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MODEL ENGINEER

Vol. 192 No. 4224

25 June - 8 July 2004

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IMLEC 2004 AT KINVER

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Diameter of Column	66.65mm
Throat	165mm
Max distance spindle to table	320mm
Height with head at top of column	1067mm
Width	775mm
Depth	559mm
Spindle speeds	400-1640
Motor	1 phase 1/2hp with F/R switch
Weight	295lb
Head tilting	90-0-90 worm gear tilt mechanism

ZX-15 Milling Machine

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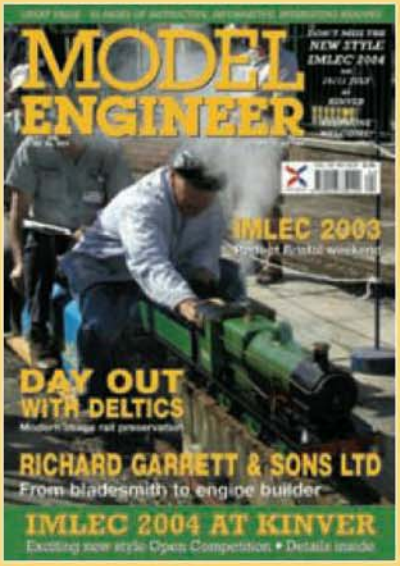

On the cover ...

Ably driven by John Ellis for owner Geoff Moore, both of Guildford MES, this 0-6-0 locomotive based on the LBSC Minx *design was the outright winner of IMLEC 2003.*
Our cover shows John preparing himself at the start of his run, the second of the event which was held on a warm and sunny weekend on the Bristol SMEE track at Ashton Court. This, the 34th in the series, brought twenty-five locomotives and drivers together for the competition.
Impeccable organisation by the experienced Bristol SMEE team ensured that the contest was managed with efficiency and without incident.
Turn to page 728 of this issue for a full illustrated report on the thrills, spills and disappointments of this memorable event.

(Photograph by Mike Chrisp)

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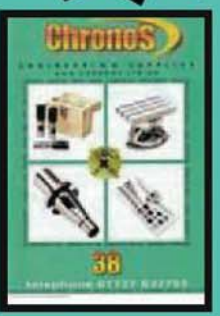

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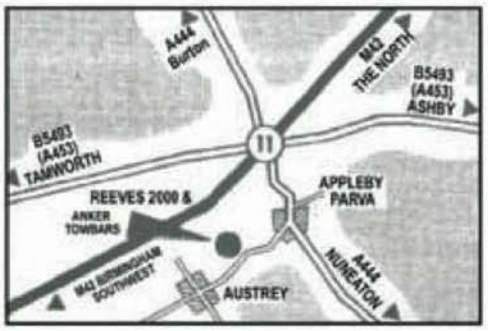

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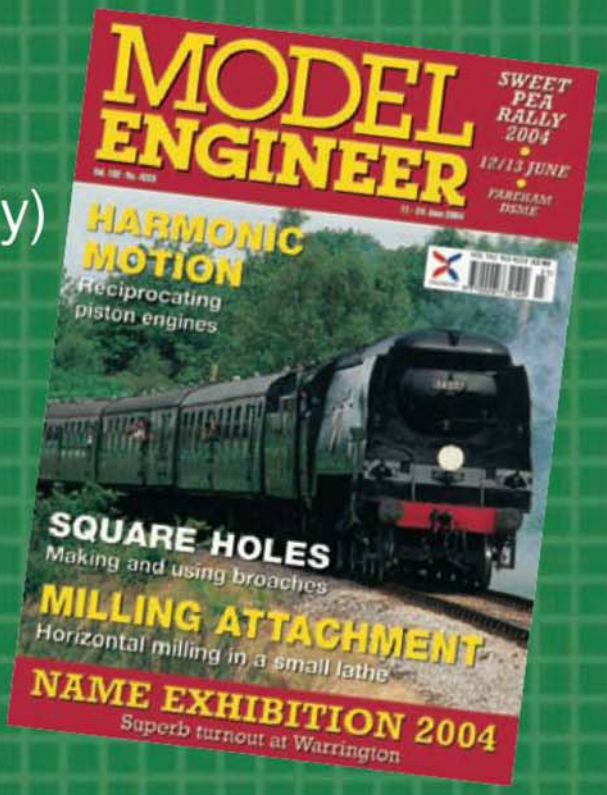

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SMOKE RINGS
With the Editor

The magnificent Martin Evans Challenge Cup is to be contested at the 2004 International Model Locomotive Efficiency Competition for steam locomotives of 3½ and 5in. gauges, now in its 35th year and hosted 11/12 July 2004 by Kinver & W. Midlands Society of Model Engineers Ltd. (see pp736-7 for full details).

Forthcoming events

IMLEC 2004

Readers will doubtless be aware that IMLEC 2004 is to be hosted by members of Kinver & West Midlands Society of Model Engineers at their Marsh Playing Fields tracksite in the village of Kinver, South Staffordshire (OS grid reference SO847838). Full details of this imminent event are published in this issue — see pages 736-7.

Prospective contestants who have left it rather late to apply for entry may be pleased to know that at the time of writing these notes, a few vacancies remain to fill the proposed maximum field of 30 runners for this event. Anyone wishing to take advantage of a last minute entry is urged to apply without further delay to Model Engineer Editorial Office, PO Box 310, Hemel Hempstead, Hertfordshire HP3 8XL.

LBSC Bowl 2004

We are very pleased to be able to confirm that the 2004 LBSC Memorial Bowl Competition will be hosted by Worthing & District Society of Model Engineers at their Field Place tracksite in Durrington-on-Sea, Worthing, West Sussex (OS grid reference TQ123036).

Competition for the magnificent Curly Rose Bowl, as it is affectionately known by many, will take place on Saturday 4 September 2004.

We would be happy to welcome owners of steam locomotives in 2½, 3½ and 5in. gauge built to or based on LBSC's many designs, to come to Field Place and enjoy a day among friends celebrating the contribution to our hobby made by this noted designer and author whose gift with 'Words and Music' brought the magical hobby of model engineering to so many.

Entry forms are available from the Model Engineer Editorial Office as above.

SEQLEC 2004

It is also with great pleasure that we can announce the annual 7¼in. gauge Model Locomotive Efficiency Competition will be hosted by Nottingham Society of Model & Experimental Engineers at their Ruddington tracksite at the Heritage Centre, Nottinghamshire (OS grid reference SK566437).

Competition for the elegant Bristol Cup will take place on Saturday 9 October 2004.

We would be very pleased to welcome owners of steam locomotives in 7¼in. gauge to come to Ruddington and enjoy a day among like-minded friends and colleagues.

Entry forms are available from the Model Engineer Editorial Office as above.

2005

It may be helpful to look ahead so that readers can make their long term forward plans.

We are pleased to announce that IMLEC 2005 will be hosted by Northampton SME Ltd. It will be held at their attractive woodland Delapré Park tracksite in Northampton (OS grid reference SP756593) over one of the early weekends in July 2005, the exact date to be agreed when programme details of the nearby Silverstone race course are available. We have no desire to clash with the Grand Prix weekend and find ourselves with no available accommodation nearby!

Members of Fareham DSME have kindly volunteered to host SEQLEC 2005 at their extensive and well appointed tracksite off Segensworth Road, Tichfield in Hampshire (OS grid reference SU541070). While for many years this event has been held in early October, we are far enough ahead to move it to an earlier date in the year, provided any new date does not clash with other activities. We would be pleased to have prospective supporters' and would-be competitors' views on the subject.

We have not yet located the LBSC Memorial Bowl Competition 2005. Bearing in mind that the most important facility required for this event is a track which will accommodate 2½, 3½ and 5in. gauge locomotives, we look forward to hearing from any club or society prepared to take on this most enjoyable and relatively 'low-key' event.

Erratum

We have been apprised of an error concerning the supplier of spring steel recommended by Keith Wilson in his recent *Logger/Slogger* feature published in *M.E.* 4219, 16 April 2004, p454.

Fernite Sales Director David Sayles telephoned to correct the details as follows: established in 1832, the company now trades as Fernite of Sheffield Ltd. and has done so since 1996. The address is Fernite Works, Coleford Road, Darnall, Sheffield and the telephone number is 0114-244-0527.

Readers may care to visit the company's website at **www.fernite.co.uk** or make contact by e-mail to **sales@fernite.co.uk**

We regret the inconvenience inevitably caused by the publication of incorrect information.

Number and letter stamps

The 'phone has just rung with an enquiry from Don Gray who with his son is building an extensive 00-gauge railway layout. The reason for his call is that he is seeking lower case letter stamps for various signs on the layout. I had to admit that I only knew of upper case letter stamps but guess that there will be some readers 'out there' who will know better.

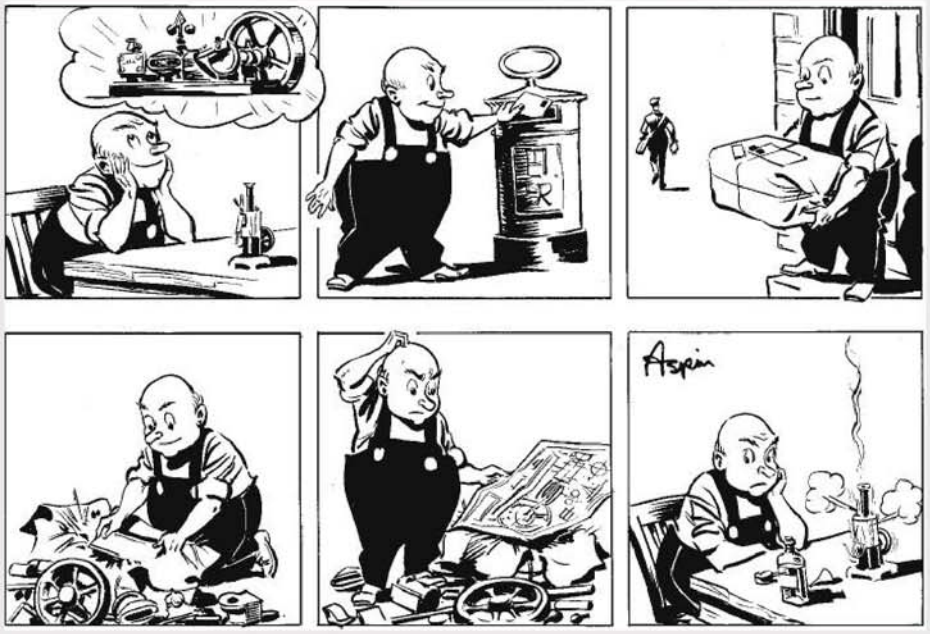
Don requires lower case serif style letters (and numbers) in 1.5, 3 and 5mm heights and would be pleased to hear from anyone who can advise him as to where he may obtain (or indeed, borrow) such items. He may be contacted by 'phone on 0208-672-7263 or 07973-132322.

Pioneer Model Racing Car Club

The Royal Horticultural Halls & Conference Centre is celebrating one hundred years as one of London's top venues for exhibitions and events. These celebrations are taking place alongside those of the Royal Horticultural Society which is marking its own Bicentenary this year.

We hope that *Model Engineer* will be involved in this celebration. Organiser René Dee (tel: 020-7828-4125) would be pleased to hear from anyone able to lead him to contact with the Pioneer Model Racing Car Club which also used the facilities at these venues.

CHUCK the MUDDLE ENGINEER — by B. TERRY ASPIN



POST BAG

Dead man's handle

SIRS, - I note with interest the report in *Club Chat* (*M.E.* 4222, 28 May 2004) that in a general overhaul of their club electric locomotive, our friends at Peterborough have included the fitting of a dead man's handle, a most prudent move borne out by the following cautionary tale of my own experience.

On completion of my 5in. gauge electric class 08 diesel shunter *Charlatan*, it did not occur to me to fit a dead man's handle. Thus the locomotive ran for several years with no more than a rheostat knob for speed control.

All was fine until the morning I entertained a small boy and his Grandparents at our club track. I carefully explained all the possible hazards and gave the lad driving tuition by sitting behind him on the driving trolley for several circuits before allowing him (with his Grandparents' blessing) to drive the locomotive by himself.

All went well for umpteen circuits with and without passengers until 'last lap' was decreed by Grandpa. The last section of the Stamford Society's ground level woodland track consists of a curve through a deep cutting followed by a long downhill straight to complete the circuit. While in the cutting, both train and driver are out of sight from the boarding area where I waited with the lad's Grandparents.

As we chatted, the locomotive and driving trolley appeared, running at top speed down the final straight but without the driver who, it seemed, had disregarded my instructions *not* to lean over and *not* to drive at top speed on sharp curves and/or pointwork. As a result he had fallen off in the cutting with the locomotive control knob at the maximum speed setting!

A top speed of 4 or 5mph doesn't sound very much; nevertheless it was far from easy to reach the controls while running alongside the locomotive, although the prospect of extensive damage resulting from an out-of-control derailment undoubtedly intensified my effort to stop the runaway.

Fortunately no damage was done either to the locomotive or, more importantly, to the young driver who was none the worse for his experience. His elders took the view that having ignored (or forgotten) sensible advice he had brought his misfortune upon himself.

But, of course, the incident might have ended much less happily, despite my appropriate insurance cover.

My dead man's handle was fitted within the week and I cannot now imagine how I ever embarked upon running the locomotive without it.

David Ash, Lincolnshire.

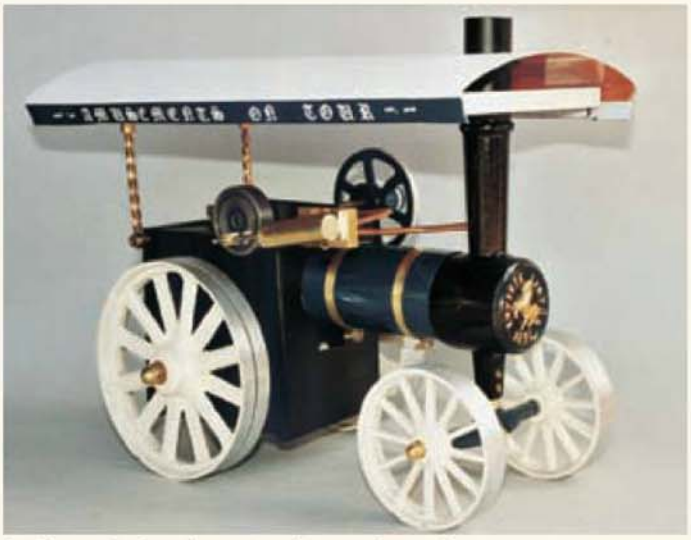
Restoration project

SIRS, - Please find herewith photographs of the little traction engine I purchased in 2002 and which I have restored. You published the previous photographs I sent you in *M.E.* 4188, 7 February 2003.

Restoration 'work' was a pleasure with the book from Mr. Dennis Hill of Leicestershire, which you forwarded to me in March 2003. With the information in this book I was able to carry out a full restoration. I remade the two axles, rear boiler end, front fork and an extension for the chimney without which the roof was too low. The addition of two boiler bands, a coat of paint and Letraset dry transfer lettering make a charming model just like those made by young engineers in the '70s.

I derived a great deal of pleasure from this comparatively easy job and send my thanks for your help and for the fellowship of the model engineering fraternity.

Dr. J.-L. Figureau,
Brioude, France.



Dr. Figureau's charming restored toy traction engine.

Lacquering

SIRS, - I may be able to help Mr. Castle-Smith (*Post Bag*, *M.E.* 4219, 16 April 2004) with lacquering of clock bits and pieces. I started my apprenticeship in the 1940s, just after the war. The country windings were no more but there were still two commercial ones left. One of these was the local brewery in Reading. There were about fifty clocks to wind every Saturday morning, mostly English dials, one or two time recorders and a rather nice grandfather strike in the firm's boardroom. They were expected to keep time to within a minute a week, and this was quite easily achieved.

Some of the conditions under which they were expected to work were far from ideal. The ones in the offices were okay, but in the brewery they had to contend with steam and vibration, especially in the power house, when the steam turbine generators and refrigerator compressors were going flat out. They were kept inside a wooden case with a glass-fronted door which kept out most of dirt and moisture

A variation in a clock's timekeeping usually meant that it was due to come into the workshop for repair. This was usual after eight to ten years. Very little is needed in the way of repairs apart from making sure that pivots are well-polished and any holes bushed, pallets properly hardened, polished and correctly set. Pallets will usually go for about twenty years before any marks appear. Lacquered plates will last about as long.

Lacquering clock plates is quite straightforward. Should you make a hash of it, just wash it off and start again. We used Canning's *Ercalene* with a golden tint, like the colour on old microscopes. First polish the plates, clean off with meths and apply the lacquer using a wad of cotton wool about one and a half inches diameter. The lacquer should be as thin as water. Apply plenty, otherwise you will end up with all the colours of the rainbow. You can do the whole job hot, first warming the pieces over a spirit lamp. You must apply the lacquer quickly with no hesitation. The more skilled you become the faster and easier it will be.

When dry and hard, make sure all pivot holes are well pegged out before putting back together. Small and delicate parts can be polished using metal polish applied with a brush, washed off, held in tissue paper and polished with a brush that has been rubbed on chalk. Badly tarnished gilded platform and watch parts may be cleaned in the same way, using ammonia and whiting.

I hope that the above will be of some help.

John Sargeant, Oxfordshire.

Portable track

SIRS, - Wishing to build a portable track, I researched through back issues of *M.E.* and found an article by the Croydon Society of Model Engineers which described a good and simple system. Needing some further details, I looked in vain for a contact address in recent issues.

In desperation, I contacted our worthy (and no doubt busy) Editor. He immediately gave a telephone number of Mr. Cave, the Croydon SME Secretary who kindly telephoned me twice to give the required information.

I simply wish to record here my thanks to our Editor, Mike Chrisp, and to Mr. Cave for their kind help. It is good to be part of so helpful and kind a group of people as model engineers, with *Model Engineer* magazine as the cement binding us all together.

David R. Machin, S. Yorkshire.

Tallow

SIRS, - A recent comment in *Club Chat* (*M.E.* 4221, 14 May 2004) concerning the Model Steam Road Vehicle Society reminded me that I have about a cubic foot of tallow originally intended for use by plumbers.

I should be very glad to give this away to anybody who wants some. All I ask is a suitable container and the anticipated cost of postage.

Be warned, candles made from this stuff make the house reek!

Jim Smith by e-mail.
(tel: 01303-267122)

Something for nothing

SIRS, - Scrap items can be obtained from computer repair shops for nothing; I hope the following suggestions may be of interest to model engineers who like getting something for nothing.

A scrap flat bed scanner will yield a length of precision ground stainless rod about 10mm in diameter.

Hard disk drives contain two very strong flat magnets bonded to a backing plate with fixing holes.

A computer mouse contains a rubber covered steel ball; if you remove the coating with paint stripper, the ball is soft and can be drilled for handles, etc.

John Korber, by e-mail.

Malcolm Stride would like to know the purpose of these units.

Mr. John Peterson's blower valve.

Precision levelling?

SIRS, - Here at Reading SME, Peter Ballard, one of our members has acquired the devices shown in the photograph above. There have been various suggestions as to their use, the most likely being as some sort of levelling device. Our question is, with accuracy via the micrometer head to a 'thou', what needed levelling to this accuracy? One suggestion is for levelling very large surface plates.

As can be seen, the major items are a pair of handed, graduated cylinders with machined top and bottom surfaces and glass inner linings. The bottom surfaces also have shallow vee grooves machined in; both have circular spirit levels built into the base and taps and hose connections at the bottom of the cylinder.

The depth micrometer has a long extension adjustable for length with a collet type lock. In use the water level is detected to an accuracy of a thousandth of an inch by winding the micrometer head until the point touches the water surface. The point of detection is accurate because surface tension causes the water to rise up the pointer slightly as soon as the surface is touched.

Marked 'Swiss Made', the device was sold by Herbert Small Tools and is in a fully fitted wooden case.

Have our knowledgeable readers any information on these devices?

Malcolm Stride, Berkshire.

Carbon filled PTFE

SIRS, - I received much helpful assistance via your columns a few years ago; my enquiry concerned valve gear for LBSC's *Pansy*. Following help from yourself and several others, the problem was eventually resolved (I think!)

Shortly after this, illness forced a stop to my workshop activities so the project had to be shelved. I am pleased now to be 'workshop semi-active' again, so I have returned to the *Pansy* project as well as a marine triple expansion engine which exercised my mind during some of my idle time.

I want to try carbon loaded PTFE piston rings backed up with silicone O-rings for both engines but I have failed to find a source of suitable bar or tube in small quantities. It is much too expensive to buy a two or three metre length when only a few inches are required.

I wonder if anyone can point me towards a supplier that can help.

Tom Collins, Bristol.

External blower valve

SIRS, - Peter Fagg's beautiful *Sir Bors de Ganis* (*M.E.* 4222, 28 May 2004) has the blower valve in the conventional position within the cab, rather than on the outside of the smokebox, but this modification to the prototype may not be necessary.

On my own two North London Railway locomotives I have copied the full size arrangement; the photograph shows this on my 5in. gauge model of Adams' 4-4-0 No. 12 of 1867. An internal pipe feeds steam from the dome to the front of the boiler, then via a pipe inside the smokebox to the front of the blower valve situated on the outside of the smokebox.

A push rod operated by a screw in the cab opens the valve which, like a little whistle valve, contains a spring-loaded ball. This allows steam to pass to the rear of the blower valve and back inside the smokebox to the blower ring.

Despite the use of 3/16in. x 60tpi unions inside the smokebox, I admit that the valve is slightly overscale, but it does have some advantages. It has never failed. It looks right, both at the front and in the cab. It is not difficult to connect up inside the smokebox, although, of course, you have to tighten the back union first as part of the smokebox assembly. Most importantly, it does not require a hollow longitudinal stay in the boiler, which can leak.

There may be problems in trying to adapt this valve for operation by a handrail, but I'm sure they could be overcome.

John Peterson, Norfolk.

'Peak' engine

SIRS, - I last visited Hemel Hempstead in England some ten years ago. We talked about the Australian Miniature Boiler Safety Committee, and our Codes for the construction and operation of miniature steel and copper boilers. I'm still the Secretary, as no-one else seems to want the job!

My reason for writing concerns the article by Roger Backhouse in *M.E.* 4211, 27 December 2003, about the Markham Grange Garden Centre. My eye was caught by the engine at the bottom right hand of page 761 where it is stated that *"this two-cylinder slide-valve engine was built in 1902 by Robey & Co. for Cromford Silica Firebrick Works."*

I would like to correct this statement, if I may, as I've been trying to trace the fate of this engine since I was last in the UK. I found it then in a shed at the bottom of the Cromford and High Peak Railway, near the Cromford Canal in Derbyshire, along with other items of steam equipment. As it was locked up, I could only see it through a crack in the doors, and no one at the adjacent museum seemed to know much about who owned it. I subsequently found a photograph of it in a museum near Doncaster, as shown in the magazine *Old Glory*.

My interest in this engine relates back to the years 1959 to 1961, when I was Maintenance Engineer to the Derbyshire Silica Firebrick Company at Friden, on the Buxton-Ashbourne Road. This was a few miles 'up the hill' from Cromford!

During my time at the works, I was responsible for the maintenance of the engine and organised its total re-build. This consisted of new bearings, cylinders re-bored *in situ* (we had to knock two holes in the engine house wall to get the boring machine in!) new piston rings, overhauled governor, and installation of a steam drier in the main steam line. After I had re-set the valves, the engine ran at 90rpm unloaded, dropping to 88 on load. A big difference from before, when it dropped to 75!

The engine was situated in a cramped stone engine house, and drove an 11ft. pan grinding mill, two jaw crushers and the associated material elevators, de-dusting fans, etc. With all flat leather belt transmission, it produced approximately 50% of the works material for refractory brick making. The exhaust from this engine was directed under the brick drying floors which were covered with cast iron plates. The subsequent condensate was collected in a pond at the front of the works, from where it was pumped back to the two coal fired Lancashire boilers.

The majority of the work was carried out by Lancaster & Tonge of Pendleton in Manchester. Due to emigrating to Australia I had lost touch with the 'Peak' engine, as it was called. It was refreshing to 'find' it again, and obviously in such good hands! One day, I might even get to renew my acqaintance with it. I must say that it was really well presented, as it never had that nice timber cladding on the cylinders, or the paintwork while I had anything to do with it. It was a working engine, and was painted black!

Incidentally, does anyone know what happened to the other Robey at the works? It was a single cylinder engine, and was near the front of the sand sheds.

Dave Merrifield,
New South Wales, Australia.


Dave Tompkins


John Ellis


Stuart Duncan


Dave Mayall

IMLEC 2003
HOSTED BY BRISTOL SMEE

Neil Read
reports a hotly contested event.

It has been previously reported in these pages that the 2003 International Model Locomotive Efficiency Competition, thirty-fourth in the series, was hosted by Bristol SMEE 12/13 July at their miniature railway located in the Ashton Court Estate on the outskirts of Bristol. The track itself is nominally 1,640ft. long in an elongated kidney configuration with a minimum radius of 78ft. and maximum grade of 1:120. Long straight stretches and generous curves make this a relatively fast track, but management of the gradients requires forward planning on the part of the driver.

After raising steam, competing locomotives were coupled to their train and ran light up to the station area where passengers embarked. All runs were made in a clockwise direction which meant starting on an uphill grade; however, this section of track was cleaned and sanded before each run to ensure that competitors were provided with good starting conditions. Twenty-five entries were received three of which were withdrawn prior to the event. Two entrants fell by the wayside during the event leaving twenty sets of results for the judges to consider. Only one 3½in. gauge locomotive was entered.

Run 1 - Dave Tompkins

First man away was Dave Tompkins of Guildford MES with his 5in. gauge 0-4-0T Railmotor *Woodbourne* to Don Young's design. Neither Dave nor his locomotive are strangers to IMLEC; after the engine was completed as a small boilered No. 2 version in the early 1990s, it ran at Kinver in 1994. For the last four years it has run with the larger boiler and cylinders of the No. 1 version, competing in that form at Northampton in 1999.

Dave took four passengers and although hampered by lack of steam which limited his distance travelled, reported an enjoyable run. He also forgot that the run ended at the station, perhaps not so surprising when you are first to run in a fiercely contested event. The results shown on the event scoreboard indicated his retirement, but sufficient data was available to credit Dave's effort with an efficiency of 0.395%.

Run 2 - Geoff Moore

Our second entry was a 5in. gauge 0-6-0 *Minx* based on the well-known LBSC design. This was one of two locomotives entered for the competition by last year's winner Geoff Moore of Guildford MES. Following criticism from a few who felt it to be unfair on other competitors to allow any driver to drive more than one entry, Geoff entrusted his locomotive to John Ellis, a fellow Guildford MES member.

Despite this being only the second time that John had driven Geoff's *Minx*, the run went very well. He chose to take eleven passengers which proved to be about right for the prevailing conditions. John reported being able to maintain 20lbf. draw bar pull on the level and up to 50lbf. on the two main banks. The engine tended to pull the fire to pieces but pressure would return as soon as coal was added. He found the coal excellent and the track suited the locomotive well. Barely using one tank of water during the run, John always looked well in control and his incident-free run gave an efficiency figure of 2.456%.

Run 3 - Stuart Duncan

Third to run was Stuart Duncan driving the ex-Percy Wood 5in. gauge LNER Hunt class 4-4-0. Stuart, is a regular competitor at locomotive efficiency competitions and a member of the host society; he bought the engine, *Percy*, in 1997 since when he has made several minor improvements. However, despite much encouragement from fellow members, the tender remains unpainted. The late Percy Wood, builder of the locomotive and one time member of Chingford DMEC, gained third place with it in IMLEC 1983, so the locomotive is therefore somewhat of a veteran of events of this type.

Stuart elected to take eleven passengers but, with the benefit of hindsight, later realised that this was probably too many as the engine would only just get over the summit in the deep cutting in full gear with the regulator fully open. That said, the engine ran like the thoroughbred she is and no problems were reported with maintaining steam levels. Stuart's run gave an overall efficiency figure of 1.852%.

Run 4 - David Mayall

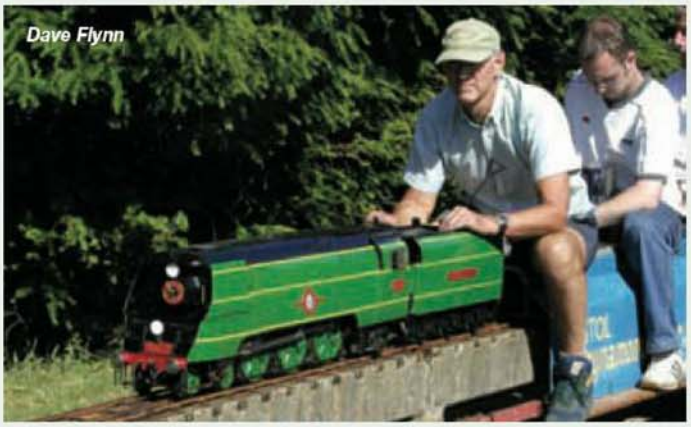
Another active IMLEC supporter is Dave Mayall of Bracknell DMRS; he entered his 5in. gauge *Speedy* 0-6-0T. This neat little engine was bought as a part-built chassis and a 'pile of bits'. It first ran in 2001, and was placed fourth in Leeds in 2002. Dave is no stranger to Bristol as he ran there in the 1991 IMLEC event.

Dave took twelve passengers and was running


Mike Keighley


Glyn Winsall


Stephen Coles


Dave Flynn

well until a blocked gauge glass caused him to lose sight of the water level. Blowing down the gauge cleared this problem but caused him to take his eyes off the fire with a resultant loss of steam pressure. This situation was only retrieved by stopping, reversing and rebuilding the fire. The remainder of the run was without incident and an overall efficiency figure of 1.293% was recorded.

Run 5 - Mike Keighley

A member of Bristol SMEE, Mike Keighley entered his 5in. gauge SR King Arthur class 4-6-0 *Sir Valence*. This locomotive was built by John Coleman to his own design and was purchased from the builder a couple of years ago. John drove the locomotive at Kinver in 1998 and was also the driver this year. Unfortunately this locomotive was one of the retirements. During steaming up it was found that no steam was reaching the injector. It was also found that the axle pump had ceased to function. Since no means was available to feed water to the boiler John had no alternative but to retire from the competition.

Run 6 - Glyn Winsall

Representing Rugby MES Ltd. Glyn Winsall entered his 5in. gauge 2-4-0T *Metro* tank to the Martin Evans design. This locomotive has run in IMLEC in 1980, 1984 and 2002 when it finished fifth. Glyn competed at Bristol in 1991with a different locomotive.

This year Glyn chose to run with 7 adults and a youngster. He reported no problems and said he enjoyed himself, finding the coal to be particularly good. Glyn admits he cut the fire level a 'bit fine' towards the end of his run but recorded an overall efficiency figure of 1.514%

Run 7 - Stephen Coles

Appropriate for an event held in the heart of GWR country was the 5in. gauge GWR Hall (No. 5955 *Garth Hall*) owned by Stephen Cole of Sale Area MES and driven at the event by Ray Edisbury. This was a first appearance for this fine locomotive designed and built by T. Curry.

Ray reported an injector problem at boiler pressures below 50psi but still managed to 'crack on' at 8 to 9mph and had no problems ascending the banks. Thirteen passengers were taken and the overall efficiency attained was 1.700%.

Run 9 - John Lloyd

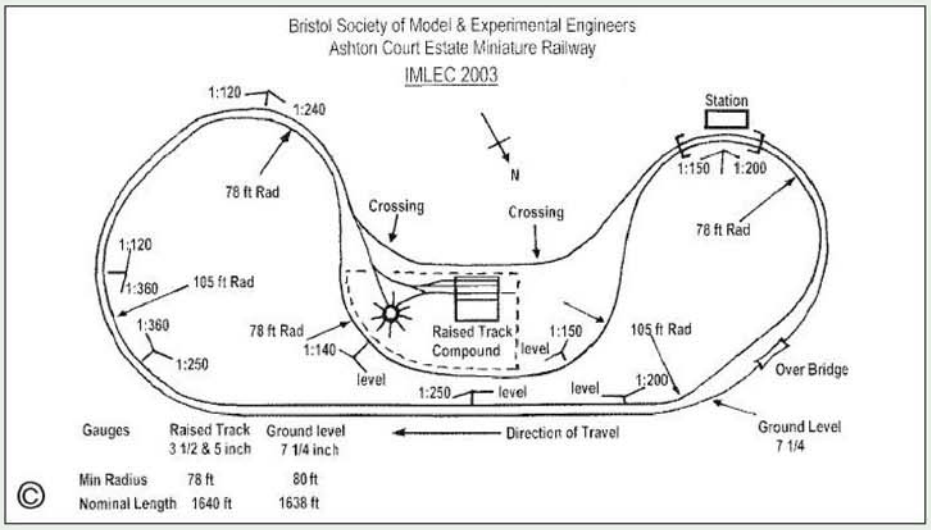
The next entry caused a ripple of excitement as some mechanical problems were experienced and model engineers, or more correctly the spectators who are model engineers, like mechanical problems as it gives them something to debate and fuss about despite the feelings of the owner/driver on the day. John Lloyd of the Southampton club entered his SR Merchant Navy class 4-6-*2 Union Castle* depicting the prototype in its original form. Construction of this locomotive started in 1975 and it features the correct chain-driven valve gear, oil sump and pump lubrication, steam reverser, thermic siphons and brick arch in the firebox; impressive stuff by any standards.

