

MODEL ENGINEER

Vol. 192 No. 4218

2 - 15 April 2004

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Diameter of Spindle	63.5mm
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
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A 'LAMMAS' TOOLPOST FOR THE UNIMAT LATHE

A miniature version of this popular and
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On the cover ...

This handsome well-bottomed London
 milk float, circa 1921, was one of several
 fine models of horse drawn vehicles
 entered by Mr. Harry O. Baker at the
 73rd Model Engineer Exhibition.

All of Mr. Baker's exhibits were
 exceptionally well painted, but this
 vehicle, which was finished in the livery
 of Daltons of Hayes End, seemed to
 capture particularly well the spirit of the
 times when it was in current use.

Fully equipped with miniature crates,
 bottle carriers and milk bottles,
 the model seemed only to need
 a small horse and driver to be ready
 to be put to work.

The Judges awarded this model a
 Commended Certificate.

For further details of the horse drawn
 vehicles exhibited at the 73rd Model
 Engineer Exhibition plus the Junior
 entries turn to page 368 of this issue.

(Photograph by Mike Chrisp)

WORLD TIME DIAL CLOCK

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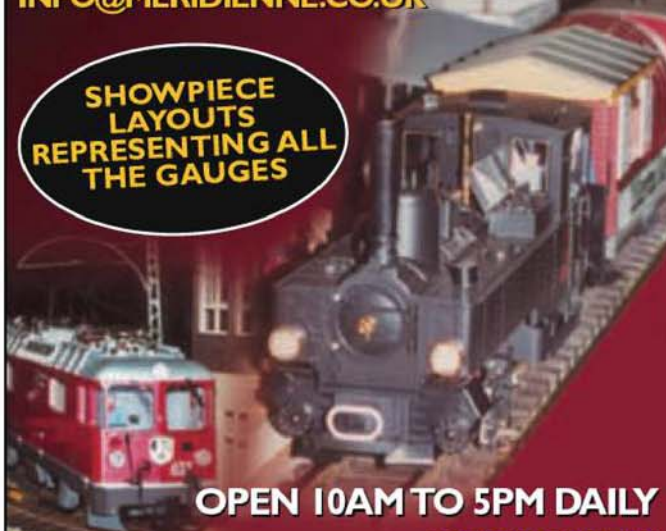
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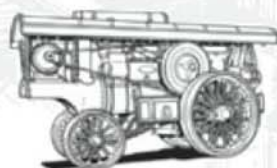


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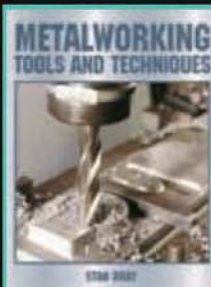
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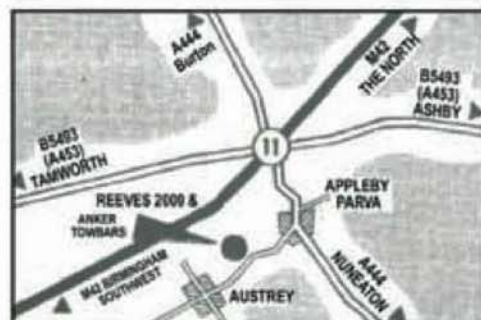


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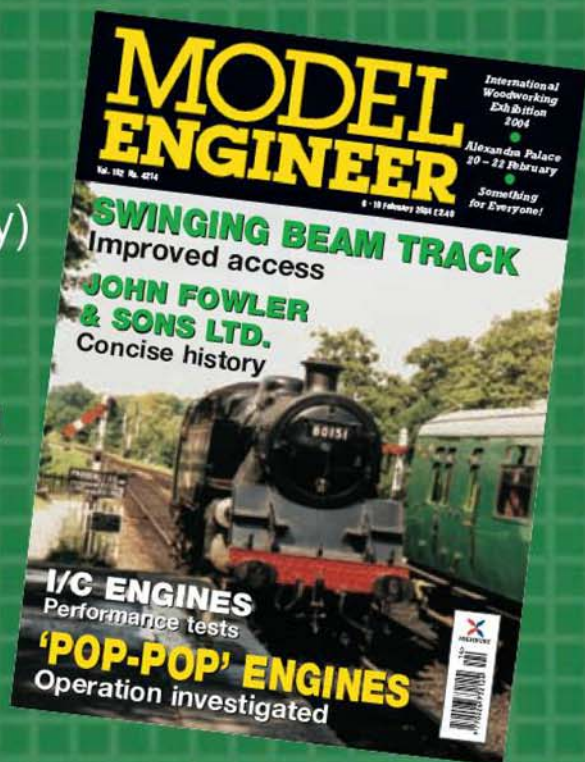
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SMOKE RINGS

With the Editors

Gremlins

Regrettably we have to admit to some recent errors and omissions which we hope to correct with the publication of this note.

John Jones of Guildford Model Engineering Society has drawn our attention to the incorrect date shown in *Club Chat* (M.E. 4214, 6 February 2004) for the GMES Anniversary Weekend. We apologise to all concerned and are pleased to confirm here that this special event is to take place 5/6 June 2004.

Sue Parham of Maidstone Model Engineering Society (UK) has written to highlight problems which can occur concerning details relating to Maidstone MES (New Zealand) events and those for Maidstone MES (UK). A recent *Club Diary* entry (M.E. 4212, 9 January) for the New Zealand club's Festival and Open Days 17-19 January emphasised the problem when several friends of the UK club called to find out what was actually happening. We apologise to all who have been confused by our attempts to be helpful!

While on the subject of Maidstone MES (UK) we would like to take the opportunity to congratulate them on 2004 being their 75th year, and to draw readers' attention to the fact that the Southern Federation Autumn Rally will be hosted at their track in Mote Park on 18 September 2004.

Keith Wilson has drawn our attention to the fact that several items of basic information were omitted from his feature on Baggeridge Miniature Railway as published in M.E. 4216 (5 March 2004). This railway was built and is operated by Wolverhampton & District Model Engineering Society and is open to the public 13.00-17.00 (weather permitting) on Bank Holidays and the third Sunday of each month March-October. Visitors wishing to run 5 or 7 1/4 in. gauge steam locomotives are welcome provided they remember to bring a current boiler certificate.

Baggeridge Country Park is situated 5 miles due south of Wolverhampton on the south side of the A463 Sedgley to Wombourne road, map reference 897 937 on Ordnance Survey map 139 (Birmingham & Wolverhampton). The track is to the east of the childrens' play area, about 1/2 mile into the park.

Wolverhampton DMES meets at 7.45pm on the first Friday of each month at Fordhouses Community Centre, Marsh Lane, about 4 miles north of Wolverhampton. Further information is available from Keith Wilson (tel: 01902-712704) or e-mail: keithgwrloco@blueyonder.co.uk

Contacts

Following various rearrangements of facilities at the new Highbury Leisure Publishing Limited offices at Orpington, we have been asked to let readers know that the Customer Services Department is now based at Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0PS; tel: 01689-886660 or 01689-886661; fax 01689-886666; email: customerservices@highburyleisure.co.uk

Readers are reminded that communications relating to editorial matters only will receive prompt attention if directed to the Model Engineer Editorial Office, PO Box 310, Hemel Hempstead, Hertfordshire HP3 8XL; tel/fax: 01442-269366; email: mike.chrisp@virgin.net Editorial items sent to Berwick House will be subject to inevitable delay caused by the need for redirection.

Forthcoming events at Kew

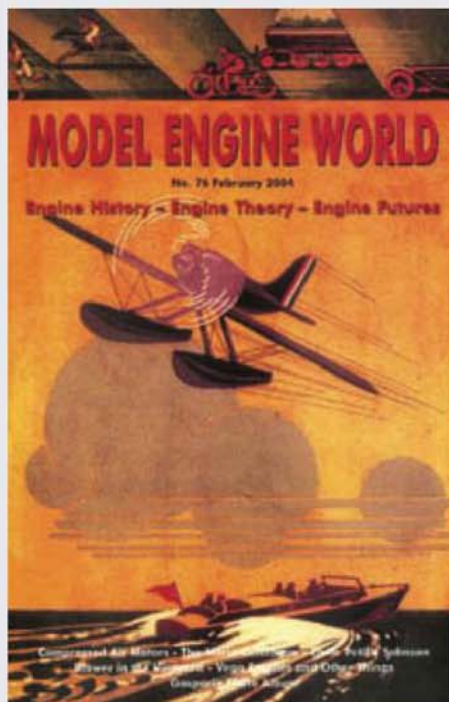
As part of its programme of events throughout the year, Kew Bridge Steam Museum will be holding a *Magic of Meccano Show* over the weekend 24/25 April and a *Historic Fire Engine Rally* on Sunday 16 May. A new event has been announced for 12/13 June. Kew Bridge Steam Museum and the Medway Queen Preservation Society have teamed up to present a *Model Boat Show* at the museum when a wide variety of boat models will be on display together with trade and society stands.

The events run from 11am-5pm each day and, as happens every weekend at Kew, the museum's giant water pumping beam and rotative engines will be in steam. The *Water for Life* gallery will also be open, tracing the history of London's water supply from Roman times to the present day. The steam railway operates on Sundays giving free rides. There is a free car park, a café serving hot and cold food and a souvenir/book shop.

Further information concerning admission prices and a full calendar of events is available from the museum (tel: 020-8568-4757; fax: 020-8569-9978; website: www.kbsm.org)

Forthcoming event at Tywyn

The fifteenth *Tom Rolt Vintage Rally* will be held on Sunday and Monday 30/31 May 2004 at Hendy County Showfield (off A493) Tywyn, Gwynedd. This special event will feature steam road vehicles, vintage cars, lorries, buses and fairground attractions. Open 10am-5pm both days, other attractions include crafts, models, miniature railway, fairground organs, trade stands, Tywyn Silver Band, refreshments, real ale tent and much more. Admission: £3.50 (adults); £2 (children/OAPs); £9 (family). Contact the Talylllyn Railway at Wharf Station, Tywyn, Gwynedd LL36 9EY (tel: 01654-710472; fax: 01654-711755; www.tomroltrally.org.uk) for further details.



Model Engine World

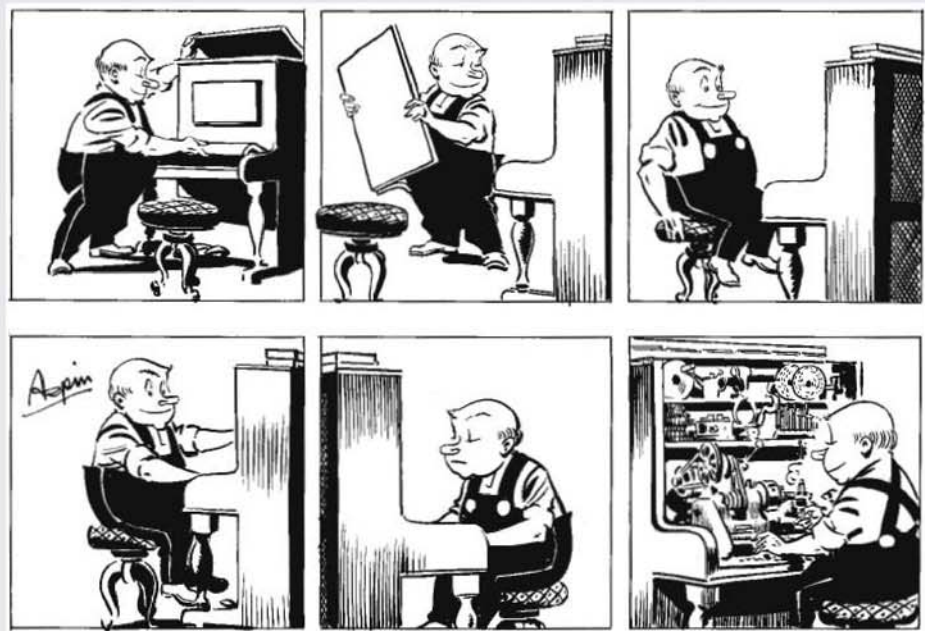
We have recently received a copy of *Model Engine World* No. 76, the most recent issue released for February 2004. *Model Engine World* is devoted to the history, theory and future of the internal combustion engine and is published quarterly.

Issue No. 76 contains 28 pages and presents a fascinating and well illustrated mixture of articles. Deviating slightly from the main subject matter, there is an article on compressed air motors for model aircraft, a review of the Morin catalogue No. 12, a description of an impressive blown V8 built in California, an historical feature on the work of Emile Salmson and an article on Vega aero-engines. These, together with readers' letters and the advertisements make for an interesting read for anyone keen on internal combustion engines.

The magazine is printed in black and white with a colour cover (illustrated above) on good quality paper. Further details concerning subscriptions and availability of this and previous issues are available from *Model Engine World*, 74 New Street, Woodbridge, Suffolk, IP12 1DX.

CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN



POST BAG

Martin Evans

SIRS, - On reading your editorial in *M.E.* 4213 (23 January 2004) may I say how sad I am to learn of the demise of Martin Evans. I met Martin on several occasions and found him to be a rather reserved, gentlemanly kind of man. I came to *Model Engineer* magazine in my teenage years when the great LBSC was still very much a contributor and a few years just before Martin started to write for *M.E.*, so I am sure you will understand that I feel I grew up with Martin.

While I have never built a model to one of his designs I can say that I followed his articles avidly and within these he very often provided a solution to a problem I encountered when designing my own models.

Martin had his critics over the years, including myself, but despite this, it is he who has left us a very marvellous legacy in his numerous locomotive designs and I am absolutely certain that Martin has probably done as much as, and probably a lot more than LBSC before him, to encourage people into our hobby.

Before Martin came on the scene, old model engineers were always recommending LBSC's *Juliet* design as the design for inexperienced model engineers to build as a first off for them to cut their teeth on. Martin took on the idea of designing a model specifically for newcomers to our hobby and produced his *Simplex* design for the purpose. They did indeed cut their teeth on this locomotive, so much so that by now the design has probably been built in thousands. He produced many designs much more complex than *Simplex*, but in terms of the encouragement he gave to prospective model engineers into our hobby, I feel that *Simplex* is probably the greatest of his designs.

Martin's demise is a sad day for our model engineering world and it will be a long time before his like is seen again.

Pete Rich, Monmouthshire.

Drummond lathes

SIRS, - I was particularly interested in Ron Etter's articles in *M.E.* 4209 and 4211 (28 November and 27 December 2003) concerning the restoration of his old Drummond lathe because at about the time of the first article I had just purchased one of these lathes in rather mucky and battered condition from a car boot sale.

Consulting the database at www.lathes.co.uk I deduced that my lathe

was a little later than Mr. Etter's, probably about 1908. However, having restored the machine to usable condition, the top surface of the cleaned up bed, near the tailstock end, revealed the inscription MCH B No 7236

This suggests to me that, at least at the factory level, these lathes were indeed designated as model B, contrary to the statement on the database, since repeated by Mr. Anning in *M.E.* 4214 (6 February 2004).

It would be interesting to know if other lathes surviving from this time have similar inscriptions. If not, an obvious explanation is that the beds have been reground. Being on the working surface, the inscription would undoubtedly have been obliterated.

Ray Trimby, by e-mail.

First and third

SIRS, - As a self-taught worker largely ignorant of engineering drawing, I found Jim Haslam's article most helpful (*M.E.* 4216, 5 March 2004).

Having read it, I proceeded to sketch in front and end elevation one of those truncated cones that the experts like to add to their drawings. I then understood for the first time why one way round the two views indicate first angle and the other way round show third angle.

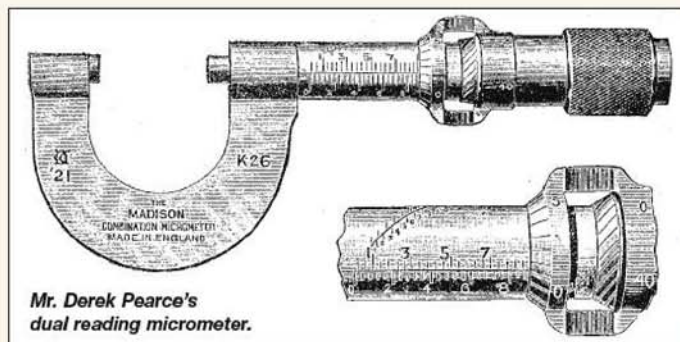
George Winspur, by email.

Pin pusher

SIRS, - Peter Spenlove-Spenlove wonders if pushpins (*M.E.* 4216, 5 March 2004) are still available.

