Editor, John Townsend, has emphasised the importance of receiving contributions by the copy date in order that the newsletter is produced on time each quarter. This has reminded me to get a move on with this column in order that I am not in trouble with our Editor! In the same newsletter, Richard Donovan describes his use of an old record deck turntable as the basis of a spray booth. Richard uses perforated hardboard as the back plate which allows air flow but traps the overspray.

The club *Charlatan* battery electric locomotive at **Leeds SMEE** has been repaired by member Ian McHugh. Ian has sorted out the controller and motors and also repaired and repainted the body shell in BR Blue.

The members of **Melton Mowbray** DMES were held spellbound by Mary Matts' presentation on the Foxton Canal, locks and inclined plane. Mary told many tales including those of water running through her canal-side house letterbox when the locks were misused and the renumbering of the lock gates and bridges from the other end of the canal when it was taken over. I have personal memories of this amazing flight of locks from canal boat holidays in my younger days. However, I don't think we ever flooded the local houses! The newsletter carries a tip from the *"Professor of Engineering, University of Life's Experience"* suggesting the use of Grundfos central heating pumps as suds pumps. I suggest those removing the domestic pump to try it wait until the warm weather when the misappropriation is less likely to be noticed!

The website of **Peterborough SME** has been completely redesigned and can be found at **www.peterboroughsme.co.uk** I have had a look at the site and it is certainly very well laid out. It even has a page to be used for video clips in the future.

The journal of the **Society of Model and Experimental Engineers** carried a note concerning the future availability of cellulose paint and thinners. Apparently the E.U. has been at it again, and after 2010 it will no longer be possible to paint your car using cellulose paints unless you can prove it was painted in such paints originally and have a licence. It will also not be possible to buy cellulose products after 2007 unless the product was manufactured before January 2007. The website quoted did not work for me, so if anyone can provide more information or sources of such we will publicise it. Andrew Curl noticed that round an old tin of Fluxite were the words *"another use for Fluxite, hardening tools and case hardening"*. Have any of our knowledgeable readers any experience of using Fluxite for such things?

In his editorial for the **Stamford MES** newsletter, Joe Dobson describes his use of integrated circuits for controlling model railways. Joe has built two circuits based on the 555 integrated circuit. Once he has provided a suitable power supply he will no doubt try them on the railway. Mike Smith, who assisted Joe with his circuits, described his own electronics for controlling the boiler water level on his Clayton wagon. Mike's system uses the electronics to control the steam valve for the duplex water pump, rather than to control a bypass valve. Mike's other device is for monitoring the water level in the supply tank on his wagon and provides an audible warning when the level gets low.

Some sad news from **Stockport DSME** is that the society has had to vacate the site in the grounds of the Royal Schools it has operated at for the many years. The school is extending the buildings and require use of the land. The last trains ran on 22 July last year and the removal of the tracks and equipment was completed in mid-December. As Steve Whittaker comments *"this is a great disappointment to our 120 members"*. He does also point out that *"they have enjoyed 40 vandal free years"* which must be some sort of record these days. The society is looking for suitable alternative sites and we will be pleased to pass on details should

pleased to pass on details should anyone know of suitable sites in the local area.

Having a long interest in I/C engines I am very pleased to report that Alec Hadfield's fine twin-cylinder *Wallaby* engine to the Westbury design was awarded *Best Model* at the **Taunton Model Engineers** trophy night. I am sure Nemett would be interested in some more details and photographs. The society membership continues to grow and the construction of new facilities at Creech St. Michael also continues to make progress.

Dennis Westlake of the **Sutton MEC** is seeking information on a very unusual locomotive. The engine in question has its own living accommodation which Dennis describes as *"like half a railway carriage*". The locomotive was apparently a travelling home for a railway inspector who worked round the country. If any readers can help we will pass on the information.

In the autumn of last year, members of **Tyneside SMEE** had a very busy Sunday supported by Henry Hills with his mini-digger. Between them they excavated a 67-metre trench, laid a drain and then backfilled the trench. The task included the removal of an old raised track plinth which was in the line of the new drain. The day was described as very successful and special mention was made of the efforts of two younger members, Stuart Blackburn and Joseph Gibbons, who *"worked themselves to exhaustion"*. This makes a welcome change from the usual reports of the vandalism activities that we hear so much of these days. Perhaps if those in authority did more to encourage model engineering and similar activities, there would be less vandalism!