Dave Flynn was the driver chosen to do battle at Bristol, however valve gear problems, thought to be due to the steam reverser, were experienced soon after the start and the locomotive was sidelined for adjustments. After some surgery in the steaming bays, the locomotive returned to the track later in the day and ran well covering the third longest distance run by any entry. However, coal consumption was high and this resulted in an overall efficiency figure of 0.916%.

Run 10 - David Williams

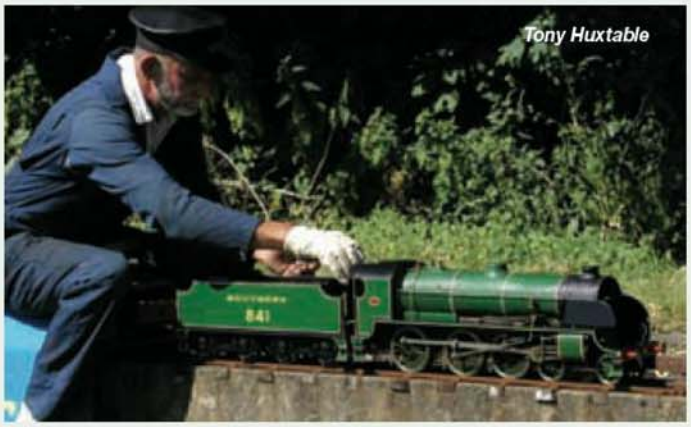
The next locomotive to run was another popular Martin Evans design, a 5in. gauge 0-6-0T *Simplex* belonging to David Williams and driven by Barbara Milton. This locomotive was the winner of the first Welsh IMLEC held at Llanelli and also appeared at Guildford in 1990, Bristol in 1991 (finishing fourth) and Kinver in 1995.

Barbara Milton was at the controls on all these previous occasions. These little locomotives always seem to go well and this occasion was no ▶




Barbara Milton


Dave Roberts


Tony Huxtable


Richard Linkins

exception. Apart from one brief stop for a 'blow' Barbara reported no problems and the run was largely uneventful. Nine passengers were taken and the overall efficiency figure was 1.096%.

Run 11 - David Roberts

It was time for a model representing a narrow gauge locomotive and Dave Roberts' 5in. gauge Beyer Peacock 0-6-2T was made ready for competition. Dave's model, representing Urmston DMES, is one of a pair built by two colleagues to a scale of 1:7.2. The prototype was built for the La Guaira & Caracas Railway in Venezuela in 1888.

David's recollection of the run, for which he chose to take 16 passengers, was that the engine performed well but he himself was a little over-cautious and had to work the engine harder than expected. He also felt he had allowed the fire to get too thin. Nevertheless the laps were reeled off in fine style and the final efficiency figure achieved was 1.052%.

Run 13 - Tony Huxtable

This entrant started his run secure in the knowledge that, provided he finished in the appropriate manner, he could not fail to be the best 3½in. gauge entry as his was the only entry of this gauge. A previous visitor, Tony who represented North Devon MES, is familiar with the Bristol track. His entry was his self-built SR 4-6-0 *Greene King* constructed approximately ten years ago to Martin Evans' design.

Despite looking diminutive against the 5in. gauge opposition the little locomotive took a load of 3 passengers and completed its allotted run without significant difficulty to give an overall efficiency of 0.576%.

Run 14 - Richard Linkins

Hailing from Maidstone MES, Richard Linkins drove his 5in. gauge BR Standard Class 2 2-6-0 which was completed approximately 5 years ago. This locomotive was built basically to the Don Young design but includes several modifications derived from principles established by the late Jim Ewins.

Richard took 9 passengers and reported that his engine ran well with little slipping provided he kept the speed down. A lack of familiarity with the coal led to some loss of pressure, but he quickly adapted and managed to maintain the fire without blowing off, to finish the run a little early. His trouble-free run gave an overall efficiency figure of 1.433%.

Run 15 - Michael Harrison

One of several GWR locomotives contesting the

Bristol Society of Model and Experimental Engineers
IMLEC 2003 Final Results Chart

Position	Run Number	Owner	Society	Driver	Gauge	Wheel Arrangment	Locomotive	Load	Run Time mins	Distance feet	Work Done ft lbf	Coal Used lb	Ave Speed mph	Ave DB Pull lbf	Ave DBHP	SFC lb/dbhp hr	Efficiency %
1	2	Geoff Moore 2	Guildford	Owner	5	0-6-0	LBSC 'Minx'	11	31.5	24660	565400	2.028	8.90	22.93	0.544	7.10	2.456
2	25	Geoff Moore	Guildford	Owner	5	4-6-0	LNER B1 'Impala'	14	30.8	24660	442000	1.634	9.10	17.92	0.435	7.32	2.383
3	20	David Neish	Guildford	Owner	5	4-6-2T	LBSCR J2 'Bessborough'	12	29.02	19728	336500	1.281	7.73	17.06	0.351	7.54	2.314
4	22	Brian Clarke	Kinver	John Hurley	5	2-8-4T	NG Hunslet 'Dholpur'	25	29.52	21372	791500	3.492	8.23	37.03	0.812	8.74	1.997
5	3	Stuart Duncan	Bristol	Owner	5	4-4-0	LNER Hunt class	11	29.5	18084	422200	2.008	6.97	23.35	0.434	9.42	1.852
6	7	Stephen Coles	Sale	R Edelsbury	5	4-6-0	GWR 'Garth Hall'	13	30.53	21372	515600	2.672	7.95	24.13	0.512	10.26	1.700
7	6	Glyn Winsall	Rugby	Owner	5	2-4-0T	GWR 'Metro'	7.5	31.8	19728	212200	1.235	7.05	10.76	0.202	11.52	1.514
8	21	George Golightly	Llanelli	Owner	5	4-6-0	LMS 6100 'Royal Scot'	15	29.4	21372	468500	2.846	8.26	21.92	0.483	12.03	1.450
9	14	Richard Linkins	Maidstone	Owner	5	2-6-0	BR Standard class 2	9	28.58	19728	275400	1.693	7.84	13.96	0.292	12.17	1.433
10	4	David Mayall	Bracknell	Owner	5	0-6-0T	'Speedy'	12	30.3	16440	264300	1.801	6.17	16.08	0.264	13.49	1.293
11	10	David Williams	Bristol	Barbara Milton	5	0-6-0T	'Simplex'	9	31.06	14796	197200	1.585	5.42	13.33	0.192	15.91	1.096
12	11	David Roberts	Urmston	Owner	5	0-6-2T	Beyer-Peacock NG	16	29.57	13152	345600	2.895	5.05	26.28	0.354	16.59	1.052
13	15	Michael Harrison	Kinver	Owner	5	4-6-0	GWR 'Crynant Grange'	9	29.77	19728	402400	3.717	7.53	20.40	0.410	18.29	0.954
14	23	Andrew Harvey	West Huntspill	Owner	5	2-8-2	US NG pacific tender loco	29	29.4	21372	907600	8.653	8.26	42.47	0.935	18.88	0.924
15	9	John Lloyd	Southampton	Dave Flynn	5	4-6-2	Unrebuilt Merchant Navy	12.5	30.5	23016	434400	4.18	8.58	18.87	0.432	19.05	0.916
16	18	Bob Liddle	West Huntspill	Owner	5	0-6-0	'Simplex'	8	30.25	18084	159500	1.634	6.79	8.82	0.160	20.28	0.860
17	13	Tony Huxtable	North Devon	Owner	3½	4-6-0	SR S15 "Greene King"	3	37.67	11508	69500	1.063	3.47	6.04	0.056	30.28	0.576
18	17	Ray Hillman	Fareham	Owner	5	2-8-4T	NG Hunslet 'Dholpur'	19	28.63	3288	153200	2.809	1.31	46.59	0.162	36.30	0.480
19	1	Dave Tompkins	Guildford	Owner	5	0-4-0T	Railmotor	4	34.5	6576	54300	1.21	2.17	8.26	0.048	44.12	0.395
20	19	Paul Tompkins	Guildford	Owner	5	0-8-0	T9 North Eastern 'Netta'	7	30.53	4932	65200	1.603	1.84	13.22	0.065	48.68	0.358
	5	Mike Keighley	Bristol	John Coleman	5	4-6-0	SR 'King Arthur' class	Retired									
	16	Dennis Pearson	Llanelli	Owner	5	4-6-0	GWR 'Arden Manor'	Retired									
	12	David Wrenn	Fareham	Owner	5	4-6-2	Britannia 'Black Prince'	Withdrawn									
	8	Dick Payne	North London	Owner	5	0-6-0T	LBSC 'Eva May'	Withdrawn									
	24	Lionel Flippance	Guildford	Owner	5	2-8-2	BR Proposed Freight Loco	Withdrawn									


Mike Harrison


Dennis Pearson


Ray Hillman


Bob Liddle

competition was the 5in. gauge GWR 4-6-0 Grange *Cryant Grange* owned and driven by Michael Harrison representing Kinver & West Midlands SME Ltd. This locomotive first steamed in 1999 and is a close scale representation of the prototype. Finished in black, it shows the locomotive as it appeared in 1954.

Michael's run was not trouble free and he reported some difficulty getting the injector to work. He also had to stop at the station to drop off three of his nine passengers. Perhaps as a result of these distractions, his overall efficiency was 0.954%.

Run 16 - Dennis Pearson

Also GWR mounted was Dennis Pearson of Llanelli DMES driving his 5in. gauge 4-6-0 Manor *Arden Manor*. Construction of this locomotive was completed in 1989 and it ran in IMLEC at Gravesend in 1994 and again in Northampton in 1996.

Unfortunately trouble struck this entry early on in the run when, after a good start and with a good fire and plenty of steam, a faulty injector caused retirement.

Run 17 - Ray Hillman

The next entry was one of two 5in. gauge Hunslet 2-8-4T *Dholpur* locomotives entered in the competition. Ray Hillman was representing Fareham DSME and his locomotive was built using the well-known GLR castings. The prototype ran on 2ft. 6in. track which this makes the 5in. version heavy at 405lb. This model took eleven years to build and includes such features as steam-operated brakes and drain cocks, a working headlight and a turbo-generator.

Ray set off with nineteen passengers but he soon realised that he needed to drop two off. He said afterwards that he should have dropped four. He also admitted that the axlebox springs appeared to need adjustment and that the coal provided did not burn as hot as the anthracite he normally uses. The overall efficiency recorded during this run was 0.480%.

Run 18 - Bob Liddle

The second 5in. gauge 0-6-0T *Simplex* to contest the event was that of Bob Liddle of West Huntspill MES. This locomotive upheld the tradition of trouble-free runs of this design although Bob reported that he needed to keep his wits about him on the banks. Even so it pulled its eight passengers with aplomb and recorded an overall efficiency of 0.860%

Bristol Society of Model and Experimental Engineers
IMLEC 2003 Locomotive Weights Chart

Run Number	Owner	Society	Driver	Gauge	Wheel Arrangment	Locomotive	Leading Truck 1	Leading Truck 2	Driving Axles 1	Driving Axles 2	Driving Axles 3	Driving Axles 4	Driving Axles 5	Trailing Truck 1	Trailing Truck 2	Total
1	Dave Tompkins	Guildford	Owner	5	0-4-0T	'Railmotor'			61.7	35.8						97.5
2	Geoff Moore 2	Guildford	Owner	5	0-6-0	LBSC 'Mink'			41.6	45.0	45.8					132.4
3	Stuart Duncan	Bristol	Owner	5	4-4-0	LNER Hunt class	17.2	16.6	65.0	42.5						141.3
4	David Mayall	Bracknell	Owner	5	0-6-0T	'Speedy'			41.7	50.0	55.0					146.7
5	Mike Keighley	Bristol	John Coleman	5	4-6-0	SR 'King Arthur' class	16.7	18.4	55.0	45.8	40.0					175.9
6	Glyn Winsall	Rugby	Owner	5	2-4-0T	GWR 'Metro'	17.5		42.5	35.0						95.0
7	Stephen Coles	Sale	R Edisbury	5	4-6-0	GWR 'Garth Hall'	13.4	13.3	45.0	50.0	45.0					166.7
8	Dick Payne	North London	Owner	5	0-6-0T	LBSC 'Eva May'	Withdrawn									
9	John Lloyd	Southampton	Dave Flynn	5	4-6-2	Unrebuilt Merchant Navy	19.1	18.4	56.7	58.3	61.6			24.0		238.1
10	David Williams	Bristol	Barbara Milton	5	0-6-0T	'Simplex'			35.0	34.2	32.5					101.7
11	David Roberts	Urmston	Owner	5	0-6-2T	Beyer-Peacock NG			49.1	59.2	65.9			40.8		215.0
12	David Wrenn	Fareham	Owner	5	4-6-2	Britannia 'Black Prince'	Withdrawn									
13	Tony Huxtable	North Devon	Owner	3½	4-6-0	SR S15 'Greene King'	5.0	5.0	15.8	27.5	14.2					67.5
14	Richard Linkins	Maidstone	Owner	5	2-6-0	BR Standard class 2	14.2		40.0	49.2	41.7					145.1
15	Michael Harrison	Kinver	Owner	5	4-6-0	GWR 'Crynant Grange'	14.1	11.7	62.5	50.8	39.1					178.2
16	Dennis Pearson	Llanelli	Owner	5	4-6-0	GWR 'Arden Manor'	13.3	12.3	54.2	50.0	31.6					161.4
17	Ray Hillman	Fareham	Owner	5	2-8-4T	NG Hunslet 'Dholpur'	73.4		80.0	88.3	100.0	83.4		50.0	50.0	525.1
18	Bob Liddle	West Huntspill	Owner	5	0-6-0	'Simplex'			45.9	43.4	30.0					119.3
19	Paul Tompkins	Guildford	Owner	5	0-8-0	T9 North Eastern 'Netta'			32.5	41.6	26.7	25.0				125.8
20	David Neish	Guildford	Owner	5	4-6-2T	LBSCR J2 'Bessborough'	12.0	12.0	57.5	24.2	81.7			11.7		199.1
21	George Golightly	Llanelli	Owner	5	4-6-0	LMS 6100 'Royal Scot'	13.4	12.5	68.3	48.3	81.7					224.2
22	Brian Clarke	Kinver	John Hurley	5	2-8-4T	NG Hunslet 'Dholpur'	22.7		59.2	68.3	75.0	78.3		40.0	45.0	388.5
23	Andrew Harvey	West Huntspill	Owner	5	2-8-2	US NG pacific tender loco	22.5		55.8	56.9	46.7	52.5		50.0		284.4
24	Lionel Flippance	Guildford	Owner	5	2-8-2	BR Propceed Freight Loco	Withdrawn									
25	Geoff Moore	Guildford	Owner	5	4-6-0	LNER B1 'Impala'	23.3	22.5	57.5	58.3	62.4					224.0


Paul Tompkins

David Neish


George Golightly


John Hurley

Run 19 - Paul Tompkins

Paul, of Guildford MES is another seasoned IMLEC contestant. This year he campaigned a 5in. gauge NER 0-8-0 T9 loosely based on LBSC's 1954 *Netta* design. Paul and his Uncle Dave Tompkins completed this engine in May 2003 after three years' work. The valve gear incorporates many of Dave's ideas and bits have also been incorporated from *Firefly* and *Maid of Kent*.

Unfortunately, the locomotive did not like the track conditions one little bit and severe slipping resulted in Paul having to off-load his seven passengers early on in the run. Even with just the driver and observer on board the engine was still slipping, even on the downhill sections of the track. Sufficient data was collected to give a result and this brave effort yielded an overall efficiency figure of 0.358%.

Run 20 - David Neish

David is also from Guildford MES and entered his handsome 5in. gauge LBSCR J2 4-6-2T *Bessborough*. Information provided by David tells us that the prototype was built in 1912 for fast passenger services. Rocking shafts drive the inside valve gear from outside Walschaerts gear and the locomotive runs at 100psi working pressure. This model was awarded a bronze medal at the 2002 Model Engineer Exhibition.

Out to demonstrate that the engine goes as well as it looks, David loaded up with twelve passengers. This was about right and the locomotive ran at 100psi well notched up. On two occasions, pressure fell to 50psi but did not interfere with the run. Full gear was used on the banks. The boiler was fed on the run by the injector, which was supplied with water from a bottle located on the train. The desire to conserve fuel was almost overdone and the train could only reach the station on the final lap by dropping off all the passengers. Nothing was left in the firebox when the grate was dropped. This spirited run resulted in an overall efficiency of 2.314%

Run 21 - George Golightly

While David Neish was completing his run, George Golightly of Llanelli DMES was preparing his locomotive. His entry was a 5in. gauge LMS 4-6-0 rebuilt Royal Scot 6100 to the Martin Evans design. George admitted to feeling nervous at the start of the run, and this resulted in him forgetting to notch up for three laps. As the run progressed he realised he could have coped with more passengers than the fifteen chosen but this was countered to some extent by slipping on the banks.

Bristol Society of Model and Experimental Engineers
IMLEC 2003 Lap Times - Minutes

Run Number	Owner	Society	Driver	Gauge	Wheel Arrangment	Locomotive	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Dave Tompkins	Guildford	Owner	5	0-4-0T	'Railmotor'	4.98	7.67	4.65	5.82											
2	Geoff Moore 2	Guildford	Owner	5	0-6-0	LBSC 'Minx'	2.43	2.07	2.02	2.03	2.00	2.18	2.05	2.10	2.07	2.05	2.00	2.18	2.05	1.98	2.28
3	Stuart Duncan	Bristol	Owner	5	4-4-0	LNER Hunt class	3.58	2.30	2.22	2.35	2.32	2.40	2.30	2.32	2.33	2.38	2.52	2.48			
4	David Mayall	Bracknell	Owner	5	0-6-0T	'Speedy'	3.13	2.68	2.43	2.65	3.03	9.77	2.30	2.38	2.20						
5	Mike Keighley	Bristol	John Coleman	5	4-6-0	SR 'King Arthur' class	Retired														
6	Glyn Winsall	Rugby	Owner	5	2-4-0T	GWR 'Metro'	3.08	2.30	2.33	2.27	2.17	2.30	2.07	2.15	2.33	2.28	4.53	3.98			
7	Stephen Coles	Sale	R Edisbury	5	4-6-0	GWR 'Garth Hall'	3.07	2.72	2.78	2.10	2.13	2.12	2.13	2.28	2.07	2.17	2.27	2.27	2.43		
8	Dick Payne	North London	Owner	5	0-6-0T	LBSC 'Eva May'	Withdrawn														
9	John Lloyd	Southampton	Dave Flynn	5	4-6-2	Unrebuilt Merchant Navy	2.70	2.12	2.23	2.20	2.17	2.15	2.00	1.92	1.97	2.02	2.00	2.17	1.98	2.88	
10	David Williams	Bristol	Barbara Milton	5	0-6-0T	'Simplex'	3.55	2.90	2.97	3.37	3.20	3.00	3.27	5.75	3.05						
11	David Roberts	Urmston	Owner	5	0-6-2T	Beyer-Peacock NG	7.82	2.55	2.38	2.75	3.07	2.57	5.95	2.48							
12	David Wrenn	Fareham	Owner	5	4-6-2	Britannia 'Black Prince'	Withdrawn														
13	Tony Huxtable	North Devon	Owner	3½	4-6-0	SR S15 'Greene King'	3.57	2.82	10.35	2.43	2.40	2.42	14.43								
14	Richard Linkins	Maidstone	Owner	5	2-6-0	BR Standard class 2	2.60	2.25	2.33	2.30	2.20	2.27	2.30	2.40	2.32	2.32	2.33	2.75			
15	Michael Harrison	Kinver	Owner	5	4-6-0	GWR 'Crynant Grange'	2.92	2.52	2.88	4.33	2.13	2.25	2.32	2.15	1.98	1.93	2.08	2.27			
16	Dennis Pearson	Llanelli	Owner	5	4-6-0	GWR 'Arden Manor'	Retired														
17	Ray Hillman	Fareham	Owner	5	2-8-4T	NG Hunslet 'Dholpur'	17.37	11.27													
18	Bob Liddle	West Huntspill	Owner	5	0-6-0	'Simplex'	3.30	2.82	2.92	2.75	2.70	2.68	2.63	2.62	2.58	2.72	2.53				
19	Paul Tompkins	Guildford	Owner	5	0-8-0	T9 North Eastern 'Netta'	12.90	6.77	10.87												
20	David Neish	Guildford	Owner	5	4-6-2T	LBSCR J2 'Bessborough'	2.67	2.02	2.03	2.13	2.17	2.43	3.12	2.08	2.15	2.17	2.17	3.88			
21	George Golightly	Llanelli	Owner	5	4-6-0	LMS 6100 'Royal Scot'	2.30	1.80	1.82	1.85	1.88	2.07	2.17	2.40	2.20	2.15	2.13	2.15	2.15	2.33	
22	Brian Clarke	Kinver	John Hurley	5	2-8-4T	NG Hunslet 'Dholpur'	2.33	2.32	2.12	2.02	2.00	2.00	2.15	2.20	2.17	2.15	2.55	2.27	3.25		
23	Andrew Harvey	West Huntspill	Owner	5	2-8-2	US NG pacific tender loco	3.00	2.32	2.07	2.12	2.12	2.13	2.12	2.22	2.28	2.27	2.23	2.22	2.32		
24	Lionel Flippance	Guildford	Owner	5	2-8-2	BR Proposed Freight Loco	Withdrawn														
25	Geoff Moore	Guildford	Owner	5	4-6-0	LNER B1 'Impala'	2.73	2.00	2.03	2.05	1.97	2.00	2.03	2.00	2.00	2.02	1.98	1.93	2.00	1.90	2.15


Andrew Harvey


Geoff Moore


Geoff Moore

Looking back after the run he felt the slipping may have been due to nothing more than over-oiling. George ran on one injector with a full boiler for the entire run and found the coal excellent. As the end of his run approached he decided to risk one more lap but only just made it back to the station, finishing with no fire to record a final overall efficiency of 1.450%.

Run 22 - Brian Clarke

The second 5in. gauge Hunslet 2-8-4T *Dholpur* to contest the event was that of Brian Clarke of Kinver & W. Midlands MES and driven by John Hurley. This example is approximately ten years old and looked a formidable entry in the hands of an experienced driver like John.

Twenty-five passengers boarded the train and John's approach was to try and keep the drawbar taut at all times. Because he had only driven the locomotive once before and did not fully grasp the design of the ashpan dampers, John drove with the rear one shut and the front one only one-eighth open. Consequently he was only able to raise 40psi boiler pressure which was not enough to enable the injector to work properly. Full throttle was used at times, notching up to mid-gear on the back straight. Despite these problems the overall efficiency was 1.997%.

Run 23 - Andrew Harvey

One of the great things about an event like IMLEC is the variety of locomotives entered. This was amply illustrated by Andrew Harvey of West Huntspill MES who entered his 5in. gauge USA narrow gauge 2-8-2 Pacific tender locomotive. This formidable engine pulled the largest load of the event taking twenty-nine passengers. Andrew admitted to being apprehensive about taking part in the event but then decided to throw caution to the wind and enjoy his run. His stint on the track did rather dent the coal reserves as the results table shows, but everyone came back with smiles on their faces. The overall efficiency achieved was 0.924%.

Bristol Society of Model and Experimental Engineers
IMLEC 2003 Lap Speeds MPH

Run Number	Owner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Dave Tompkins	3.75	2.44	4.02	3.22												
2	Geoff Moore 2	7.69	9.05	9.27	9.20	9.35	8.57	9.12	8.91	9.05	9.12	9.35	8.57	9.12	9.43	8.19	
3	Stuart Duncan	5.22	8.13	8.44	7.96	8.07	7.79	8.13	8.07	8.02	7.85	7.43	7.53				
4	David Mayall	5.97	6.97	7.69	7.06	6.17	1.92	8.13	7.85	8.50							
5	Mike Keighley	Retired															
6	Glyn Winsall	6.07	8.13	8.02	8.25	8.63	8.13	9.05	8.70	8.02	8.19	4.13	4.70				
7	Stephen Coles	6.10	6.89	6.72	8.91	8.77	8.84	8.77	8.19	9.05	8.63	8.25	8.25	7.69			
8	Dick Payne	Withdrawn															
9	John Lloyd	6.93	8.84	8.38	8.50	8.63	8.70	9.35	9.76	9.51	9.27	9.35	8.63	9.43	6.49		
10	David Williams	5.27	6.45	6.30	5.56	5.85	6.23	5.73	3.25	6.13							
11	David Roberts	2.39	7.34	7.85	6.80	6.10	7.29	3.14	7.53								
12	David Wrenn	Withdrawn															
13	Tony Huxtable	5.24	6.64	1.81	7.69	7.79	7.74	1.30									
14	Richard Linkins	6.68	8.31	8.02	8.13	8.50	8.25	8.13	7.79	8.07	8.07	8.02	6.80				
15	Michael Harrison	6.41	7.43	6.49	4.32	8.77	8.31	8.07	8.70	9.43	9.67	8.98	8.25				
16	Dennis Pearson	Retired															
17	Ray Hillman	1.08	1.66														
18	Bob Liddle	5.67	6.64	6.41	6.80	6.93	6.97	7.10	7.15	7.24	6.89	7.38					
19	Paul Tompkins	1.45	2.76	1.72													
20	David Neish	7.01	9.27	9.20	8.77	8.63	7.69	6.00	8.98	8.70	8.63	8.63	4.82				
21	George Golightly	8.13	10.39	10.30	10.11	9.93	9.05	8.63	7.79	8.50	8.70	8.77	8.70	8.70	8.02		
22	Brian Clarke	8.02	8.07	8.84	9.27	9.35	9.35	8.70	8.50	8.63	8.70	7.34	8.25	5.76			
23	Andrew Harvey	6.23	8.07	9.05	8.84	8.84	8.77	8.84	8.44	8.19	8.25	8.38	8.44	8.07			
24	Lionel Flippance	Withdrawn															
25	Geoff Moore	6.84	9.35	9.20	9.12	9.51	9.35	9.20	9.35	9.35	9.27	9.43	9.67	9.35	9.84	8.70	

Run 25 - Geoff Moore

The final run of the event was by Geoff Moore driving his 5in. gauge LNER B1 *Impala* and defending his title won at the 2002 event at Eggborough. Geoff chose his load of fourteen passengers with care and set off in a no-fuss manner as one would expect from this experienced driver.

His run was uneventful and drama free and considerable tension built up among onlookers as the calculation of the final result was carried out. Geoff's meritorious performance with *Impala* had resulted in an overall efficiency of 2.383%, an excellent result but one which had just been beaten by his other locomotive driven by John Ellis.

So the winner of IMLEC 2003 was the *Minx* owned by Geoff Moore and driven by John Ellis. A fine result for a relatively old design by LBSC. Curly knew something about designing miniature locomotives after all. The presentation of the Martin Evans Challenge Cup, the cash prizes and certificates, was made by Dr. John Wragg CBE, President of Bristol SMEE. Each entrant received a Certificate with a full colour photograph printed on to it taken during the competition, a pleasant and much appreciated gesture by the host society.

Our thanks go to Don Cordall and his indefatigable team for organising such a momentous event. Everything about IMLEC 2003, from the catering to the marshalling of the competitors, ran without hitch and even the 'clerk of the weather' must have been co-opted onto Don's committee to provide such a perfect weekend.

We look forward to seeing you all at IMLEC 2004 on 10/11 July at Kinver & W. Midlands SME Ltd track. See you there!

THE ANGEL SHOWMAN'S ORGAN

Raymond McMahon

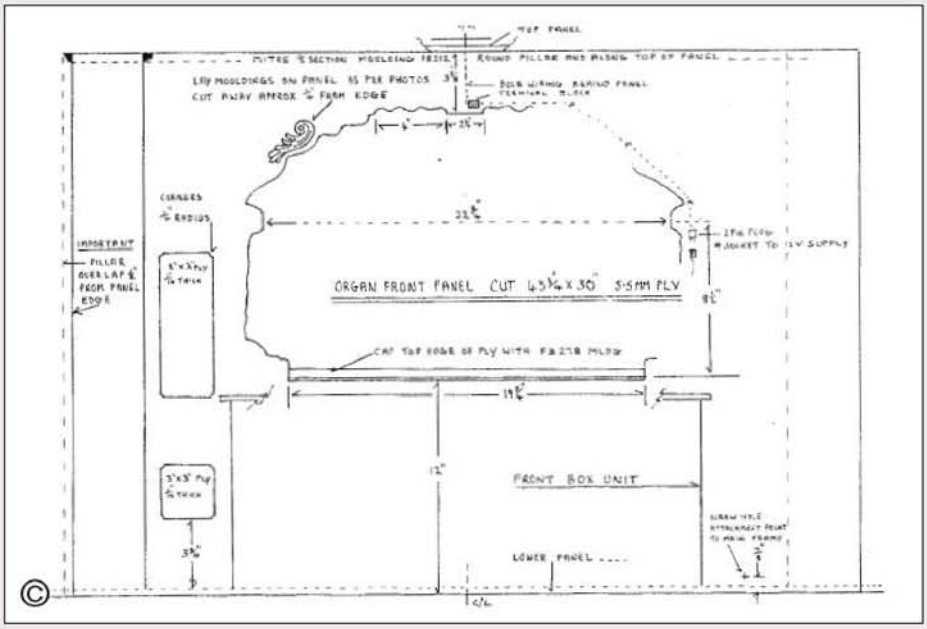
continues the description of his attractive showmans organ.

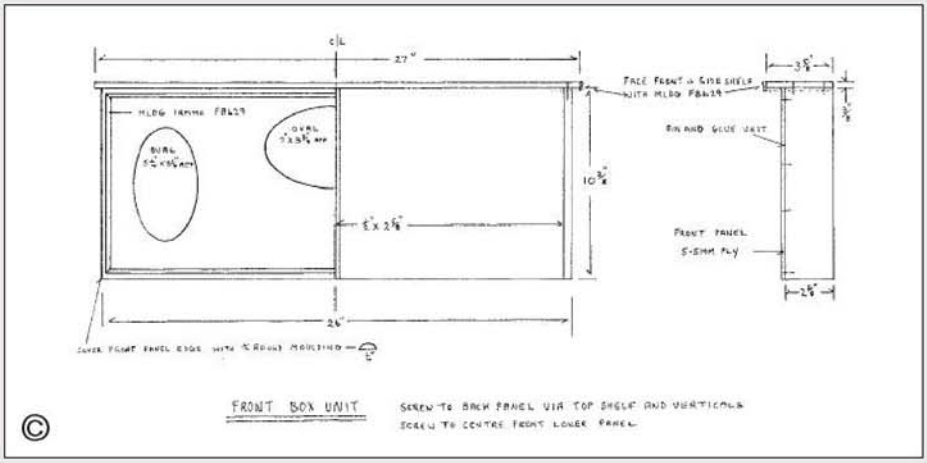
●*Part II continued from page 613 (M.E. 4222, 28 May 2004)*

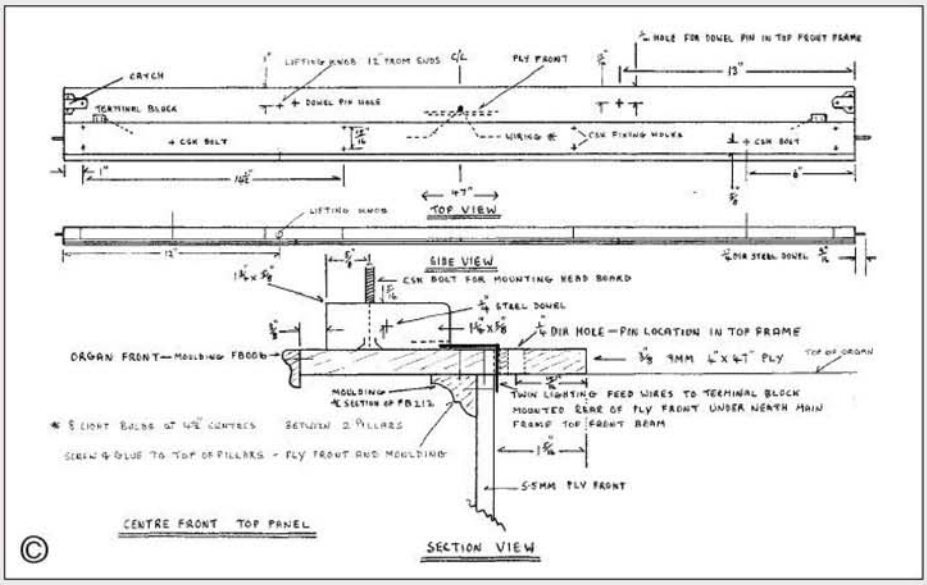
Construction is quite straightforward. The centre section contains the wind chest, which simply slides into place. It is located by four wing bolts, two on each of the fitted side panels, which are built on to the wind chest. Either side of the wind chest there are open right-hand and left-hand sections, the lower part of which are designed to house the organ batteries. One battery can be used for the blower, the other is available for a spare. Alternatively it can be used to power the coloured lights. Although actual dimensions are quoted for the framework assembly, I recommend that dimensions be checked against the major parts, i.e. the electronic component case and wind chest as supplied, just in case there are any minor differences in the sizes.