Mine (made in England by an anonymous maker) has only a plastic handle but has saved a great deal of time and damaged fingers. However, Axminster Tools offer a superior-looking pushpin by Crown of Sheffield with a "plantation grown rosewood handle" for only £6.42 inc. VAT. I have no connection with Axminster Tools other than as a very satisfied customer for some years, and have recently used their internet ordering facility at www.axminster.co.uk finding it to be the easiest internet ordering system I have ever used.

Their extensive full-colour tool and machinery catalogue is superb, it includes engineers' lathes and milling machines and accessories, hand and power tools, welders, compressors and air tools. I presume it can be ordered on their freephone number 0800-371822 and by Freepost at Axminster Power Tool Centre FREEPOST (SWB30746), Axminster, EX13 5ZZ.



And they offer a free telephone technical advice service prior to ordering.

Ian Moignard, Jersey.

Madison micrometer

SIRS, - I append a drawing of a metric/inch MADISON micrometer illustrated in F. H. Rolt's book *Gauges and Fine Measurement* 1929.

At a guess it would seem to have been made in 1921. Hopefully, a reader will be able to tell me who made this novel instrument.

Many years later, Shardlow produced a similar micrometer. Derek Pearce, Middlesex.

Cutting conditions

SIRS, - I write with reference to letters from Mr. Lake (*M.E.* 4215, 20 February 2004) and Mr. Randall (*M.E.* 4216, 5 March 2004).

Many years ago, during the '60s, I was a director of a small firm manufacturing turned parts and welded fabrications. During this time we started using inserted carbide tips manufactured by Sandvik. We had trouble with poor finishes and the tips wearing out quickly. We sent for the Sandvik technical rep. who came into the works to watch a Ward capstan lathe at work. After a short while he walked up to the lathe, slammed the speed levers into fast and put the cuts/inch to coarsest position. As a result blue chips were flying in all directions.

He advised us that carbide had to be worked hard to get the best results. Indeed, you should get a burnished finished almost like a ground workpiece. So I suggest that Mr. Lake obtains the full cutting data for the tips he is using. He will need to know the following:

- 1: Correct grade of insert for the steel he is machining.
- 2: Optimum cutting speed in feet or metres per minute.
- 3: Optimum feed rate in inches or millimetres per rev.

He will also need to use one of the following formulae to obtain the correct speed for the given workpiece:

For Imperial
 $\text{Speed in RPM} = (\text{SS} \times 12) / (\pi \times D)$
 Where SS = Surface Speed in feet/min. and D is diameter in inches.
 For Metric
 $\text{Speed in RPM} = \text{SS} \times 1000 / \pi$

Where SS = Surface Speed in metres and D is diameter in mm.

Do not forget a chip guard as blue chips are very very hot.

Now we come to High Speed Steel. Here the opposite is true. HSS is very much inclined to produce a built-up edge or a little chip of metal from the material being cut which, due to the heat being generated during cutting, welds itself to the cutting tool. Every now and then the chip breaks away and a new one forms, and so on.

This built up edge damages the surface finish leaving it rough and uneven. Again, back in the past I learnt from one of the many expert craftsmen produced by the former English Electric Company that slow speeds and fine feeds are what is required with steels, whether they are free-cutting, silver, black mild or stainless.

Free cutting can be worked a little faster but all the others should be worked as slow as possible, depending on diameter. There have been occasions when I have used bottom backgear on a ML7 Myford. Naturally one has to be very patient as it takes along time to produce this finish. However rough cuts can be done quickly to within a few thou. of the finished size.

Patience is rewarded by a finish which again looks almost as if it has been ground. I used this method to produce a collar on which an oil seal was running in a Ferguson Tractor both for the bore and the outside surfaces.

What do we need using single point tooling?

- 1: Correctly ground standard knife tool with about 5deg. of top rake; grind this tool with flat surfaces and just knock the corner off the tool with the grinding wheel, then polish with a slip stone if you have one.
- 2: Set the tool to centre height.
- 3: Select your finest feed.
- 4: Select your slowest open speed to start with to experiment; go into backgear if required.
- 5: Apply plenty of coolant to wash the chips away.

At these slow speeds the built up edge does not form and the chips are washed away by the coolant. The result should be a bright smooth surface suitable for such



The Garner Garden Tractor spotted by Mr. Bunkham at Chale on the Isle of Wight.



The late George Sallis driving his locomotive for the last time. Photograph: Gerry Collins.

items as stainless steel pump rams or axle bearing surfaces.
Hugh Castellani, Staffordshire.

Garner Garden Tractor

SIRS, - I thought you might be interested in the accompanying photographs taken at a small steam rally at Chale on the Isle of Wight last year.

As a retired mechanical engineer I was really interested to see such an impressive piece of machinery. All the parts on this 1950 tractor were fabricated. It had been made without castings.

It would be great to restore such a wonderful machine to its former glory.

Edward Bunkham, Isle of Wight.

Bending roll improvement

SIRS, - I bought one of the cheap 12in. capacity Shear, Press Brake and Roll machines to save myself the task of making a set of rolls. For the bargain price it is a very useful addition to the workshop, but its bending roll performance left much to be desired.

The problem is that the upper (removable) roll and the back roll are both fitted with hardened bearing bushes which are free to move up and down in slots in the side castings of the machine, and these slots are too wide. This causes the top roll to assume a twisted position relative to the bottom roll.

The drive gears force the right hand end of the top roll to the back of its bearing slot, while the pressure between the rolls when forming a narrow ring pushes the left hand bearing to the front of its slot. In addition the slop in the back roll makes for poor control over the bending operation.

On my machine, the bearing slots measured 0.840in. while the bushes were 0.750in. diameter. Steel rings turned from water pipe to fit over the bushes and fill the width of the slots (for both the top and back rolls) have transformed the performance of this machine.

The only complication is that the right hand ring for the top roll needs to be slightly tapered on its external diameter to enable the roll to be fitted and removed.

Norman Eastwood, East Sussex.

Gender?

SIRS, - Here's one for everyone who has ever had computer problems ...

A teacher was taking a class of students through the complexities of the French language and was explaining the fact that the French designate nouns as either masculine or feminine. 'House' is feminine: 'la maison.' 'Pencil' is masculine: 'le crayon.'

A student asked, "What gender is a 'computer'?"

Instead of giving the answer, the teacher split the class into two groups, male and female and asked them to decide for themselves whether 'computer' should be a masculine or a feminine noun. Each group was asked to give four reasons for their recommendation.

The men's group decided that 'computer' should definitely be of the feminine gender: 'la computer' because:

- 1: no one but their creator understands their internal logic;
- 2: the native language they use to communicate with other computers is incomprehensible to everyone else;
- 3: even the smallest mistakes are stored in long-term memory for possible later review; and
- 4: as soon as you make a commitment to one, you find yourself spending half your salary on accessories for it.

The women's group, however, concluded that computers should be masculine 'le computer' because:

- 1: in order to do anything with them, you have to turn them on;
- 2: they have a lot of data but still can't think for themselves;
- 3: they are supposed to help you solve problems, but half the time they are the problem; and
- 4: as soon as you commit to one,

you realise that if you had waited a little longer, you could have got a better model ...

Mitch Barnes, North London.

(We hope that readers will forgive us this light-hearted offering so close to All Fools' Day! — Ed.)

Colour code

SIRS, - I wonder how many times readers have hunted through a tin of drills or box of taps to find the size required? Why not colour code them? There is a standard colour code used in the Electronics Industry as follows:

0: Black	5: Green
1: Brown	6: Blue
2: Red	7: Violet
3: Orange	8: Grey
4: Yellow	9: White

Coding can be applied using bands of paint. Number drills or BA taps can be applied direct, reading from (say) the point end. Fractional drills could be identified by sixteenths, or thirty-seconds, or thou — whatever suits you best.

Ivan Hurst, Surrey.

The late George Sallis

SIRS, - It was nice to see the report of the Brighton & Hove Society's Annual General Meeting in *Club Chat* (M.E. 4215, 20 February 2004) and the award of the *Bostel Cup* to George Sallis for many years of devoted service to the club.

Unfortunately, George was not well enough to be present at the AGM and the presentation took place at his home a few days later. It is with sadness that I have to report that a few weeks later George

passed away following a long and painful illness.

George had spent his working life in the building industry and over the years had been exposed to asbestos dust. Several years ago he was diagnosed with asbestosis, an incurable illness, and it has been distressing to witness his decline over the past few years, knowing nothing could be done.

Last year (2003), members ensured that George attended most trackdays, although all he could do was to sit in the clubhouse and watch the trains go by. Towards the end of the year when he realised that he could no longer look after his engine he presented his battery-electric Class 31 locomotive to the Society.

George's last few days were spent at the Martlets Hospice in Hove where he received outstanding care. I saw him a couple of days before the end and although he was in great discomfort he still managed to raise a smile.

George never married; his cousin Terry had the unenviable task of clearing his workshop, and it was George's wish that any useful items should be donated to the club for use at Hove Park, or to be sold on behalf of club funds.

The funeral took place at the Downs Crematorium in Brighton on 9 January in the presence of many club members, most wearing their railway caps in tribute. George's engine driver's cap was placed on the coffin and the picture of George driving his engine for the last time, and the Bostel Award, were displayed at the head of the coffin.

George was one those model engineers who work in the background for the good of the hobby. Someone who it was a pleasure to know and respect.

George is no longer with us in person but I have no doubt that in the coming years he will be looking down on the railway in Hove Park and watch his beloved engine carrying happy youngsters around the track.

Gerry Collins, President,
Brighton & Hove SMLE.

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This fine 1:8 scale circa 1870 Herefordshire waggon was built by Roger Morgan to drawings by David Wray and was awarded a Silver Medal.



How could anyone resist buying from a butcher with such a fine delivery vehicle? Harry Baker's splendid butcher's cart was a Silver Medal winner.

COMPETITION MODELS AT THE 73rd MODEL ENGINEER EXHIBITION

CLASS G: MODEL HORSE DRAWN VEHICLES Reported by Barré Funnell:

A surprise in this class awaited the Judges at this year's show — some 1:2 or 1:3 scale models to contend with! In fact, the scales were not correctly

quoted, so the exact figure was only estimated. In all there were eight entries, up on last year, and two of them were the 'monsters'.

Roger Morgan entered a very nice Herefordshire waggon, built to a published plan, and Harry Baker entered two trade vehicles suitably painted, lined and sign-written: a butcher's cart and a coster's

trolley. They were all judged to be of Silver Medal quality, while in the Bronze Medal category was a tilt-covered Tea Waggon by Tim Smith.

The large scale butcher's cart and coster's trolley were entered by Mr. Baker, who is clearly a competent sign-writer. He also brought along a milk float, a milk van and a bird cage built to



Also by Mr. Baker was this large scale coster's trolley and beautifully executed horse. This was also a Silver Medal winner.



A close up view of the rear of Mr. Baker's coster's cart showing the high standard of sign writing achieved on the model.



This neat Brooke Bond tea wagon was a Bronze Medal winner for its builder Timothy Smith.



Harry Baker's stylish London well-bottomed milk float was awarded a Commended Certificate.



The fourth model entered by Harry Baker was this London milk van. It too was awarded a Commended Certificate.



Not so much a model but more a piece of functional furniture this novel bird cage was also by the capable hands of Mr. Harry Baker.

simulate a caravan. Mr. Baker owns, maintains, drives and occasionally builds full-sized vehicles; he showed some photographs to verify that fact. The coster's trolley was shown with a superbly carved, if highly stylised figure of a pony, which was harnessed to the vehicle with a professionally made harness. He was awarded Commended Certificates for the milk float and milk van, but while being well-made, the bird cage was considered more a piece of furniture than a model engineering project.

Brian Young won a Silver Medal and the John Thompson Trophy with another of his discoveries, a horse-drawn Weeks potato sprayer. Essentially it is a barrel of chemical — one assumes it is insecticide — with various pumps and spraying gear attached to it. The farmer could occupy the seat on top of the barrel and drive while presumably at the same time operating the spraying gear as required.

CLASSES J1 AND J2: THE JUNIOR CLASSES

reported by
Geoff Sheppard:

There were but two entries in the Junior classes this year, but both of them were outstanding. The quality of these items came as no surprise when it was realised that both entrants came from established model engineering families, with guidance from more senior members being readily available.

In Class J1 (under 14 years), Daniel Hellier presented a beautifully made and finished version of the Stuart 10V stationary steam engine. Daniel is the grandson of our old friend Derrick Crossland, whose work has been seen on many occasions. In particular, his pair of 2 1/2 in. gauge *Nigel Minor* 2-8-0 locomotives are greatly admired. Under Derrick's watchful eye, Daniel has equipped the basic engine with reversing gear, cylinder drain cocks and neat pipework. The paint scheme selected is much more cheerful than seen on most engines of this type and is well executed, resulting in a most attractive exhibit. It is understood that the

exploits of these two fine craftsmen, one very young and the other not quite so is to be published in these pages in the near future. We look forward to reading their story.

After admiring this little engine for quite a long time, the Judges were unanimous in awarding a Gold Medal and the Under 14 Cup to Daniel for his efforts.

The other Junior entry was a most eye-catching version of those lovely Chris Craft motor boats popular in the 1930s. Originally entered in Class J3 (Under 18 years) the judges took into account that the project was completed at an earlier age by its builder Nick Finch, having been a GCSE Design and Technology project, so they decided that it should qualify in Class J2.

The hull of the vessel has built-up frames, over which is laid a sheet skin, then authentic planking. Decking and interior planking are also to a high standard, with the result that the craft has that luxurious 'feel' that was characteristic of the full-size version. With electric power, neatly installed and radio controlled, this is not merely a glass case model. It well deserved its Silver Medal and Under 16 Cup which it gained for its builder, showing that Nick is following in the footsteps of elder brother James, whose award-winning Wimshurst Machine was shown in the Loan Section this year.



Technical innovation on the farm — Brian Young's Weeks potato sprayer won the builder a Silver Medal and the John Thompson Trophy.



Nick Finch was awarded a Silver Medal and the Junior Trophy (Under 18) for this fine model of a 1930s speed boat.



This well-made and finished Stuart Turner 10V engine by Daniel Hellier was awarded a Gold Medal and the Junior Trophy (Under 14).



A 20-note Busker Organ built to John Smith's original design entertained visitors to the recent Bristol SMEE Exhibition.



This view shows the of the Author's own 20-note Busker Organ which is based on the original and popular John Smith plans.

BUSKER ORGAN

David Wilcox

takes a break from his other projects to build an instrument based on the John Smith 20 note Busker Organ

Last year my wife and I visited Chatsworth House in Derbyshire. Just inside the entrance gate was a man dressed in period costume — waistcoat, bowler hat, red 'kerchief round his neck — grinding a small organ mounted on pram wheels. It reminded me of my childhood when small street organs were still to be seen and heard in towns, often in the hands of war disabled veterans, trying to earn a few pennies; in all probability they were old barrel organs and were often out of tune. They were a hangover from the nineteenth century when every town had its itinerant street entertainers. I found the music made by the Chatsworth House organ quite appealing and, as I was looking for a change of direction, I immediately pondered whether it would be possible to make one.

On returning home, I tried the internet but this is definitely not my forte. Our Editor, Mike Chrisp came to my rescue and pointed me in the direction of one John Smith who, over a period of many years has developed a range of small DIY organs, and furthermore sells sets of plans. His Busker organ is aimed at the first time organ builder with limited resources and skills, who can be assured that if he follows the plans supplied with the package, he will have an organ which works and which can be immensely entertaining. However, more experienced model engineers have the opportunity to vary, if not professionalise, certain aspects of the design and to personalise the end product.

It has to be said that the package contains 'plans' rather than engineering drawings, and some study is required in order to digest them

and understand how all the parts slot together. A very useful constructional video is provided with the plans package; this includes musical excerpts played by finished organs and provides a target to aim for. These organs regularly appear at steam fairs and provincial model engineering shows, and I understand that several hundred sets of plans have been sold world-wide — indeed, a cottage industry has grown up around them.

Principle

There are basically three different types of busker organs: barrel organs, organs using folding perforated cardboard strip, usually known as book organs, and organs using perforated paper strip. Barrel organs are no longer to be seen and most of those that have survived are either in museums or in the hands of private collectors. They suffer from the disadvantage that only a limited number of tunes can be pinned onto a barrel and, depending on the diameter of the barrel, the tunes may not last very long.