The renovation of the footbridge structural steel work has been completed at **Worthing DSME** with a repaint scheduled in the spring. A group of 16 members took eight locomotives *"to play"* on the **Harlington Locomotive Society** track last September. All who attended appreciated the excellent hospitality, especially the *"smiling faces greeting us with steaming mugs of tea and lovely bacon butties"*. The newsletter also carries details of a company that will be of interest to those wanting replacement flat drive belts for lathes etc. The company is **lathes.co.uk** and is located at Barlow, Buxton, Derbyshire SK17 8RP, tel: 01298-871633 or e-mail at **tony@lathes.co.uk** The company will make up flat belts to order and member John Fuller ordered one by telephone one day and receive the specially made up belt the next day. At the fun day in the park, the society introduced a new competition to test driver's abilities. The task was to drive slowly up to a fixed buffer and to trap an egg between the locomotive buffer and the fixed buffer without the egg breaking. It is reported that *"competitor after competitor cracked open the regulator and scrambled up the bank ...only to be foiled with a shattering result"*. Neither the magazine nor I accept any responsibility for the puns! I assume those who failed got egg on their faces!

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.

February

2 **Canvey R&MEC.** *Brains Trust for Modellers.* Contact Brian Baker: 01702-512752.
2 **Maidstone MES (UK).** *Mike & Roger: Team Quiz.* Contact Martin Parham: 01622-630298.
2 **North London SME.** *Tim Watson: Models, Microscopes & Molars.* Contact David Harris: 01707-326518.
2 **Portsmouth MES.** *AGM.* Contact John Warren: 023-9259-5354.
2 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
3 **Isle of Wight MES.** *Track & Pond.* Contact Malcolm Hollyman: 01983-564568.
3 **SM&EE.** *Prof. Peter Thomas: Building a Model Locomotive.* Contact David Boote: 01202-745862.
3 **Sunderland (City of) MES.** *Meeting.* Contact Albert Stephenson: 01429-299649.
3 **York City & DSME.** *John Chambers: English Canals.* Contact Pat Martindale: 01262-676291.
4 **Reading SME.** *Public Running.* Contact Brian Joslyn: 01491-873393.
4 **Steam LS of Victoria.** *Public Running.* Contact Graham Plaskett: (03) 9750-5022.
5 **Bournemouth DSME.** *Meeting.* Contact Dave Fynn: 01202-474599.
5 **Stamford MES.** *The Shuttleworth Collection.* Contact Derek Brown: 01780-753162.
6 **North Cornwall MES.** *Meeting & Maintenance Afternoon.* Contact Geoff Wright: 01566-86032.
6 **Romney Marsh MES.** *Tony Crowhurst: Slide Show.* Contact John Wimble: 01797-362295.
6 **Taunton ME.** *Quiz Night.* Contact Don Martin: 01460-63162.
6 **West Wiltshire SME.** *An Evening of Brief Presentations.* Contact R. Nev. Boulton: 01380-828101.
7 **Bradford MES.** *Meeting.* Contact John Mills: 01943-467844.
7 **Bristol SMEE.** *AGM.* Contact Trevor Chambers: 0145-441-5085.
7 **Chingford DMEC.** *Bits & Pieces.* Contact Ron Manning: 020-8360-6144.
7 **Guildford MES.** *Talk on Canals & Canal Boats.* Contact Dave Longhurst: 01428-605424.
7 **Leeds SMEE.** *Richard Gibbon: Brunell's USA Extension.* Contact Colin Abrey: 01132-649630.
7 **Staines SME.** *Dave Tompkins: A Talk on CAD.* Contact Stan Bishop: 01784-241891.
7 **Tyneside SMEE.** *Peter Fedoroff: Cross-USA Train Journey.* Contact Malcolm Halliday: 0191-2624141.
8 **Cardiff MES.** *Philip Javes: Tribological Tribulations.* Contact Don Norman: 01656-784530.
8 **Harlington LS.** *Nominations and Videos.* Contact Peter Tarrant: 01895-851168.
8 **Worthing DSME.** *Meeting.* Contact Bob Phillips: 01903-243018.
9 **Brighton & Hove SMLE.** *Keith Carter: Railway Branches & Byways.* Contact Mick Funnell: 01323-892042.
10 **Adelaide Miniature SRS.** *Members' Day.* Contact Bob Yule: 8387-5032.