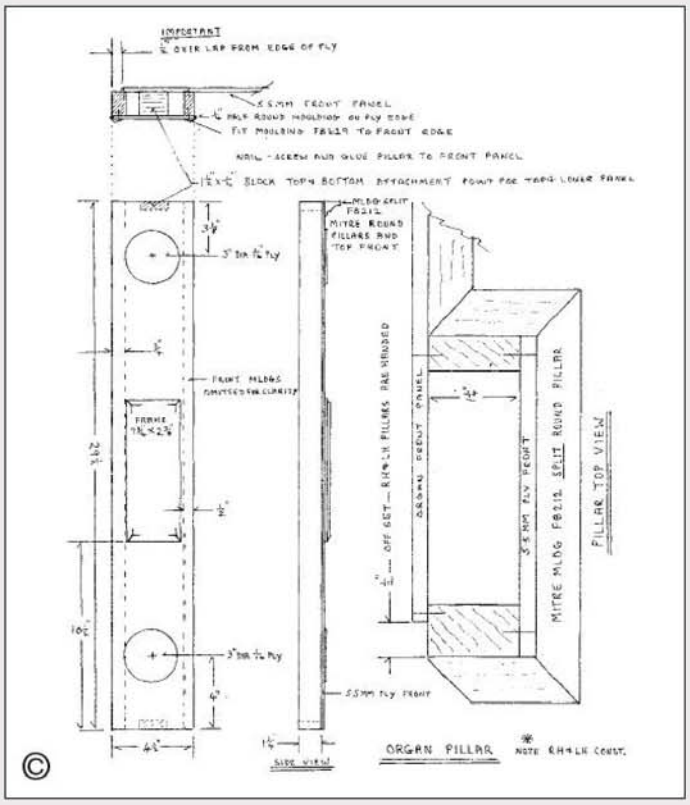
The electronic aspect of the organ consists of a number of rather complex circuit boards which are housed in a high quality instrument box. To fit this into the wooden case work, I had to chamfer one of the vertical wooden pillar frames on the inside corner 45 degrees. The instrument box itself simply rests on two horizontal wooden straps, being inserted through from the top of the organ case and retained in place by a mahogany fascia. A strip of draught excluder door seal at top and bottom help to secure it. The fascia contains a simple sliding Perspex hatch which provides some protection for the top of the instrument case

The left wing of the organ shown ready for the final painting.







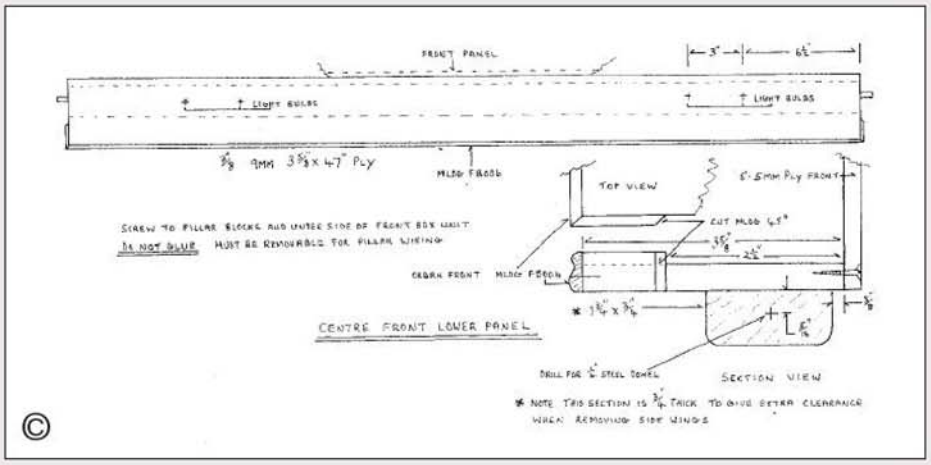


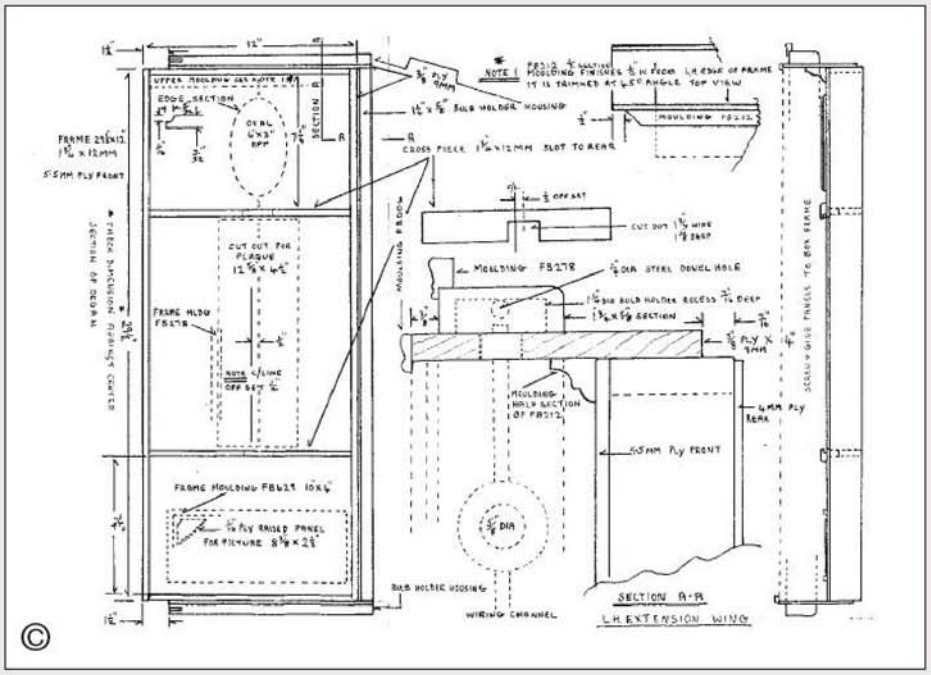
The elaborately decorated ornate organ front is seen here with much of the woodwork nearing completion.

while allowing access to the switches, etc.

I needed to fit additional switches with fuses and charging sockets to the fascia panel. The fascia panel had to be removed for this work. Before removal, careful notes were made of the position of all the wires which were then tagged before they were unsoldered.

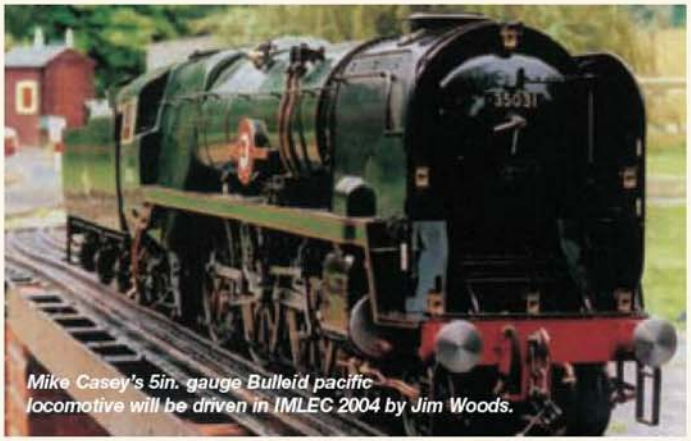
●*To be continued.*



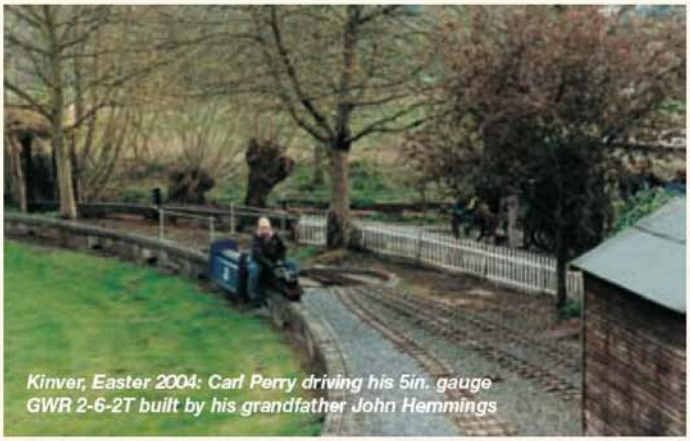


A wide variety of motifs have been skillfully blended into the overall design.

A close up of the nymph on one of the extension wings shown after painting.



Mike Casey's 5in. gauge Bulleid pacific locomotive will be driven in IMLEC 2004 by Jim Woods.



Kinver, Easter 2004: Carl Perry driving his 5in. gauge GWR 2-6-2T built by his grandfather John Hemmings

COME TO KINVER FOR IMLEC 2004

John Hurley,
2004 IMLEC Chairman, introduces the New Look Kinver event to be held over the weekend 10/11 July.

All readers are cordially invited and warmly welcome to attend IMLEC 2004 at the Kinver & West Midlands Society of Model Engineers Ltd. track, Marsh Playing Fields, Kinver, South Staffordshire on 10/11 July. The first IMLEC to be held since the death of its founder Martin Evans, over a period of more than 30 years this contest has grown to be a fascinating event. The winner is not necessarily the biggest locomotive, or the one pulling the largest load — and what a spectacle our small locomotives make, running approximately four miles non-stop, hauling up to twenty people.

As a competitor in previous IMLECs myself, and a former Western footplateman, I can assure you all that it is much harder to fire and drive our small locomotives than one of full size. This is due to the much reduced volume of steam and fire available in our miniature engines. A half hour run on a model engine feels like a four hour stint on a full size locomotive! However, as most model engineers will confirm, the experience is an enjoyable one and the performance of a 3½in. or 5in. gauge locomotive can sometimes put that of their larger 7¼in. brothers to shame.

Now I have a surprise for you all! This year's IMLEC will be run on different lines to previous events. The main changes are:

1: Previous winners can enter the event and will compete in a Previous Winners Competition to be held concurrently with the main IMLEC event.
2: Both competitions will be held under Midland Federation rules.
3: There will be no entry restrictions but entries will be considered on a first come, first served basis.

This gives those who have never won IMLEC a chance to compete again, while previous winners get to run and compete against one another. The Kinver track is a challenging one with gradients and bends. You need to *drive* your locomotive, opening the regulator for the banks and adjusting it on the downhill sections to keep within the speed limit!

There will be a small exhibition in the Kinver Conservative Association building, together with catering and trade stands.

Camping will be available around the cricket field on a first come first served basis, so prior booking is advisable; contact Mr. Graham Harris on tel: 01902-846687.

IMLEC 2004 COMPETITION RULES & ORGANISATION 10/11 JULY 2004

1: The Competition will be open to all 3½ and 5in. gauge steam locomotives capable of running on a raised track.

2: The Competition will be open to previous IMLEC winners, previous IMLEC competitors, and newcomers to the Competition, on a first come first served basis. Entries will be restricted to 15 per day.

3: The Competition will comprise a 'Previous Winners' Competition and the Annual IMLEC Competition to run concurrently. *Drivers of locomotives that have won IMLEC previously go into the 'Winners' Competition.*

4: The Competition will be run under the Midland Federation Efficiency Rules.

5: Locomotives must be in possession of a current boiler certificate and the *original* must be presented upon arrival.

6: Competitors must arrive at the Tracksite at least one and a half hours before their run is due to commence and report to the steaming bay reception where the boiler certificate will be examined, your run number confirmed, approximate run commencement time given, and the number of passengers required for your run noted.

7: You will be allocated an observer/helper and he/she will advise you when to light up, and provide you with as much wood, charcoal, and paraffin as required. You will also have an amount of coal for the first warming-up lap of the track.

8: You must tell the observer how much coal you will require for your run; this will be provided in suitably measured quantities and weighed in your presence. Coal not used will be collected and weighed in your presence at the end of your run.

9: You should have a good fire burning and have tested injectors, water gauge(s), and safety valves before going onto the track.

10: The track marshall will tell you when to back down the spur onto the track where your train will have been prepared with dyanamometer car and sufficient passenger cars to carry the number of passengers you have requested. The observer will couple your locomotive to the dynamometer car.

11: You are now ready to begin your warming-up lap, one lap of the track to enable you to build up your fire and judge if your passenger load is correct. Sand will be available for starting from the station and, at the judges' discretion, during the run. Reversing the train to start is not possible as the passenger carriages are fitted with over-run brakes.

12: You will stop back at the station at the start line and your tender or bunker will be emptied of all coal. Your observer will issue you with the weighed amount of coal that you requested.

13: Your fire will be measured and at the end of your run will be brought back to this level by adding your coal to the fire if necessary.

14: When you are ready, the timekeeper will start your run. The duration of the run is a nominal 25 minutes. A maximum of 7 minutes is allowed for stoppages, blow-ups, etc. You will be retired from the Competition if this is exceeded. You may choose to finish your run after 20 minutes running have been completed, but you must stop in the station at the start line, raising steam if necessary to complete the lap. Pushing the train into the station will disqualify any competitor. A lineside clock will be provided so that you can see the progress of your run and you will be advised when there are 10 and 5 minutes to go, and when you are on your last lap.

15: A re-run will be under the same conditions as the original run (same number of passengers, carriages, etc.).

16: A speed limit of 10mph will be in force and the observer will warn you if you exceed it. Three such warnings will result in disqualification.

17: Water will be supplied in suitable containers during the run to enable water tanks to be topped up without stopping. The amount of water used is not measured in any way.

18: Passengers and carriages may be dropped off during the run if the initial load proves to be too much, but only when the train is stationary and it is safe to do so. Additional passengers may *not* be added at any time.

19: No external assistance is to be given to the train at any time during the course of the run.

20: The use of ballast, including water, added externally to the scale outline of the locomotive (or in the case of a freelance model, the likely outline) is not acceptable.

21: For practical reasons, it may be necessary to limit the load or number of carriages pulled in the contest.

22: Judges are appointed by the Kinver & West Midlands Society of Model Engineers Ltd. and their decisions are final in all matters relating to the Competition.

Kinver, Easter 2004: John Campbell at the controls of Jim Piddock's 5in. gauge Jubilee Leander.

Kinver, Easter 2004: Paul Frewin enjoys a run with his 5in. gauge Sweet Pea

Traders wishing to attend the event can obtain further information from Mr. John Campbell on tel: 01384-891244.

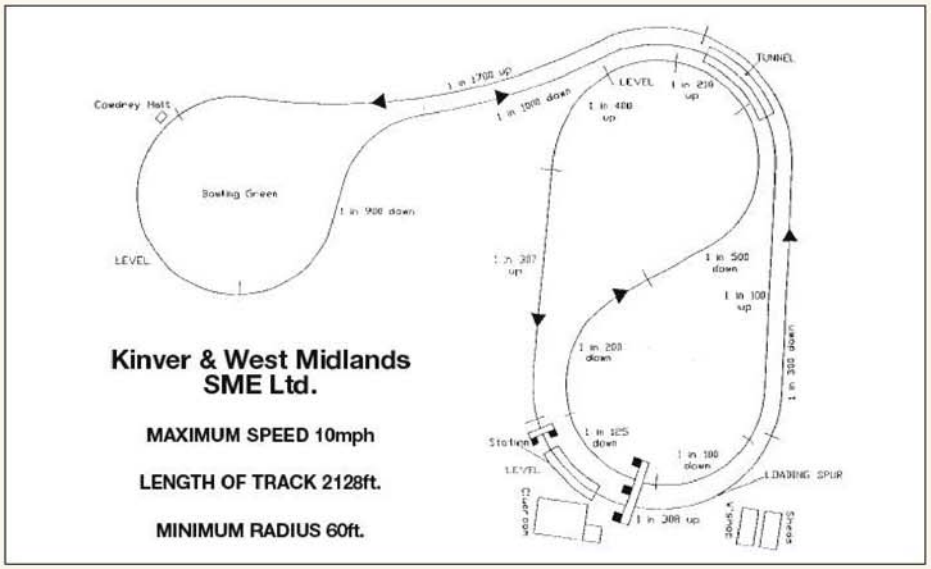
Those seeking bed and breakfast or hotel accommodation should contact the local Tourist Information Centres. Two in the area are located at the following addresses:

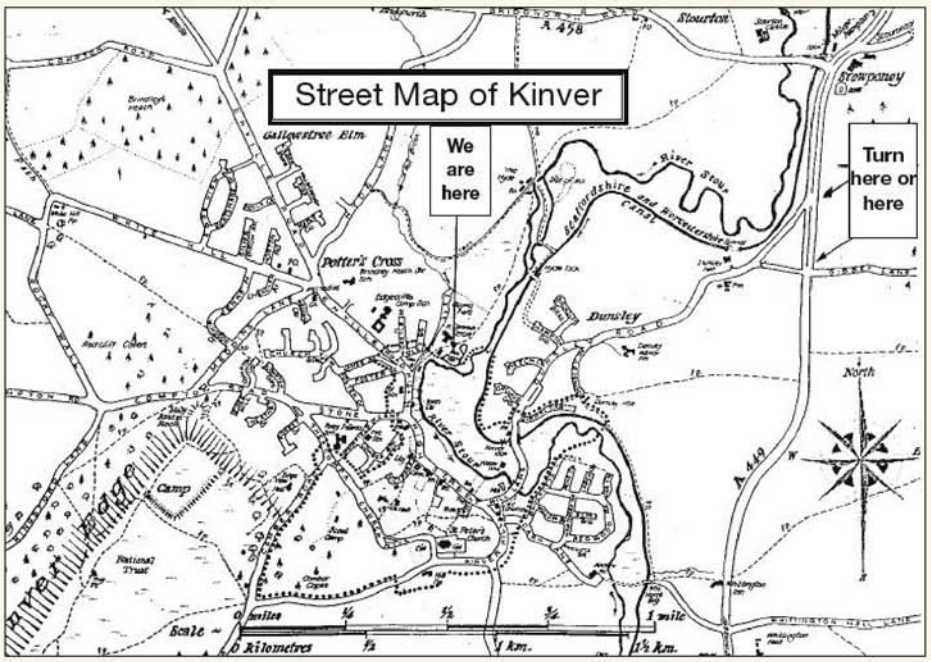
1: Load Street, Bewdley, Worcestershire DY12 2AE; tel/fax: 01299-404740

2: The Museum, 26 Birmingham Road, Bromsgrove, Worcestershire B61 0DD; tel: 01527-831809; fax: 01527-577983.

Those who wish to introduce variety into their weekend may care to visit the noted Merry Hill Shopping Centre located only five miles away at Brierley Hill, near Stourbridge. I understand coach loads of visitors travel many miles to visit this unique venue. The Severn Valley Railway is only 5 miles away at Kidderminster while the Black Country Museum is approximately 8 miles away at Dudley.

The IMLEC 2004 Committee is working very hard to make this a memorable event so please come and show your support. Take the opportunity to meet established friends, perhaps make some new ones, and be sure to have an enjoyable time. Competition Entry forms can be obtained from our Editor at PO Box 310, Hemel Hempstead, Hertfordshire HP3 8XL and I can be contacted by telephone on 01902-339275.





HOW TO GET TO KINVER

The Kinver Society tracksite is situated on Marsh Playing Fields at the end of the High Street of the Village of Kinver.

Suggested routes to the Village:

M6 South to Junction 11
A460 to Wolverhampton.
A449 out of Wolverhampton towards Kidderminster.
Approximately 10 miles along the A449 at Stourton, shown as Stewpony on the Street Map, take the second turning on the right for Kinver which is Dunsley Road, *not* the A458 towards Bridgenorth.

M5 North to Junction 6
A449 to Kidderminster.
A449 towards Wolverhampton.
Approximately 3 miles, after a left turning for Cookley, left turn into Dunsley Road for Kinver.
Very narrow, sharp turn and very easy to miss.

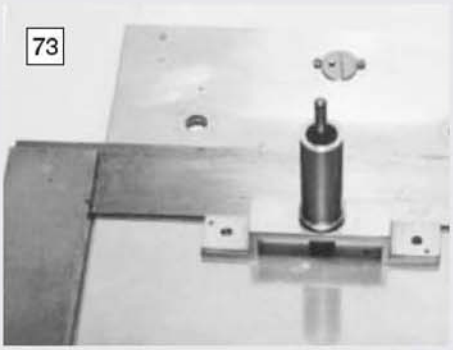
M42 West to Junction 1
A38 North towards Birmingham to M5 Junction 4.
Straight over island: A491 towards Hagley.
Large island at Hagley Hall.
Left onto A456 towards Kidderminster.
At traffic lights just before Kidderminster (Chester Road), right onto A449 towards Wolverhampton. See above.

You should now be on Dunsley Road heading for Kinver.
Follow Dunsley Road.
Past the Vine public house. Over the canal.
Along the Village High Street.
Fork slightly right at the mini-island at the end of the High Street.
Police Station on the left.
Fork next immediate right onto Marsh Playing Fields area.
Tracksite entrance right in front of you.

Parking has been arranged at Edgecliff School about 200 yards further, up the hill on the right.

Any queries, please contact Mike Harrison (0121-602-2019) or John Campbell (01384-891244)

We hope you have a safe journey.



Aligning the bridge with an engineer's square.

WORLD TIME DIAL CLOCK

Ian Beilby

fixes the bridge to the frontplate and describes the minute hand, dial plate and pillars.

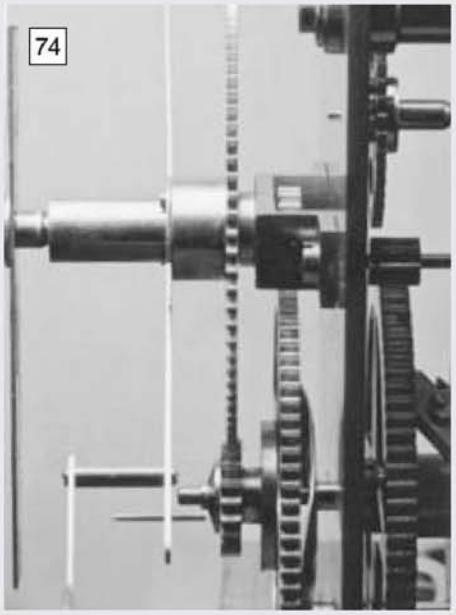
●*Part IX continued from page 615 (M.E. 4222, 28 May 2004)*

As the hour arm, pointer, wheel and fittings are now complete, the bridge can now be fitted to the frontplate. The bridge *must* be centrally aligned with the minute wheel pipe; one way of achieving this is as follows. A length of 5/16in. rod should be reamed 1/8in. and placed onto the minute wheel stud, the bridge can then be placed onto the rod and the feet of the bridge aligned horizontally to the plates with the aid of an engineer's square (**photo 73**). The bridge should be clamped to the frontplate with the aid of the toolmaker's clamps, and the 4BA tapping drill should then be used to drill the frontplate through the holes already drilled in the feet of the bridge.

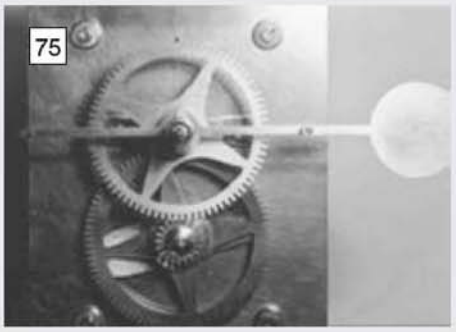
The holes just drilled in the frontplate can now be tapped 4BA and the holes in the feet of the bridge opened up to 4BA clearance. The minute wheel and pipe can then be fitted in place and a check made to ensure the bridge is centrally disposed to the pipe when screwed to the frontplate. If this is not the case, the holes in the feet of the bridge should be broached slightly in order to allow the bridge to be positioned correctly.

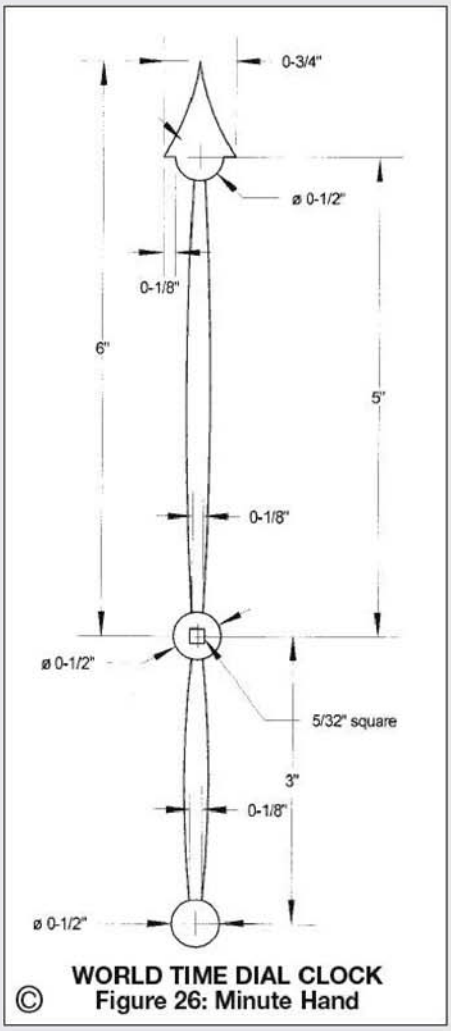
In order to drill the holes in the frontplate for the register pins in the bridge, the bridge should be correctly aligned and screwed tightly to the frontplate. A drill can then be taken through the holes for the register pins in the feet of the bridge. The register pins can then be fitted to the bridge and the holes just drilled in the frontplate broached to accommodate the pins. A punch mark should be made on one foot of the bridge, and an adjacent mark made on the frontplate so that the bridge can be repositioned correctly after dismantling.

The entire motion work can now be fitted in place with the hour pointer, and a check made to ensure everything is aligned and working correctly (**photos 74** and **75**).

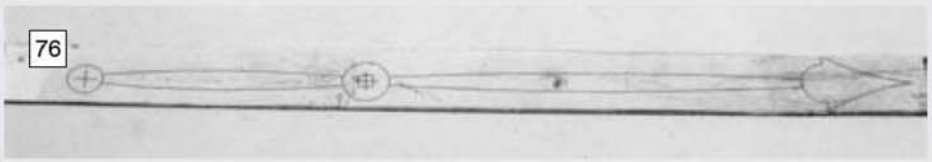


Above and below: the motion work is assembled to ensure that everything is properly aligned and working correctly.





WORLD TIME DIAL CLOCK
© Figure 26: Minute Hand



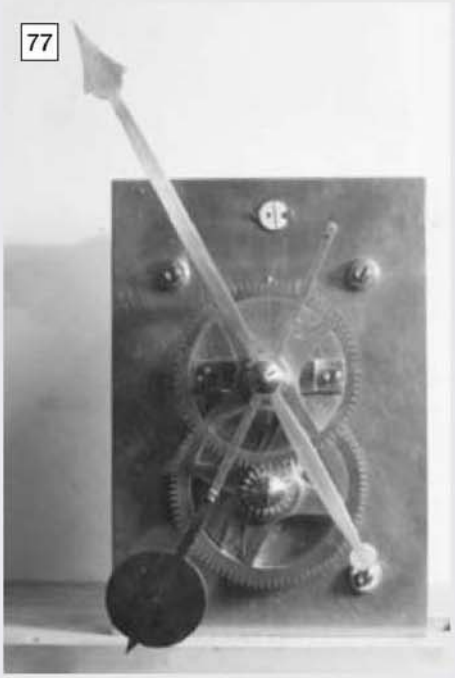
The outline of the minute hand can be drawn on paper which is stuck to a piece of steel to be cut out.

Minute hand

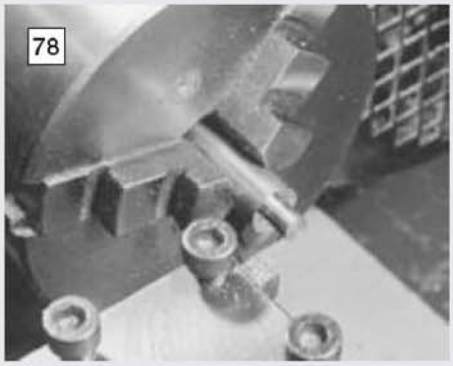
This part is dimensioned in **fig 26** and must be counterbalanced. The outline can be simply drawn out on paper, cut out and glued onto a suitable length of 1/32in. steel (**photo 76**). The hand is then and cut out with the piercing saw and filed to shape. The centre hole, which will be filed to form a square, should be drilled before cutting out the hand.

When filing the square, the hand must be a positive fit on the minute pipe and should be frequently checked when filing. As previously mentioned, the hand must be counterbalanced. The easiest way of achieving this balance is to attach a brass counterweight at the opposite end of the pointer, which is what I have done. The weight was simply attached to the front of the hand with an 8BA screw. The size of the counterweight will depend on your finished hand and some constructors may prefer mounting the weight at the rear of the hand.

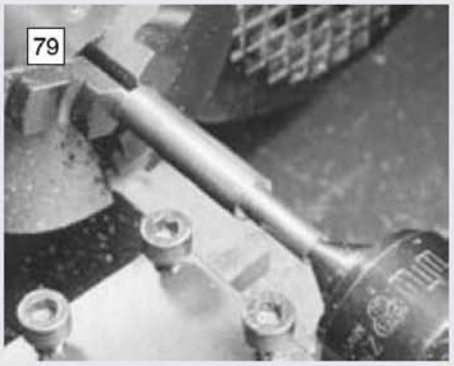
In my case the weight was some 7/32 x 1/2in., and if placed at the rear of the hand it may have marked the country dial, so I attached it to the front. The hand can then be fitted to the movement and secured in place with the hand collet and cross-pin. The pin should hold the



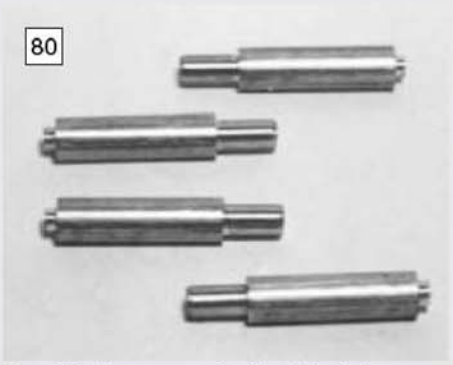
The movement can now be assembled and run.



A 3/16in. spigot is first turned on the dial pillars.



The other end is reduced to 1/4in. diameter.



Four dial pillars are required for this clock.

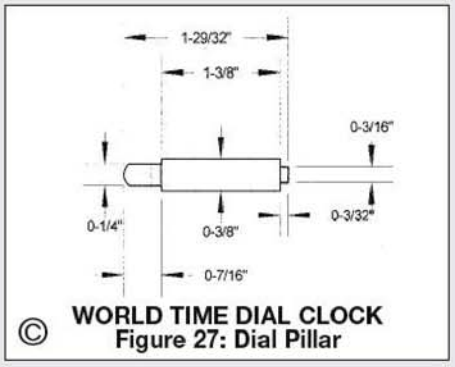
assembly in place on the minute wheel stud with a very small amount of endshake.

As the gearing on the motion work for this clock is fairly coarse, there is a certain amount of backlash on the minute hand, mainly due to the indirect drive employed in the design. However, this should be an acceptable amount if all the components have been correctly made and fitted.

The movement can now be left running with the minute hand and hour pointer in place while the dial and dial pillars are made (**photo 77**).

Dial pillars

The dimensions of the four dial pillars are given in **fig 27**. All four pillars are identical, so it is a good idea to carry out the various machining operations on all four pillars at the same time in order to save time in re-setting the lathe. A 2 1/4in. length of 3/8in. brass is held in the 3-jaw chuck and a 3/16in. dia spigot is turned for a length of 1/4in.; the shoulder should be undercut (**photo 78**).