A small specialist industry still makes book organs, but at a price since they require a multiple valve mechanism interposed between a tracker bar and the pipes. The organ at Chatsworth works on this principle. This leaves the perforated paper strip organ which, in its simplest form, uses no valves; it is one of this type which John Smith has designed. He also has plans for a more sophisticated and powerful paper strip organ which does use valves.

In essence, the John Smith organ consists of a pair of bellows operated through connecting rods to a double-throw crankshaft turned by a crank handle. The bellows feed air to a reservoir which stores air under low pressure (about 4in. water gauge). This air is fed to an airtight pressure box which contains the perforated paper strip feed spool, tracker bar and take-up spool. The tracker bar is pierced with 20 holes, each of which is connected by a tube to a particular organ pipe. As

the handle is turned, so the paper strip is transported over the tracker bar and when a hole is uncovered by a hole in the paper, air under pressure is fed by tube to the chosen pipe.

The 20 stopped pipes cover roughly $2\frac{1}{2}$ octaves and use the standard Raffin scale which was developed specially for small organs. There is a freewheel arrangement in the drive mechanism to enable the music spool to be rewound. The whole is contained in a box approximately 15in. wide, 12in. deep and 14in. high. The general idea is depicted in fig 1 but note that this is how I built my organ which, as I will explain, differs in several detailed respects from that in John Smith's plans.

Pipes

Dimensions are provided for the organ pipes which may be made from a variety of materials. John Smith used balsa wood because it is easy to obtain, fashion and glue. I used 2 and 4mm MDF board, however, almost any wood could equally well be used. Old time church organ builders used well seasoned pine. To some extent the material used may affect the tone of the pipes.

With a bandsaw and a sanding machine, I found it was possible to make up all 20 pipes and their close fitting tuning stoppers in just a few days. Preliminary tuning was carried out by blowing gently through a tube connected to the bottom of each pipe and adjusting the position of the front covers for the best note. Each pipe was then tuned with the stopper using an electronic tuning device. Smaller than a paperback book and equipped with an LCD scale, these tuners show the note being played and, on a centre needle meter, the extent to which it is sharp or flat of the desired note. They cost about £20.

The tuning stopper is moved in or out to centre the meter needle. Nothing could be simpler. The lengths suggested for the pipes are purposely 5-10% too long, so invariably the pipes have to be progressively shortened. I lined the tuning



Rear view showing crank handle, pressure box lid open and shallow duct at back for tubes to bass notes in base.



Front view showing the drive pulley and jockey wheel in slack (re-wind) position; note the plastic tubing connecting the pipes to the tracker bar.

stoppers with thin suede leather taken from a jacket cast off by my wife, but thin chamois leather could be used. John Smith also reports the use of foam plastic draught proofing strip.

Bellows and reservoir

The twin reciprocating bellows and the air reservoir are a built-up construction of plywood and wood strip which very closely follow the supplied plans. Instead of the traditional strained sheepskin leather, heavyweight rubberised blackout fabric is used for the moving parts. Both the bellows and reservoir are fitted with inlet and outlet valves made from soft leather. Foam plastic draught proofing strip is used to form the seal between the bellows and the reservoir. A strong spring attached to the top of the reservoir establishes the pressure and holds it reasonably constant while pumping.

Pressure box

The pressure box is made from plywood or MDF (I used a bit of both). Some of the dimensions are critical to within a millimetre or two and the box must be absolutely square and airtight. A hinged lid with a transparent window is sealed to the lower half of the pressure box using foam draught proofing strip. The box contains the feed and take-up spools and the tracker bar, this latter having 20 holes graduated in size and precisely spaced to match the standard of the music roll.

These holes have to be led within the tracker bar to metal tube stubs each about 1in. long protruding from the underside. Some PVC tubing is used to connect the tracker bar stubs to similar metal tube stubs fixed in the bottom of each pipe. The tubing is chosen such that its internal diameter is a tight push fit on the metal tube stubs. To ensure these connections do not come loose, they should be pushed on about 1/2in. at both ends. Naturally, each connector should be very carefully labelled with either the relevant tracker bar hole number, or the note.

Wind from the air reservoir has to be led to the pressure box by means of a tube having a suggested internal diameter of not less than 1/4 inch.

Here some initiative is required since the air outlet is on the side of the reservoir and the air inlet is on the side of the pressure box. I found that plumber's merchants stock 19mm plastic right-angled elbow joints, two of which connected by a short length of suitable PVC tubing provided a neat and air-tight solution.

Crankshaft

In John Smith's design, the crankshaft which drives the reciprocating bellows is conventionally cranked to drive the rear bellows but open cranked on the front end to drive the other bellows. Also, the front connecting rod is dog-legged to align it with the front bellows. I didn't much care for this design and so I built up by silver-soldering a conventional double throw crankshaft from brass bar. I should have used steel but it wasn't to hand! This meant that the bellows and reservoir had to be re-sited directly below the pressure box so as to align the cranks with their respective bellows. In the John Smith design, the bellows/reservoir is offset towards the front of the case which allows space for the air tubes to the bass pipes to be routed down behind

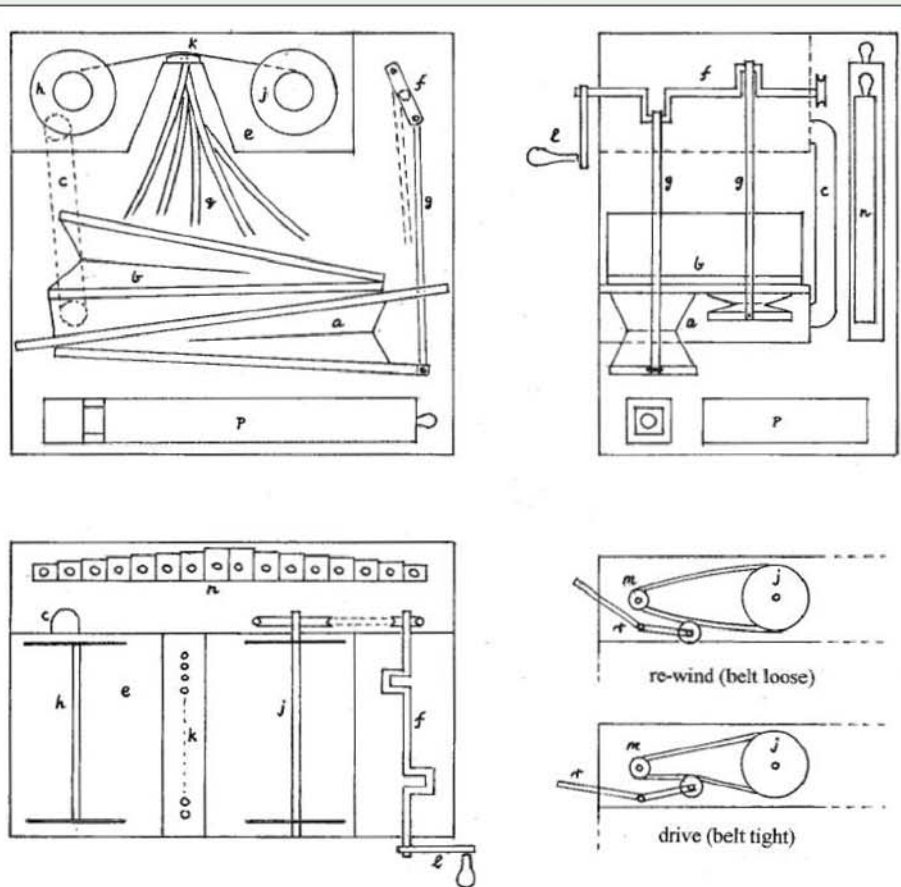


FIGURE 1 - GENERAL ARRANGEMENT OF AUTHOR'S 20-NOTE BUSKER ORGAN

a:	Twin bellows	k:	Tracker bar
b:	Air reservoir	l:	Hand crank
c:	Air connector	m:	Drive pulley
e:	Pressure box	n:	Melody and accompaniment pipes
f:	Crankshaft	p:	Bass pipes
g:	Connecting Rods	q:	Tubes to pipes
h:	Feed spool	r:	Jockey wheel/lever
j:	Takeup spool		



The set of 20 pipes with rubber bands securing top caps prior to voicing.



Top and bottom views of the tracker bar.

the rear bellows. I overcame this problem by providing a shallow enclosed duct which is slightly proud of the back wall of the organ.

In my variation of the John Smith design, space has to be found beneath the bellows for four rather than three bass note pipes. This means that the three lowest note pipes have to be folded by mitring. This appears not to affect the tonal quality but it does sharpen the note a little so the pipes should not be shortened until they have been tuned after mitring. It was quite a juggle to get the bass pipes into the space available.

Drive mechanism

The hand crank, which is screwed to the rear end of the crankshaft, was fashioned from brass sections and given a turned boxwood handle. On the front end of the crankshaft in the John Smith design, there is a small friction wheel with its periphery covered with coarse emery cloth. This drives a grooved idler wheel fitted with a Hoover Junior rubber belt, which in turn engages with a wheel turned from MDF and fixed to the take-up spool shaft. In order to re-wind the music spool at the end of a run, the idler wheel is disengaged from the drive by means of a spring loaded lever.

Once again, I didn't much care for this arrangement and designed instead a jockey wheel system configured so that the jockey wheel can be levered up to tighten a rubber drive belt connecting a small pulley on the crankshaft to a larger pulley on the take-up spool shaft. It is similar to the clutch on my motor mower. In the 'loose' position, the belt slips to permit the spool to be re-wound. It took a lot of time to get it right but it was worth it in the end.

One has to remember that the pulley drive ratio has to be set for a paper speed across the tracker bar of somewhere between 50-70mm per second. John Smith says that commercially produced music is cut at 70mm per second but the music which I have purchased sounds better when played slower than this. At the same time, the crank turning rate should be between 70-80 revolutions per minute to ensure that enough air is pumped by the bellows.

The pulley drive ratio also has to take account of the diameter of the take-up spool. The plans propose using a short length of 4in. diameter drainpipe but since I did not wish to purchase a minimum 3 metre length, I settled for a piece of 2 1/2in. diameter drainpipe which happened to be to hand. Of course, as the take-up spool fills



Twin bellows, air reservoir and release valve.

during a run, the diameter effectively increases, and the turning rate will need to be reduced. My drive belt, incidentally, is a 3/16in. cross-section 'O'-ring of approximately 5in. internal diameter. Which reminds me that all my Unimat Lathe drive belts are also 'O'-rings but of 1/4in. cross-section which cost a few tens of pence instead of pounds! So, if you choose to vary the design, you may have some sums to do to achieve the right pulley drive ratio. John Smith suggests hardwood bearings for all the shafts but I chose to use clock-type brass bushes let into the MDF.

Pipe layout

The plans pack suggests dimensions for the case and also suggests a layout for the pipe front panel. There is considerable scope here to personalise the layout and appearance of the organ. It is certainly worth giving a lot of thought to an instrument you will undoubtedly wish to show off. Once again, I varied the design by making the case slightly taller and slightly deeper so as to give me more room for my arrangement of the pipes. If one does vary the design, one needs to be aware of the need to be able to gain access to the innards of the machine and the need, for example, to be able to readily disconnect the bass pipes if one has to remove the bellows/air reservoir.

I found it useful to cut a square hole in the side, covered by a screwed panel, to give access to the bolts linking the connecting rods to the bellows arms. Because I varied the design in several respects, I was led into a lot of trial-and-error and see-if-it-would-fit/work activity, but I was rewarded by the end result.

The sub-assemblies were all glued with PVA adhesive and everything else was bolted or screwed. No pins or nails were used.

Summary

In the plans pack video, you will see sequences describing a music roll punch for which plans are also available. It is possible to buy marked-out music rolls which then need punching. It is also possible to buy ready-cut music rolls to suit the organ. There is, too, a booklet available which explains how it is possible for people with little or no musical knowledge to translate a simple music score into a punched music roll.

For the plans you should contact John Smith, (tel: 01525-712496).

For ready perforated music, kits of parts and tuning meters, contact Rollcutter, (tel: 01843-847308/587100). Both www.buskerorgan.com and www.rollcutter.com may be found on the internet. I hasten to add that I have no connection with these suppliers.

In summary, I would recommend this as an excellent project for someone looking for a change of direction or a short diversion from some other project demanding years of work. It is all the more satisfying to construct something that does something rather than sitting in a glass case. There is a good mix of wood and metal work and parts which a model maker feels he might not be able to tackle, such as the crankshaft, can be purchased separately.

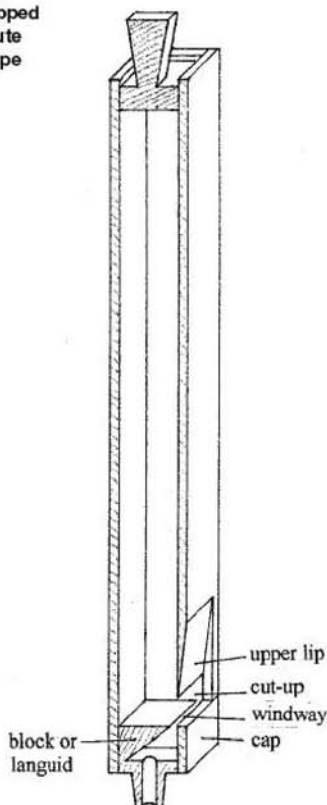
Model engineering skills and machine tools are not necessary, but if one has them, then a more professional result is possible. You may be assured that if the plans and directions are followed, the organ will work and provide much entertainment. The construction of this organ took me about 150 hours but it could have been completed in a lot less time had I stuck closely to the plans. You may well find yourself getting hooked on organs and if so, then plans are available for more advanced organs. You will be joining a growing fraternity.

Organ pipes

To round off this article, I am including a few notes on organ pipes. The voice of an organ lies in the pipes and their method of construction will determine the tonal qualities of the organ.

Church organs have many ranks of pipes divided into registers with 'stops' which connect the air supply to one or more ranks of pipes. Some of the more sophisticated busker organs may have more than one rank or register of pipes. Pipes may be open or closed (stopped), square, rectangular or circular in cross section and may be constructed from many different materials including wood,

FIGURE 2
Stopped
flute
pipe



MDF, metal or even cardboard. Using special techniques, pipes can be made to imitate the sound of many different wind and string instruments. Vibrating reeds may also be used in organs.

Figure 2 shows the cross-section through a stopped pipe. Wind entering the foot hole is directed past the block or languid through a narrow slit (the flue or windway) to impinge on the sharp upper lip. Here the wind flow is disturbed so as to cause eddies which set the column of air in the pipe oscillating at the resonant frequency determined by the length of the pipe. The position of the upper lip in relation to the airflow through the slit is critical and is part of the voicing process. These pipes

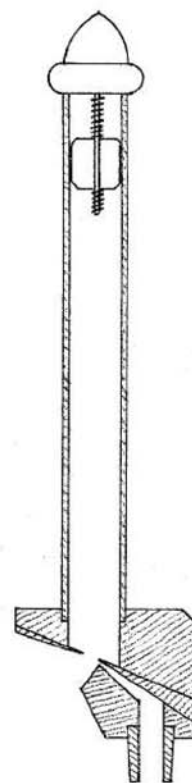
are easy to make using John Smith's approach and fun to experiment with using gentle lung pressure to voice them.

Due to the position of the nodes, i.e. where there is no displacement of the oscillating air molecules, an open pipe will resonate at a frequency twice that of a stopped pipe, so for the same frequency an open ended pipe will be twice as long as a stopped pipe. Hence for compactness, stopped pipes are more often used on small organs. This is perhaps a pity because open pipes will support all the overtones of the fundamental frequency and so tend to produce brighter tones than stopped pipes which support only the odd harmonics. As a result, closed end pipes may sound rather dull on their own. Stopped pipes use a close fitting sliding stopper for tuning while open end pipes use some form of slider to lengthen or shorten the pipe.

Tubular metal organ pipes can take many different forms. Church organ pipes are made from a special tin/lead alloy; they would be beyond the scope of most model engineers and are not found in portable organs. A register of pan or piccolo pipes on the other hand, is often found in portable organs and certainly lend themselves to model engineering skills. The profile of a piccolo pipe is shown in fig 3. These pipes differ from the others in that the wind is blown transversely across the lower end of a vertical tube. They are high pitched and are usually played in unison with a register of wooden flutes sounding an octave below. Traditionally, piccolos are tuned by means of a plug attached to a screwed rod turned by a wooden acorn at the top of the tube.