10 **Glasgow & S.W. Rly Ass'n.** *Alan Mackie: Signalling today on the former G&SWR.* Contact Bruce Steven: 0141-810-3871.
10-12 **North Norfolk MEC.** *Thomas the Tank Engine Days.* Contact Gordon Ford: 01263-512350.
10 **SM&EE.** *Training Seminar.* Contact David Boote: 01202-745862.
11 **York City & DSME.** *Running Day.* Contact Pat Martindale: 01262-676291.
12 **Bedford MES.** *J. Sinclair: A brief history of computing.* Contact Ted Jolliffe: 01234-327791.
12 **Erewash Valley MES.** *Bits & Pieces.* Contact Jim Matthews: 01332-705259.
12 **Saffron Walden DSME.** *Club Night.* Contact Jack Setterfield: 01843-596822.
13 **Northampton SME.** *AGM.* Contact Pete Jarman: 01234-708501 (eve).
13 **Taunton ME.** *Working Party.* Contact Don Martin: 01460-63162.
14 **Chingford DMEC.** *Jon Marsh: Slides of Steam.* Contact Ron Manning: 020-8360-6144.
14 **High Wycombe MEC.** *Bill Richardson: Sulzer Traction.* Contact Eric Stevens: 01494-438761.
14 **Norwich DSME.** *Film Evening.* Contact Paul Reed: 01603-462925.
14 **St. Albans DMES.** *Dan Keen: Auction.* Contact Roy Verden: 01923-220590.
15 **Adelaide Miniature SRS.** *Meeting.* Contact Bob Yule: 8387-5032.
15 **Cardiff MES.** *Forum.* Contact Don Norman: 01656-784530.
15 **Harlington LS.** *AGM.* Contact Peter Tarrant: 01895-851168.
15 **Isle of Wight MES.** *Ken Harrison: Societies Petrol Engines.* Contact Malcolm Hollyman: 01983-564568.
16-18 **Brighton *ModelWorld*** at the Brighton Centre. 10am-5.30pm; Adult: £8, Child/Senior Citizen: £5, Family: £19. Contact Tim Steven: 01444-254057.
16 **Canvey R&MEC.** *Club Auction.* Contact Brian Baker: 01702-512752.
16 **Romford MEC.** *Chris MacDonald: LBSC his Life and Times.* Contact Colin Hunt: 01708-709302.
16 **Romney Marsh MES.** *DVD/Video Evening.* Contact John Wimble: 01797-362295.
16 **Steam LS of Victoria.** *Gathering.* Contact Graham Plaskett: (03) 9750-5022.
17 **Canvey R&MEC.** *Members' Only Running Day.* Contact Brian Baker: 01702-512752.
17/18 ***Festival of British Railway Modelling*** at the Yorkshire Event Centre, Harrogate. Advance booking (to 15 Feb 2007): Adults: £5.50, Children: £3.50, OAP: £4.50, Family (2+3): £18. Information and Ticket Hotline: 01778-392089. **www.brmodelling.com**
17 **Steam LS of Victoria.** *Club Running.* Contact Graham Plaskett: (03) 9750-5022.
17 **York City & DSME.** *Malcolm High: Laser Cutting.* Contact Pat Martindale: 01262-676291.
20 **Chesterfield MES.** *Meeting/Talk.* Contact Mike Rhodes: 01623-648676.
20 **Taunton ME.** *Traction Engines.* Contact Don Martin: 01460-63162.
21 **Bournemouth DSME.** *Richard Knott: Annual Video Show.* Contact Dave Fynn: 01202-474599.
21 **Chingford DMEC.** *Keith Brunt: The Larkswood Signalling Project.* Contact Ron Manning: 020-8360-6144.
21 **Guildford MES.** *Bits & Pieces.* Contact Dave Longhurst: 01428-605424.
21 **Leeds SMEE.** *Bits & Pieces.* Contact Colin Abrey: 01132-649630.
21 **MELSA.** *Meeting.* Contact Graham Chadbone: 07-4121-4341.
21 **Norwich DSME.** *Annual Society Dinner.* Contact Paul Reed: 01603-462925.
21 **Staines SME.** *Video/DVD Evening.* Contact Stan Bishop: 01784-241891.
22 **Cardiff MES.** *Brian Davies: Colliery Railways in the 1960s.* Contact Don Norman: 01656-784530.
22 **Harlington LS.** *Bring and Buy.* Contact Peter Tarrant: 01895-851168.
22 **Worthing DSME.** *AGM.* Contact Bob Phillips: 01903-243018.
23 **Brighton & Hove SMLE.** *Ian Wright: Then West Somerset Railway.* Contact Mick Funnell: 01323-892042.
23 **Hereford SME.** *AGM.* Contact Nigel Linwood: 01432-270867.
24 **Chesterfield MES.** *Public Running.* Contact Mike Rhodes: 01623-648676.
24 **SM&EE.** *AGM.* Contact Maurice Fagg: 020-8669-1480.
25 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.
26 **Bedford MES.** *AGM followed by presentation.* Contact Ted Jolliffe: 01234-327791.
26 **Canterbury DMES (UK).** *Bob Goss: Adhesives.* Contact Mrs P. Barker: 01227-273357.

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