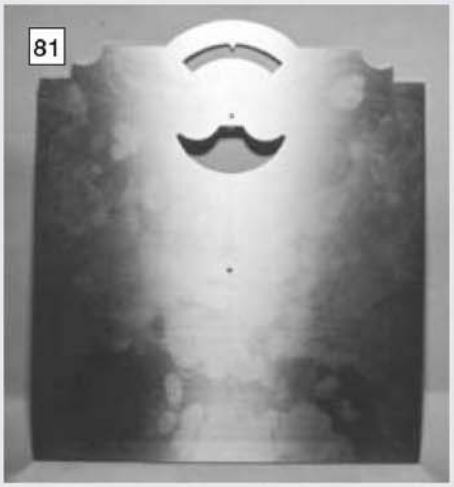


The stock is then reversed in the chuck, and held by the 3/16in. spigot. After facing and centre drilling, and with tailstock support observing the measurements in fig 27. The 1/4 x 7/16in. dimension is then turned (**photo 79**). All four pillars should have a shoulder-to-shoulder length of 1 3/8 inches. The work can then be held by the 3/8in. diameter in order to bring the 1/4in. spigot to 7/16in. length and remove the centre. The end of the spigot should be tapered in order to facilitate fitting to the movement frontplate. The pillar is then reversed in the chuck and the 3/16in. dimension, which forms the rivet, is reduced to 3/32in. length.

The cross-holes for the taper pins which hold the dial pillars to the movement should not be drilled yet until the dial pillar holes in the movement front plate have been drilled. **Photograph 80** shows the four dial pillars.

Dial plate

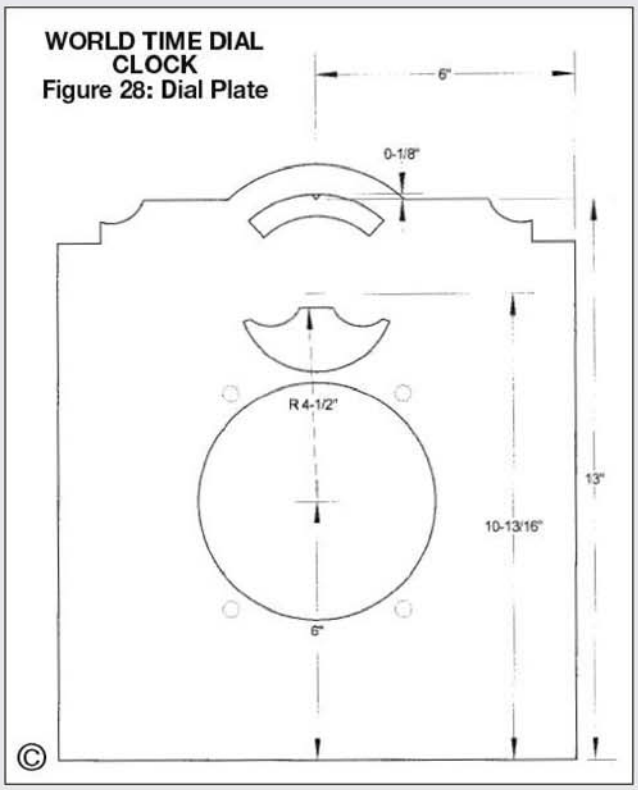
This is cut from 1/16in. brass sheet, dimensioned as in **figs 28** and **29**. The sheet should be filed square and the various dimensions marked out. The positions of the dial centre and the centre of the moon disc should be carefully marked and then accurately centre punched before being drilled 1/8in. diameter.

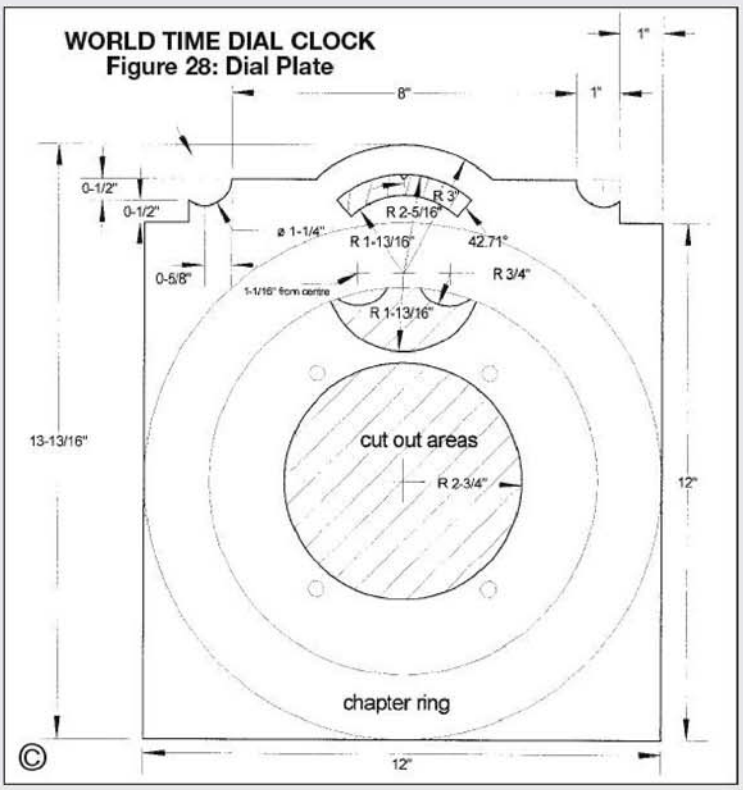


The 1/16in. brass dial plate takes shape.

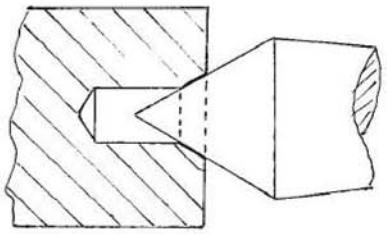
The apertures for the moon disc should be cut out, and carefully filed to the line, however the dial centre should not be cut out at this stage. Finally, the decorative top of the dial can be cut and filed to shape (**photo 81**).

●*To be continued.*

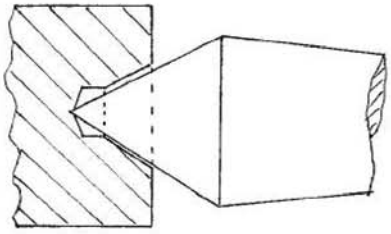




PETE'S PAGE



A centre hole produced by a centre drill in good condition will have a pilot hole which clears the tip of the centre and will provide a reservoir for oil or grease lubricant.



A centre hole produced by a centre drill with a short pilot will allow the tip of the centre to 'bottom' in the pilot hole and throw the workpiece off centre.

CENTRE DRILLS
POINTS TO PONDER

Peter Spenlove-Spenlove offers advice on a little tool that is so often taken for granted.

A centre drill, sometimes called a Slocumbe drill or a combined drill and countersink, is used to produce the hole in the end of a bar which is to be supported by centres in a lathe or other machine tool. It does this by a drilling and countersinking action performed in a single operation. Centre drills are also very often used to give an accurate start to a standard twist drill. While the included cone angle is usually 60deg., other angles are available for special work including very heavy parts like steam locomotive wheels on their axle and rolling mill rolls. The centre drills which we buy for normal machine shop use are the 60deg., type which matches the point angle of standard Morse taper shank lathe centres whether of the solid or revolving variety.

Bottoming

The point of a centre drill will eventually become dull or blunt in service and will have to be sharpened. Following this, the point, which is really a pilot drill, will therefore be a little shorter. After a few regrinds, the sharp tip of the lathe centre may 'bottom out' in the pilot drilled hole, thereby preventing the 60 deg. cone from seating correctly and doing its job.

Consider this: you will have screwed the tailstock centre into the work. Without you being aware of it, the sharp tip will have actually penetrated into the bottom of the pilot hole. All seems well until you find that the work is not running true. Your first reaction is to withdraw the tailstock centre and clean the hole and centre although you thought they were clean before. Perhaps a fragment of swarf or grit had been attracted by the oil or grease. You return the centre into the workpiece only to find the problem remains.

On re-inspection, you might spot the dent at the bottom of the hole, but try the following test. Sparingly apply a trace of engineer's blue (not marking out blue, you need the non-drying, greasy sort usually sold in a little flat tin or tube) to the newly cleaned cone of the centre. Feed the centre into the freshly cleaned centre hole again (without lubrication) and rotate the work through a couple of turns. Withdraw the centre and look to see how well the blue has transferred. If the transfer is uneven or non-existent, the pilot hole is not deep enough. The pilot on the centre drill which you used is worn too short and should only be used for starting twist drills.

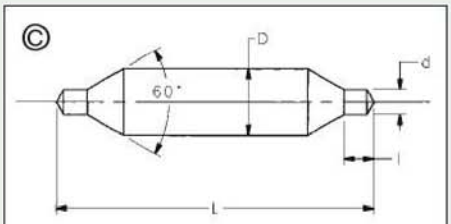
Most centre drills are double ended, but if both pilot drills are now too short, you have three options:

1: increase the depth of the pilot hole using a small twist drill,
2: buy a new centre drill, or
3: remove the point on the lathe centre by grinding, leaving a flat of about 1/16in. dia. for our size of centre work.

The rather drastic third option above is sometimes used in industry. However, we model engineers often need the sharp tip on our lathe centre. For example, it is often useful for aligning and centring a component in the independent 4-jaw chuck or on the faceplate. It is often handy to fit the sharp tailstock centre point into a centre pop in the workpiece to hold the work against the faceplate while fixing the clamping equipment, or adjusting the chuck jaws. My advice therefore, is avoid option three. Keep the worn centre drill for starting twist drills and for deburring holes.

A fourth option, not yet mentioned, is to discard it as a centre drill but salvage it for conversion to a small cutter for a boring tool or suchlike as described below.

A group of six centre drills ranging in size (L-R) from BS6 (5/8in. dia.) to BS1 (1/8in. dia.) The long centre drill in the foreground is a special BS3 (1/4in. dia.)



Ref No.	Body dia. (Din.)	Drill dia. (din.)	Drill point length (lin.) Max	Drill point length (lin.) Min	Overall length (Lin.)
BS1	1/8	3/64	5/64	1/16	1 1/2
BS2	3/16	1/16	3/32	5/64	1 3/4
BS3	1/4	3/32	5/32	1/8	2
BS4	5/16	1/8	3/16	5/32	2 1/4
BS5	7/16	3/16	9/32	1/4	2 1/2
BS6	5/8	7/32	11/32	9/32	3
BS7	3/4	5/16	15/32	13/32	3 1/2

Lubrication

The space formed by the pilot of a centre drill provides clear space for a centre tip and to form an oil reservoir while the centre is in use during turning, etc. The oil lubricates the cone from the inside better than when applied from the outside.

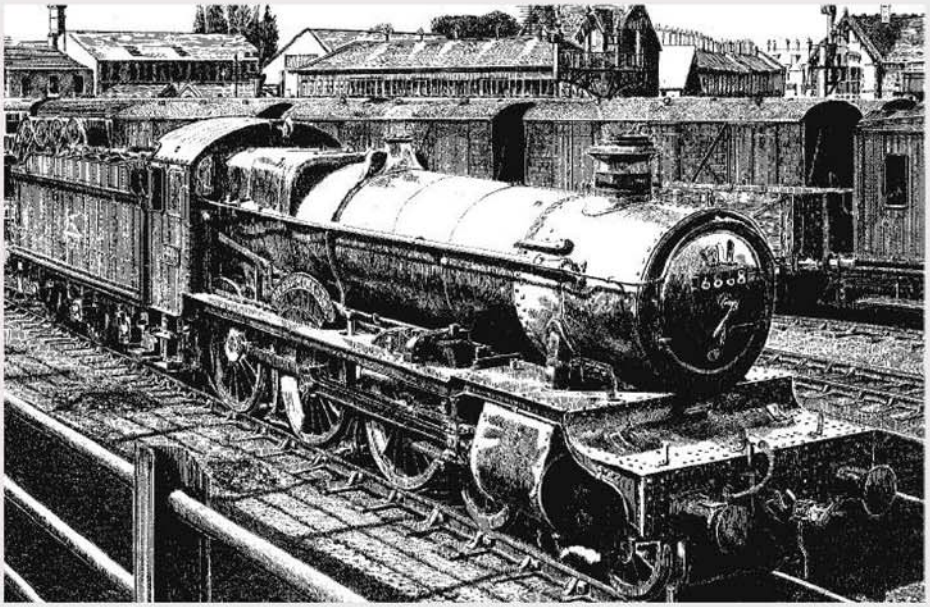
In recent years I have noticed that a number of the cheaper drill chucks made for the amateur market, while having a small body size, can open out their jaws to accommodate quite large drills. However, their location depth is relatively small, i.e. the drill shank can enter only a short distance. As centre drills are double ended, it is frequently impossible to grip onto the plain part of a centre drill properly with these chucks, the inner end of the centre drill taking up most of the jaw length. Do not be tempted to use large centre drills in these chucks unless the chuck design allows you to drill a clearance hole into the back end behind the chuck jaws. This may allow the centre drill to be inserted more deeply and enable it to be held securely.

If not gripped firmly by its plain shank, a centre drill may rotate while in use and chew bits off the chuck jaws due to the two flutes acting like cutting edges as they pass each jaw. Furthermore, the tip on the outer end may snap off to add to the fun!

Salvage

As previously mentioned, broken centre drills should not be discarded; they make good countersink cutters, whether used in a machine tool, or fitted into a file handle for deburring holes. Unlike 'rose' type countersinks, they make a chatter free cut. Suitably ground, they can also be used in boring bars as a normal cutting tool.

Most centre drills are made of high speed steel (HSS). If there is doubt because the markings are worn off, try the spark test. First, lightly dab a piece of carbon steel, such as silver-steel (UK) or drill rod (USA) onto your grinding wheel. Observe the bright flashy sparks. Now repeat the exercise with the old centre drill. If it is HSS the sparks will be less bright and flashy. If in doubt test known steels (not carbides) and compare the sparks. This test works for ferrous materials but only when free of paint, dirt, oil and electroplating which, unless removed, may give false results — especially nickel plating.



PENRHOS GRANGE

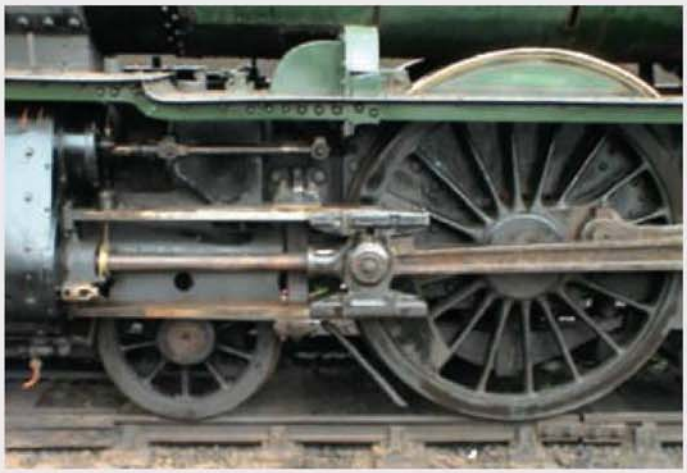
Neville Evans
continues work on the cylinders.
●*Part VII continued from page 624 (M.E. 4222, 28 May 2004)*

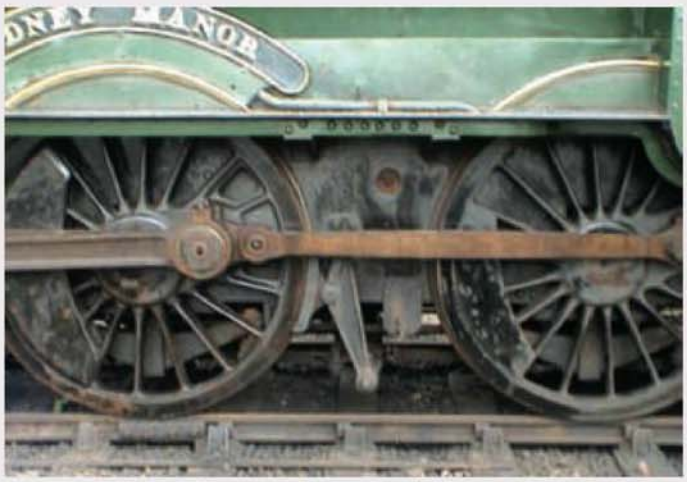
As I mentioned in the articles on the Highland Railway locomotives, the cylinders largely present a series of problems that are concerned with sealing. Piston to main bore, piston and valve rod glands, and in this particular case, the piston valves themselves. As is my general practice, I have not only drawn upon my own experience, but upon that of some of the folk that I consider to be real experts. The general consensus seems to be that the twin goals of maximum steam tightness, coupled with minimum friction, are best achieved by a combination of good design and excellent workmanship and that there are a number of solutions to this particular problem. I furthermore have always believed that if you can design a problem away, then it goes away permanently.

Piston

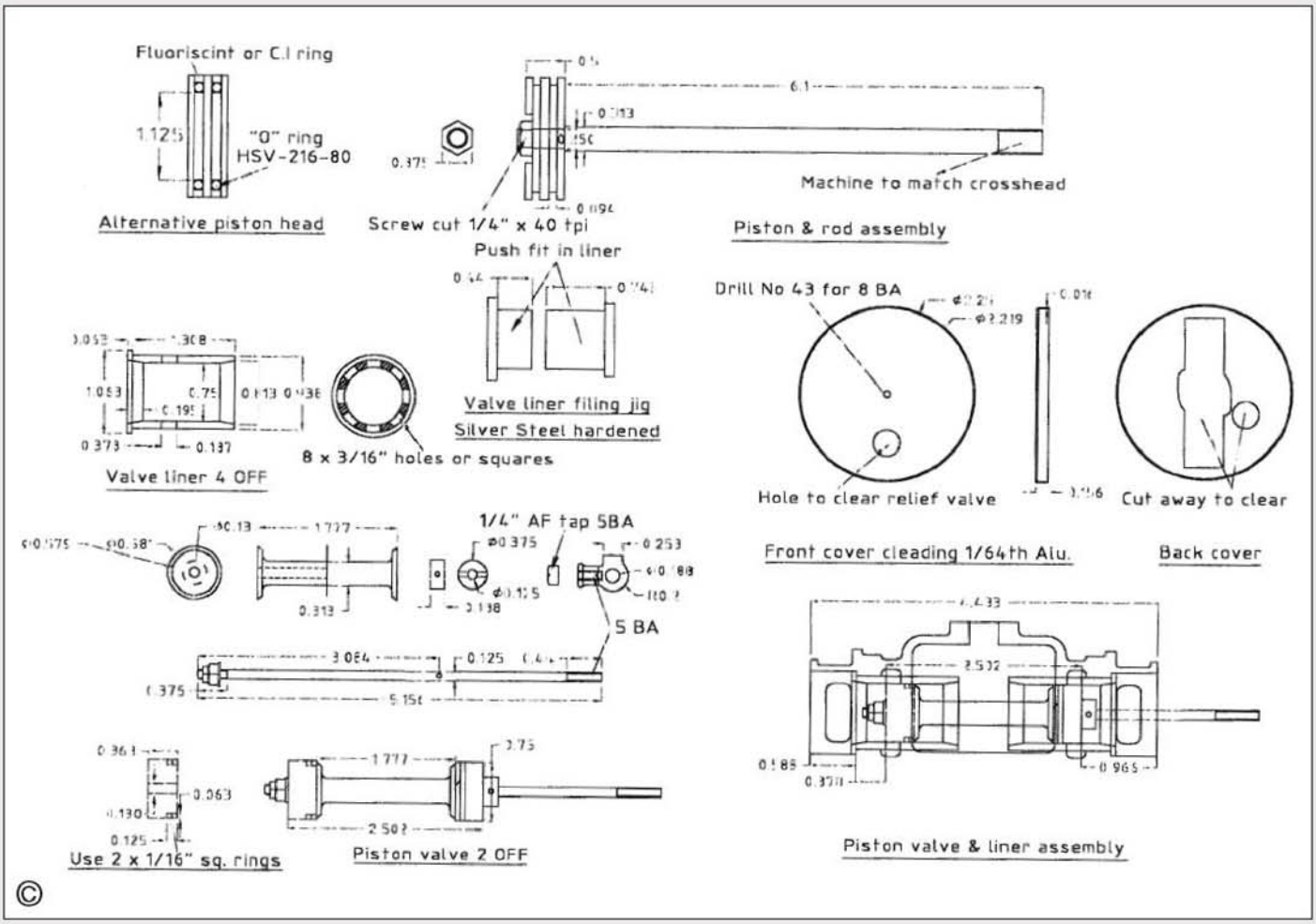
The material from which the cylinder is made defines the metal that we use for the piston, that much is obvious. For a cast iron cylinder there is no real substitute for a cast iron piston with cast iron rings. I would recommend Clupet rings, which are made by Allan Smith (tel: 01900-818361). I have used these rings myself with great success in my Loch. Their obvious advantage is that due to their double wound construction, leakage through the ring gap is most unlikely.

An alternative is to use two separate single rings with the gaps diametrically staggered and possibly with O-rings underneath. This arrangement has been used with complete success in recent years. The obvious advantages are that the O-ring prevents leakage underneath the ring, and it also holds the ring against the bore. This means that the ring can be made the same diameter as the inside of the bore without worrying about resultant high ▶





These four photographs of the wheels and rods of* Odney Manor *were taken recently at Minehead on the West Somerset Railway. The differences between Manors and Granges relevant here are that the balance weights are less deep on a Manor than on a Grange, otherwise rods and wheels are identical.



friction caused by the ring springing tightly against it. Allow 1-1^1/2 thou. total end clearance between ring and groove and make certain that the finish on the ring grooves and the sides and face of the rings themselves is of a very high order. Beware of commercial rings that possess a large gap and require a great deal of pressure to close them. They cause a great deal of unnecessary friction, not to mention the extra wear on the bores.

With gunmetal cylinders or phosphor bronze liners, I would use a good quality aluminium alloy, together with two Fluorosint, (glass filled PTFE) rings, again using an O-ring backing. This system is well proven to give minimum friction and maximum seal. We used to be able to obtain a grade of aluminium alloy called Dural, which I believe was a proprietary product from High Duty Alloys of Slough. There are modern equivalents; your metal supplier will be able to advise. Geoff Moore's IMLEC-winning LBSC *Minx* used gunmetal cylinders, aluminium alloy pistons and O-rings. Need I say more.

On the vexed question of O-rings, I have received a lot of assistance from the Hydraulic equipment supermarket in Gloucester, on the advice of Mike Smart who is, of course, an expert in sealing matters. I spoke to their man John on 01452-730774. Basically he can advise you on where to obtain Viton 80 O-rings in the correct size. The one that we'll be needing is HSV-216-80 to use under a 3/32in thick Fluorosint or cast iron ring.

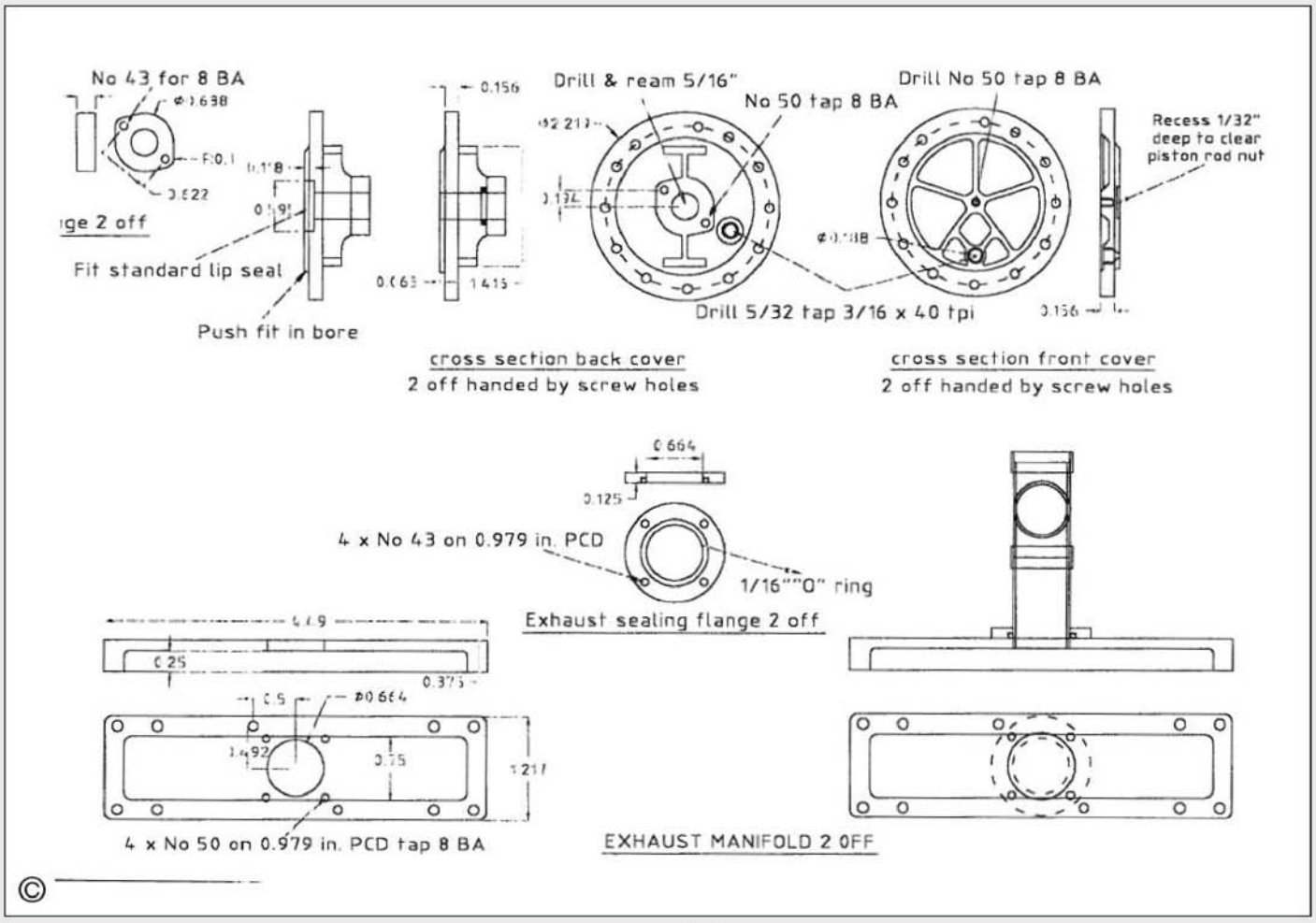
Whichever material is used, make certain that the bores are well finished and that the pistons are given from 1 to 1^1/2 thou. clearance for cast iron and 2 thou. for aluminium alloy in gunmetal. I invariably finish cast iron cylinders on a Delapena lap, which leaves a lovely cross-hatch finish, the bore will polish to a mirror finish after a couple of hours running. The cross hatching holds oil in the early running-in period and I must say that in motorcycle practice I ran aluminium alloy pistons with cast iron rings in cast iron bores with great success.

I have always believed in finishing gunmetal or bronze bores on the lathe using a sharp tool with a slightly rounded tip and only about 2 or 3deg. of clearance angle. I fancy that lapping or honing is liable to leave embedded fragments of ceramic in a non-ferrous bore which will have a deleterious effect on the piston in later life, no matter how hard one tries to get it clean with white spirit and other unguents.

Mike Harrison at the regulator of his handsome* Crynant Grange *during his competitive IMLEC 2003 run on the Bristol SMEE track at Ashton Court.

Piston valves and liners

The same remarks on fitting apply to piston valves; these devices need sealing where the hot high pressure live steam impinges upon them. In other words, on the inside face of the valve with inside admission. Hence the rather unorthodox feature of two rings with radially opposed gaps, used in conjunction with built up valve spindles and separate heads. If the cast iron bobbin ring grooves are machined carefully with a razor sharp knife edge tool, they should be very accurate in depth and width. It would be quite possible to use O-rings under these rings as well, which should give very good piston-valve sealing.



Obviously, the liners are of paramount importance, and each bobbin must be fitted to its own liner. In the past I have made the bobbins a little tight in the liner and then pressed them through a few dozen times from each end, lubricating them copiously the while with molybdenum grease. Don Young, of blessed memory, recommended this method of fitting piston valves, with plain phosphor bronze bobbins, without the thin labyrinth oil grooves that LBSC used to use. I tried it on the 5in. gauge King with excellent results. The surprising thing was that they loosened off to a lovely sliding fit, after half an hour or so of compressed air running.

On the vexed question of ports, Simon and I hold different views. The last set of liners that I made was for the King, and I contented myself with holding each liner on a mandrel held in the dividing head chuck on the milling machine. I then drilled through with a 3/16in. dia. Slocombe drill, from memory eight ports per liner. I must say that on valve setting I was very happy with the crisp, even beats of the exhaust and would not hesitate to use this on my own cylinders. Simon, on the other hand, is quite adamant about squaring off the ports. If you do decide to square off the ports, then please make two simple jigs as shown from hardened silver-steel so that some accurate filing can be carried out. If two filing jigs are used, note that the liners have to be made very accurately so as to make sure that there is no overlapping (or under-lapping) of the hole and jig.

I invariably fit my liners with an adhesive such as Loctite. The obvious advantages include the ability to machine to size prior to fitting. (With a press fit one always squeezes up a bore which may also leave it slightly oval). A further advantage is that if necessary one can dismantle by breaking the Loctite seal by heating in the oven. With the main bore, there is no possibility of the liner shifting under steam because it is held down by the cylinder covers. With the valve liners however, although I know that the Loctite will do its job at temperatures up to anything that our little superheaters can achieve, I still can't resist putting in a little grub screw to add belt to the braces. This can be conveniently located on the top of the cylinder to touch onto the valve liner flange.

The final assembly of liner and valve is performed through accurate measurement. The sequence of operations that suits me best is as follows:

1: Complete the machining of the cylinder block, and measure the outside length of the valve chamber. It should be 4.433 inch.
2: Measure the depth of the valve liner recess. It should be 0.588 inch.
3: Measure the distance from the inside of the valve liner flange to the leading face of the port. This should be 0.378 inch.
4: Add 2 and 3. This should add up to 0.966 inch. Multiply by 2 = 1.932 inches. Take away from 4.433in. = 2.501 inches. This figure represents the outside length of the piston valve.
5: It is almost unavoidable that your measurements will differ slightly from the originals. This doesn't matter (at least, within reason). The important thing is that you measure your own block and liners and work from there.

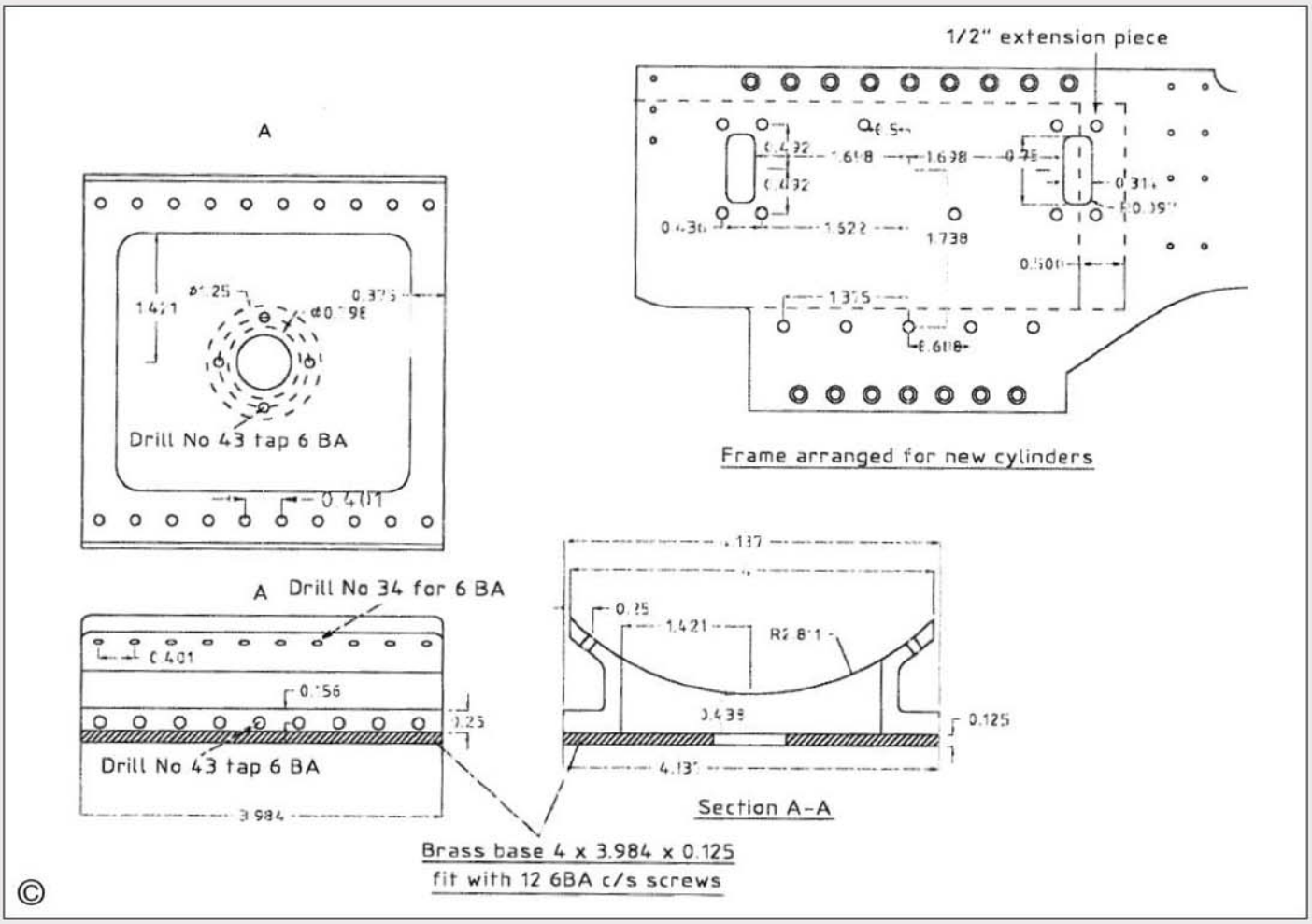
Cylinder covers

The front covers require no description. The operations necessary for both ends include the positioning of the stud holes and fairing in the top of the spigot to allow free passage of steam. Note that both covers are handed by the bolt holes. When turning the spigot I make a practice of making a small groove with a very fine knife edge tool at an appropriate radius and marking out the stud holes from the inside. I say stud holes because studs are the correct practice. However, as our little cylinders won't have the covers taken off and on as frequently as full size covers would have to be, most people will find it easier to use hexagon headed or even countersunk screws in this application. You can't see them because they are hidden under the end cover cleading.