The word 'scale' in the context of organ pipes is used to describe the ratio of pipe length to pipe cross-section. For any one register of pipes, this is usually a constant in order to achieve a tonal balance across the notes of that register. Narrow cross-section open pipes enhance the harmonics further and tend to sound brighter than fatter pipes of the same length. Clearly there is great

FIGURE 3
Piccolo
pipe



scope for amateur experimentation in the building of organ pipes.

For greater detail covering the construction of pipes suitable for small organs, the reader is referred to a book entitled *The Fairground Organ - Its Music, Mechanism and History* by Eric V. Cockayne, or alternatively *Waldkirch Street and Fairground Organs* by Herbert Juttermann, ISBN 3-87885-249-5. The latter is available from Camden Miniature Steam Services, Barrow Farm, Rode, Frome, Somerset BA11 6PS, tel: 01373-830151; fax: 01373-830516; website: www.camdenmin.co.uk

Interested readers are also directed to Alan Pell Music (tel: 01406-330279).



SYNTHETIC CAST IRON

Ernie Henne

in Australia, discusses the basic metallurgy of grey cast iron and describes his approach to its production in a home foundry.

Some time ago a friend of mine built a small induction furnace and wanted to test its performance when melting cast iron. I suggested that he could make cast iron by using mild steel scrap and raising the carbon content until a soft cast iron resulted. He would operate the furnace and I would be the amateur metallurgist deciding what ingredients to add.

The goal was to make soft cast iron from various types of scrap steel available in the amateur workshop. The reason why I wanted to try this method is that, because of the distance involved,

I could not attend a hobby foundry course at a university. So, once a year on open days I would go and observe on how cast iron was made from mild steel scrap.

In my workshop, cast iron is melted using a waste oil fired crucible furnace and a cupola to supply castings for model steam engines and workshop equipment, so an offer to try a new method of melting was jumped at.

Making cast iron

To make cast iron you have to know what cast iron consists of. A typical analysis is 3.5% carbon, 2.0% silicon the balance being iron and many trace elements such as phosphorus and sulphur. Mild steel has approximately 0.15% carbon, 0.1% silicon and many trace elements such as phosphorus and sulphur. So for cast iron, the carbon content has to be raised to the proper level, but what happens is that the carbon remains

dissolved as a solid solution of cementite resulting in white cast iron which is very hard.

To soften it ferrosilicon is added. This alloys with the iron, but the solid solution cannot remain when silicon is present and is thrown out as graphite, becoming a mixture of iron, silicon and graphite. The more silicon is added the more carbon comes out of solution and the cast iron becomes more soft. Often the trace elements can have a considerable effect on how well the silicon softens the cast iron.

Ferrosilicon comes in two forms. It can be supplied in lumps weighing on average 100g or in a crushed form where each piece weighs under 0.5 gram. The crushed product dissolves quickly and is usually preferred. Ferrosilicon can be purchased from firms offering foundry supplies. John Winter & Co. Ltd. advertise in *Model Engineer* and would therefore be a good place to start. They can be contacted at PO Box 21, Washer Lane Works,



The furnace is charged with layers of rusty nails, pulverised coke and ferrosilicon.



Reaction with the carbon in the pulverised coke reduces the melting temperature of the steel.



Ferrosilicon controls the form of the carbon in the resultant iron, ensuring the casting is not hard.

Halifax, HX2 7DP; tel: 01422-364213; fax: 01422-330493; e-mail: carol@johnwinter.co.uk; website: www.johnwinter.co.uk If telephoning, ask to speak to Carol White. At the time of writing, ferrosilicon ladle alloy was available from this company at £6.76 plus VAT per 200g pack. Please note that John Winter operate a minimum order policy of £25 nett.

Ingredients

In early experiments with the induction furnace, I used carbon rods to bring the carbon content up to cast iron level; it dissolved very easily when stirred around in the molten metal. Getting enough carbon rods can be a problem so their use was abandoned. When melting scrap cast iron in the cupola I noticed that the resulting castings were always softer than castings melted in the crucible furnace. Enquiries were made as to why this was happening. I was told that when molten cast iron flows over coke in a cupola it absorbs carbon from the coke plus the trace elements in it, so it will have a different analysis than the cast iron from the crucible furnace. So I used crushed coke to take advantage of its ability to soften cast iron.

To start the melt, a handful of rusty nails is placed in the bottom of the furnace and crushed coke is sprinkled over them until they are covered. This is repeated with further layers until the furnace is full. Then the power is switched on. As the temperature of the steel rises, it begins to absorb carbon until a point is reached where sufficient has been absorbed; the surface then melts and runs down to the bottom of the furnace. The surface is no longer steel; it is cast iron which melts at a lower temperature (1,150-1,250deg. C). On its way down it picks up more carbon, becomes very fluid and will dissolve steel very quickly.

The actual melting point of mild steel was never reached. As the surface of the steel in this process melts it can be watched with the naked eye whereas steel melting is too dazzling for the naked eye. All the earlier melts were started by melting cast iron and then dissolving the steel into it. When the furnace was full, carbon rods were stirred in. This method was used because steel melts at a very high temperature and crucibles do not last long with this kind of treatment. If steel has plenty of carbon to absorb, the melting point is considerably lowered, melting proceeds much more quickly and crucibles last longer.

As you learn more, methods can be changed to improve the process. To find out if enough carbon

has been dissolved a carbon rod is stirred in, if it dissolves quickly more coke has to be added. If it does not then ferrosilicon can be added. Ferrosilicon contains 75% silicon with the balance of iron and other trace elements.

A calculated amount is added to raise the silicon content from 0.1% to 2%. A wedge test is poured and broken to see if it is completely grey, if not, more ferrosilicon is added (*A wedge test involves casting a wedge shaped specimen like a knife blade. A typical one might be 4in. long, 0.4in. wide at the back and 1.25in. deep. This is quenched after solidification and broken in half. The depth of chill can then be assessed with a special gauge — Ed.*) I found by carefully weighing the ferrosilicon, a 2% silicon content in cast iron always resulted in a soft metal friendly to cutting tools.

Test castings

After many melts and trial castings machined in the lathe, I was amazed how easy it was to make soft castings. I fully expected them to be very hard to machine with the tool bouncing off the hard spots! Flushed with success other steels were tried, i.e. high tensile bolts. The resulting castings were slightly harder but there were no hard edges. So I decided the ultimate test would be to use ball bearing races which are extremely hard.

To my amazement, the small flywheel I made machined really well and had a very fine grain, it looked like free cutting steel after it had been machined in the lathe!

Another experiment

After many successful melts I decided to use this method with my waste oil fired crucible furnace using a clay graphite crucible. When melting cast iron in this furnace, the maximum temperature inside the furnace before the crucible is taken out for pouring is 1,550-1,580deg.C. The metal temperature is 1,420-1,450deg.C, so the metal temperature is always 100-130deg.C below the furnace temperature. Since the melting point for mild steel is well over 1,500deg.C, this furnace cannot melt mild steel.

The process is similar to that when mild steel is case hardened by carburising, except that it happens more quickly at higher temperatures. The same thing happens when salt is sprinkled on snow. The snow melts as the salt lowers the melting point of ice. Some mild steel was placed in the crucible and completely covered with

crushed coke and the furnace was fired up. After about 45min. all the mild steel had absorbed the coke and was in a molten state, so more steel and coke were added until the crucible was full. Ferrosilicon was added and the metal poured into moulds. The metal was extremely fluid to pour and did not have the usual slag on top.

With much anticipation the castings were knocked out of the moulds and test cuts were made in the lathe. Unfortunately they all had a hard skin on the edges, so they were rejects, some were remelted in the induction furnace and more coke added to soften the metal. These castings were soft to machine.

There are fundamental differences in the way the two furnaces work. Crucible furnaces always have a flame above the metal and also oxidise the metal. The furnace has to be switched off to add coke to the metal so it can be stirred in. The temperature of the metal drops and less carbon dissolves so the furnace has to be switched on to reheat the metal. When you do that a few times it can be a hot, tiresome process. My friend suggested trying the experiment again but this time cutting back the blower air and making the furnace run a lot cooler. So the furnace was set to run at 1,400deg.C. To my surprise it took only a few minutes longer to melt and proves that the mild steel absorbs enough carbon to lower its melting point. More coke was dissolved in the molten metal than the previous time and all the castings were soft to machine.

Conclusions

The induction furnace is a lot easier to operate than a crucible furnace. As an added bonus, there is no noise from the furnace so neighbours are completely unaware that a foundry is operating in their midst! All model engineers throw away their mild steel swarf, with this furnace it can be remelted and used for other projects. Stainless steel and any other exotic alloys can be melted for gas turbine blades, so the possibilities are endless.

The furnace operates on 240V single phase power, so any standard 13A plug can be used. It uses about 4kWhr. of power to melt a crucible full of cast iron, so is very cheap to run. From a cold start it takes about 1 1/4hr. to melt a full crucible of cast iron which holds 3kg of molten iron.

I must admit that I grew used to using it and when using my old furnace in comparison I found that it was doing things the hard way! 

PETE'S PAGE

Peter Spenlove-Spenlove

takes time away from his workshop to visit the Cathedral of the Canals, a splendid example of Victorian waterways engineering, 1875.

The Northwich district of Cheshire lay above vast deposits of salt (sodium chloride) which for centuries has been mined for culinary use and as a feedstock for the region's chemical industry. Two navigable waterways run through the district; one is the River Weaver with access to the Mersey and the open sea, the other is the Trent & Mersey canal from the industrial Midlands. It was necessary to transport goods both ways, from the Mersey to the Midlands and vice-versa. The snag was that the canal was 50ft. higher than the River Weaver.

At Anderton, just outside Northwich on the north-western side, the canal was only 400ft. from the river. Goods here were unloaded and carried on pack animals up and down the steep slope. Bulk salt was shovelled into tubs from the canal narrow boats and wheeled to wooden chutes down which it was tipped into River Weaver boats below. As a result of this procedure the river water became very salty and corrosive.

Packed in straw, pottery also had to be taken from the canal boats and re-packed into pannier loads for the pack animals to take down to where the plates, cups and so on were re-packed into the Weaver boats. These latter vessels brought flint stone from Kent and china clay from Cornwall collected from sea-going ships in the Mersey. These heavy materials had to be carted or carried up to the canal for their trip to the pottery makers. All this cartage between the waterways added to the cost. Furthermore, the pottery people were getting fed up with the resultant breakages.

Captains of industry asked for a proper water link whereby boats could pass through this bottle-neck. With typical Victorian flair, a flight of locks or an inclined plane system were rejected in favour of a relatively new idea. The notion was to run the boat into a tank of water, lift it 50ft. up to the canal level and sail out again. Simple! The Victorians had the technology, so they built the Anderton Boat Lift. No more broken china nor manhandling of flint stones, though of course lots of other goods were also carried. The Victorian engineers knew all about hydraulic (water) systems. In London a network of underground pipes conveyed hydraulic power to lifts (elevators), dock cranes and moving bridges, all powered from central pumping stations with accumulators. Liverpool's docks were similarly equipped.

Although the river was 400ft. from the canal, a warehousing basin with wharves extended towards the canal so that the salt could be tipped down steep chutes. The boat lift was built here (see sketch). From the canal a small basin was constructed where boats could await their turn to descend. After reading John Olsen's European canal systems articles, overseas readers should



The right-hand caisson is on its way down. The brick hut was originally for the toll collector. The sloping 'A' frames support the 1908-1983 winding system which serve no function today.



The trip boat is descending the 50ft. 4in. from the Trent & Mersey Canal to the River Weaver. Note the 3ft. dia. ram under the left hand caisson. Its ceramic coating protects it against corrosion.

THE ANDERTON BOAT LIFT

note that the British inland canals were much smaller. Locks, bridges and other structures were standardised into two sizes and the boats were made to fit. Barges were 13ft. wide and 72ft. long, lock entrances being slightly wider.

For various reasons, a few canals used narrow locks. Boats using these were half the width at 6ft. 6in. but were still 72ft. long; hence the term 'narrow boat', not barge! When working through the wide canals a crew would often tie two narrow boats side by side to save costs.



The Anderton Lift viewed from the south. The right-hand caisson gate is closing after the trip boat has left on its way into the River Weaver.

The Anderton lift, when it was first opened in 1875, consisted of two caissons at river level placed side by side. Each weighed 250 tons in working order, and one barge or two narrow boats could fit in each, the caisson being 75ft. long and 15ft. 6in. wide. It was constructed of wrought iron with rubber sealed guillotine (i.e. raise and lower) gates at each end. Under the centre of each caisson was a 3ft. diameter hollow cast iron hydraulic cylinder extending almost 60ft. down, founded on firm rock below a gravel stratum. These two rams were connected by 5in. pipes and valves so that as one went up, the other caisson came down. To maintain the water in the hydraulic system, a 10hp steam engine pumped water into a gravity weighted ram accumulator at well over 600psi.

To steady and guide the caissons, a frame of stout cast iron vertical members braced each to the other, was constructed. Slipper blocks on each corner of the caisson slid on guideways cast on the uprights. The boat floating in the upper caisson was level with the canal and a newly constructed side basin. An aqueduct of wrought iron on cast iron columns reached out from the basin and connected with the caisson's guiding frame. The aqueduct had a dividing wall along its centre and two independent guillotine gates at each end. The raised caisson was exactly in line with one gate. The guillotine gates could be raised to let the boat leave and enter the aqueduct.

Now the gates were lowered, the boat would go to the other end and, when that gate was raised, it would go on its way along the Trent & Mersey. The toll was paid at the bottom and a transit was said to take 10-15 minutes. Both caissons were used but if one needed attention, the other could be used on its own. Such a transit took up to 30 minutes as the steam engine had to work much harder.



A 72ft. narrow boat is steered under Ashby canal bridge 52 without bumping the sides - no easy task when a wind is blowing!



Converted working narrow boats, and others, await weekend leisure use on the Ashby canal in Leicestershire.



A typical 6ft. 6in x 72ft. UK narrow boat. A cabin has been fitted over the original open cargo space to provide all the comforts of home.

The lift in close-up

When I recently travelled on the Anderton lift our tour guide provided many facts and figures. Unfortunately I have forgotten the length of the aqueduct, however I should guess that it is somewhere in the region of 150-200ft. long. A fellow passenger in our glass-topped tour boat asked the tour guide "If you have a gate in the caisson end and another close to it in the aqueduct, why do you need one from the aqueduct to the canal?" "Good question" replied the guide "If the caisson gates should fail to shut or break away, all the canal water back to Manchester would pour down 50ft. and wash us down too!" We all smiled! "This lift was built in 1875 and it has never happened — yet!" A pause, then "But don't worry, ladies and gentlemen, we have cameras and sensors watching every moving part. The controller has TV screens and computer interlocks in his cabin above us. Through big windows he can see everything too, including us in this boat."

The 1875 water hydraulic lift was doing good business but, by 1904, the salt water had caused serious corrosion to the rams. It was therefore decided to build a new lift around the existing one. This took two years to complete, meanwhile the original lift carried on, albeit with a few 'stoppages' (canal speak for a temporary closure). Five tall 'A' frames were raised on each side to support a machinery deck above the existing structure. Rows of huge geared pulleys on this deck were driven by a 30hp electric motor (one for each caisson, I suspect) through a worm gearbox and bevel gears to a long shaft of pinions mating with the 6ft. diameter gear pulley castings.

There were 1 1/4in. wire ropes running over these pulleys and down to each side of a caisson. Huge (cast iron?) weights hung on the other end of the ropes, all suspended outside the 1875 framework and between the 'A' frames. It is often conventional to quote ropes by its circumference but our guide said "1 1/4in. wire ropes." I suggest that he meant diameter. Old photographs in the Visitor Centre showed a mass of ropes which were clearly not thin! The rams were removed as redundant.

By 1908 the lift was fully electric and running. Instead of working valves for 600psi water, the controller now had 400 volt knife switches, ammeters and a voltmeter (or two ammeters, one for each motor, the photograph is not clear) and a 'tram type' motor controller. From his cabin he could not see what was going on, so it is not clear how he stopped the lift at the exact position for opening the guillotine gates. Another old photograph shows a man winding the gates up or

down but I suspect motors were later used as we were told that now with electric lifting, only two men were required to operate the lift, plus a labourer to marshal the boats and grease the machinery, gears, ropes, etc. Each caisson could work independently.

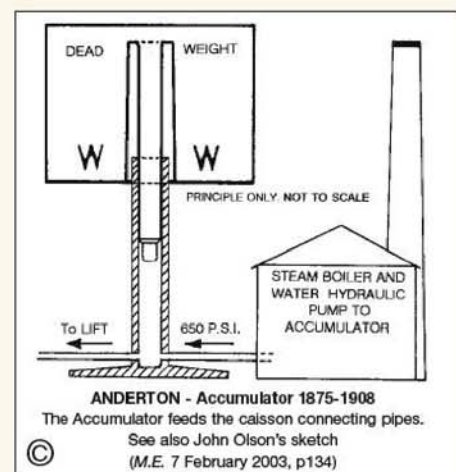
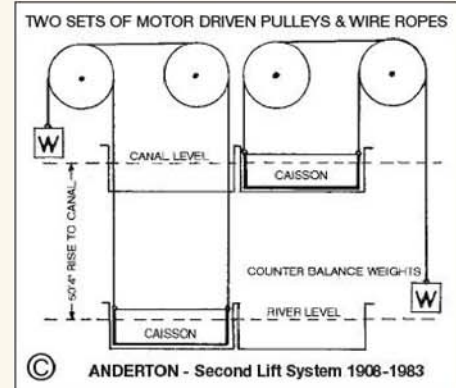
New lease of life

By the early 1980s the lift was found to be badly corroded, was deemed unsafe, and was closed. Before the waterways were nationalised in the 1950s, the lift was administered by a Trust. Fortunately, just before its closure, the lift was given 'Ancient Monument' status and as such could not be destroyed. Various groups then set about raising money to preserve and hopefully to restore the lift for traffic again. Work commenced in 2000 and, by Spring 2002, the two caissons once again carried boats between canal and river. However, in this third phase of the ship's operating history it had reverted to hydraulic power, oil this time!

New ceramic coated rams in fresh cylinders were duly fitted. Where badly corroded, all wrought iron, mild steel and cast iron parts were replaced or reinforced. We learned that the original wrought iron resisted corrosion far better than the later (1900s) steel additions. This fact has been observed many times elsewhere. The second system of 'A' frames, pulleys, etc., has been retained but has no historical value as only the ropes and counterweights are absent. Painted in matt black, the Anderton lift looks most impressive and our boat was raised in approximately 10 minutes.

The cost of restoration and, I presume, the buildings, etc., was said to be £7 million which was met by 'Friends', The National Lottery Fund and British Waterways. The body is active in re-opening old canals and locks for pleasure use. With 2,000 miles of navigable inland waterways at our disposal for boating, fishing and nature's peace, Anderton is well worth a visit. Try to pick a dry day as it could be difficult to see clearly through the trip boat's glass when rain spattered.

Although someone had built a model of the Anderton Boat Lift from thousands of matchsticks, only model engineers who love cutting herringbone gears should attempt one. There are seventy-two 6ft. gears with 72 pinions and the bevel gears number either four or eight. These too, are cast in iron with herringbone teeth. The pinions are shrouded. Being exposed to the weather, the gears were heavily greased and said to run quietly! As the public may not go onto the machinery deck, I suspect that the gears up there cannot rotate any more and are coated with a maintenance free weatherproof coating.



We were told that a model of one side of the lift was made ages ago, possibly for the engineers. This is on display at the British Waterways Canal Museum at Stoke Bruerne in Northamptonshire. On my visit I looked out for dimensioned drawings, but found none of use to a model engineer. Maybe, in due course, one will be published. However, I did discover an interesting repair detail. When the first 3ft. diameter ram became seriously corroded and grooved, water leakage through the stuffing box, or gland became a problem. The ram was extended to expose the damage so that some poor fellow could chisel grooves to be filled with copper strips which were filed level.

This worked fine for a while, but the salty water made a good electrolyte and the iron/copper junctions corroded even faster! This could obviously not go on as the lift was now very busy. The trustees therefore initiated the design and construction of the electric system using wire ropes and counterbalance weights without too much



A view south from the upper basin, along the aqueduct. The 1875 brick boiler and pump house is under the aqueduct. Note the control cabin over the end of the aqueduct. Landscaping of the site is now almost complete.



A view from the public grounds looking south-west. The massive upper structure on its five plus five 'A' frames is not functional, although is retained as the structure has 'Ancient Monument' status. For safety, the massive balance weights and wire ropes have been removed but are on display.



On board the trip boat and approaching the aqueduct (canal). The guillotine gate is visible as our guide provides a commentary on the lift's history.

interference with traffic using the hydraulic system. The steam engine was compounded and its condensate water replaced the canal water in the rams etc. Corrosion still occurred, we were told, and it was not possible to delay the rope system.

This continued with very little trouble until road haulage resulted in commercial traffic dying away to leave a burgeoning use of the canal system by pleasure craft. Many old narrow boats have been converted to pleasure use and new ones built, mostly to the 6ft. 6in. width to allow access to almost 2,000 miles of inland waterways at a 4mph speed limit. Ducks, waterfowl and the earthen banks in some canals do not appreciate a high speed bow wave!

Overseas readers having read about ship lifts on wide canals in mainland Europe may not realise that almost all canals in the UK are narrow. The Romans dug one of the very first to move corn, stone, etc. At the very beginning of the industrial days, many miles were dug to move coal, bricks, lime, wool and corn, etc., hauled by horses. They thrived at first, but the newly emerging railways brought about a loss of trade for the canal narrow boats and barges. Many miles of our inland waterways became derelict, silted or overgrown with nature's incursions.

Fortunately, recent decades have seen great strides made to restore the canal system for pleasure craft and occasionally a small amount of commercial use. One can still see a horse pulling a narrow boat, but most boats rely on rather noisy

diesel engines. A few enthusiasts have even fitted a steam engine which is very quiet until the warning whistle is blown! A converted working narrow boat can provide living accommodation for a

family while spending a week or two exploring the canals, either in their own boat, or one hired from a number of inland boat yards which are often called marinas!

A question of levels

When explaining how the system works today, I was asked a very pertinent question. "The Weaver is a river, does its level vary with rainfall?" Due to the fact that it has been canalised by adding a lock system and overflow to maintain a constant water level, the answer is no. Man-made canals use similar systems. Water

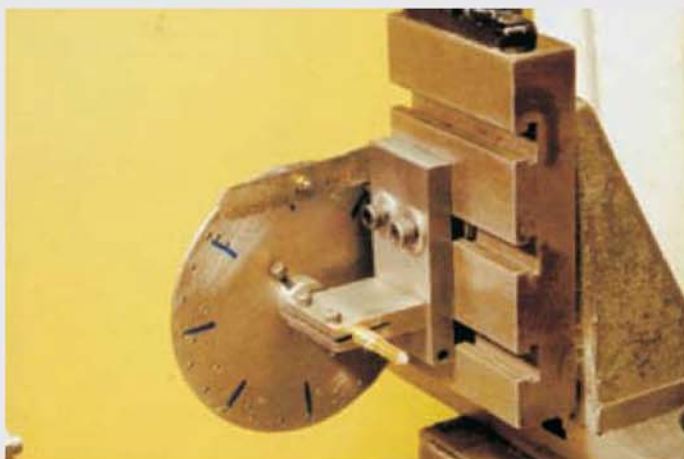
losses are made up from canal reservoirs or even pumped water from nearby rivers by wonderful old steam engines, several of which still work and are visitor sites in their own right. Very occasionally a prolonged drought may cause levels to drop in some districts. The canal may also be closed to boaters in winter due to ice, although in older days, ice-breaking narrow boats kept the waterways clear for working boats. Today very few tourist boaters venture forth in such conditions, although most converted narrow boats now boast heating and all home comforts.

At the Anderton Lift, small changes in water level of an inch or two can be accommodated by equalising the caisson water level with the river or canal before fully opening the guillotine gates. This took about two minutes before our trip boat entered or left a caisson, whether going up or down. During the 1875-1908 hydraulic days, the caisson at the canal (top) position received slightly more water than the caisson below. The extra weight during descent drove the lower one up. The lift operator controlled the water transfer between the ram cylinders by using valves in the connecting pipework. During maintenance, one caisson and ram can be isolated. The steam engine pump and accumulator could raise a caisson, but our guide said it took about half an hour.

If you have access to the web, try visiting www.andertonboatlift.co.uk. They seem so proud of their restoration that I feel sure this site should provide points of interest. At the time of writing the lift is open to land borne visitors (car park 100 yards) every day from late March until early October. Call 01606-786777 to confirm facilities. As the lift is manned, I presume that the same times apply to boats as well.

Cathedral of the Canals, a 30min. video, is available for £9.99 plus £1.95 post and packing from Anderton Boat Lift, Lift Lane, Anderton, Northwich, Cheshire CW9 6FW. 





The clock pinion cutting fixture mounted on a vertical slide with a previously machined pinion in place.



The fixture in use. The cutter is driven by the lathe mandrel and the work fed towards the operator.

CLOCK PINION CUTTING

John W. Parslow

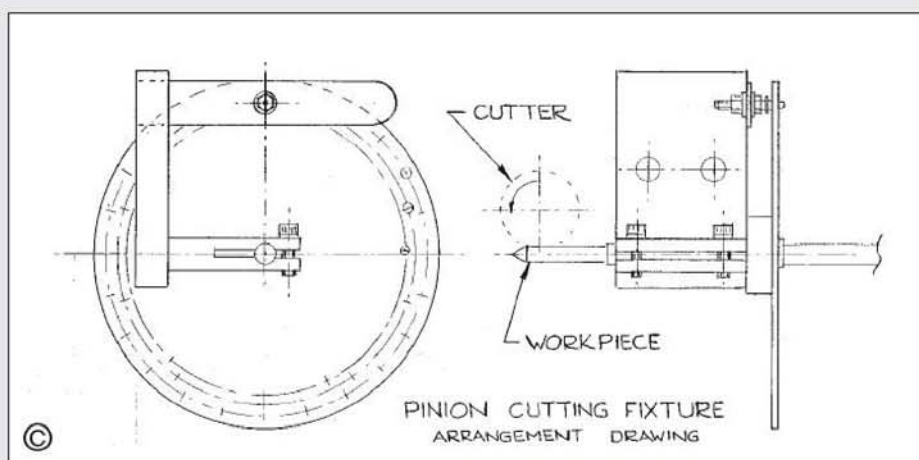
describes useful techniques for the aspiring horologist.

As a relative newcomer to clock making, I read Ian Beilby's article on pinion cutting with considerable interest (*M.E.* 4201, 4203, 8 August and 5 September 2003). Mr. Beilby describes the process of pinion cutting in some detail and makes a strong case for separate pinions and arbors assembled using Loctite. However, as he states, the root of the pinion has to be of sufficient diameter to allow this technique to be used.

A commonly used module on skeleton and bracket clocks is 0.6; pinions of this or smaller modules need to be cut integrally with their arbors if flimsiness of construction is to be avoided. This short article is intended to complement Mr. Beilby's by showing how this can be done on the small lathe.

Two problems arise when making combined arbors and pinions. The first is how to depth the train without an elaborate and expensive depth tool. The second is how to heat treat the finished arbors without distortion.

The first is easily solved by making exact replica pinions in brass which can be drilled and mounted on suitable runners in the simple



depth tool referred to by Mr. Beilby and described by a number of writers in the past. The second is by substituting the commonly used silver-steel with EN24T (ref 1). This material has been recommended by several writers in recent years. It is a high tensile steel which machines more easily than silver-steel and requires no further heat treatment. Whether it is as durable as silver-steel I do not know, but I have a bracket clock made with arbors and pinions in this material which has been running for some seven years and shows no sign yet of wear. Of course, if

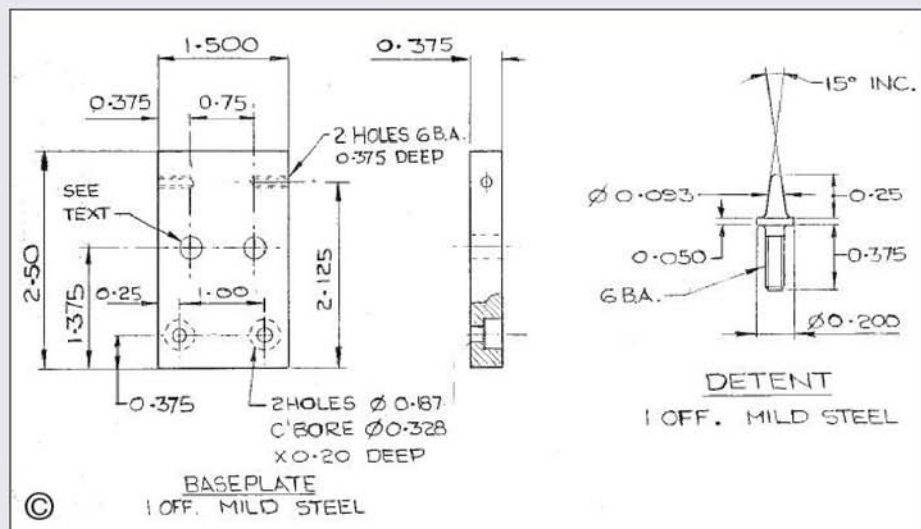
you are confident of your heat treatment technique then by all means use silver-steel or EN8M (ref 2).

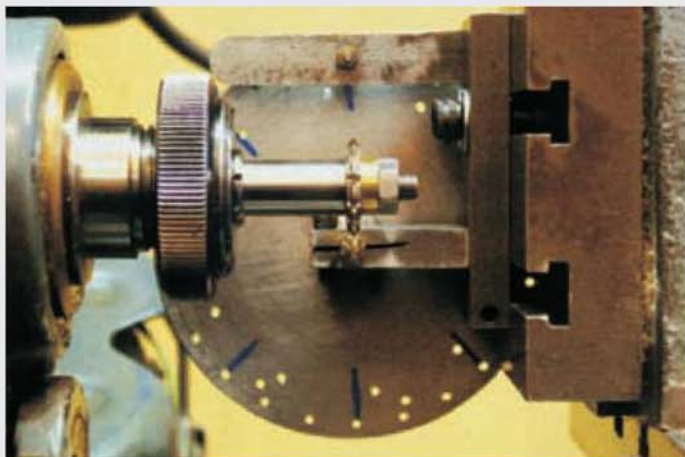
Looking around for a suitable method of making combined pinions and arbors I came across a series of articles in *The Clockmaker* magazine (ref 3) by Eliot Isaacs FBHI in which he describes the making of a 'beginner's clock'. These articles were intended to introduce the model engineer to the techniques used in clock making. They described a method of milling pinions using the lower speed range and rigidity of the lathe to drive the cutter with the pinion blank held in a small milling fixture attached to the vertical slide of the lathe.

I tried this method and found it to be almost ideal. The cutter arbor and milling fixture were easily and cheaply made from readily available materials and proved to be very rigid in use. A further advantage is that the indexing system used allows the pinion blank to be removed for inspection at any stage in the milling procedure and replaced without losing the indexed position.

Although the method was designed to cut 0.6 module pinions on Myford Series 7 lathes, it is easily adapted to other modules and almost any make of lathe equipped with a vertical slide. All credit is due to Mr. Isaacs for the concept.

As there appears to be a resurgence of interest in clock making in *M.E.* and *The Clockmaker* ceased publication around 1994, it seemed worthwhile to bring the method to the attention of constructors who may not have seen the original articles.

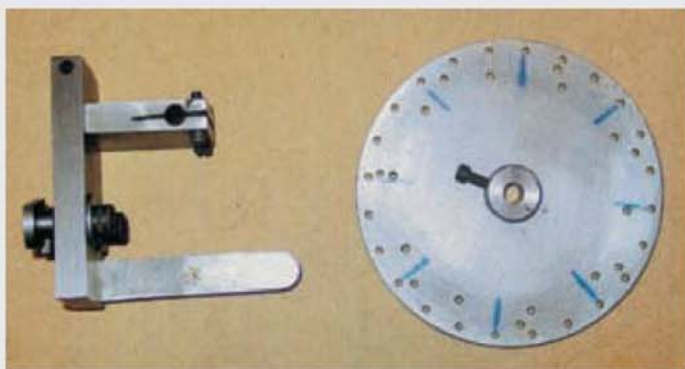




The operator's view of the cutting process with the work rigidly held in the fixture and the cutter mounted on an arbor gripped in a collet.



A bird's-eye view of the set up shown at left. Indexing is by use of the division plate and spring detent shown to the right of the photograph.