My method is to push the cover onto the cylinder in its final position, spot through one hole at clearance size and drill down tapping size for 6BA to a depth of 5/16in. or so. I then use a cordless drill set to the lowest speed and with the most sensitive setting, put in a 6BA taper tap followed by a bottoming tap. Fit one locating screw to hold the cover in place and ditto for the other 11. Using this method I find that I can put 48 holes in two sets of covers in a quarter of an hour or so without breaking taps or having sore fingers.

The back cover carries a gland as well as the hole for the piston rod. Make sure that said hole is drilled and reamed without disturbing the cover, to ensure concentricity with the flange. The full size Great Western glands contained metallic labyrinth seals and so were bolted up flush as can be seen from the photographs. This means that a squeezed up gland containing steam packing is inappropriate. We can either use an O-ring as detailed or, as in the second drawing, we can employ my favourite method, which is to use a lip seal on the inside of the cover.

These seals are available from your friendly local bearing suppliers and are now stocked by Bruce Engineering. I haven't given an exact measurement for the press fit, as the seals, which ▶



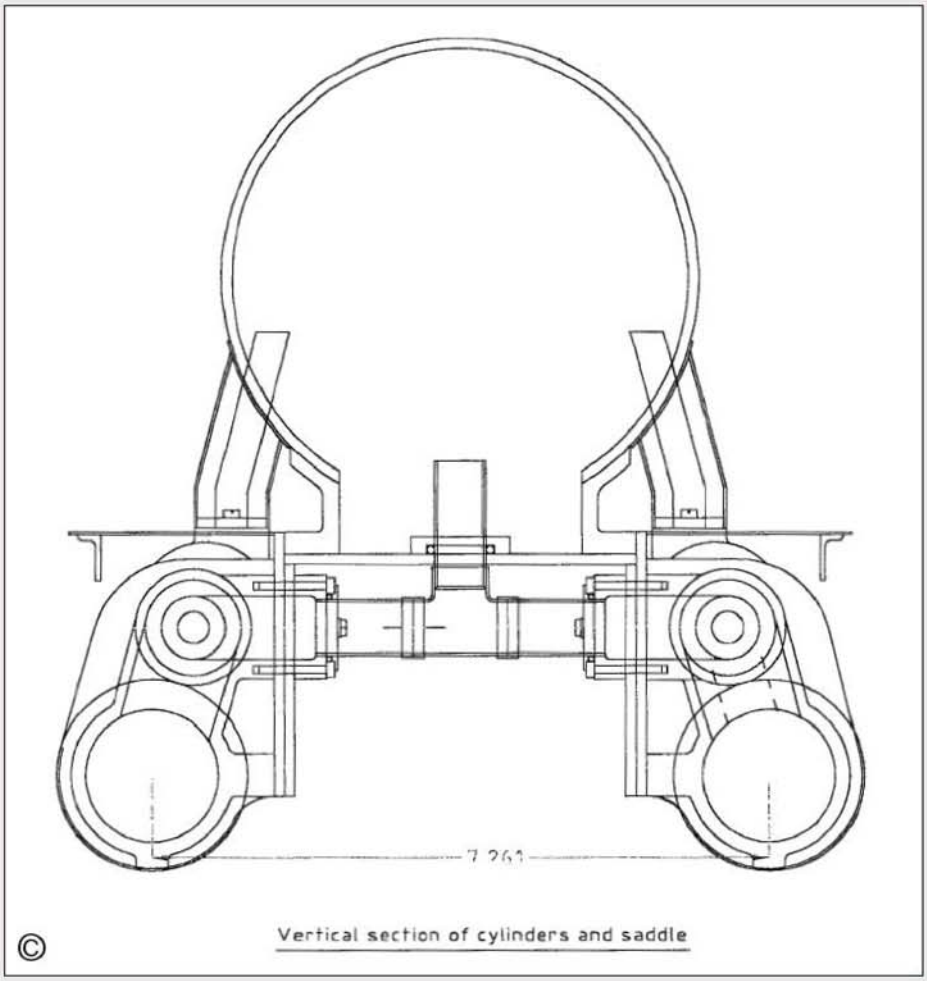
have a steel case, may vary slightly in dimensions. Just give them a thou. interference fit and squeeze them gently in. Don't fit them the wrong way round otherwise they'll pump up your boiler instead of sealing the piston rod. Only joking! The obvious snag is that to fit them you have to take off the piston or the crosshead. The up side is that they last an awfully long time, they certainly shouldn't need looking at between ring examinations. O-rings of course can be renewed by cutting them with a razor blade and sticking them back together with Superglue. To avoid embarrassment, lightly smear some oil on the piston rod first, otherwise the O-ring will stick to said rod.

Frame alterations

Due to the modified exhaust system, we have to lengthen the frame doublers by 1/2in. to give a continuous seat for the exhaust manifold, as can be seen from the small frame drawing. An alternative is, of course, to make a new, longer frame doubler. Make sure that there are no leaks in the crack between the plates, by using a sealant in the join.

I have also included a cross-section of the smokebox saddle and cylinder assembly. Note that I have shown a simple, easy to adjust 90deg. joint up to the blastpipe. My friend Colin Burrow is building a County, and has gone to the bother of splicing together a lovely smooth streamlined joint here. I don't think that it will make any difference, but it certainly looks the part. The smokebox saddle is quite straightforward; it sits on the doubler and has a brass plate screwed to the underside. This plate forms the base of the smokebox, as per the Highlanders. It has the advantage that it is self-sealing, and forms an ideal base for the blastpipe and blower assembly.

●*To be continued.*

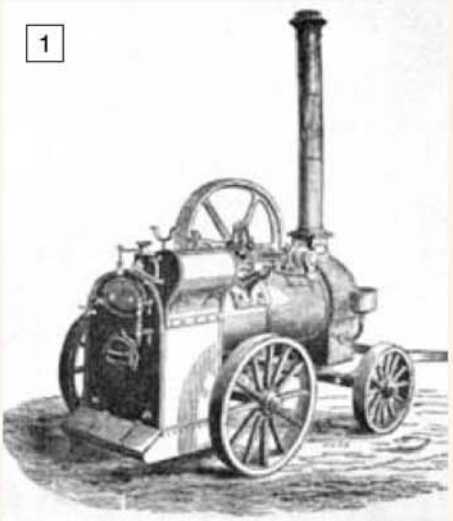


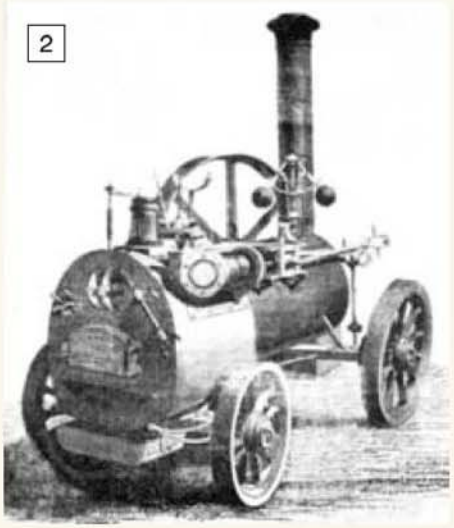
ROAD STEAM

Martin Wallis

charts the early years, introduces their successful 4CD tractor and the topic of superheating.

●*Part I*





Left: an 1852 portable engine, the firebox is 'wet' having water all the way around it. The bottom row of fire tubes would be below the level of the grate. Right: by the end of the 1850s Garretts were using the more usual locomotive boiler.

RICHARD GARRETT

SOME NOTES ON A COMPANY AND ITS PRODUCTS

Richard Garrett & Sons Ltd. of Leiston in Suffolk is the last engine manufacturer to be reviewed in the present series before work starts on the 'Universal' Savage steam wagon construction series. It will be good to start on model construction again, and it is hoped not to 'tread on the toes' of the Fowler steam wagon. There are fewer Savage wagon builders than there were *Little Samson* builders, but I have a very comprehensive pile of illustrative material and this time the series is accompanied with excellent CAD drawings courtesy of our resident model *Road Steam* expert Stan Nipper.

There were four Richard Garretts, so for convenience and to avoid confusion I shall call them Richard I, II, III and IV. Richard Garrett I arrived in Leiston in 1778 to work as a blade smith at the forge of William Cracey. The same year Richard Garrett I was married and by 1779 had a son who was named Richard Garrett II. Cracey died in 1782 and in 1783 Richard Garrett I bought the forge which at the time employed about ten men.

Richard Garrett II took over the business in 1805 and in 1806 married Sarah Balls, the son of John Balls who had instigated several improvements to threshing machines, thus the company of Garretts expanded into threshing equipment as well as the established and well thought of blacksmithing trade. The order books steadily developed, gradually departing from repair and maintenance to manufacture and new designs.

Richard Garrett III was born to Richard Garrett II and Sarah in 1807, and by the time he was 19 years old he was running the financial and day-to-day affairs of the family company. Richard III married and had four sons the first of which was inevitably named Richard (Richard Garrett IV born 1829) and five daughters.

Expansion

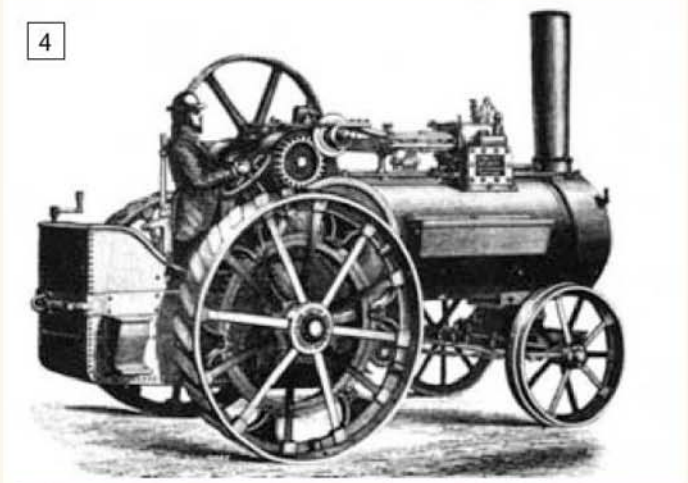
The Garrett business expanded considerably and by 1830 Richard Garrett III was employing 60 men. Products included threshers, seed drills, ploughs, winnowing machines, ornamental gates, cast iron fireplaces, cooking stoves, and a vast array of hand tools and implements. In addition a great deal of general cast iron work was undertaken, examples surviving including the communal pump on the Town Steps in Aldeburgh dated 1840, a cast iron road bridge at Thurlow in Suffolk dated 1851, and some cast iron grave stones in Leiston, one of which was in memory of Richard Garrett I's wife.

By 1850 Garretts were employing 300 men and in 1851 had a substantial stand at the Great Exhibition in Hyde Park. Their main product was the portable and semi-portable engine both of which were suitable for driving light agricultural machinery, sawmills and small workshops. The portable exhibited at the Great Exhibition had a return tube boiler and wet-bottomed firebox. An example of a wet-bottomed portable is shown in **photo 1**, note the unlagged cylinder and that the overhung crankshaft runs in front of the smokebox.

By the late 1850s the Garrett portable had settled into the usual arrangement of a locomotive firebox with the cylinder above it; the crankshaft was mounted in cast brackets over the boiler barrel. An example is shown in **photo 2**.

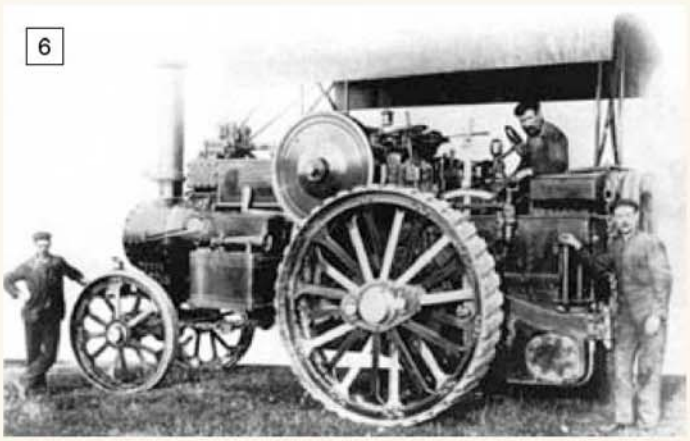
The Long Shop and flow production

The appetite both at home and abroad, for these new portable steam engines was insatiable and Garretts were receiving a great many orders, far more than ▶



Left: an early Garrett chain engine using Aveling's patent fifth-wheel steering. Right: Garrett's first gear-driven traction engine built in 1876. The Stephenson valve gear is clearly on the other side of the engine, so what might be mistaken for the valve chest cover must be for another purpose.

The only surviving Garrett engine to have worked as a showman's locomotive is this splendid example in Sheppard's livery.



A 1908 Garrett road locomotive which was sold to Lalonde Bros & Parham Ltd. of Weston-Super-Mare and had several owners including Norman E. Box.

This 6nhp engine was in a sorry state when photographed. I believe the engine is No. 33068 completed in June 1918.

A fine example of a 4CD tractor in full showman's form. The engine is No. 33278 of 1918.

the company with its existing infrastructure could cope with. A workshop specifically designed to produce the portable engine in the numbers required was therefore built. The building was the 'Long Shop' which was completed in 1853. On the ground floor was a central aisle running lengthways with two overhead travelling cranes above and further aisles to each side equipped with fitters' benches, lathes, planers and other machine tools. A substantial elevated gallery ran around the inside walls of the entire building with additional benches, light lathes and smaller machines for the manufacture of engine parts and fittings which were passed down to be fitted to the engines below.

The 'Long Shop' is widely quoted by historians as the birthplace of flow production and is now a grade II listed building. The raw boilers were first fitted with wheels and brought into the building at one end, and as they moved through the building the engine and all the fittings were assembled so, by the time the engine left the building at the other end, it was complete and ready to be despatched to the paint shop.

Garrett's were soon by far the largest company in Leiston and, among other things, supplied the town with gas from their gas works, had fresh water pumped from their own well and were responsible for manning and running the town fire service. As more and more gas lights were fitted, both public and private, by 1910 the demand was so great that the Leiston Gas Company was formed with a Richard Garrett, naturally, as the majority shareholder.

Station Works

The Long Shop proved very successful and productivity was noticeably improved. By 1857 there were 500 men working and by 1863 the works employed 600 and covered over 10 acres. By the early 1900s employment had reached 1,000. An ever-increasing proportion of output was exported, the Empire providing a seemingly bottomless market. By the end of the 1890s no less than 90% of production went abroad. In consequence, by the turn of the century the 'Main' or 'Town' works were becoming very cramped and a 'New' or 'Station' works was built. The woodworking and foundry departments were moved there.

By far the most popular and successful product throughout Garrett's many years building steam engines was the humble portable engine, but a great many other steam engines and vehicles were also built. Examples of early Garrett self-moving engines are included in **photos 3** and **4**. When the 'Station' works opened, Garretts were building a whole range of agricultural engines, road rollers, steam tractors and latterly steam wagons. In addition, they made a host of other products from threshing drums and assorted agricultural implements to steam winding engines.

Road locomotives

Comparatively few large Garrett road engines were built, probably due to design defects in the transmission, with numerous failures of crankshafts and back axles. Only a handful survive. An example is No. 27160, a 6nhp engine completed in June 1908 (**photo 5**). No. 27160 was not built as a showman's engine but was converted during her working life, the signwriting illustrated being taken from a surviving contemporary photograph. It is interesting to compare No. 27160 with No. 26695 illustrated in **photo 6**. The two engines were completed within three months of each other and the differences highlight the lack of standardisation on their larger engines.

It is true that No. 26695 was built as a road locomotive and No. 27160 was a compound traction engine (the spoked flywheel has been plated) but there are still striking differences. One engine is has the steering on the left and the other on the right, the tender cut-outs and reversing levers being accordingly different ways around. Both have rim brakes but the brake levers are mounted quite differently, the back of the tender on one is straight, the other is set back, and the rope pays out from the top of the drum on one and from underneath on the other.

4CD Tractor

I believe it fair to say the best known Garrett road engine was the well respected 4CD tractor. In their sales catalogues, it was Garrett practice to refer to a 6nhp engine as a No. 6, a 7nhp as a No. 7 and so on. The No. 4 CD was thus a 4nhp engine with the CD suffix identifying it as a compound engine. An example is shown in **photo 8** in showman's form and as a steam tractor in the half size model in **photo 9**.

The 4CD history may be traced back to the Garrett single cylinder No. 3 tractor which was designed in 1904, the first example being manufactured in 1905. Weighing just less than 4 tons empty and just over 4 tons with coal and water, it was the smallest gear-driven engine built at Leiston. Unlike Garrett's other engines, which were of four-shaft configuration, the new No. 3 was importantly a three-shaft engine. Apparently, while the engine performed very well, it did not sell in large numbers, so a slightly larger version of this engine which became the No. 4 in the Garrett

Terry Young's extremely fine half-size 4CD which has appeared several times in these pages; no apologies for including it again.

A 6nhp single cylinder superheated Garrett completed in August 1911. Note the prominent smokebox shape and plethora of pipework.

7nhp Garrett, No. 28249 was completed in January 1910. It is included here for comparison with the superheated Garrett shown in photograph 10.

The Garrett foundry looks a demanding place to work. Note the wall mounted rails for the overhead travelling crane needed for heavy lifting.

Station Works blacksmith shop with a line of treadle operated steam hammers down the middle of the shop and forges to the left and right.

listings was therefore completed in January 1906.

The first No. 4 engine was Works No. 25646. The design was very similar to the No. 3 but was scaled up; the cylinder was increased from 5 1/4in. to 6 1/2in. diameter and the stroke from 9in. to 10 inches. The engine had two speeds and the working pressure was 160psi. The No. 4 single-cylinder engine enjoyed much steadier sales as did the 6 ton roller built around the same boiler/cylinder. The No. 4 weighed 4 tons 17cwt empty and 5 tons 10cwt full.

The change from the No. 4 single into the No. 4 compound (4CD) was probably down to an enquiry from the North Eastern Railway for a slightly heavier engine with better fuel economy than the No. 4. Both could be achieved simultaneously by compounding. A compound cylinder, crankshaft, and motion were thus grafted on to a No. 4 tractor and the pressure increased to 180psi. Garrett pamphlet No. 538 lists the No. 4 CD as weighing 6 tons 10cwt empty and 7 tons 10cwt in full working order. The substantial increase from the 4 tons 17cwt (empty) of the No. 4 single to the 6 tons 10cwt (empty) of the compound must be down to more than just compounding, presumably the shafts and gearing were more substantial, negating the shortcomings of the bigger engines.

The stroke on the compound design remained 10in., with a 4 1/2in. HP bore and 6 7/8in. LP bore. The success of the modifications was marked, while the No. 4 used 4lb. coal per bhp/hour the No. 4CD used 3 1/4lb., a similar percentage saving being recorded in water consumption. An additional bonus was that if necessary, the 4CD could be pushed to manage a standard 54in. threshing drum whereas the No. 4 could not. The first 4CD built was Works No. 26063 completed in May 1907 and the last was No. 35225 which was built in 1928 and sold in 1929. A total of 514 were manufactured, a significant proportion being sold to the Ministry of Munitions during the First World War.

Superheat

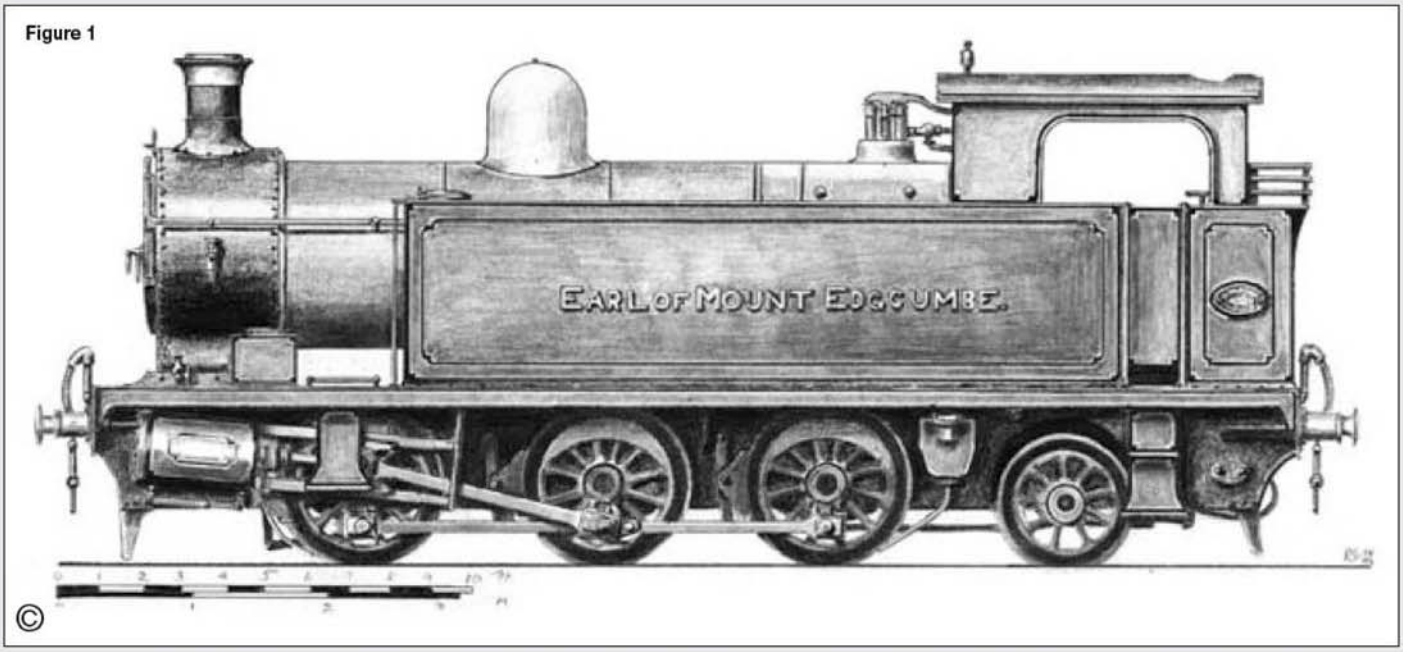
In common with other traction engine manufacturers, Garretts experimented with superheat with a view to increased economy. A number of portables and semi-portables were so equipped, in conjunction with piston valves which were better suited to the hotter and drier steam than slide valves. In 1907 a No. 6 engine, Works No. 26446, was fitted with an experimental smokebox superheater. The arrangement was in the form of banked return coils in the top half of the smokebox, directly above the top row of boiler tubes. To accommodate the superheater coils, the smokebox was extended upwards and fitted with a flat top. To accompany the superheater, the No. 6 engine was fitted with a new cylinder employing the piston valve. The compound engines proved more economical but were not popular on the home market and most were exported. However, happily 6nhp superheated engine No. 29764 survives in the UK (**photo 10**).

The square topped superheater smokebox was fitted to quite a few 4CD tractors, paired with a special compound piston valve cylinder. They were more successful on the home market and doubtless fuel and water economies were made, but Garrett's one time claim of a 20% fuel saving is probably somewhat optimistic.

Previous notes have included pictures of manufacturer's machine shops, so for a change some foundry and forge facilities have been included here. The pictures were taken post-steam engine production, but essentially both are unchanged. Next time we will look at Garrett steam rollers and steam lorries.

●*To be continued.*

Figure 1



EDWARDIAN ELEGANCE

Ron Isted

describes the Plymouth, Devonport & South Western Junction Railway and its six-coupled tank locomotives.

●*Part VIII continued from page 496 (M.E. 4220, 30 April 2004)*

Way out west in the wild wilderness around the border between Devon and Cornwall, the natives seem to have displayed a certain lack of unanimity in deciding the gauge of their railways. In addition to the 7ft. 0¼in. broad gauge South Devon Railway, the 4ft. 8½in. 'narrow' gauge London & South Western and their various satellites, there existed at one time or another the 'Dartmouth' gauge of 4ft. 6in., used by the Plymouth & Dartmoor line and the Lee Moor Tramway, the 3ft. 6in. gauge tracks of the East Cornwall Minerals Railway and Plymouth Breakwater Railway, a 3ft. gauge tramway at the North Devon Clay Company's Marland works near Torrington and even a 2ft. gauge line at the Wilmestone Quarry at Tavistock, while a little further east was the 4ft. 3in. Haytor line equipped with rails hewn out of solid granite! Although the Sutton Harbour branch in Plymouth was 4ft. 6in./7ft. mixed gauge and a fair amount of combined 4ft. 8½in./7ft. was necessary for interchange between the two major companies, the more exotically dimensioned systems were pretty isolated, which is probably just as well, as anyone who has attempted to lay mixed gauge 2½in./3½in./5in./7¼in. points will doubtless testify!

Onto this multi-gauge stage enter the Plymouth, Devonport & South Western Junction Railway, which opened its 4ft. 8½in. gauge line between Lydford and Devonport in 1890 and shortly afterwards bought out the 3ft. 6in. gauge East Cornwall Minerals Railway, thereby becoming the proud owner of a 30 mile system divided into two totally unconnected and incompatible chunks. To sort out this situation, which even by West Country standards was pretty silly, the PDSWJR called on the services of a young, somewhat eccentric, but highly capable engineer by the name of Holman Stephens, better known in later years to connoisseurs of (usually decrepit) light railways as Colonel Stephens, although he was in fact a Lieutenant Colonel. The son of a pre-Raphaelite painter, he was born in Hammersmith, West London, and suffered as badly as the Devon & Cornish natives from 'gaugeitis', being associated at various times with railways of 1ft. 11½in., 2ft. 3¾in., 60cm., 3ft., 3ft. 6in. and 4ft. 8½in. gauges.

As a sort of trial run for his future career, Mr. Stephens, as he then was, not only converted the PDSWJR's Cornish mineral line from 3ft. 6in. to the standard gauge of 4ft. 8½in., but also built a very elegant (and expensive) viaduct over the River Tamar, so that the two systems actually made contact with each other by means of a junction at Bere Alston, just across the border in Devon. On the Cornish side of his new viaduct, he installed a wagon lift to lower trucks the 112ft. to the river at Calstock Quay, to replace a 1 in 6 incline previously worked by a stationary engine, but the gradients elsewhere remained fierce, including a stretch of two miles at 1 in 38.

The original 'main' line of the PDSWJR had been worked by the London & South Western Railway since it opened, but for some reason, perhaps prodded by the enthusiastic Holman Stephens, the smaller company decided to work the new branch, officially known as the Bere Alston & Calstock Light Railway, with its own rolling stock. Of the two original East Cornwall 3ft. 6in. gauge locomotives, both 0-4-0 saddle tanks, one had been sold, but the second was successfully converted to a 4ft. 8½in. gauge 0-4-2ST, after which it pottered around Callington until it too was sold off shortly before World War One. Obviously something larger was required for both passenger and goods services on the new line, so the PDSWJR, placed an order for two 0-6-2Ts and one 0-6-0T with one of the oldest firms in the engine building business, R. & W. Hawthorn Leslie & Co. of Forth Banks Works, Newcastle-upon-Tyne.

The firm was founded by 21 year-old Robert Hawthorn in 1817, joined a year later by his brother William, his junior by three years; youthful entrepreneurs are not a recent phenomenon. At first, the brothers concentrated on marine engines, but built their first railway locomotive in 1831 and 20 years later at the Great Exhibition, the firm showed a locomotive fitted with an interesting variation of the Stephenson/Howe link motion in which the expansion link was about twice the usual length and connected directly to the valve spindle, while the eccentric rods were connected to the ends of a sort of outsize dieblock instead of to the ends of the link. The idea was to increase the bearing surface of the block and thereby reduce wear; it was also claimed to require less headroom under the boiler, an important consideration in the days when most locomotive designers considered a low centre of gravity essential.

Another invention of Robert Hawthorn's fertile brain was a new type of slide-rule which became very popular with the engineering fraternity; obviously the days of running round and round in ever-decreasing circles of specialisation until you disappear up your own exhaust pipe had not yet arrived. After merging with A. Leslie & Co. in 1885 and Robert Stephenson & Co. in 1937, the combined firm later became part of English Electric, and finally sank without trace into the faceless conglomerate of GEC Traction in the 1960s. The Newcastle Forth Banks Works had already closed and was later demolished, a sad end to a direct link with the earliest days of railways.

To return to the PDSWJR's new engines (**figs 1** and **4**), all three were officially designed by the makers and the two 0-6-2Ts, named *Earl of Mount Edgcumbe* and *Lord St. Levan*, were very similar to an 0-8-0T, rejoicing in the name of *Hecate*, supplied by Hawthorn Leslie three years earlier to another struggling concern associated with Holman Stephens: the Kent and East Sussex Light Railway. Two more slightly smaller 0-6-2Ts

Figure 2

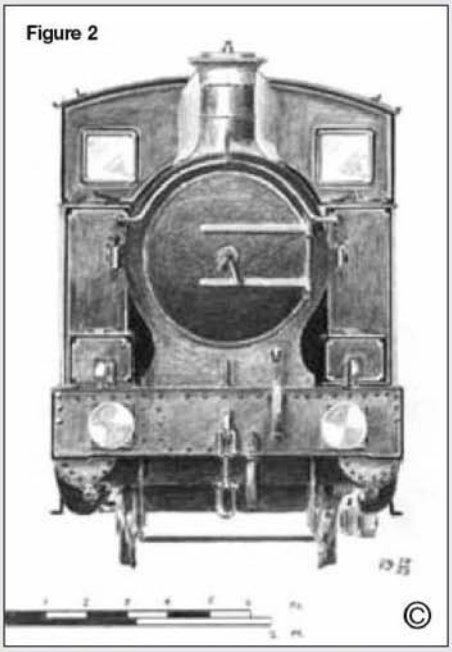
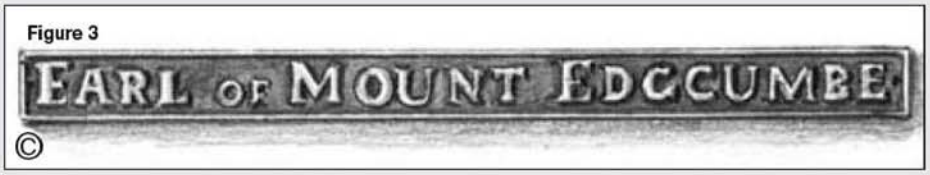


Figure 3



with equally exotic names, *Pyramus* and *Thisbe*, were built a few years later for yet another of Mr. Stephen's lines, the Shropshire & Montgomeryshire. While on the subject of names, the PDSWJR's new engines were of course painted and named at Messrs. Hawthorn Leslie's works at Newcastle and duly posed for the firm's official photographer. Incidentally, this gentleman, probably for reasons of space, elected to use a very wide angle lens, which nearly 100 years later has caused me a great deal of aggravation in scaling the drawings!

It was only after delivery 400 miles to Devon that the 0-6-0T was discovered to be masquerading as *H. S. Harris* instead of *A. S. Harris*: presumably somebody's handwriting or typing was illegible or inaccurate on the original order and I wonder who was responsible for the error? Was it a junior employee or could it have been Holman Stephens himself? We shall never know, but the Hawthorn Leslie official photograph was duly published in *The Locomotive* in May 1908 and no doubt caused some irritation to Mr. Harris; perhaps it is as well the engine wasn't named after a later member of that clan with the initials K. N., well-known to older readers of *Model Engineer*! I have failed to discover the identity of A. S. Harris, but the Earl of Mount Edgcumbe was chairman of the PDSWJR and Lord St. Levan a director, and both gentlemen were extensive landowners in the area.

I said that officially the design of the new locomotives was all Hawthorn Leslie's own work, but as such similar engines were supplied to other Stephens lines, I have my suspicions that Mr. Stephens may also have had a finger in this particular pie. Whether he did or not, the three PDSWJR locomotives were highly successful and lived to a ripe old age for railway engines — just under 44 years in the case of *A. S. Harris* and 49 and 50 years respectively for *Lord St. Levan* and *Earl of Mount Edgcumbe*. The smaller engine cost £1,920 and the two larger machines, £2,115 each, which averages out at about £1.20 a week over their working lives — not a bad investment,

Although the last 0-6-2T, *Earl of Mount Edgcumbe* was taken out of service as recently as December 1957, no works drawings of any of them appear to have survived, so the illustrations to this article have been scaled entirely from photographs, and even those are not exactly plentiful.

Two weight diagram sketches still exist, but they are visually very inaccurate; the smokebox saddle for example is shown with vertical sides, but as can be seen in the front elevation of *Earl of Mount Edgcumbe* (**fig 2**) it was in fact very elegantly 'waisted', not unlike those of the later locomotives on the Brighton line. For the same reason, I cannot give you a drawing of the valve gear, and I'm not even certain that it was Stephenson link motion, although it is highly unlikely to be anything other than a fairly standard version of that gear with locomotive type links. At least you have the compensation of drawings of two locomotives for the price of one, and I can tell you that the distortion produced by the use of a wide angle lens on the Hawthorn Leslie official photographs made scaling off very difficult, as the engines appear to be rather seriously bent, the front and rear facing in different directions, rather like those funny little fairground roundabout locomotives built, I believe, by Savages of Kings Lynn.

At this point, I can hear cries of *"Why bother?"* when so little information is available. The answer to that is they are extremely good looking locomotives, and perhaps more importantly, several commercially available designs and castings can be 'borrowed' to build a miniature version of either one of the 0-6-2Ts or the 0-6-0T, which was somewhat smaller and lighter than its cousins.

Taking the 0-6-2T first, in 3½in. gauge, there are several similarities to one of LBSC's most successful and popular designs, *Juliet* (in its original form, not the later version with outside Baker gear): the cylinders specified by Curly are exactly to scale for the 16 x 24in. of the full size *Earl of Mount Edgcumbe*, and similarly inclined. It is probable that the inside Stephenson valve gear of Juliet could also be incorporated into a miniature version of a PDSWJR 0-6-2T, but the distance from the cylinder centre line to the driving axle for *Juliet* is the equivalent of 12ft. 9in. compared to the 9ft. 8in. of the *Earl*, so it is much easier to steal these components from another excellent design, Martin Evans' 0-6-0T *Rob Roy*, in which the equivalent figure is 9ft. 5in. The only possible problem for disciples of Inspector Meticulous is the specification of launch type expansion links, which I very much doubt were used on the full size engine, but they do aid clearances and require smaller eccentrics, so I would not hesitate.

The driving and coupled wheels of the *Earl* and the *Lord* had 12 spokes and were 4ft. diameter, equal to 3in. in 3½in. gauge; *Juliet* or *Rob Roy* castings are correct size, but I am not certain about the number of spokes, as the original drawings in *M.E.* are silent on the subject: Reeves catalogue quotes 14, and Norman Spink has just counted his over the phone for me: 13! The radial wheels are equal to 2¼in., with 9 spokes, and LBSC's *Doris* bogie wheels should do nicely, though whether the full size engine was fitted with a pony truck or a radial axlebox is impossible to tell from photographs: my guess is the latter.

The boiler on the 0-6-2Ts scales off at 4ft. 6in. diameter over cladding with Belpaire firebox and Martin Evans' design for his *Ivatt* 2-6-0 (parallel version) described in *M.E.* 3832, 2 September 1989 appears to be tailor made for the job, both in diameter and in overall length.

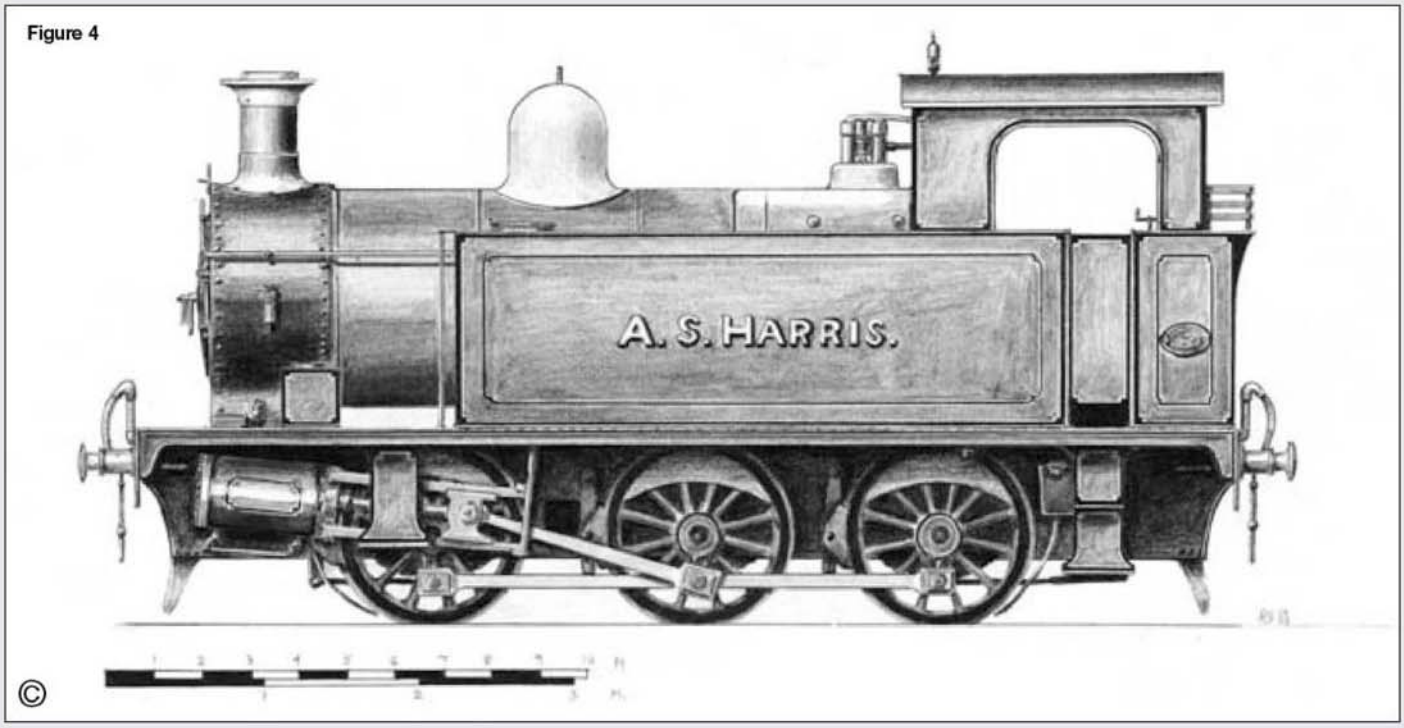
Moving on to 5in. gauge, the wheel castings for Martin's popular *Simplex* have the correct 12 spokes, but would need to be turned down an eighth of an inch below the specified diameter of 4⅜in. although the balance weights are the correct pattern for our PDSWJR 0-6-2T. Suitable cylinders are not quite as simple as in the smaller gauge, as the bores of most published designs are much larger than we require, but Neville Evans' *Jones Goods* castings could probably be utilised, being the equivalent of 17in. diameter, rather than the 16in. we need. The overall diameter of the boiler in this scale should measure 4 25/32in. if my calculations are correct, but I don't think even Bill Carter would have objected if we round this down to 4¾ inch! Another of Martin's boiler designs, this time for the GWR 2-4-0T *Metro*, could be used as a basis for our 0-6-2T, although the barrel would need to be lengthened by about 10%; not enough to warrant a change in tube diameter.

When we come to 7¼in. gauge, the wheels and cylinders for *Holmside*, described in *M.E.* from April 1977 by Martin Evans, should be suitable, except that a little doctoring of the balance weights will probably be necessary. The overall diameter of the boiler for the PDSWJR 0-6-2T in this gauge works out at 6¾in., including cladding, and the nearest appears to be that for *Dart*, the GWR 0-4-2T, though again the barrel would have to be lengthened.

The PDSWJR 0-6-0T *A. S. Harris*, as already mentioned, was a smaller and lighter engine, with cylinders 14 x 22in. and 3ft. 10in. diameter wheels, although the boiler appears to be the same overall diameter, i.e. 4ft. 6in. over cladding, but is of course shorter. For a miniature version, most of the remarks regarding the 0-6-2Ts apply, but in 7¼in. gauge, I had hopes of using the cylinders for Martin Evans' 0-4-0ST *Singapore*, the prototype of which was also built by Hawthorn Leslie. Unfortunately, the stroke on Martin's version is exactly scale to the 18in. of the full size engine, so I fear the castings will not be long enough. An alternative is not to use castings at all, but to fabricate the cylinders and excellent articles on this topic have appeared over the years, two of the best being a brief series by Don Young starting in *M.E.* 3462, 6 April 1973 and a pair of articles by Fred Cottam starting in *M.E.* 3891, 15 February 1991.

One of the many attractive features of the Plymouth, Devonport & South Western Junction locomotives was their colour scheme, although it is only fair to warn you that the inverted corners to the lining are a complete pain in the posterior to draw on paper with a pencil, never mind on sheet metal with wet paint! As originally turned out, the basic colour was a rich dark blue, lined in black, edged each side with a fine red line; the edges of side tanks, bunker, cab side, cab front and rear, cab door, sand boxes, footsteps, cylinders and bottom edge of main frames were also black with a red line between the black and the blue. All corners, except the lower edges of the footsteps, were inverted as shown on my drawing; I make the total approximately 396, so good luck. Boiler bands were black with a fine red line on either side, while wheels were blue with black tyres, the centres being black outlined in red, but with an additional black circle around

Figure 4



the outside edge of the wheel centre also outlined in red — and if you are not confused by now, you're a better man than I am.

The PDSWJR running numbers 3 (*A. S. Harris*), 4 (*Earl of Mount Edgcumbe*) and 5 (*Lord St. Levan*) were carried only on the buffer beams at front and rear and despite published statements to the contrary, there is photographic evidence to show they were carried until the LSWR takeover in 1922. The chimney was copper-capped, and according to Don Bradley (see references), the dome, safety valve base and cab window frames were polished brass, although this does not appear to be the case on any of the half dozen photographs I have of the engines before the LSWR took over the company.

At first, the names were painted in gold on the tank sides as shown in figs 1 and 4, but shortly before the First World War cast brass plates were substituted (**fig 3**); fortunately Mr. Harris' initial had been corrected before this decision was taken, and the safety valves were enclosed in brass casings at about the same time. The PDSWJR directors also decided that their locomotives should in future be painted the same brilliant emerald green with black and white lining as those of the LSWR; this made sense, especially as Eastleigh works had agreed to supply the paint, probably for nothing.

Now, in order to explain the next rather startling development in PDSWJR colour schemes, I'm afraid I need to indulge in a brief lesson in railway geography on the Devon/Cornwall border. There were then two routes between Lydford & Plymouth: the LSWR via Bere Alston which, as we have seen, was actually owned by the Plymouth, Devonport & South Western Junction Railway, and the line via Yelverton owned by the Great Western. No love was lost between the two companies and tales were told for many years in the local hostelries of dastardly doings by both lines to poach customers from the rival concern.

Surely the most audacious and spectacular effort must be the appearance one May morning in 1914 of the PDSWJR's 0-6-0T *A. S. Harris* newly repainted in middle-chrome green complete with black and orange lining looking for all the world as though it had just emerged from Swindon! The Great Western effect was emphasised by the brass name-plate with lettering similar to that used by the Wiltshire works, not to mention the existing copper-capped chimney, although whoever perpetrated the deed stopped short of painting Great Western on the side-tanks. How this came about is lost in the mists of time, but happen it certainly did, as I have a photograph of *A. S. Harris* in the rival company's colour scheme. One wonders what Mr. Harris' reaction was — or was he the mastermind behind the crime as a revenge for the fiasco of the original mistake in his initials?

The two 0-6-2Ts were duly outshopped in South Western colours and *A. S. Harris* finally followed suit, but this engine (or its namesake) must have had a really obstinate streak, as the background to its nameplate was orange while its two larger cousins used a very bright red. When the South Western finally took over the PDSWJR in 1922, the letters LSWR were painted on the side tanks above the nameplates and the numbers 756, 757 and 758 allocated to *A. S. Harris, Earl of Mount Edgcumbe* and *Lord St. Levan* respectively. Incidentally, there is confusion over the works numbers: according to Hawthorn Leslie the builders, they were 2695, 2697 and 2698 in the order shown above, but in later years, those of the 0-6-2Ts were reversed, although a hand-written caption to a photograph supplied to me by the National Railway Museum shows the number of the *Earl* corrected to the original. A minor eccentricity is the punctuation on the builder's works plates (**fig 5**): one would normally expect a full stop after the R (as there is one after the W), and a comma after Hawthorn, and why the two dots under the td of Ltd? Messrs. Hawthorn Leslie's works plates are in fact strangely inconsistent; some do have the comma and some even have full stops not only after the R, but also after the words Engineers and Newcastle upon Tyne for example.

A detail alteration to the two 0-6-2Ts around the time of World War One was the cutting of a square opening in the cab side sheets; these appear from photographs to have been fairly useless as a look-out as they were far too small and by the time of the formation of the Southern Railway in 1923, they had been suppressed. The new owner's colour scheme did not appear until 1926, on the 0-6-0T, followed a year later by the two 0-6-2Ts: the word Southern was in expanded Egyptian style serif lettering on the side-tanks above the nameplate and the running number below it in plain sans-serif numerals with, until 1931, a very small letter E (for Eastleigh) just above them. Both lettering and numbers were in middle-chrome yellow and unshaded. The works plates remained in their original position on the bunker side.

A tribute to the excellence of the 0-6-2Ts was the submission in 1926 by Messrs. Hawthorn Leslie, at the request of the Southern Railway, of tenders for the construction of six brand new locomotives in a superheated version, but otherwise to the original design, now nearly 20 years old. These were required for the newly opened North Devon & Cornwall Junction Light Railway between Torrington and Halwill Junction, part of which utilised the track bed of the 3ft. gauge Marland line mentioned in the opening paragraph, and various other duties on what later became infamous as the Southern's 'withered arm'. Unfortunately, Harold Holcroft, one of the Chief Mechanical Engineer's assistants, discovered that not only did the Southern have a surplus of pony trucks acquired a year earlier as part of a job lot from Woolwich Arsenal, but some of the ex-Brighton Railway Stroudley 0-6-0Ts were also surplus to current requirements, so he put pen to paper and the result was the Elr 0-6-2Ts at a cost considerably less than new construction. A pity really, as I would love to have seen a Hawthorn Leslie locomotive dashing down the line from Barnstaple Junction at the head of a section of the 'Atlantic Coast Express'.

Although *A. S. Harris* left the West Country as early as 1929, the two 0-6-2Ts remained on their native heath until the mid-1950s and both were always well maintained and well cared for. Early in 1941, *Lord St. Levan* was repainted in unlined dark green with the Bulleid 'sunshine' lettering, and later the same year its twin was turned out in black relieved only by the same style of lettering. After nationalisation in 1948, both 0-6-2Ts were renumbered as 30757 and

Figure 5

30758 and painted in the lined black scheme for secondary passenger locomotives.

A small detail which to me is somehow symbolic of the early years of the state-run railway system, was the repositioning of the nameplates of *Lord St. Levan* lower down the tank side in order to make room for that gruesome 'constipated lion' device to be applied in the exact place decreed by the men in grey suits at the Railway Executive HQ at Marylebone, aka *The Kremlin*. When the locomotive was repainted two years later, someone actually had the sense to realise that the BR totem could be placed at the correct height in front of the nameplate's original position, so it was duly moved back again! I wonder how much taxpayer's money, not to mention the amount of Railroad Esperanto from the lads who actually did the job at Eastleigh Works, was expended on this totally futile exercise?

To end on a happier note, it is still possible to travel over part of the Plymouth, Devonport & South Western Junction line from Plymouth as far as Gunnislake, one of the few remaining sections of the London & South Western's former extensive network in the West Country. I can highly recommend it, not only for its scenic attractions, but also for probably the best view from anywhere of Brunel's Royal Albert Bridge at Saltash.

Plymouth, Devonport & South Western Junction Railway
Useful Dimensions

Note: these are intended specifically for use in producing a miniature version of these locomotives, so 'internal' measurements such as heating surface and boiler dimensions are omitted. The figures for 3½in. and 5in. gauges have been calculated to the nearest 1/64in., using ¾in. to the foot and 1 1/16in. to the foot respectively. For gauge 1, halve the 3½in. gauge figures, for 2½in. gauge, halve the 5in. gauge figures, for 7¼in. gauge, double the 3½in. gauge figures. Figures prefixed by ≈ are approximate only and should be treated with caution due to distortion on the original photographs (see text).

0-6-2Ts *Earl of Mount Edgecumbe* and *Lord St. Levan*

Description	Full Size	¾in. scale (3½in. gauge)	1 1/16in. scale (5in. gauge)
Length over buffers	31ft. 5in.	23 9/16in.	33 3/8in.
Length of main frame	≈28ft. 10in.	21 5/8in.	30 5/8in.
Height to top of chimney	12ft. 4in.	9 1/4in.	13 7/64in.
Height to top of whistle	12ft. 7 3/4in.	9 31/64in.	13 7/16in.
Height to top of cab roof	11ft. 10in.	8 7/8in.	12 9/16in.
Maximum width over footsteps	8ft. 6 1/2in.	6 13/32in.	9 5/64in.
Width over cylinders	8ft. 4in.	6 1/4in.	8 55/64in.
Width over cab	8ft. 1in.	6 1/16in.	8 19/32in.
Height to top of footplate	≈4ft. 3in.	3 3/16in.	4 33/64in.
Locomotive wheelbase, total	16ft. 9in.	12 9/16in.	17 51/64in.
Divided into	5ft. 9in.	4 5/16in.	6 7/64in.
	5ft. 3in.	3 15/16in.	5 37/64in.
	5ft. 9in.	4 5/16in.	6 7/64in.
Diameter of driving/coupled wheels	4ft 0in.	3in.	4 1/4in.
Diameter of radial wheels	3ft. 0in.	2 1/4in.	3 3/16in.
Pitch of boiler	7ft. 6in.	5 5/8in.	7 31/32in.
External diameter of smokebox	≈5ft. 0in.	3 3/4in.	5 5/16in.
Diameter of boiler over cladding	≈4ft. 6in.	3 3/8in.	4 25/32in.
Visible length of smokebox	≈2ft. 11in.	2 3/16in.	3 3/32in.
Diameter of smokebox door	≈4ft. 0in.	3in.	4 1/4in.
Height of chimney above cladding	≈2ft. 4in.	1 3/4in.	2 31/64in.
Cylinder bore	1ft. 4in.	1in.	1 27/64in.
Piston stroke	2ft. 0in.	1 1/2in.	2 1/8in.
Length of connecting rod	≈6ft. 1in.	4 9/16in.	6 15/32in.
C/L cylinders to C/L driving axle	≈9ft. 8in.	7 1/4in.	10 17/64in.
C/L of motion inclined at	≈1 in 12½		

0-6-0T *A. S. Harris*

Length over buffers	25ft. 7in.	19 3/16in.	27 3/16in.
Length of main frame	22ft. 11in.	17 3/16in.	24 11/32in.
Height to top of chimney	≈11ft. 7 1/4in.	8 45/64in.	12 21/64in.
Height to top of whistle	12ft. 5in.	9 5/16in.	13 3/16in.
Height to top of cab roof	11ft. 6 1/2in.	8 21/32in.	12 17/64in.
Height to top of footplate	≈4ft. 1 1/2in.	3 3/32in.	4 25/64in.
Length of cab	≈6ft. 2in.	4 5/8in.	6 35/64in.
Locomotive wheelbase total	10ft. 6in.	7 7/8in.	11 5/32in.
Divided into	5ft. 6in.	4 1/8in.	5 27/32in.
	5ft. 0in.	3 3/4in.	5 5/16in.
Diameter of driving/coupled wheels	3ft. 10in.	2 7/8in.	4 1/16in.
Pitch of boiler	6ft. 10in.	5 1/8in.	7 1/4in.
External diameter of smokebox	≈4ft. 10 1/2in.	3 21/32in.	5 11/64in.
External diameter of boiler over cladding	4ft. 6in.	3 3/8in.	4 25/32in.
Visible length of smokebox	≈2ft. 6in.	1 7/8in.	2 21/32in.
Diameter of smokebox door	≈4ft. 0in.	3in.	4 1/4in.
Height of chimney above cladding	≈2ft. 4in.	1 3/4in.	2 31/64in.
Cylinder bore	1ft. 2in.	7/8in.	1 1/4in.
Piston stroke	1ft. 10in.	1 3/8in.	1 61/64in.
Length of connecting rod	≈5ft. 0in.	3 3/4in.	5 5/16in.
C/L cylinders to C/L driving axle	≈9ft. 2in.	6 7/8in.	9 47/64in.
C/L motion inclined at	≈1 in 12½		

Dimensions indicated thus ≈ have been scaled from a drawing or photograph.

References

1: *The Locomotive*: 15 March 1907 (courtesy I. Mech. E. Library). Outline drawings of 0-6-2T and 0-6-0T, the latter with dimensional inaccuracies, together with description of line and photograph of Tamar viaduct under construction.

2: *The Locomotive*: 15 May 1908 (courtesy I. Mech. E. Library). Hawthorn Leslie's official photographs of *H. S. Harris* (*sic*) and *Earl of Mount Edgcumbe* together with main dimensions.

3: Outline Weight Diagrams:
NRM ref. 2/GW/17685; Southern Railway 756 *A. S. Harris*: gives useful dimensions, but draughtsmanship is not accurate. Some unknown hand has altered the name back to *H. S. Harris*!
Southern Railway 757 *Earl of Mount Edgcumbe* and 758 *Lord St. Levan*: Philip Atkins at the National Railway Museum kindly unearthed this for me, but it carries no reference number and suffers from the same inaccuracies as the drawing of 756.

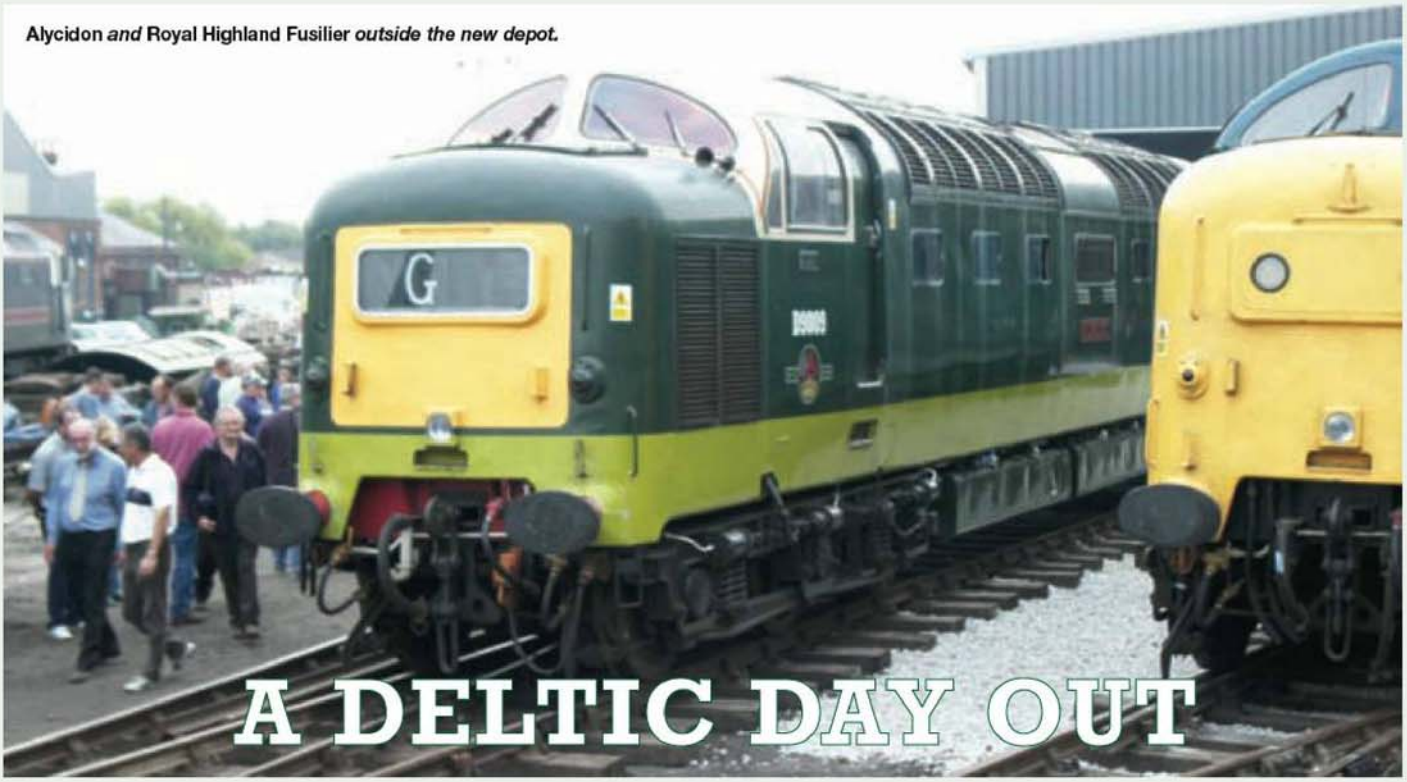
4: Hawthorn Leslie official photograph of *Earl of Mount Edgcumbe*; as mentioned in the text, the use of a wide angle lens has led to noticeable distortion, but it is still a superb picture. Copies are available from both the National Railway Museum (Negative No. 477184) and also from Tyne & Wear Archives Service, Blandford House, Blandford Square, Newcastle upon Tyne NE1 4JA. The official photograph of *A. S. Harris* seems to have disappeared.

5: Photographs from John Alsop collection: one of *A. S. Harris*, three of *Earl of Mount Edgcumbe*, all pre-1922, photographers not known.

6: *Locomotives of the Southern Railway Part 1*: Don Bradley, published Railway Correspondence & Travel Society, 1975. Excellent case histories of all three locomotives, lists of dimensions etc., and four photographs of them in later life.

7: *Britain's Light Railways*: M. Smith, published Ian Allan, 1994: includes history of Bere Alston & Calston Light Railway, and an excellent photograph by Rixon Bucknall of both 0-6-2Ts.

●*To be continued.*



Alycidon *and* Royal Highland Fusilier *outside the new depot.*

A DELTIC DAY OUT

Tim Marfell
presents some highlights of a day at Barrow Hill Roundhouse organised by the Deltic Preservation Society.

A logical extension of a railway enthusiast's hobby is to join one of the many railway preservation societies in the UK. Most are for steam enthusiasts, but for 'petrol heads' what could be better than The Deltic Preservation Society? With over 900 members this society exists primarily to maintain its three Deltic locomotives: *Royal Highland Fusilier, Alycidon* and *Tulyar*. When in service with British Rail these beasts were the most powerful locomotives to grace the UK rail network.

Like anything mechanical, these locomotives need a lot of work to maintain them in top working order, and this requires space. The society has been fund-raising for some time now and has managed to build its own facility to store all three locomotives and space for all the spares they come with. Saturday 20 September 2003 was all about the culmination of a dream — the new shed was to be officially opened to the membership.

It is a large modern building with three 'roads' and space at the side for workshops, crew facilities and mess room. At present only the shell has been completed, the rest will come in time and as funds allow. The DPS has recently attained charitable status, which will benefit the society enormously and was helped by the society's aim of opening the depot to the general public with the objective of educating visitors in the role played by the diesel engine in modernising rail transport in this country.

A great deal of planning went into the day, with static displays from enthusiasts. These displays included nameplates and various other items of Deltic memorabilia. Several model Deltics were also on display, ranging from '0' gauge up to 5in. gauge. The DPS had its own stand from which gifts, keepsakes and models were sold to raise funds for the society.

The Napier Power Heritage Trust had a stand to promote Napier Power. The Deltic locomotives are powered by two 18-cylinder Napier Deltic engines, from which the class draws its name. However, Napier engines have been around for a long time, and not just in railway engines. A marine version of the Deltic engine has been installed in fast motor launches, primarily for military use, and although not built these days, their history is well documented. Napier also built car engines, very successfully, including the Napier Special *Golden Arrow* which successfully attained the world land speed record in 1929 by reaching 231.36mph.

A privately owned 1960s racing car was also on display, a modified Bentley 8 litre chassis that was married to a 24 litre Napier *Sealion* engine. This awesome and incredibly noisy beast produces 470hp at 2000rpm with 1250ft.lbf. of torque available.

A 5in. gauge model of *Deltic*, the first prototype was on display. Built by Mr. Brian Waite this fabulous piece of work took 10 years to build, involving some 8,000 man hours. All the patience and hard work paid off as it was awarded a Gold Medal and the Charles Kennion Trophy at the Model Engineer Exhibition in London. The detail is absolutely superb, even down to dog ends in the driver's ashtray at No. 1 end.

The original prototype Deltic.

A working model Deltic locomotive.

Alycidon *alongside a spare power plant on a truck.*

Front view of prototype Deltic

Clen Tomlinson's 18-cylinder marvel.

Royal Highland Fusilier *revs up.*

Another model making marvel on display was a 1:8 scale model of an 18-cylinder Deltic engine. Built over 2 1/2 years by Mr. Clen Tomlinson, this 160cc model turns over, but as yet lacks the ignition source to run. The ignition unit is the big step to allowing the engine to run and is Mr. Tomlinson's ongoing project.

The real prototype *Deltic* has been very generously loaned to the society by The National Railway Museum in York and was on display in the shed throughout the day. Although in fine condition and capable of being towed from York to Barrow Hill, the power units are no longer functioning. As I understand it, the NRM has no plans bring these back to working order, so *Deltic* will remain a static exhibit. The DPS will keep the prototype to enable a full engineering survey to be carried out prior to returning it to the NRM in York.

Having had a good look around inside it was time to get outside to 'Roundhouse Halt', Barrow Hill's own station. From here trips were being made up the line for half a mile or so in two carriages topped and tailed by *Alycidon* and *Royal Highland Fusilier*. A brief trip perhaps, but a superb photo opportunity for enthusiasts. Once finished with the joyriding, many of the exhibits were on view in the Barrow Hill Roundhouse itself which provided a welcome interlude until the barbecue and beer tent opened.

For the modern image rail enthusiast this was a superb day out, offering plenty to feast the eyes on with static model displays, memorabilia, static locomotive displays and locomotive movements including the train rides.

Anyone interested in the society or just wanting more information may wish to visit the website at **www.thedps.co.uk**

One of the spare Deltic power plants.

Brian Waite's miniature masterpiece in 5in. gauge.

The project to be described. The milling cutter adaptor at the top of this group is shown with its draw bar, spindle plug and nut.

A set of three-flute cutters ideal for use with the adaptor described. These cutters can be used for both end milling and slot drilling operations.

SETTING UP THE CLARKE CL300M LATHE
SMALL MILLING CUTTER ADAPTOR

Neil Wyatt

Introduces milling in the small lathe.

●*Part III continued from page 637 (M.E. 4222, 28 May 2004)*

A simple milling cutter holder and a draw bar to match is a simple project and an excellent introduction to cutting threads and simple turning. In turning, the work revolves and the tool is held against it. In milling it is the cutter which rotates, hence the ability to carry out milling operations in the lathe doubles its applications. There are two approaches, either the work can be held in the chuck and the tool mounted in a milling spindle mounted on the toolpost, or the cutter can be mounted in the lathe mandrel and the work mounted on the cross-slide. This and the next article look at the latter approach. This first one deals with mounting the cutters, and the next at mounting the work.