Left: main components of the pinion cutting fixture. The indexing plate is attached directly to the clock pinion.



Right: typical cutters and arbors seen here with a pinion blank and a finished pinion.

Description

The accompanying drawings show details of the milling fixture, which is basically as described by Mr. Isaacs but with a more versatile indexing system enabling pinions of 6, 7, 8, 10, and 12 leaves to be cut. The two fixing holes in the back plate will depend on what vertical slide and fixing arrangements are to be used.

The bearing block is probably best faced on all sides, drilled and reamed 0.250in. dia. in the 4-jaw chuck. Ideally it should be made from 3/8in. thick material. The 1/16in. wide slot needs to be fairly deep. Merely cutting through to the 0.250in. bore will require excessive force to be used on the 4BA clamping screws to properly secure the pinion blank. The bearing block is secured to the back plate with two 2BA cap head screws which, when well tightened, produce a rigid assembly.

The dividing plate can be cut to diameter then held in the 3-jaw chuck to be bored 0.437in. dia. and the dividing hole positions transferred from a wheel cutting dividing plate fixed to the rear of the headstock spindle. A drilling spindle can be used if available but, in my case, a sharp pointed tool was fitted to the lathe tool post and the three pitch circle diameters were scored into the surface of the plate, pulling the chuck round by hand. A dividing plate was then set up in the rear of the headstock spindle and the position of the dividing holes transferred by scoring across each pitch circle diameter. The intersection of the score lines provided an accurate location for a centre punch before drilling the holes.

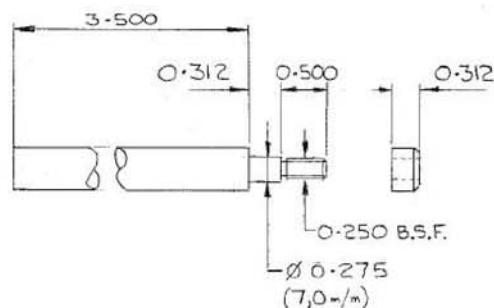
The stub mandrel which carries the pinion cutter was made from 1/2in. dia. silver-steel, the ground diameter of which will ensure a true running cutter when held in a 1/2in. dia. collet. Alternatively, one of the commercially available soft-nosed taper arbors (ref 4) could be machined to hold the cutter.

Setting up

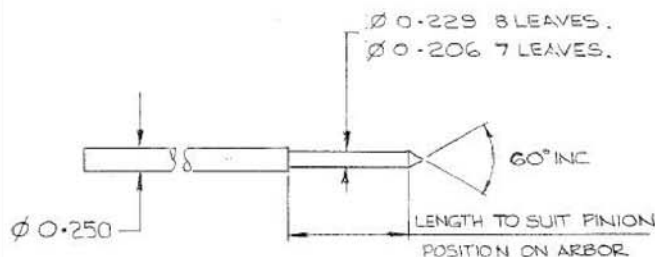
To set up the cutting process, first prepare the number of pinion blanks required plus a couple of spares. Some pieces of 1/4in. dia. brass rod will also be needed to produce the replica pinions already mentioned. Attach the milling spindle to the vertical slide such that the pointed end of the pinion blank points toward the front of the lathe and the dividing plate is at the back. Square up the fixture to both axes of the lathe using a dial test indicator and a piece of 1/4in. dia. silver-steel held in the bearing block as a test bar. This should be done accurately.

Fit the pinion cutter and arbor to the headstock of the lathe. It is now necessary to centre the cutter and pinion blank. This can be done as suggested by Mr. Beilby, using the pointed end of the pinion blank as a centre. The method I use is to centre the cutter and pinion blank by eye then take a light vertical cut just over halfway across the faced end of a piece of brass rod held in the bearing

block. Index the rod around 180deg. and take a second vertical cut to meet the first. Any discrepancy in alignment will show up at the intersection of the two cuts as twice the actual

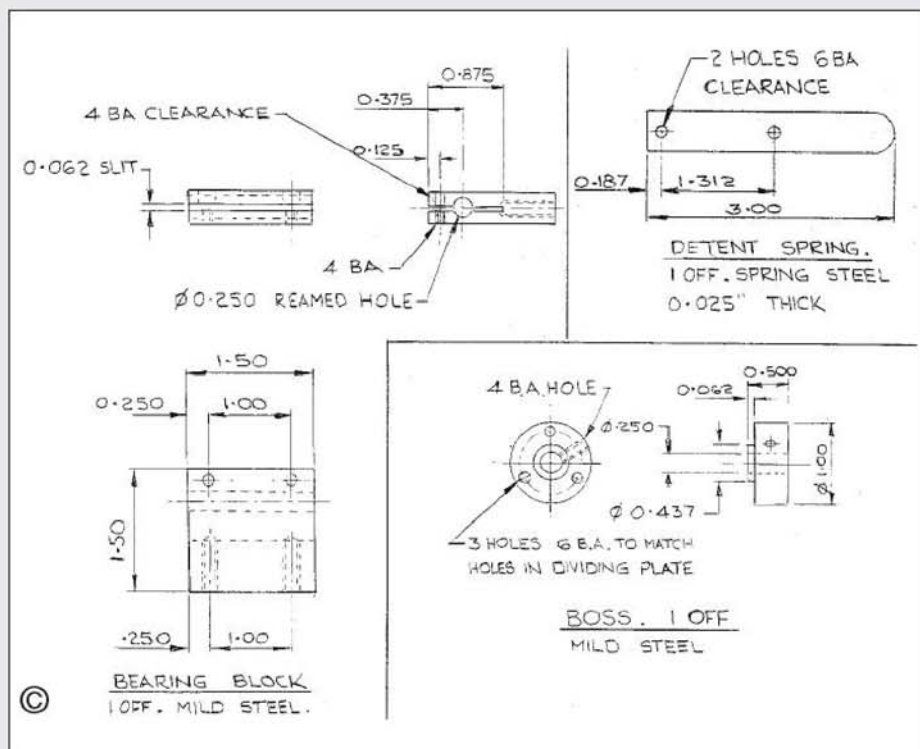


CUTTER ARBOR AND COLLAR
MATERIAL Ø 0.500
SILVERSTEEL.



PINION BLANK FOR 0.6 MOD.
PINIONS.
MATERIAL SILVERSTEEL EN 8M
OR EN 24T (SEE TEXT).

©



error. The saddle position is then adjusted and the test repeated until the two cuts align perfectly. Lock the saddle. This may sound a little long winded but it is easier to do than to write, and it does centre the cutter and arbor very accurately.

Pinion milling

Insert a pinion blank into the bearing block with sufficient length protruding. Fit the dividing plate to the pinion blank and secure firmly with a 4BA cap screw. Set up the spring detent to index the required number of pinion leaves with just sufficient tension to provide positive indexing. Ensure that the dividing plate boss is in contact with the bearing block and clamp the pinion blank into the bearing block with two 4BA cap head screws.

Position the pinion blank underneath the cutter and set the lathe in forward motion at 200 to 250rpm. Raise the pinion blank until it is just 'brushed' by the cutter. Note the index reading on the vertical slide. The depth of feed from this position for a Thornton, 8 leaf 0.6 module cutter is 0.065 inch. Take three successive cuts along the blank, regulating the depth of cut with the vertical slide index, leaving about 0.003in. to 0.004in. for a finishing cut.

Index the pinion blank around to the next position and repeat until all the leaves have been formed. Now adjust the depth of cut 0.001in., at a time, cutting a little way into two adjacent grooves until the two addendum curves just meet. Lock the vertical slide firmly in this position. Finish cut the pinion without moving the vertical slide.

When you are satisfied with the finish, complete the pinion. With the vertical slide still firmly locked, replace the pinion with a piece of brass rod and cut a replica pinion. The leaves can easily be cut at a single pass with the lathe turning at high speed. This will produce an exact replica of the steel pinion just cut (but check with a micrometer to make sure) which can be used for depthing in the simple depthing tool.

When cutting integral pinions it is important to finish each cut at the same distance along

the pinion blank, otherwise the run out between pinion and arbor will look a mess. Use the cross-slide index to control the finishing point of each cut. Use the powered cross feed on the lathe with a feed of about 0.002in. per cutter revolution and apply a light cutting fluid. Brush the swarf away as machining progresses as suggested by Mr. Beilby. This produces an excellent finish that requires little polishing. A strategically placed tin will catch the falling fluid, which can then be decanted off the swarf for re-use.

That completes the cutting process and the pinion blanks can be finish machined to form the required arbors and polished as described by Mr. Beilby.

Notes

With careful control of the finishing cut, it is quite possible to produce a set of pinions closely enough matched to obviate the need for more than one replica pinion for any particular leaf count. The replica pinions need be no more than 1/4in. long. In the case of 0.6 module pinions, these can be drilled 0.050in. and mounted on a shouldered runner in the simple depthing tool. Accurate depthing can be obtained by adjusting

the runners of the depthing tool so that the tips of the pinion leaf and wheel tooth just brush together. Then close the runners by a distance equal to the sum of the addenda of the pinion leaf and wheel tooth.

The milling fixture can easily be modified to cut long case clock size pinions by making the bearing block 7/16in. thick and boring this and the dividing plate boss 5/16in. diameter. This will allow pinions up to 8-leaf, 0.8 module to be cut; 0.6 module, 12-leaf pinions, as used on regulator clocks can be cut using shouldered pinion blanks. These larger pinions can be mounted as separate pinion heads.

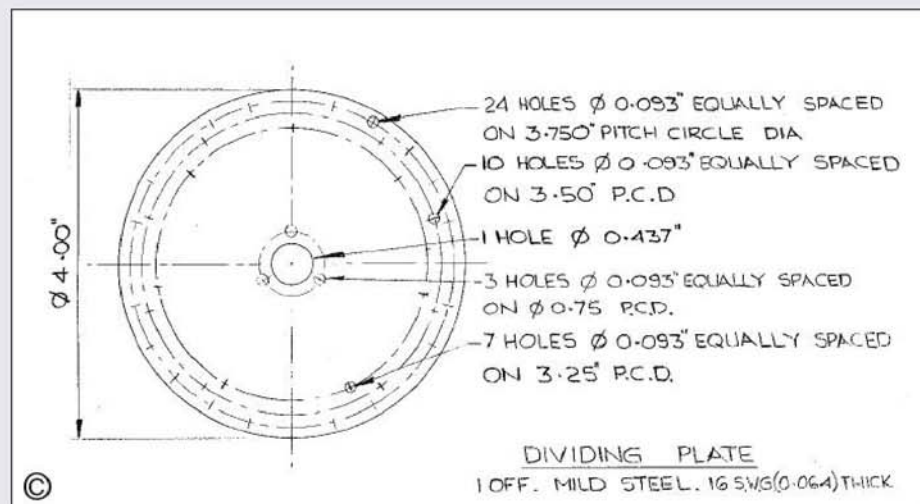
There has been some discussion in the press about how much clearance is required between pinion head and arbor when using separate pinion heads. Opinions range from a 'sloppy' fit, which leaves space for the adhesive but risks some eccentricity, to a push fit which ensures concentricity but risks wiping away the adhesive. Making the arbor a light push fit into the pinion head ensures concentricity and cutting three grooves about 0.005in. deep in the arbor under the pinion head provides space for the adhesive and a secure fit.

Current practice seems to advocate using a 0.55 module cutter to cut pinions to mesh with 0.6 module wheels, keeping the pinion blanks 0.6 module diameter. I have tried using a 0.55 module, 8 leaf cutter to cut both 7-leaf and 8-leaf pinions on 0.6 module blanks. Depthed as suggested above, this has resulted in a very free running train with no trouble at all, and it saves the price of a cutter.

The methods described above are the ones I have tried and found to be satisfactory. Other constructors may well find equally satisfactory alternative methods better suited to their equipment and circumstances. I wish then happy clock making.

References

- 1 & 2: These materials are available from JMW (Clocks), 12 Norton Green Close, Sheffield S8 8BP; tel: 0114-2745693.
- 3: *The Clockmaker* April/May 1990, February/March 1992.
- 4: These arbors are available from Chronos Limited, Unit 8 Executive Park, 229/231 Hatfield Road, St. Albans, Herts; tel: 01727-832793.



Neville Evans

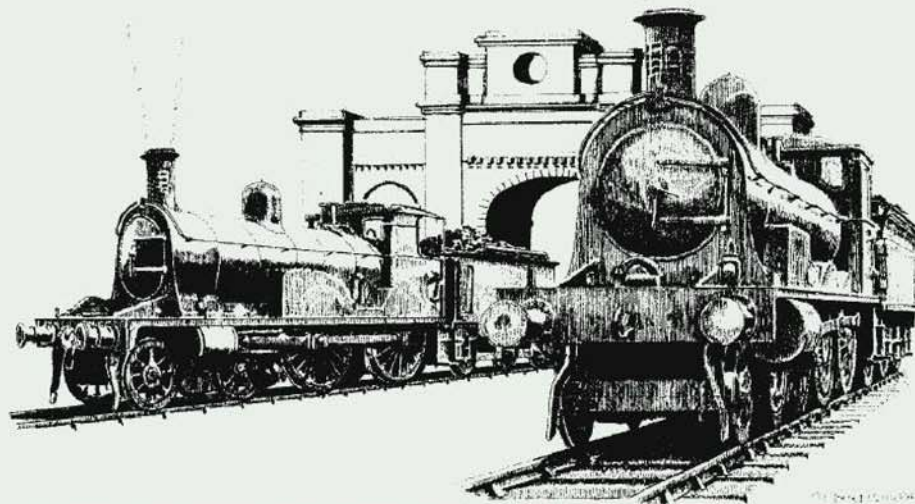
provides a melange of musings before continuing work on his Highland locomotive tenders.

●Part XXXV continued from page 148 (M.E. 4214, 6 February 2004)

I find Ron Isted's series of articles *Edwardian Elegance* to be a continuing source of enjoyment. His recent offering on the two huge Caledonian 4-6-0s is of particular interest, as these locomotives, together with the two even more impressive 'Cardeans', have fascinated me for many years. They seemed to represent the very antithesis of the policies of most other railways in that they were designed for a specific task. To build four engines just to haul 400 ton trains up the Caley main line banks is a pretty daft thing to do. The bankers are going to be in place anyway, and if they aren't, what about the other trains that presumably are being hauled up the same banks, to the same timings, by little 4-4-0s? Or were they supposed to have special smaller loads allocated to them. I somehow doubt it.

It seems to me that these large, out of date dinosaurs with their short con-rods, fragile crank axles, overlong boilers, cramped ash pans and tiny smokeboxes, were simply expensive trinkets, what the wide boys from the smoke call 'a little bit of toot'. An advertising gimmick, and a jolly effective one too. If a little expensive withall. To answer the point about McIntosh's staggered blastpipes, which must have been a source of amusement in drawing offices throughout the world, his comment was "*It allows for the forward motion of the engine.*" The mind boggles.

The simple fact was that the Stroudley/Drummond school of design had been overtaken, even in Britain, by 1903. Those who were unable to appreciate this fact, or were unable to advance due to lack of scientific knowledge, were liable to pay the price in clumsy, expensive and inefficient duds. One has only to look at McIntosh's successor Mr. Pickerskill, to see a succession of attractive looking but hopeless engines, which seemed to be copies of the admirable Smith 'Rivers'. These splendid locomotives were bought brand new from the Highland by the Caledonian after Smith's unfortunate fracas with his own civil engineer. Unfortunately Mr. Pickerskill didn't seem to realise that "*handsome is*" is not necessarily



THE HIGHLAND RAILWAY JONES 'BIG GOODS' & LOCH 4-4-0 LOCOMOTIVES IN 5in. GAUGE

"handsome does", and that he had much to learn about cylinders, valve gear and exhaust draughting as well. Perhaps he hadn't leaned his blastpipe far enough forward?

Under Churchward's inspired leadership, the policy of the GWR of gleaning information from all over the world from a study of engineering books and periodicals, paid handsome dividends. One should remember that by 1908 the Germans had, in the Prussian P8, designed the definitive mixed traffic locomotive of which nearly 4,000

were made. The Stanier black 5 used, I believe, an exact proportional copy of the P8 valve gear. The French, Swiss, Belgians, Germans, Austrians and of course the Americans, were streets ahead of most of the British designers; I don't suppose that we ever caught up with them. Reference to people like S. O. Eli ignores that fact that he was merely repeating research that had already been done by the likes of Chapelon, DuBousquet, Kordina and Vauclin many years before.