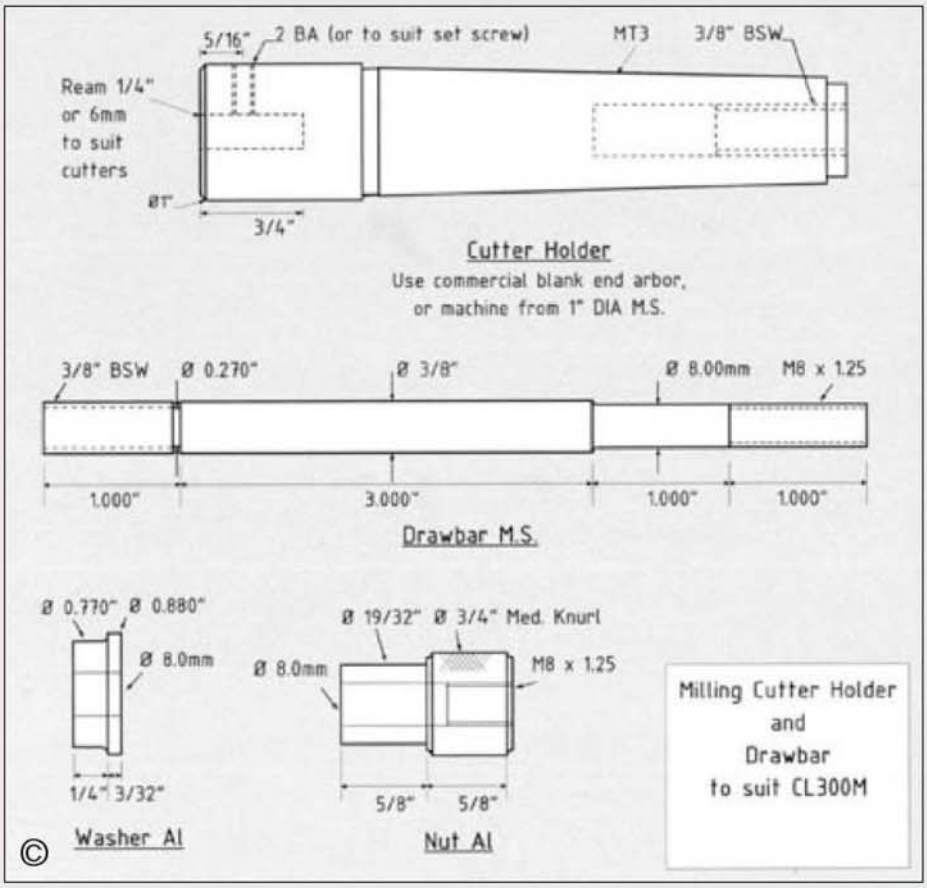
While it is possible to hold milling cutters in the chuck, a proper cutter holder gives much better results. Many cutters have a shank threaded to fit special collets, but the smaller sizes are available with plain shanks. These are usually 6mm dia. for metric sizes and 1/4in. dia. for imperial sizes. These are precision tools and should be held in a holder that matches their accuracy. It is not difficult to make one of these from a suitable 'blank arbor'. MT3 arbors to fit the lathe mandrel taper, with easily machined 1in. or 7/8in. dia. spigots are readily available.

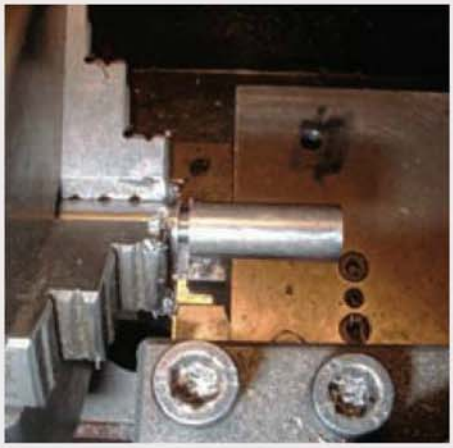
Chuck body

With a little care it is possible to achieve an accurately centred hole which is a close sliding fit for the cutters. Check that the lathe is switched off; remove the chuck from the lathe by unscrewing the three 6mm nuts, and clean out the taper in the end of the mandrel with a tapered piece of wood, *definitely not* your finger. The MT3 arbor should slip in securely, with a gentle twist to lock it in place. Now use the tailstock drill chuck to make an accurate hole in the end of the arbor to suit your milling cutters.

Start with a well-lubricated centre drill followed by an intermediate drill to full depth. Minimising the extension of the tailstock barrel and 'almost locking' its movement both help to get a good result. Then drill undersize by several thousandths of an inch before reaming to the exact size. For 1/4in., letter C is ideal, or 15/64in. at a pinch. If you would prefer to use metric cutters, then you will need to aim for a final size of 6mm instead. Reaming needs care. Look for good tailstock alignment, the right amount of material to remove, speed about half that for drilling, and some cutting fluid. A brush or oil can be used to apply the fluid, you do not need a continuous flow. Make the cut with steady pressure. *(For optimum accuracy, the hole should be drilled approximately 1/32in. undersize and then bored to reaming size with a single point boring tool prior to reaming. The boring tool will remove any eccentricity in the hole introduced by drill run-out and enable the reamer to cut to size — Ed.)*

If you have no suitable reamer, you can make a D-bit from a piece of 1/4in. dia. silver-steel ground as shown in the accompanying sketch, then hardened and tempered, and the tip lightly re-ground. In use, a D-bit works like a slow drill. Keep it well lubricated, feed it in slowly, and it will produce a remarkably accurate hole.

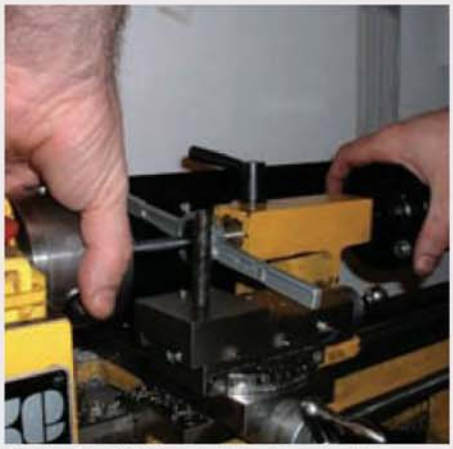




Using a parting tool to create a run-out groove prior to screw cutting.

The gear train set up for screw cutting 16 threads per inch.

Making the first pass with the screw cutting tool. Note the tailstock support.



Cutting the M8 thread with a die using the tailstock to ensure that the thread is true.

Controlling drilling depth by using a piece of insulating tape as a marker.

Knurling using a caliper type knurling tool. This tool relieves the lathe of excessive knurling loads.

To lock the cutters in place, a radial hole for a grub screw is needed. This screw engages with a flat on the shank of the milling cutter. I chose 2BA as I had a suitable grub screw to hand; you may wish to use M5. Drill the hole on the drill press with the arbor held in a vice. A centre pop will help ensure the drill does not 'skid' on the surface.

Drawbar

Milling cutters tend to 'grab' more readily than drills, pulling the taper from its socket with disastrous results for the work and the cutter. The solution is a drawbar — a rod screwed into the end of the holder and pulled up against a stop at the far end of the mandrel. My original drawbar was a horrid bit of 3/8in. dia. studding and a nut in a plastic holder scavenged from my daughter's stair gate. I thought I should do the job properly for readers of this august journal.

My arbor was threaded 3/8in. BSW (an obsolete, and hence regularly encountered thread), so I began with a 6in. length of 3/8in. dia. rod. Without an appropriate die, I had to cut a suitable thread on the lathe. Before cutting the thread, the end is drilled from the tailstock chuck to put a 60deg. centre hole in the end of the bar. Now extend the bar a few inches and support it with a centre in the tailstock — don't forget a drop of oil or a spot of grease in the centre hole if you are using a fixed centre. This will keep the screwcutting tool well away from the chuck, just in case you are slow at stopping the feed. Screwcutting is also less nervewracking if you cut a groove into which the cutting tool can run. 3/8in. BSW uses the 55deg. Whitworth thread form to a thread depth of 0.040in., so use a small parting tool to cut a groove slightly deeper that this.

The standard 'imperial' leadscrew on the CL300M is 16 threads per inch (tpi), so to cut a 16tpi thread means the leadscrew must make one turn for each turn of the mandrel. A table on the lathe suggests we use a 40:65:40 train of change wheels. The 65 is an 'idler' and could be any convenient value; what matters is that the two end wheels are the same i.e. a 1:1 ratio. To change from the 'standard' slow feed you will need to reverse the collars on which two of the gears turn, and adjust the spacing. The gears should mesh easily and turn without excessive noise.

A suitable tool needs to be ground to a 55deg. profile. This is a standard size, but watch out for 60deg. metric or UNF cutters. It is not difficult to grind your own cutter offhand, but be sure to get the tip to the right angle and reasonably well aligned with the tool shank. You can use a suitable screw thread as a template for the cutter, or a commercial screw thread gauge. After screw cutting nearly to depth, to get a fully formed Whitworth profile, you should use a special form tool called a chaser to round off the top of the threads. I used an ordinary knife tool to take just 4 thou off the diameter, and polished the job off with a piece of Scotchbrite pad. Check the fit of the thread in the end of the arbor *before* altering any settings, in case you need to take a few more cuts.

I have not mentioned the screwcutting index wheel. Since we are cutting a 16tpi thread using a 16tpi leadscrew, it does not matter when you engage the clasp nut — it will always be okay. However, for other pitches, you should consult the table in the manual or the chart on the lathe itself which will indicate a set of index numbers at which you can engage the clasp nut for any given pitch of thread.

Now reverse the drawbar end for end and reduce the last 2in. to a shade under 8mm diameter; this will make cutting the M8 thread slightly easier. For this and several other cuts on this job I used a tool with a radius of about 1/16in. ground at the tip. The result is a gently rounded shoulder at the end of the cut, rather than a sharp square one. To make it easier to start the die, put a slight chamfer on the end of the workpiece. In the old days you might have chosen to do this with a few careful strokes of a file, but it is safer to make a light cut with an angled tool bit.

The next job is to cut a thread on this reduced section, for which I used an M8 die. If you do this 'freehand' with the work held in a vice the thread will probably turn out rather wobbly or 'drunken'. The ideal solution is a tailstock die-holder, but for the time being there is a satisfactory 'bodge'. Remove the tool-holder from the top-slide to make some space and secure the tailstock so that the spindle is close to the end of the workpiece. Fit the die in an ordinary die holder, and disconnect the lathe. Position the die ready to cut the thread and wind the tailstock spindle forward so it gently pushes on the die holder. Now turn the chuck using one hand and advance the tailstock spindle using your other hand. One arm of the die holder will rest on the top-slide and you will start to cut a thread. The skill is to match the fairly hefty turning force needed on the chuck with gentle pressure from the tailstock. You may be surprised at how good the results are! Cut 1in. of thread.

Tapping the draw bar nut using a tap mounted in the tailstock drill chuck to ensure correct axial alignment.

Using the milling cutter adaptor to machine a small component mounted on the rotary table located on the lathe's cross slide.

Spindle plug

The next item is a simple plug to fit the end of the mandrel, 'though the diameters are fairly critical. The plug must be an easy fit in the mandrel, with a larger shoulder, which just fits through the hole in the lathe's gear cover. The rounded tool is useful as the end of the mandrel has a slight internal chamfer and the curved shoulder fits this nicely.

Nut

The final item is the nut. Start with a slightly over-length piece of 3/4in. dia. round stock. I used aluminium alloy for this job, though brass or mild steel would be better. Face the end and turn down the shank of the nut. Start a hole with a centre drill and drill right through tapping size for an 8mm thread (7.1mm, letter K, or 9/32 inch). Now open out the bore to 8mm for roughly half its depth — I use insulation tape around the drill bit as a depth gauge. Lightly chamfer the sharp edges.

Reverse the nut end-for-end in the chuck and face it smooth. Once again, unplug the lathe. Grip an 8mm tap firmly in the tailstock chuck and, turning the chuck by hand, tap the nut. Now assemble the plug and nut onto the drawbar, and grip the drawbar in the chuck to allow you to knurl the nut. If you have no knurling tool, the hole for a tommy bar alone will be fine.

The secret of a good knurl is to start with light pressure, so the pattern has a chance to establish itself properly and thus avoid the dreaded 'bastard knurl'. Once the pattern is established, move the tool slowly from side to side and gently increase the pressure until it cuts its full depth. On a lathe the size of the CL300M I advise using a caliper type knurling tool as shown here. The sideways force associated with other types will do no favours to a small lathe, no matter how robustly it is built.

Finally, use that rounded tool again to trim off the first 1/16in. or so of pattern from each end of the knurl, and get a truly professional result.

Assembly and use

You are now ready to set up a milling cutter. Fit one into the holder, and lock it in place with the grub screw. Remove the chuck and check the taper socket is clean with that bit of wood. Push the taper into the socket with a gentle twisting motion — aim for a secure fit that will not pull out with a gentle tug, but do not force it in or use anything other than finger pressure. Insert the drawbar through the back end of the mandrel, and screw it into the holder. Assemble the plug and nut onto the drawbar, doing them up securely, sufficient to stop the taper slipping under vibration or if the cutter 'grabs' the work.

You can now practise milling material held in the toolpost. But, to realise the true potential of the lathe for milling, you need a vertical slide. In the next instalment of this series, I will cover the attaching and setting up of a vertical slide, and some simple accessories and techniques for milling on the CL300M.

●*To be continued.*

ELECTRONIC BOILER CONTROL FOR A MODEL BOAT

John Schofield

describes the trials and tribulations of developing a boiler control system for a model boat.

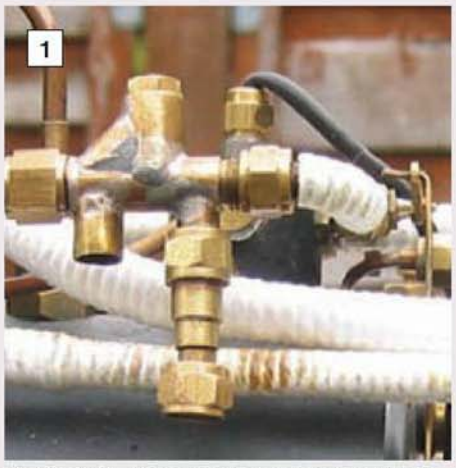
I started building the twin propeller version of the Caldercraft tug kit, *Imara*, using two production Cheddar Models *Gemini* engines with water pumps and *Proteus* boiler with superheater. Fuel for the ceramic burner was a 70/30 mix of Butane/Propane gas. The plant was mounted with all associated items, including the Cheddar Models ABC unit (Automatic Boiler Control) on a single light alloy plate. De-mineralised water supply was from two 0.7 litre tanks alongside the boiler and a similar sized bilge tank.

When purchased, the 'handed' engines had 'handed' water pumps whose vertical axes were at 90deg. to the axis of the cylinders. Space restrictions between the engines meant that the pumps had to be out-board of the engines. As a result, fitting and maintenance of the steam plant assembly in the hull was difficult. Later, Cheddar Models pumps were modified to bring their axes to align with that of the cylinders.

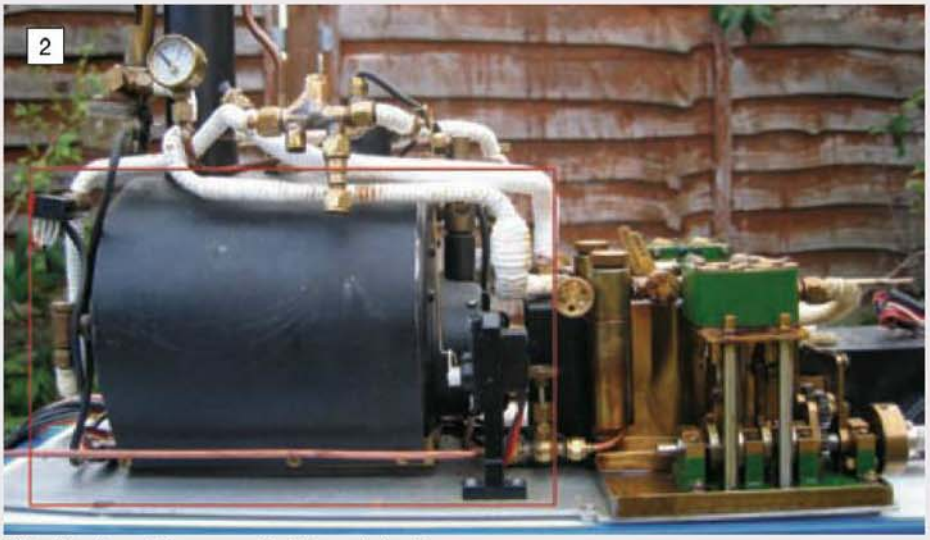
At the Donington Engineering Exhibition in October 1999, I was introduced to D.A.G. (Derek) Brown on the SMEE stand. He was about to publish a series of articles in *Model Engineer* on the theory and manufacture of injectors ranging in size from 4 to 26oz./minute. These figures describe the rate of supply of water into the boiler. I was very fortunate to be given an 8oz./min. (0.23 litres/min) injector (**photo 1**) by Derek who was particularly interested to learn of my progress. He felt that if I was successful, the system principles could possibly be applied to small gauge locomotives.

The advantages of using an injector included greatly simplified pipework which resulted in more space in, and easier access to the hull. A further advantage was that the engines would not have to cope with a sudden load from the pumps when the ABC water by-pass valve closed.

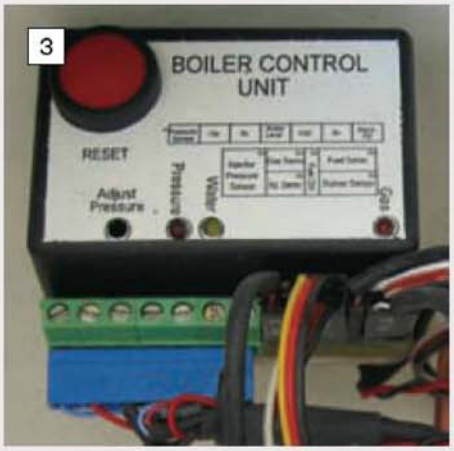
Originally, the pipework for the water supply to the boiler took water from the tanks to a central



The 8oz./min. injector kindly made and provided by D.A.G. Brown.



This side view of the power plant is marked with a red outline to indicate the position of the port side tank. Note also the injector control valve to the right of the injector.



Above: the boiler control employs a computer (PIC16F84) to control all the functions.

Below: the boiler control unit circuit board.

point between the engines, through two filters and then to the pumps. A manifold connected the high pressure outlets of the pumps to a non-return (clack) valve and the by-pass valve, this directing any water not required back to the tank under control of the ABC unit. Using an injector, the water from the tank is directly connected to the injector via a filter. Non-superheated steam from the steam dome is fed via the injector control valve to the injector. The output from the injector (delivery) is connected to the boiler via the clack valve, a total run of about 6in. of pipe. Disadvantages included the fact that the feed water has to be well filtered as the steam delivery cone bore is a mere 0.018in. diameter, and the annular gap between the steam cone and the combining cones a little over 0.005 inch. I also had now to design and make a control system.

I started experiments using the steam plant and some existing electronics to operate the injector control valve. Initially, the valve was of the type which used a nitrile ball, being closed or opened by means of a lever moving through approximately 110deg., connected to a 32tpi helix. I found that this type opened neither quickly nor far enough for the injector to operate cleanly.

A change was made to an in-line 'barrel valve' designed for servo operation and supplied by Bruce Engineering. The only practical position for the injector was above the water level in the tanks, a position which also meant that a water valve was not required. A red outline (**photo 2**) indicates the position of the port side tank. Photographs 1 and 2 also show the injector control valve to the right of the injector. However, this resulted in a jet of steam at approximately 165deg.C from the injector overflow into the tank until the water had been lifted to the injector.

This was overcome after the initial operation, simply by fitting a non-return valve in the water feed to the injector. With 0.23 litres of water entering the boiler per minute and the capacity of the boiler approximately 0.6 litres, the duration of operation had to be closely controlled. Too much water would result in the engines losing more power than that taken by the original pumps. In addition, the burner would have to recover the excessive loss of boiler pressure.

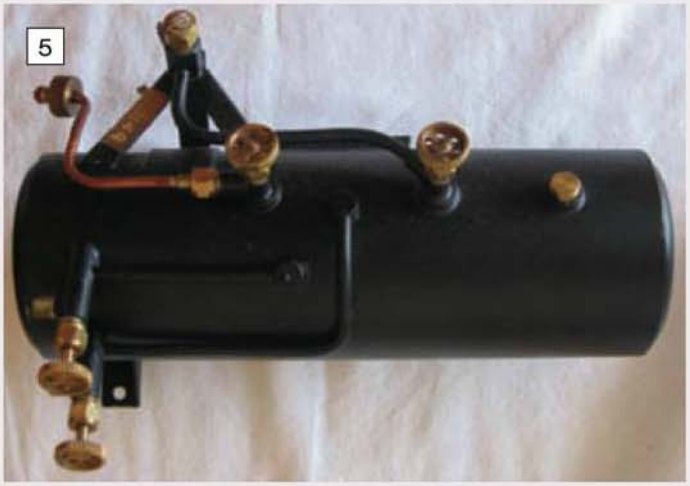
Although the installation as used on a locomotive operates well with a human in charge, a more sophisticated form of control was required when installed in a boat being remotely controlled. Experiments showed that these were:

1: Boiler water level sensor.
2: Boiler pressure sensor.
3: Sensor to monitor the operating pressure range of the injector.
4: Detection of an injector mis-fire.
5: Indication of supply tank empty or injector failure.
6: Indication that the boiler required water during the time that the injector was 'out-of-pressure-range'.
7: Closure of gas valve if '5' above existed for 3 minutes.
8: Closure of gas valve if '6' above existed for 3 minutes.

Expanation

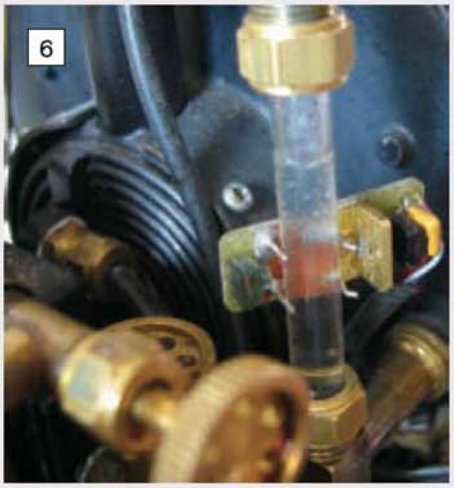
1 and 2: The water level sensor and boiler pressure sensor were initially from the Cheddar Models ABC unit.
3: The injector only functions correctly above a minimum pressure. With this injector, this is above 50psi.
4 and 5: Injector mis-fire can occur for many reasons including blockage, pressure too low, ball valve not seating, supply water too warm (above about 40deg.C), air/steam leak, etc. The system control allows six misfires before the system decides that a total failure or empty water tank is the cause.
6: This could occur when steaming at

▶



Left: after removal of the copper strips to combat the cooling effect of gas extraction, the fuel gas tank was tested certified and painted.

Right: water level is by means of a level sensor on the water gauge glass seen in the foreground of this view. Visible in the background is the 7-turn gas vaporising coil adjacent to the burner. 3/32in. copper pipe was used for the purpose.



Between the vaporising coil and the gas control valve are two isolating valves, the upper being manual, the other servo controlled.

The gas control valve (left) operates under the control of the boiler control unit by means of the servo (right)

sustained high speed or with a cold or empty gas tank giving very low gas pressure and consequently a poor 'fire'.

7: An empty water tank gives the same symptoms as an injector failure, therefore this also starts the 3 minute count. In this case, this sequence does not re-set.

8: To safe-guard the boiler, if no water has been injected into the boiler for 3 minutes, the gas supply is reduced to a pilot flame. A recovery of pressure during this time re-sets this sequence. This is in addition to the protection given by the boiler pressure sensor which will do the same if the boiler is empty of water.

The boiler control unit (BCU) I produced is contained in a box 60 x 40 x 20mm and uses a computer, a PIC16F84 to control all the functions (**photo 3**). Peripheral components are three comparators (on a single chip), LEDs, a transistor and a few passive components. Two of the comparators are connected to the Boiler Pressure Sensor, one providing an output at the 90psi operating pressure, the other providing the 'window' between 65 and 90psi for the low pressure limit of the injector operating range. The third comparator is connected to a sensor in the injector delivery pipe. This verifies the operation of the injector and is set to be true above 90psi pressure.

Three LEDs were provided to indicate when the boiler requires gas or water and to indicate, by an externally connected LED, an alarm condition as in 4, 5 and 6 above. Number 5 is indicated by a fast flashing LED, and 6 by a slowly flashing LED. A total failure, i.e. when the gas valve has been closed following 4, 5 or 6, is indicated by the alarm LED remaining illuminated.

Control of the injected water was initially by the water level sensor (**photo 6**), and the injector pressure range window. Owing to the slow response of the pressure sensor (in reality a temperature sensor), and due to the mass of copper from which the boiler is constructed, too much water could be injected, resulting in the boiler pressure dropping too low and the engines losing power as a result. Software modification to provide a fixed time for the injector control valve to be open, followed by a recovery time, was an improvement, however balancing the requirements for fast and slow running was difficult and the result unsatisfactory.

Experiments to improve the level stability in the gauge glass without increasing its diameter (5mm) included making the top connection to the steam turret with either single or twin glasses and proved inconclusive, as did experiments using a single 5mm glass and an 8mm brass tube in parallel to form a column type water gauge. A scheme which gave reasonable results was connecting the top of the column type gauge to the steam outlet connection feeding the injector control valve. Opening the control valve caused a depression which raised the level in the glass keeping the glass clearer of bubbles and condensation.

All inputs to any computer should have anti-bounce routines or hardware circuits to ensure that the computer 'sees' valid data. Using the rise in water level and the anti-bounce software routines achieved control of the injector control valve without additional timed routines. Though an improvement, it meant the injector fired frequently and for a short period. Not ideal, this resulted in the tank water temperature rising progressively and would have caused excessive wear to the servo and valve.

Injector misfires or no water is tested for by the pressure sensor in the pipe between the injector on the water delivery side and the clack valve. With the injector control valve open, the delivery pressure should exceed the boiler pressure — in practice it is usually 20-50% above the boiler pressure. If not above the boiler pressure, the control valve is closed and after one second, a re-try cycle is started. After 6 successive re-tries, the software shuts the control valve assuming either an injector failure or that there is no water.

I took the steam plant to the Midlands Model Engineering Exhibition at Donington in October 2000 for a private demonstration which turned public, so had made up a semi-presentable demonstration rig. This included the electronics and software necessary to achieve the engine's directional control (**photo 4**) and provision for mounting two of the model's water tanks. This would be the first time the system would be configured as I intended it to be installed in the model. The tank adjacent to the injector drain has a channel and anti-spill valve which collects the drips from the injector before returning them to the tank. A rushed and brief test before taking it to Donington, showed all to be well — an error as it turned out.

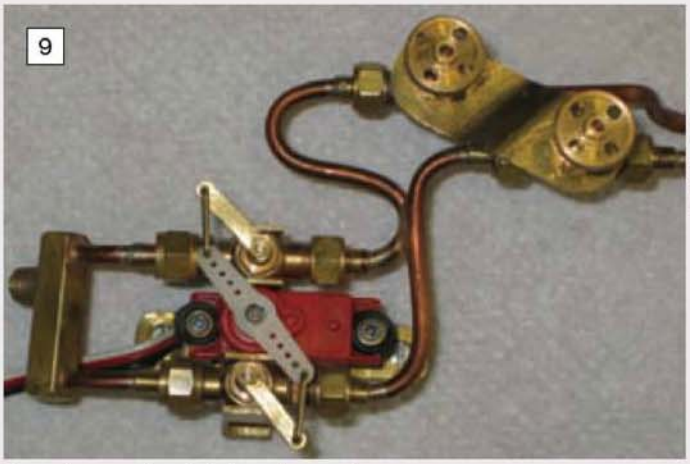
Initially, the demonstration went well for about 15 minutes. During this time I manually failed the injector several times. This allowed the six one seconds jets of steam into one water tank, the tank directly connected to the injector! Shortly after this, the injector began to mis-fire and finally failed. This at least proved that the electronics had recognised what was happening, and had performed the shutdown as designed.

A quick look revealed that the tank water temperature had risen and the tank was now too hot to touch. In normal operation, any drips from the injector drain (at about 60deg.C) and the very brief jet of steam into the tank which occurs immediately before the water is picked up, will raise the water temperature, but not to failure temperature. Prior to this demonstration, the water 'tank' had been a yoghurt pot as was the separate collection 'tank' below the injector drain, so this problem had not been recognised.

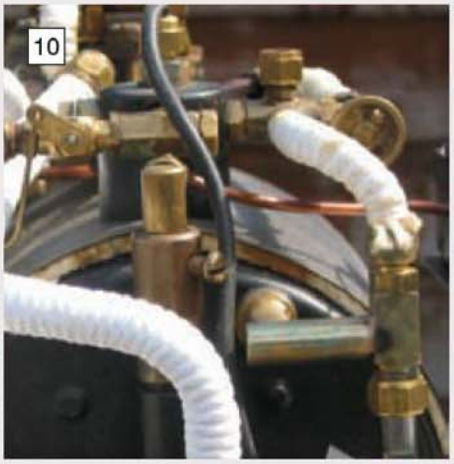
In the model, to eliminate, or at least reduce, the temperature rise, two courses of action were open: to discharge the drips and steam into the lake, or to cool the water in the tanks. As the injector is only just above the lake level, that would have been a problem, even without the additional problem of discharging the steam to atmosphere outside the hull. Connections directly to the injector drain are a probable cause of problems, particularly as this pipe would have almost no 'fall', so the answer was to cool the tanks. This is achieved in the model by using the two propellers to pump lake water around cooling coils fitted inside the tanks, which is then discharged back into the lake. A test proved that very little cooling was required in normal operation. Bench tests showed a flow of 200ml./min. reduced the temperature in the tank following successive operations of the injectors.

After the Donington Exhibition, the model was floated with simulated weights for the then missing superstructures. I was concerned to find that it floated rather too near the water line at the bow, but required ballast at the stern. As I could not be certain if the simulated superstructures were the correct weights, this prompted a change from using a 500g disposable gas tank (weight full 650g) in the bow, to a refillable tank in the stern, containing 400g of gas, (weight full 1.1kg).

The bilge tank was also removed, saving the weight of 0.7 litres of water plus the weight of the tank (total 860g), leaving a tank capacity of 1.4 litres, plus the 0.6 litres in the boiler. A gas tank was then constructed, pressure tested, certified, and painted. As the tank was now isolated by a bulkhead from the radiated heat, copper strips were laid between the engine base plate and the gas tank mountings to offset the chilling effects of drawing off gas. Having installed them, I was not convinced that there would be enough heat transfer along these strips alone to have any significant effect, particularly in the cooler weather. This matter was discussed with



Left: two in-line barrel gas control valves are connected to the manual gas tank outlet valves and are operated by a servo connected to both.



Right: the later and more successful version of water level control involved a single 6mm gauge glass set away from the boiler as can be seen to the lower right of this view of the backhead.

Peter Arnot, and a decision taken to change to a vaporising system. As a result, the strips were removed, the tank cleaned and rebuilt with a sump and an additional valve added to control the 'liquefied gas' taken from the sump (**photo 5**). The pipe and valve on the left are for venting and the other pipe and valve are used to fill the tank. More tests, certification and painting.

The next activity was to fit a vaporising coil (**photo 6**); this was done externally on the back of the burner housing. It consisted of a serpent of 7 turns of 3/32in. copper pipe. Between the vaporising coil and the gas control valve (**photo 7**) are two isolating valves, the upper being manual, the other servo-controlled by a gas detector sensor in the bottom of the hull. The gas control valve (**photo 8**) operates under the control of the BCU unit. This control valve uses a nitrile ball and O-rings, which meant that the temperature had to be kept within the range -10 to +110deg.C. As it turned out, the temperature has never reached higher than 65deg.C, even after running for an hour-and-a-half at a medium engine speed. This will increase when enclosed in the model, but should not reach 110deg.C.

Delays in response from the pressure sensor are required to be minimised so that the boiler pressure stays within the 'pressure window'. To aid this, a new sensor was made with the sensor element isolated from the gland nut by two O-rings, the gland nut being made from stainless steel, a relatively poor conductor of heat. In use, the vaporising system requires that the initial 'fire' is lit using gas, and when the vaporising coil has reached a temperature high enough to vaporise the liquefied gas, the liquefied gas is turned on and the gas turned off. This is achieved by using two in-line barrel valves (**photo 9**) connected to the respective tank outlet valves, and operated by a servo connected to both.

A manifold connects the outlets of the two valves to the vaporising coil. A temperature sensor was fitted to the vaporising coil and tests were conducted to determine at what temperature the change from gas to liquefied gas could be safely made. This was found to be between 25-30deg.C so, to provide a safety margin and to keep above a reasonable ambient temperature, 40deg.C was chosen. Software routines and more hardware were added to the BCU to control the change-over. This resulted in having to re-design and make another printed circuit board with an additional LED indicating the fuel in use.

The change-over operates well, and there is no noticeable difference, except that the back of the burner is now nearly 10deg.C cooler because of the liquefied gas, and the tank no longer 'freezes', only cooling slightly during the period that the burner uses gas, which is less then one minute. However, I have yet to find out how I can automatically revert to gas prior to shutting the burner off, when I don't know when that will be! One of the spare Tx/Rx channels is used to switch back to gas a few minutes before turning the burner off to ensure that no liquefied gas remains in the supply pipes.

Five years on, the Author's twin-prop version of the Caldercraft tug kit **Imara** *first sailed in May 2002 when the model performed well, sailing for more than an hour without attention.*

I was still unhappy with the water level control so began some further experiments. Finally, I was reasonably satisfied with a single gauge glass, now of 6mm diameter (**photos 6** and **10**) set away from the boiler to limit the heat on the electronics and with a bleed pipe feed into the steam supply to the engines, this bleed being restricted by a disc having a 0.8mm hole through it. This appears to be large enough to reduce the bubbles and condensation, but not large enough to significantly lift the water level caused by changes in steam demand by the engines.

The software was modified to provide a 5 second timed opening of the injector control valve. Every 100 milliseconds during this period the boiler pressure is monitored to ensure the pressure is within the 'pressure window'. Detection outside the 'window' closes the valve. The software also checks that the water level is valid for a total of 8 seconds, 5 seconds before opening the gas valve and a further 3 seconds before then opening the injector control valve. This 3 second period is used to pre-heat the boiler and reduce the pressure reduction during this cycle. During this rather long period, any bubbles will (hopefully) drift through the gauge glass. At this time, the water level sensor was also re-designed thanks to information given to me by Gloucester Model Boat Club member, Frank Oakey, but still using the gauge glass installation described above.

The first sailing was in May 2002 when the model performed well, sailing for more than an hour without attention. The boiler control functioned correctly and the engines' rotational speeds, ahead/astern and rudder, which are all independent, but controlled from a single stick on the transmitter, also operated correctly making the model very manoeuvrable. A problem not yet resolved is of a black 'goo' that after hours of running, eventually stops the gas control valve operating correctly. This may be caused by overheating of the liquefied gas in the vaporising coil.

The model is now complete and has taken nearly five years to build. The only items used from the original kit are the fibreglass hull, superstructures and lifeboat mouldings. All other fittings and 'woodwork' except the 'A' frames have been made by myself using 'exotic' woods and suitable materials which have been electroplated, black or bright nickel, wherever possible, as I have trouble producing a good finish with paint (**photo 11**).

Finally, I have no commercial connection with either Cheddar Models or Bruce Engineering other than as a satisfied customer. I would like to acknowledge the help generously given me during this project by D.A.G. (Derek) Brown, Peter Arnot and others.

NORTH AMERICAN STEAM LOCOMOTIVE BUILDER'S PLATES

Eric Ellis

continues his series with a look at the Lima Locomotive Works.

●*Part II continued from page 634 (M.E. 4222, 28 May 2004)*

Lima (pronounced 'Liema', not 'Leema') and Shay are of course synonymous, but there was more to the company than a breed of logging locomotive. They will be dealt with in a later article on geared, steam traction. However, as the history of Shay is intertwined with that of Lima some mention must be made of them here and now. The Lima Machine Works had its origins in an engineering company that manufactured mill machinery, traction engines, and boilers, etc, in Lima, Ohio, starting around 1870. Their first geared locomotive was built to the design of Ephraim Shay, a logger who had been tinkering with steam traction in unconventional ways in Michigan, more economically to get logs out the woods he found there.

It was successful, Shay patented his ideas in 1881, sold the manufacturing rights to Lima Machine Works, which flourished, and there we must leave the Shay story for now. (Some conventional, i.e. rod locomotives, were also turned out during the early years).

In 1892, the company name changed to Lima Locomotive & Machine Works which, by the early years of the 20th century, was producing more and more rod engines. Around 1902, the amalgamated build numbers were separated into two lists for the two types of locomotive for future orders. Manufacturers of steam locomotives used various descriptions for the numbers given to identify their products. Some called them construction numbers, some builder's or serial numbers. At least two, Lima and Climax, favoured shop numbers. In order to avoid confusion, I have used build, or builder's number throughout this series of articles.

The name changed again in 1912 to Lima Locomotive Corporation, and by 1914 the number of conventional locomotives built overtook Shays. The name changed yet again in 1916 to Lima Locomotive Works and, thank goodness, stayed at that until 1947.

New York Central became a regular customer, and during the early 1920s, Lima built an experimental 2-8-2 based on one of their designs; followed in 1925 by what was almost a revolution in steam design using knowledge gained from the 2-8-2. A-1 was a 2-8-4 with huge boiler, large firebox, improved superheater, bigger cylinders, feed-water heater, and booster, etc, etc. During testing on the Boston & Albany, No. 1 produced more horsepower at higher speed, more tractive effort and reduced coal and water consumption for the same amount of work, as well as faster schedules. The engine was the precursor of an entire family of locomotives with four-wheel trailing trucks. Lima called it *Super Power*, and so it was.

Unfortunately, the company suffered much reduced orders during the Great Depression (as did all steam engine builders — indeed the whole of industry worldwide) with consequent staff lay-offs. Matters slowly improved in the late 1930s and business dramatically improved when the US entered the war in 1941.

A short time after World War Two, the pinch of much reduced steam orders was felt and merger took place with the General Machinery Company of Hamilton, Ohio, in late 1947. The new company became the Lima Hamilton Corporation. A final partner appeared in 1950, to form Baldwin-Lima-Hamilton. The last steam locomotive built at the plant was a Nickel Plate Road 2-8-4, delivered in May 1949.

Super Power was Lima's real claim to fame. Of roughly 4,800 conventional engines produced, about 700 were of that ilk. The best known are probably the Nickel Plate 2-8-4s, Chesapeake and Ohio 2-10-4s, Southern Pacifies 4-8-4s, and the massive 2-6-6-6s of the C & O/Virginian.

The first builder plates were rectangular with 4-bolt corner fixings and LIMA MACHINE WORKS as the first line, LIMA, OHIO, U.S.A. as the second, build number in the bottom left quarter, with (shortened) month and year in bottom right quarter. Plain lettering in capitals was used, with the first letter of each word larger. At some point Shay plates were circular, and we will forget them again for now.

As far as I can tell, this size, shape, lettering style and fixing continued on rod engines right through to 1916, with of course company name changes as previously mentioned. The material used was brass. The first photograph in a future article on geared locomotives is of a Shay plate, but if the patent information was removed, and the serial number changed, it would illustrate the rod loco design of the time.

Following the 1916 change of name of the company, there came slight changes to the font and a new shape — the familiar diamond. It was in two sizes, reflecting the size of the loco, with a lettering and number style and layout as **photo 1**. There were minor differences to composition over the years, for example, some plates did not have an underlined number, or INCORPORATED was underlined, or maybe the LIMA, OHIO-USA was not included, but with the month just above the date. This particular plate for an export 2-10-0 is of aluminium alloy, but brass and cast iron were also used. It was cast flat with two spacers (top and bottom) to fit the curve of the smokebox. Fixing holes were for four bolts. The smaller plate size appears to have been dropped in the 1920s, the larger being used through to the end of steam engine building.

The final plate, introduced at the 1947 merger was a diamond as before, with LIMA-HAMILTON-CORPORATION replacing the LOCOMOTIVE WORKS line, but otherwise as the photograph.

As with Alco, that was not all. Although the Pennsylvania and Baltimore & Ohio Railroads did not buy many Lima built locomotives, they both had oval builder's plates on the ones they did. **Photograph 2** shows an example. Fixing holes are for two bolts. Made in brass, this one is from a B & O 2-10-2. Lima was the smallest of the three main contract builders in the USA by a considerable margin, but they were still making efforts to improve and sell the steam locomotive to the end in 1949.

Finally, I must mention a wry tale. As mentioned in Part I of this series, Alco had closed its tender shop by 1948 and Lima supplied tenders for their last steam builds. At least two published photographs of P & L E No. 9401 show that the Lima builder's plate has been scratched out, or obscured. Ah, human nature!

Acknowledgements

My thanks go to V. Edwards and Alan Miller who helped with photographs and information for this article. Sources were many including:

1: *Early American Steam Locomotives* by John H. White, Jr.

2: *A Short History of American Locomotive Builders in the Steam Era* by John H. White, Jr.

3: *Guide to North American Steam Locomotives* compiled by George H. Drury, published by Kalmbach.

All three books are first class, and can be recommended to anyone with an interest in North American steam.

Undoubtedly there are mistakes and gaps in the articles; I would be delighted to hear from anyone who can expand or correct such knowledge as I possess.

●*To be continued.*

Post-1916 diamond style nameplate as used by the Company until 1947. (Photo: V. Edwards)

Oval style plate as used on locomotives for certain customers. (Photo: V. Edwards)

CLUB CHAT
With Stan Bray

Before I start the normal news for this issue, I have a couple of items which may be of interest to our readers. I have received information from **East Europe Rail Tours** who operate steam rail tours and steam driving courses in Poland and Ukraine. Further information can be obtained by 'phone (01299-861529) or from **www.easteuroperailtours.com** The other item is as a result of a recent need to get some chrome plating carried out on a small silencer. It took me some time to find a company to do this, so for those who need such a service I can recommend **Wooburn Metal Polishing & Plating** located in Wooburn, Buckinghamshire (tel: 01628-850911). Other than as a very satisfied customer, I have no connection with them. That's enough of the commercials; now on with the proper business.

UK News

The first meeting of the year for the **National 2½" Gauge Association** took place at Leatherhead in April. Lots of items were discussed including Steve Eaton's new driving car which has disc brakes. LBSC's famous *Ayesha* was at the meeting and was the subject of much discussion because the society is producing a 'modernised' version of the design. Two new Zealand Ka locomotive chassis were also on display, and because they are a narrow gauge 'pacific' design they looked massive. Peter Gain's *Toby* chassis was also on show alongside a Vale of Rheidol 2-6-2T chassis. Mike Bennet of REMAP gave a presentation of their work and lunch was provided by Ann Cook. The association will have a stand and test track at the Guildford Weekend on 17/18 July. The society will also be present at the Staines 2½in. gauge rally on 21 August.

The first tryout of the new video equipment at **Bristol SMEE** took place in January with videos by Bernard North (the last day at Canford Park and the first day at Ashton Park), Paul Martin (*Snow* – a British Railways presentation from the winter of 1963), David Hockin (a film about old Frenchmen who had built a line with 1:100 for the flat and 1:70 for the hills), and finally Ken Moody with 2½ minutes of the 'TV show' 'advertising' the 2002 exhibition which was apparently shown especially for the benefit of Geoff Sheppard. The society has also had a presentation by Kevin Slater on '3D Computer Aided Design'. Kevin did 'live drawings' of his Stuart 10 during the evening but in case of any problems had wisely stored *"... some he had prepared earlier"* in best *Blue Peter* style. A milestone was recently reached when the council building inspector arrived to inspect the new carriage shed, announced that he was 'perfectly satisfied' and was going back to his office to sign the certificate. A portable exhibition stand built by members to make life easier when supporting other society's exhibitions was used successfully for the Model Exhibition at Yeovilton Fleet Air Arm Museum in February. The east

Above: towards the end of 2003, this group of Gravesend MM&ES members prepare to demolish their old and vandalised hut.

Right: February 2004, the new secure hut arrives on site.

footbridge on the Ashton Court track has been shot blasted and repainted with the assistance of local contractor A1 Blasting Company.

Christmas preparations get earlier each year! **Cardiff MES** is already advertising that tickets for the Santa Specials will be on sale from 25 July. It is reported that around 25 members and families attended the New Year's Day steam-up with four locomotives. The locomotives included Harrye Frowen's 5in. gauge *Lion* which was on its inaugural run. This locomotive was completed in 13 months and is to the 1954 LBSC design. Harrye is now intending to construct a 7¼in. version from full scale drawings. He anticipates this will take two years. Ken Stoat reports that the club is now halfway through the replacement of the old wooden sleepers on the raised track with plastic ones. So far they have used 1,088 sleepers, 3,264 plastic chairs and 7,000+ screws. As Ken says *"Thank goodness for battery powered screwdrivers!"* The 00-gauge layout 'Warsash' had its first outing at the Cardiff model railway exhibition and *"...survived its maiden showing, in almost finished condition, with flying colours."*

To celebrate its 50th year of existence, **Gravesend Model Marine and Engineering Society** held a successful open weekend in 2003. At the time the club had exactly 50 members and put on a display of 50 locomotives. The celebrations were attended by the Mayor and Mayoress. Early in the new year, members took down the old hut at the track 'Fred Dibnah' style. It had been on site for ten years and had been vandalised as many times. The club bought a vandal proof container complete with all facilities to replace the old ▶

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.

JUNE

25-27 **New Jersey Live Steamers, Inc.** *Members' Weekend.* Contact Karl Pickles: 718-494-7263.
26 **Guild of Model Wheelwrights** *at Sandringham Show, Near Dursingham, Norfolk.* Contact Biddy Hepper: 01492-623274.
26 **Hornsby ME.** *Family Day & Boiler Inspection.* Contact Ted Gray: 9484-7583.
26 **Talyllyn Railway.** *Victorian Train.* Enquiries: 01654-710472.
26/27 **Cambridge MES.** *CMES Rally.* Fulbrooke Road. Contact Rex Mountfield: 01284-386128.
26/27 **G.W. Soc.** (Didcot Rly. Ctr). *Flower, Fruit & Veg. Event.* Contact Jeanette Howse: 01235-817200.
26/27 **Ribble Valley Live Steamers.** *Open Weekend.* Contact Mrs K. Avon: 01254-385170.
27 **Amnerfield Miniature Railway.** *Public Running.* Contact David Jerome: 0118-9700274.
27 **Bradford MES.** *BMES Open Day.* Contact John Mills: 01943-467844.
27 **Cardiff MES.** *Open Day.* Contact Trevor Jenkins: 029-2075-5568.
27 **Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243-542266.
27 **Frimley & Ascot LC.** *Open Day with Public Running.* Contact Bob Dowman: 01252-835042.
27 **Guildford MES.** *Members' Running Day.* Contact Dave Longhurst: 01428-605424.
27 **Harlington LS.** *Public Open Day.* Contact Peter Tarrant: 01895-851168.
27 **Hereford SME.** *Public Open Day.* Contact Richard Donovan: 01432-760881.
27 **High Wycombe MEC.** *Public Running.* Contact David Savage: 01494-527402.
27 **Keighley DMES.** *Open Day.* Contact K. Parkin: 01274-564866.
27 **Leighton Buzzard NG Rly.** *Vintage Vehicle Rally.* Enquiries: 01525-373888.
27 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.
27 **Otago MES.** *Public Running.* Contact John Clover, 221 Ravensbourne Road, Ravenbourne 9002, New Zealand.
27 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.
27 **Staines SME.** *Passenger Day.* Contact Stan Bishop: 01784-241891.
27 **Teesside Small Gauge Rly.** *Running.* Contact Mike Aslin: 01642-724255.
28 **Bedford MES.** *Noel Shelley: Casting for Amateurs.* Contact Ted Jolliffe: 01234-327791.
28 **Hornsby ME.** *Meeting & Social.* Contact Ted Gray: 9484-7583.
29 **Surrey SME.** *Bits & Pieces.* Contact John Cook: 020-8397-3932.
30 **Wigan DMES.** *Visit by Chernobyl Children.* Contact John Chamberlain: 01744-882255.

JULY

1 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
1 **Sutton MEC.** *Bits & Pieces.* Contact Mike Dean: 0208-657-5401.
2 **Canvey R&MEC.** *Meeting.* Contact Brian Baker: 01702-512752.
2 **Maidstone MES (UK).** *Evening Run & Pizza.* Contact Martin Parham: 01622-630298.
2 **N. London SME.** *Forum: Measure Twice, Cut Once!* Contact David Harris: 01707-326518.
2 **North Norfolk MEC.** *Traction Engine & Static Engine Steam-Up.* Contact Gordon Ford: 01263-512350.
2 **Rochdale SMEE.** *Annual Models Running Night at Springfield Park.* Contact Mike Foster: 01706-360849.
2 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
2 **Vale of Aylesbury MES.** *Track Night.* Contact Clive Ellam: 01296-623433.
2 **West Wiltshire SME.** *Steam-Up.* Contact R. Nev. Boulton: 01380-828101.
3 **Cardiff MES.** *Steam-Up and Family Day.* Contact Trevor Jenkins: 029-2075-5568.
3 **Frimley & Ascot LC.** *Scout's Railway Event.* Contact Bob Dowman: 01252-835042.
3 **Lancaster & Morecambe MES.** *Open Day & Annual Exhibition.* Contact Harry Carr: 01524-411956.
3 **Society of Ornamental Turners.** *Roy Clarke: CAD Applied to Drawing the Evans OT Slide Rest* Contact N. S. Edwards: 01234-359392. ▶

In Memoriam

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

Mick Airey	*Colchester SMEE*
Paul Ridley	*Sutton MEC*
Russ Seon	*Toronto SME*

building. The new building was craned onto the site and rests on eight concrete pads. Following this a JCB was hired to dig a large hole for a cesspit to link to the new toilet. The 'pod' was put into the hole and then the members mixed 10 tonnes of ballast and 40 bags of cement to fill in around the pod. All this was finished two days prior to the first running day of the season. Our photos show the two stages of the hut replacement with the happy gang in front of the old hut which they are about to demolish.

Guildford MES is celebrating the completion of the new engine and carriage shed. Those who have visited the Stoke Park track will know that this is a very impressive building indeed and congratulations are due to all who helped with its construction. The two remaining items nearing completion are the coal store and hydraulic locomotive lift. The new rolling stock will also be completed this year. Those attending the 'Golden Jubilee Rally' on 17/18 July will be able to see the new facilities at first hand. As a result of all the activity related to the 50th anniversary, Chairman Ian Carney muses about model engineering in the past and what the future holds for the hobby. He comments that the club has few new junior members joining each year but the membership is increasing. As Ian says *"...perhaps model engineering is always going to be a mature interest."* Whatever happens we all congratulate Guildford on its 50th year and wish the club many more successful years in the future. In January, Frank Perriman gave a talk on the mechanisms associated with steering ships. The devices used started from simple steering oars (from which the word 'starboard' was derived) and progressed through tillers which, as the size of ships increased, could not be operated by manpower alone, to various other means which were devised. These were initially mechanical but eventually electrical systems took over. Apparently the maximum rudder throw is 35deg. as more than this gives no extra steering benefit and maritime regulations state that the maximum time from hard starboard to hard port rudder is 31 seconds. This prompts the question *"Why 31? Why not a nice round 30 seconds?"* Answers on a postcard to the Editor please. Jim Wilson reports on the Guildford Stand at Sandown in 2003, admitted that he enjoyed the exercise and that he and Brian Barrow *"...might be persuaded to do it all over again."* Can I take this opportunity to thank Jim and Brian, and all those others out there who put in time and effort to make the club displays the success they most undoubtedly were.

Gas Flow, newsletter of the **Internal Combustion Engine Builders Group** carries photographs of the display at last year's Bristol Exhibition. With the widely spread membership, the group is trying to improve communication between members in different parts of the country to share more information. The group will be at the Guildford Rally and at Bristol again in August. Anyone interested should contact Secretary Ron Hankins on 01420-487122, e-mail **engineshed@cwcom.net** or Brian Perkins on 01454-633494, e-mail **bper311742@aol.com** for more information.

The 'Wednesday Warriors' at **Reading SME** continue to make improvements around the site. These include fitting a swing barrier to the ground level platform to prevent passengers walking along the platform during public running. The bank has been reinforced behind the club house to remove the risk of it (and the footpath above) collapsing onto the ground level track. Plans are under way to tarmac the entrance drive which should ease the never ending battle against pot holes. The club has decided to purchase an electric locomotive for public running use. This will be 5in. gauge so that it can be used on both raised and ground level tracks. It will be named *Gordon Spring* in honour of the late member whose bequest has made the purchase possible. Member Brian Joslyn has modified the clutch mechanism on the 7¼in. gauge 08 petrol locomotive *Cyril Kimber*. Mike Sinclair is modifying the braking system on the raised track passenger trucks to provide a brake handle at each end. Both driver and guard will have a brake which should be good for emergency stops!

Gerry Willis was made 'Engineman of the Year' at **Taunton ME** in recognition of his contribution to public running. Gordon Hartnell and Andy Webb were jointly selected 'Members of the Year' for their work with the new site and track construction. Congratulations to all three on their awards. Taunton is another club with increasing insurance premiums which in their case amount to about £10 per member. Work on the new carriage shed was halted while the building regulations requirements were resolved. These have been agreed, so work can re-start. Almost 500ft. of track has now been constructed and was taken to site in January and laid temporarily to confirm alignments. The club is seeking a team leader to start a weekend working party to complement the Thursday gang, the Saturday Track Construction gang and the rolling stock team. The society has a new Secretary in the person of Andy Cooke who can be contacted on tel: 01823-277255.

Sutton Coldfield MES is still attempting to persuade the local planning authorities to approve the extension of the club house in some way. Stuart Harrison even attended a planning meeting for another application to gain an insight into the issues discussed. In order to ease overcrowding, the Santa Specials are to be spread over two days this year. Other events may be restricted in numbers to ensure that the safety of those attending is not compromised. The society is holding a 2½in. gauge rally on Sunday 1 August.

Members of **Wimborne SME** are keen to encourage those on holiday in the area to visit their track. Further details can be had from Eric Basire (tel: 01202-897158) if you are in the area.

After three years as Chairman of **Worthing SME**, Mike Wheelwright has stood down and his place has been taken by Dereck Langridge. We wish Dereck success in his new role. The club dinner which took place on 5 March was attended by

3 **Talyllyn Railway.** *Victorian Train.* Enquiries: 01654-710472.
3 **Woking MRS.** *Hospice Children's Barbecue.* Contact Ronald Dewar: 01932-343331.
3 **York City & DSME.** *Summer Special.* Contact Pat Martindale: 01262-676291.
3/4 ***Chiltern Traction Engine Club, Chiltern Steam Rally,*** Prestwood, Nr. Great Missenden, Bucks. Adults £4, OAPs £2.50, Children £1. Contact John Turner: 01494-526807.
3/4 **GL5MLA.** *GL5 Running Weekend at Gilling.* Contact Chris Nesbitt: 01332-756128.
3/4 **Guild of Model Wheelwrights** *at Blists Hill Open Air Museum, Telford.* Contact Biddy Hepper: 01492-623274.
3/4 ***Wolverhampton Model Railway Club Fire Rail 2003 Exhibition*** at St. Peter's Collegiate School, Compton, Wolverhampton. 10am-5pm. Adults: £3, Concessions: £1.50, Families: £7. Contact: Peter Wise: 01384-830432.
4 **Basingstoke DMES.** *Public Running.* Contact Guy Harding: 01256-844861.
4 **Bedford MES.** *Invitation Day & Public Running.* Contact Ted Jolliffe: 01234-327791.
4 **Bristol SMEE.** *Public Running Day.* Contact Trevor Chambers: 0145-441-5085.
4 **Ellenroad Engine House,** Elizabethan Way, Milnrow, Rochdale, Lancashire OL16 4LE. *In Steam plus NW Meccano Exhibition.* Enquiries: 01706-881952.
4 **Frimley & Ascot LC.** *Public Running.* Contact Bob Dowman: 01252-835042.
4 **Great Western Soc.** (Didcot Railway Centre). *Freight & Passenger Steamday.* Contact Jeanette Howse: 01235-817200.
4 **Guildford MES.** *Disability Challengers.* Contact Dave Longhurst: 01428-605424.
4 **Leighton Buzzard NG Rly.** *Model Railway Mania.* Enquiries: 01525-373888.
4 **Leyland SME.** *Ground Level Public Running Day.* Contact Mark Entwistle: 01772-422411.
4 **Malden DSME.** *Public Open Day.* Contact John Mottram: 01483-473786.
4 **Oxford (City of) SME.** *Public Running.* Contact Chris Kelland: 01235-770836.
4 **Plymouth MSLS.** *Running & PMS Exhibition.* Contact John Brooker: 01752-671722.
4 **Reading SME.** *Public Running.* Contact Graham Bustin: 0118-9615450.
4 **Royston DMES.** *Running Day.* Contact Jeff Dickinson: 01763-261670.
4 **South Durham SME.** *Running Day.* Contact B. Owens: 01325-721503.
4 **Stockholes Farm MR.** *Public Running.* Contact Ivan Smith: 01427-872723.
4 **Surrey SME.** *Members' Steam-Up.* Contact John Cook: 020-8397-3932.
4 **Sutton Coldfield MES.** *Steam-Up.* Contact Neal Harrison: 0121-378-3992.
4 **Taunton ME.** *Public Running Day.* Contact Don Martin: 01460-63162.
4 **Teesside Small Gauge Rly.** *Running.* Contact Mike Aslin: 01642-724255.
4 **West Wiltshire SME.** *G.B.R. Bulkington Fundraising for Village Hall.* Contact R. Nev. Boulton: 01380-828101.
4 **Wimborne DSME.** *Running Day.* Contact Eric Basire: 01202-897158.
5 **Lancaster & Morecambe MES.** *Members' Running Evening.* Contact Harry Carr: 01524-411956.
5 **Peterborough SME.** *Visit to Pro Machine Tools.* Contact Tony Meek: 01778-345142.
6 **Basingstoke DMES.** *Meeting Night.* Contact Guy Harding: 01256-844861.
6 **Pinewood MRS.** *Committee Meeting.* Contact Ivan Hurst: 01276-28803.
6 **South Durham SME.** *Meeting.* Contact B. Owens: 01325-721503.
6 **Taunton ME.** *Barbecue.* Contact Don Martin: 01460-63162.
7 **Bradford MES.** *Steam-Up & Pop-Pop Competition.* Contact John Mills: 01943-467844.
7 **West Wiltshire SME.** *Steam-Up.* Contact R. Nev. Boulton: 01380-828101.
7 **Tyneside SMEE.** *Video Evening.* Contact Ian Spencer, 0191-2843438.
8 **High Wycombe MEC.** *Track Evening.* Contact David Savage: 01494-527402.
8 **Leyland SME.** *What Is It Night?* Contact Mark Entwistle: 01772-422411.
8 **Sutton MEC.** *New Drivers' Run.* Contact Mike Dean: 0208-657-5401.
8 **Worthing DSME.** *Steam-Up & Barbecue.* Contact Bob Phillips: 01903-243018.
9-11 **Vale of Aylesbury MES.** *Thomas Weekend.* Contact Clive Ellam: 01296-623433.
10 **Amnerfield Miniature Railway.** *Steam Open Day 5in. & 7¼in.* Contact David Jerome: 0118-9700274.
10 **Cardiff MES.** *Lord Mayor's Charity Day.* Contact Trevor Jenkins: 029-2075-5568.
10 **Isle of Wight MES.** *Track & Pond at Broadfields.* Contact Ken Stratton: 01983-531384.
10 **Romney Marsh MES.** *Saturday Track Meeting.* Contact John Wimble: 01797-362295.
10 **Stockholes Farm MR.** *Birthday Party.* Contact Ivan Smith: 01427-872723.
10 **Talyllyn Railway.** *Victorian Train.* Enquiries: 01654-710472.
10/11 **British Columbia SME.** *Annual Meet.* Contact Sean Laurence: (604) 931-1547.
10/11 ***Model Expo 2004,*** *National Exhibition Centre, Birmingham. 9.30am-6.30pm (5.30pm Sunday 11th). Information 0121-767-3817 or 0121-767-2439.*
10/11 **Kinver & W. Midlands SME Ltd.** ***35th INTERNATION MODEL LOCOMOTIVE EFFICIENCY COMPETITION.*** Everyone welcome. Contact John Hurley: 01902-339275.

33 members and partners who enjoyed *"...an excellent meal."* The club is organising a summer outing to the Romney, Hythe & Dymchurch Railway on 4 July. The committee has set up a *"Radiation Message System"* so that urgent information can be rapidly cascaded to all members quickly and with the minimum effort.

World News

Canada

Members of **Toronto SME** enjoyed an interesting selection of items brought to their recent meetingso I have included full descriptions here. Bert de Kat described the workings of the basic thermocouple to measure temperature. They are made from two dissimilar metals joined at one end. Heat applied to the joint produces a very small thermo-electric voltage which can be calibrated to give a temperature reading. A disadvantage with this simple design is that ultimately the 'cold' joints will reach the same temperature as the dissimilar metal joint and the resultant generated current fall to zero. An improvement is to have two thermocouples in series, one for the temperature to be measured, the other set in a known, fixed temperature source. The latest versions now have an integrated circuit with an electronic reference temperature. Very small voltages are involved: 25deg.C - 1mV; 200deg.C - 8.1mV; 750deg.C - 31.3mV. The output is therefore usually processed to give 10mV per degree. Bert described his use of the thermocouple to check the temperature of a modified iron used to iron on paper in making circuit boards obtained from **www.techniks.com**

Steve Lilly showed his recently completed air powered single cylinder engine. Castings came from Roland Manufacturing in the US. The design is unusual in that the piston is rigidly fixed to the crankshaft with no crosshead. The piston has an O-ring which acts as a seal until it reaches bottom dead centre, where the seal allows the air to exhaust as the piston has tilted over relative to the cylinder bore. Steve demonstrated the engine in operation, and said that he had to slightly alter the angle of the piston on the crankshaft in order for the seal to release the exhausting air. The piston impacts on the inlet valve at top dead centre to open the valve for inlet air for the power stroke.

Remo Cosolo showed his Violin Playing Machine – second version (the first one went berserk!) Violins require to be *"played in"* to produce a decent sound and the machine is designed to do this. An oscillating lever moves the bow back and forth while another lever connected to the same motor rocks the violin so that each string is played in turn.

Alex Barrie had made a dash panel in aluminium alloy for a friend's 1991 Honda *Civic*; the original was plastic. There was much milling out for the various slots and Alex used jacking screws to maintain the widths of finished slots while milling others.

Kyle Simmons showed his Wankel-like piston and explained how he machined its 3-sided profile using a rotary table and machining the three curved sides in turn. He also showed a 3-sided piston which could rotate in a square cylinder. Kyle explained his design for a Wankel type engine on which he is now working to run on air.

Dave Sage brought in the cylinder from a 1930s marine engine he is rebuilding. Dave explained the make-and-break ignition driven from the top of the oscillating cooling water pump which is driven by an eccentric on the crankshaft. There is no spark plug, the make and break ignition is inside the cylinder.

Bob Morrow showed his 120psi pressure gauge which he had made from scratch with a 1in. dial. Bob detailed how he made the Bourdon tube from a small diameter flattened tube. An inner flat strip was inserted before bending the tube to prevent it collapsing then withdrawn after the tube had been silver-soldered to the centre block. Bob used part of a watch gear to drive the needle from the 'free' tube end with another small watch gear on the needle shaft.

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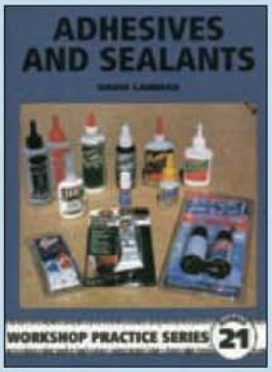

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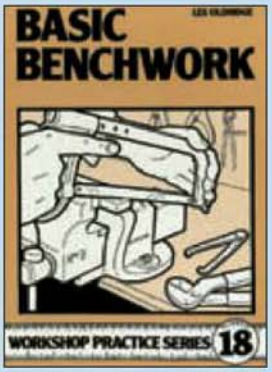

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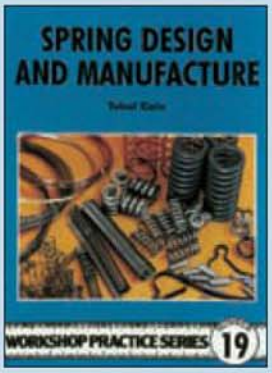

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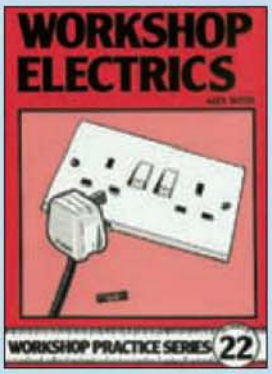

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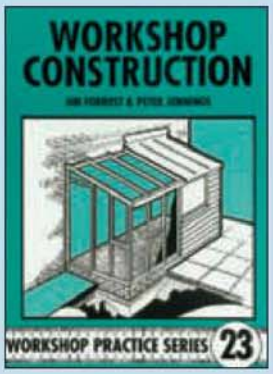

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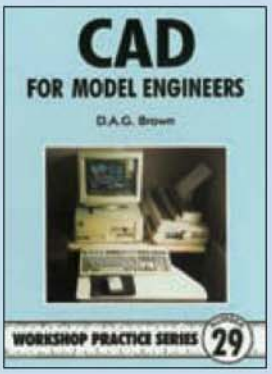

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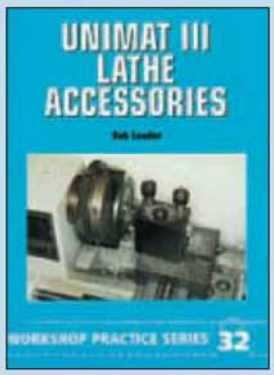

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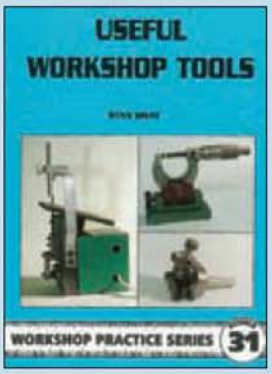

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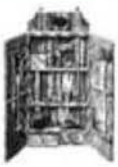

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