Frustrating though it may be to look back at what we could have done, we must remember that most of these engines performed their allotted tasks in a competent manner, and indeed that a few of them could perform brilliantly when required. The problem was that the technology involved in the design of small engines that could produce a lot of power for their size, albeit inefficiently, didn't lend itself to enlargement. The amount of fuel they needed to haul heavy, fast trains could be beyond the strength of a human fireman. This simple fact, coupled with the disappearance after the First World War of a whole generation of willing, obedient, skilled workmen who maintained and drove these engines, meant that a new type of efficient, simple and accessible locomotive had to be



The part-finished Hielan' Lassie.



A 3 1/2in. gauge LNER Peppercorn A1 based on a modified Hielan' Lassie chassis with 3-cylinders and correct rear framing. (Photos: Paul Wiese)

evolved. Not too difficult, as far sighted engineers like Robert Urie and Smith of the Highland had already begun to look to the engines that our private companies had been building for overseas. It wasn't long before engines like the Urie H15s and the Smith 'Rivers' began to appear: Northern British shop engines, modified for British use.

The main attraction as far as we of the modelling fraternity are concerned, lies in the undoubted beauty of the old-fashioned concept, the *Edwardian Elegance* that Ron Isted so rightly brings to our notice in such an elegant manner. These engines, in our smaller sizes and with modern innards, are capable of performances that would have astounded the full size engineers of the old days.

Leaf springs

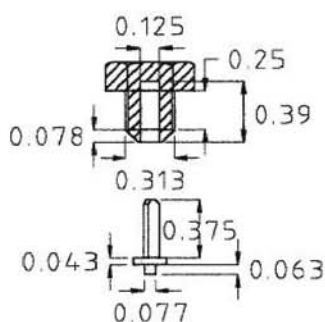
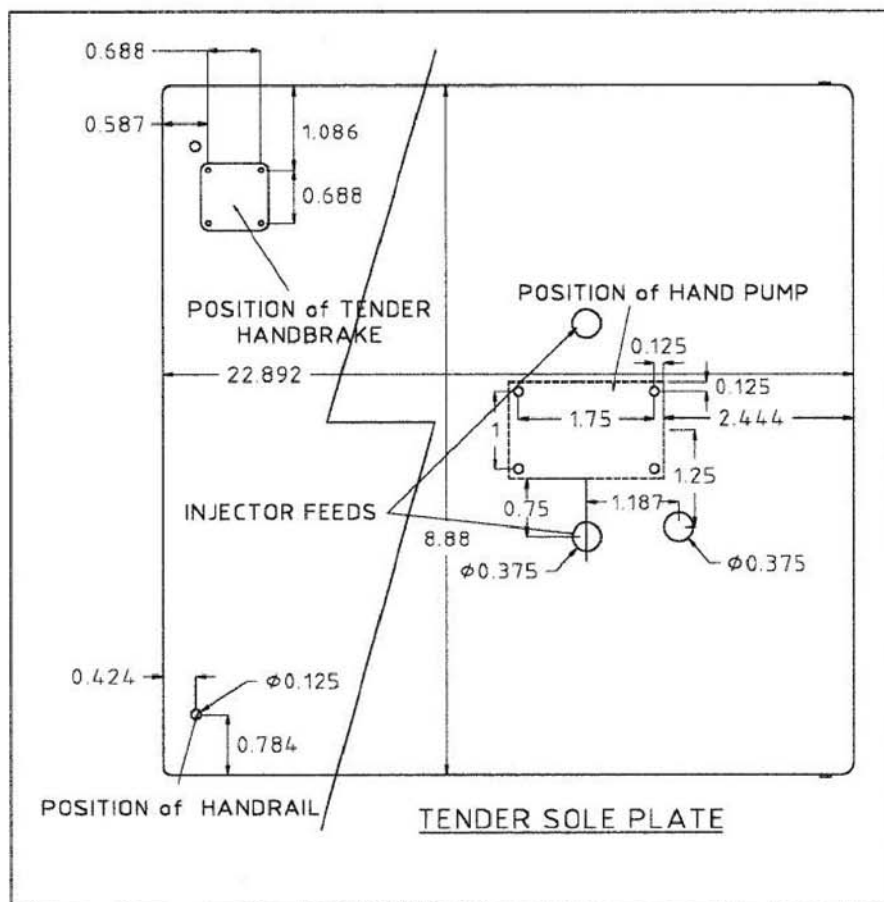
An interesting letter from Mr. Norman Barber appeared recently (*M.E.* 4213, 23 January 2004) concerning the method of making leaf springs, that I suggested for the Highland Railway tenders (and locomotives too for that matter). I must humbly apologise for my mistake in specifying 20 gauge metal in the text and 22 gauge on the drawing. The preferred size is, of course, 22 gauge and is the thickness supplied by Doug Hewson. The only thing that I can advise Mr. Barber to do, is not to knock it if you haven't tried it. Doug has been using and selling this material for years. It has always given total satisfaction. The method of hardening and tempering is also well proven.

The usual method of holding the leaves together for treatment is to put a rivet through the centre. I don't do this because I think that it weakens the spring, as I explained in the article. If you don't want to harden in the buckle as I do, then just wind a bit of iron wire around the centre of the assembled block. If you would rather harden each of the 78 leaves separately and temper them over, or in a bath of molten solder, of indeterminate temperature (does it contain Cadmium or any other heavy metal additive? because if does, you're in trouble) then please feel free to do so, but if you get a lungful of the stuff then don't blame me. Alternatively just ignore the whole thing and carry on as before.

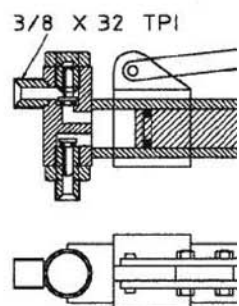
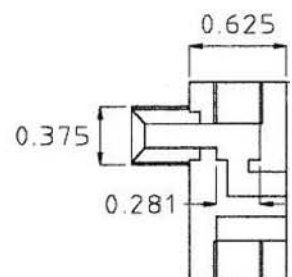
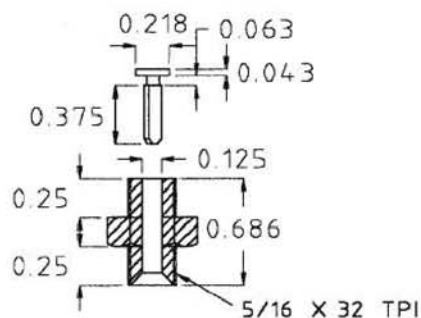
Phoenix arisen

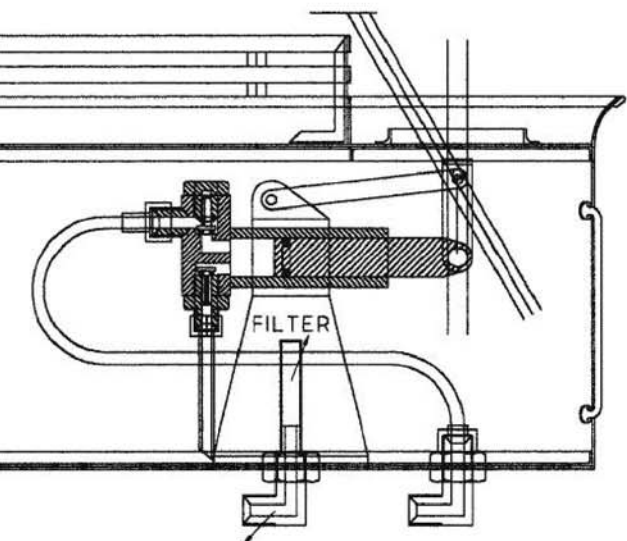
I'm sure that many engines have been built to LBSC's *Hielan' Lassie* design, possibly the largest 3 1/2 in. gauge locomotive ever offered as a published design, and a very fast and powerful engine. I had one myself and found much to admire in the model. One thing that I hated, however, was the awful appearance of the thing. The story of how Mr. Thomson reshaped the lovely Gresley A1 Pacific, and the very first one, 4470 *Great Northern*, to compound the felony, is too well-known to need retelling. Suffice it to say that a professional locomotive builder of my acquaintance said that he had a customer for such an engine, mentioned a huge sum of money and off it went. Unlamented.

A few weeks ago, however, fellow conspirator Paul Wiese, he of the 2 1/2 in. gauge *Flying Scotsman* described in these pages 20 odd years ago, told me of a rebuild that he was carrying out on his own *Lassie* to convert it into a Peppercorn



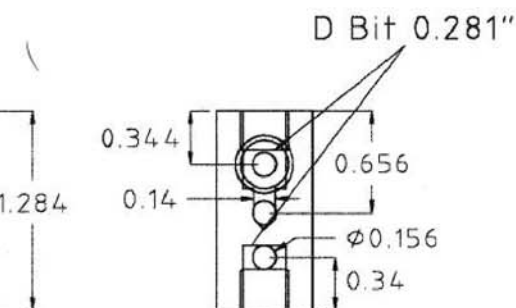
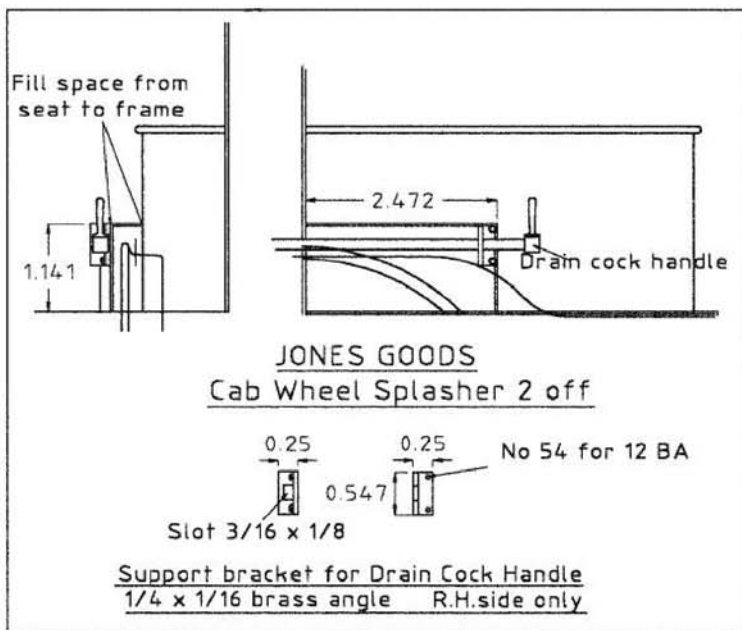
○ — O Ring Holder Section(





INJECTOR FEED

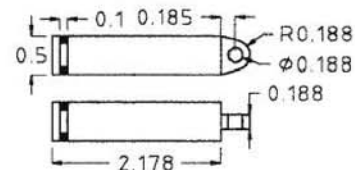
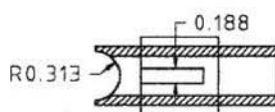
TENDER HAND PUMP ASSEMBLY



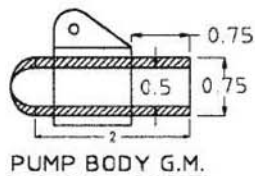
VALVE CHAMBER Brass



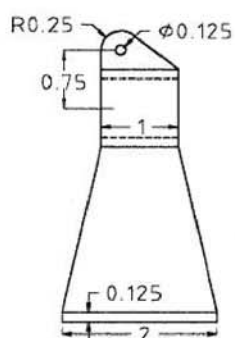
TENDER HAND PUMP



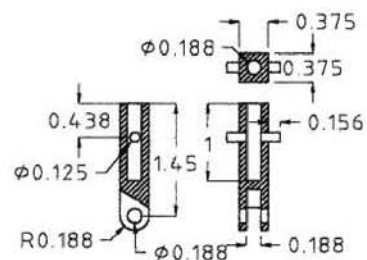
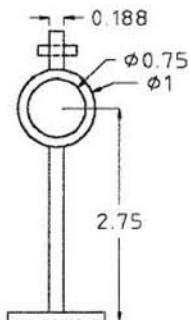
PUMP RAM ST. STEEL



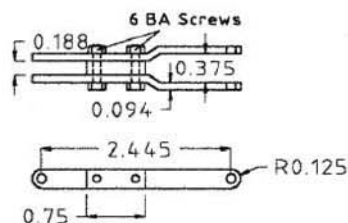
PUMP BODY G.M.



PUMP STAND Brass



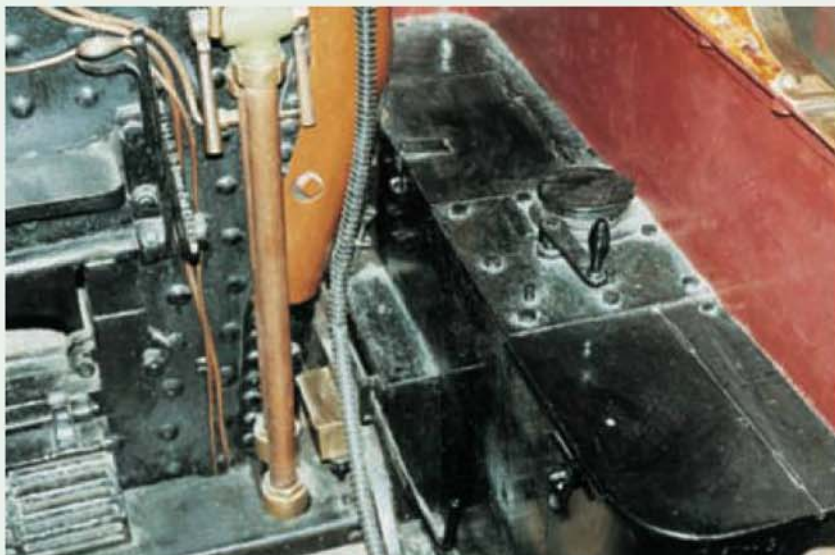
HANDLE SOCKET Brass



PUMP HANDLE LINK Brass

SUPPLIER

Drawings, castings, laser cut frames, etc. are available from Practical Scale, 46 Pentyla, Port Talbot, West Glamorgan SA12 8AA tel/fax 01639-883741. Please send a stamped self-addressed envelope for details.



The right-hand cab seat as seen on the Glasgow Museum of Technology's exhibit, locomotive No. 103. (Photos: Bob Raffan)



RH cab seat. Note bracket for supporting drain cock operating rod. (Unsatisfactory wood tops to be remade.)

Al. Now that is my idea of a real engine, and I include a couple of photos to whet your appetites. If there is sufficient interest, then Paul and I can do a very mini series, with the odd drawing and an up-to-date valve gear. Though there was nothing wrong with LBSC's arrangement, as used on the *Hielan' Lassie*, the outside motion is quite different from the Peppercorn Als, which had their outside cylinders placed between the bogie wheels. This necessitated lengthening of the outside con-rod and a redesign of the outside Walschaerts valve gear. The inside engine complete, the boiler and most of the rest can be used without too much alteration. I rest my case and await your comments.

Tender sole plate

While I did specify that the sole plate be cut from flat 1/16in. brass sheet, I chose to delay publication of the drawing until the position of the fixing holes for the brake control wheel, hand pump and injector outlets had been fixed. Here then is the drawing, somewhat foreshortened but still, I hope, understandable. There are also further holes, to be

tapped 5BA in the bottom of the tender hand rails. The rails are then affixed to the sole plate by means of screws inserted from underneath. All I can find to say is that if you don't fit a hand pump, you won't have to drill so many holes.

Tender hand pump

This pump is based on one that Goodall D. has been using for the last 20 or so years. It has never failed to deliver the goods and as can be seen, contains no balls to stick up after a period of inactivity. It is completely fabricated and easy(ish) to make, in fact the only item of interest is the long stand on which it is perched. This idea is pinched from Gordon Smith, the safety valve expert, who reasoned that if the pump was lifted in the tender chassis, you could poke the wagging gubbins out through the filler cap hole instead of having to take the tender half to pieces. The two valves are almost identical to the one specified in the clack valve described a few months ago. Incidentally, this valve has been very well received, as has the late Jim Ewins' variable feed oil pump.

Cab seat/wheel splasher mods.

Another interesting letter from Bob Raffan, concerns the cab seat arrangements for the 'Big Goods'. It appears that I missed a detail on No. 103, the preserved locomotive in Glasgow Museum of Technology. According to the G/A. drawing that I worked from, the cab seats cover the wheels where they obtrude into the cab.

Not so. It would seem that there is a small splasher between the main seat and the engine main frame, as per the drawing and Bob's photos. I have reproduced a part of his drawing for your entertainment and elucidation as can be seen. The *Loch* has no such subsidiary splasher and the main wheels are contained within the cab seats. Care must be taken, however, to ensure that there is sufficient clearance for said wheel inside the seat box, especially on the left side, where the reverser goes. There isn't a problem on my engine, but it's something (else) to look out for. Bob also brings to my notice that I have wrongly dimensioned the rear tender brake rod hole at 3/16 instead of the correct 1/8 inch.

●To be continued.



WATER SLIDE TRANSFERS FROM PHOENIX PRECISION PAINTS

Long associated with paints and varnishes designed for putting the finishing touch to a wide variety of models, Phoenix also supply a large range of transfers for lettering and lining model locomotives based on prototypes drawn from a number of operational companies.

The samples submitted to us were for 7 1/4in. gauge LNER locomotives and comprised the LNER 12in. (in full size) letters in gold shaded with red, black and white; LNER lining straights for cabs, tenders and tanks in black/white and white/black/white; two packs of assorted lining curves in white/black/white and a couple of buffer beam numbering sets of different types.

All these products were beautifully made and presented and came with full instructions for their use. All were of the water slide variety and feature a special varnish cover coat claimed to be the first of its type for British transfers and the thinnest available. Crystal clear, the coating is claimed never to discolour.

Further details of the full range of water slide transfers, and a comprehensive and informative 24 page catalogue (price 50p + sae) are available from Phoenix Precision Paints Ltd., PO Box 359, Cheltenham, Gloucestershire GL52 3YN; tel/fax: 01242-575326; email: sales@phoenix-paints.co.uk website: www.phoenix-paints.co.uk

PHOENIX PRECISION

CATALOGUE
Number 25
(January 2004)

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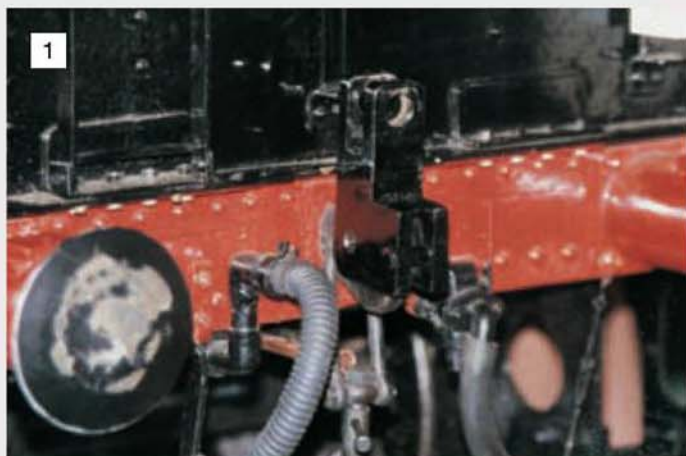
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COUPLING CONVERTER



The coupling converter in use on the author's locomotive. It simply slips over the hook without disturbing the screw coupling.



In order to use the device it is then dropped down into the horizontal position ready to be coupled to the flat draw bar.

John Cousins

details an ingenious design to provide peace of mind for those who haul passengers behind their 7¹/₄in. gauge locomotives.

After building an accurate model of a locomotive with screw couplings it seems a shame to have to remove the rear one to go passenger hauling. I therefore devised a converter so that a bar coupling could be used safely without removing the screw coupling.

Converter

To make this device you need a piece of steel 1¹/₄ x 5/8 x 2¹/₁₆ inch. Prepare the material and mark it out. Drill the holes first then mill the slots. Note the dimensions marked * may have to be adjusted to suit your application. Next saw away the bottom corner and fit the two pins. I used hollow spring

pins which have proved to be satisfactory, but if you prefer, you could make headed pins positively located with clips or cotters. The device could also be adapted to take high tensile bolts with locking nuts if there is concern that the spring pins could work out of position.

Pin and coupling bar

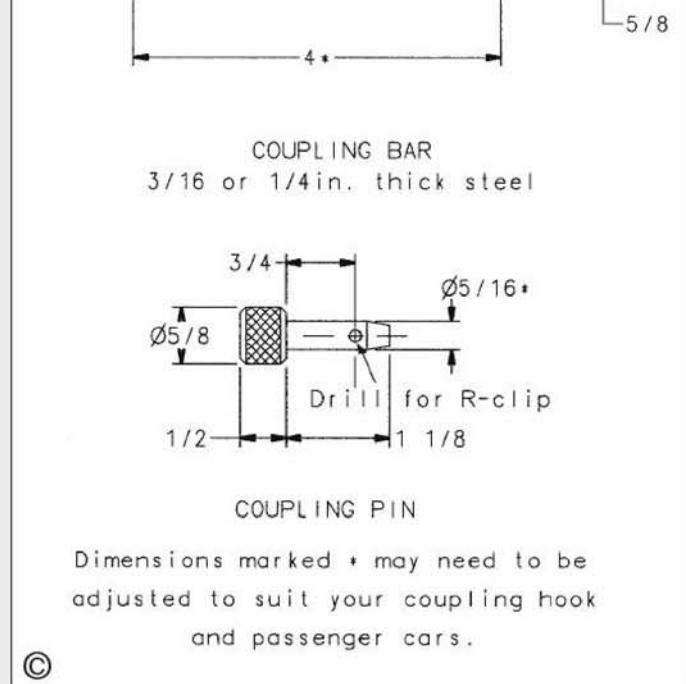
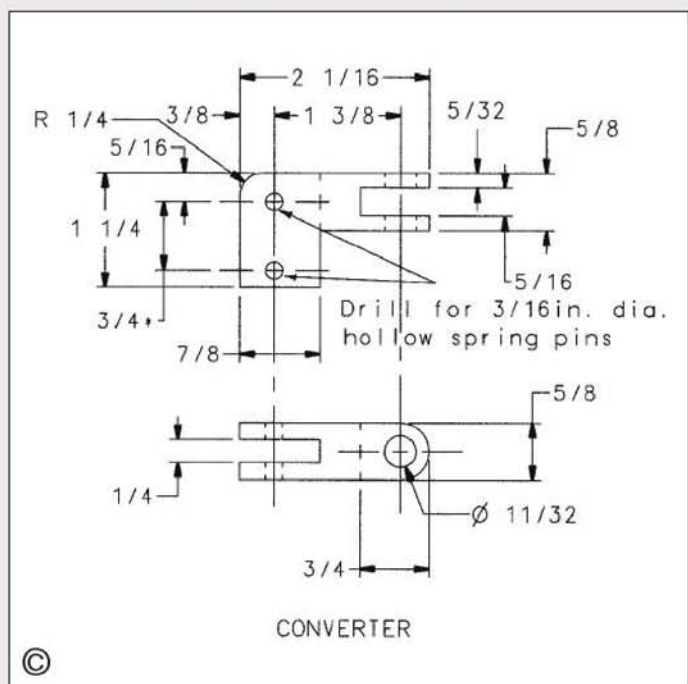
Make the pin and coupling bar if required. The pin is just a simple turning job. Mine has a knurled head to facilitate extraction and a cross hole to take an R-clip so that it cannot work out of position during use. The coupling bar is simply a flat piece of 3/16 or 1/4in. mild steel. The drawing shows the dimensions of mine but its length will need to be chosen to suit your locomotive and rolling stock combination.

Finishing and use

My adaptor body was given a coat of paint to match the locomotive. In use the device is slipped onto the coupling hook as shown in photo 1. It then drops down into the horizontal position ready to take the draw bar pin as shown in photo 2.

Warning!

When using this device be sure to use the train brakes to stop you. If the locomotive brakes are used heavily it may bend the coupling where it leaves the buffer beam.



1



An atmospheric shot of NEB's Fowler B6 road locomotives Titan and Vulcan, each with a 45 ton marine boiler en route from Newcastle to Southampton in 1919. Titan has a coal wagon in tow and Vulcan the crews' living van.

Martin Wallis

uses some unique photographs to illustrate an account of noted heavy haulier Norman E. Box.

●Part III continued from page 273
(M.E. 4216, 5 March 2004)

Norman E. Box (NEB) was probably the most celebrated heavy haulage contractor of the steam era. Happily a good photographic collection of his activities has survived and is held in the archives of the Road Locomotive Society (RLS).

Lantern slides

Part of the credit for the survival of these pictures much must go to some remarkable detective work on behalf some unknown person at the Post Office.

In the summer of 1974 Mrs. Sefton, NEB's eldest daughter, posted a letter addressed to 'The President, Road Locomotive Society, Llandrindod Wells, North Wales'. No name, house number, or street was given. In addition, the President in question had moved away from Llandrindod Wells to Norwich some five years previously. Rather than 'return to sender', incredibly the letter was duly delivered; it contained an offer to the RLS of the NEB lantern slides. Two wooden boxes containing

2



Vulcan and Atlas with a 70 ton transformer in 1929.

some 150 3½in square lantern slides were readily accepted and collected by a RLS member from Altrincham in Cheshire and

personally delivered to another RLS member, the late George Cushing, at the Thursford steam collection in Norfolk.

3



A good 'working' picture of a famous Norman Box engine, in this case Atlas, Works No. 17105 built in 1928. The engine is class B6, weighs 16½ tons and is rated 8nhp. The picture was taken at the same occasion as photo 2. Another equally clear photo of Vulcan survives.

4



Happily, Atlas has survived into preservation. Note the crane fixings on the fore carriage, and winch drum under the crankshaft.



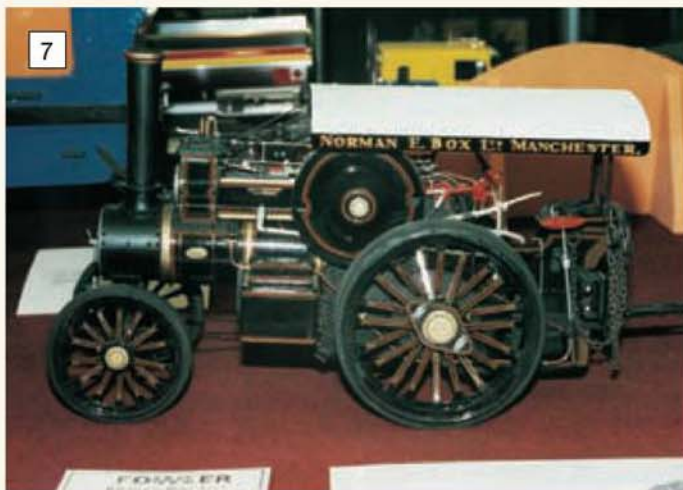
5
Talisman with a 60 ton condenser en route to Manchester docks. Note scotches under trailer wheel and large pulley block lying in the road between engine and load.

A hunt commenced for a RLS member with an old-time magic lantern and, once found, the magic lantern was brought to a committee meeting in the autumn of 1974 where the slides were viewed. The importance of the unique

collection was quickly confirmed. Presumably the lantern slides are the work of Messrs Entwistle Thorpe who were entrusted to record the heavy loads NEB undertook, they covered many years although 1924 was the most popular.



6
Following Edward Box's death, his business and engines were sold to Marston Road Services Ltd. including B6 17106. This photograph was taken in 1927.



7
This superb 3/4in scale model of Talisman was made by Eric Best from card and plastic sheet and is rivet for rivet correct.



8
Works No. 17106 Duke of York is in preservation; however the crane has been temporarily removed to facilitate transportation by low loader.

Missing information gathered

The late Tom Paisley then arranged to have the lantern slides reproduced in the modern 2in. square format from which sets of black and white prints could be taken. These sets proved invaluable in identifying the engines, locations and loads as no notes or index were supplied with the lantern slides. After much research by RLS members, most of the missing information has now been gathered.

Among all sorts of steam paraphernalia I have accumulated over many years is a much treasured set of black and white prints, presumably taken from these lantern slides. Most pictures are clear and sharp; they reward an inspection with a magnifying glass more readily than those pictures reproduced in a host of books written by different RLS members over the years. I was given the set of prints by a friend who knew Tom Paisley well, and I believe it a fair assumption I have one of the sets he so carefully copied. Occasional pictures from this set have already been used in the *Road Steam* column and herewith are some more.

I must straight away thank the RLS for the captions herewith and other details that accompany the pictures. The RLS is an admirable institution and the custodians of a great deal of historical information on all types of road steam. They often have a stand at some of the larger traction engines rallies and members have published many books on traction engines.

Norman E. Box

NEB was born into a family already heavily involved with road steam. His father Edward Box and grandfather William Box both owned road engines which were employed with road haulage and other tasks, but mainly in the delivery of Lancashire boilers and machinery to either customers in the UK or to the docks for export. Trading under 'Edward Box and Co.' Edward Box had premises in Brazenose Road, Bootle, Liverpool. In his formative years Norman must have thus gained a great deal of practical experience, and when he saw John Fowler & Co. advertising in the trade papers for a demonstrator to lead a sales team bound for South Africa, he applied and was duly appointed.



Misadventures did occur; here in 1907 an Edward Box & Co. engine is in trouble in Burnley when the boiler presumably over ran the engine on the downhill gradient. The views of the householder are not recorded — perhaps it is just as well!

Edward Box was suitably impressed and in preparation of his son's return purchased a second set of premises in Manchester. To equip the new yard he bought a new Fowler B6 to which he gave the name *Titan*, and two substantial four wheel bogies suitable for hauling Lancashire boilers. In addition he changed the name of his company to 'Edward Box & Son'. However, upon his return, rather than entering his father's employ Norman chose independence and purchased his own engine, a single cylinder Fowler called *Viking*, plus two wagons, and commenced his own enterprise hauling lime.

Working agreement

In consequence Edward Box found he had rather more work than he had envisaged, and maintaining

control of two premises, together with an extra engine and wagons, became quite a burden. However, a year later father and son reached a working agreement whereby each retained their independence; *Titan* was transferred to NEB along with the bogies and the company 'Norman E. Box' was created trading from the Manchester premises. In 1909 a second engine, an 8nhp McLaren called *Magic*, was transferred from Edward to NEB.

There was no shortage of work hauling boilers and machinery in the Manchester area and the new company 'Norman E. Box' flourished. NEB was kept very busy. He bought and sold various engines, mainly Fowlers, and as his finances steadily improved he bought

several new engines from John Fowler including R3 *Dispatch*, Works No. 13036 in 1913, Fowler B6 *Vulcan* Works No. 14844 in 1919, Fowler B6 *Titan* Works No. 14843 in 1919 (taking its name from the previous engine *Titan*), both Fowler B6 *Talisman* and *Jix* Works Nos. 16263 and 16264 in 1925, and lastly Fowler B6 *Atlas* Works No. 17105 in 1928. In addition he bought a new McLaren 8nhp engine Works No. 1570 in 1918, and two large McLaren engines from the war office surplus in 1919; numerous other second-hand engines were also bought and sold.

NEB clearly knew his own mind and had his own individual way of running his enterprise. He invariably personally supervised particularly



The NEB photos contain a number of shots taken in 1924 of parts in transit for HMS Rodney. Here one of the two cast steel propeller shaft brackets is being moved. Each bracket weighs 35 tons.



Titan with a 24ft. wide rudder casting for HMS Rodney from Cammell Laird & Co. Ltd., Sheffield, here pictured at Manchester docks in 1924.



Vulcan with HMS Rodney's cast steel marine rudder bracket from Cammell Laird & Co. Ltd., bound for Birkenhead. The weight is about 30 tons.

14



More parts for HMS Rodney. These are the mountings for the 16in. gun turrets, each load weighing about 20 tons. Titan is just visible at the front.

tricky or heavy loads, quite literally every step of the way — reputedly walking alongside all the way, changing socks and boots twice a day. If one of his drivers became ill when he was travelling with NEB the driver was always retired to the van and NEB drove himself. When new engines were delivered, one of the first things NEB did was remove the steersman's seat, thus preventing him from ever falling asleep, and also to make it easier to rapidly dismount if necessary and apply the trailer brakes. Your author has also noted that on most of his engines the brake screw and hand wheel was also removed, presumably so it could not be used, forcing a driver/steersman to scotch the engine instead, a much safer arrangement.

Heavy loads moved

Loads moved were many and varied, a large proportion were Lancashire boilers, power station transformers and other heavy electrical gear, and heavy machine tools such as hydraulic presses. In addition, armour plate and castings/forgings/fabrications for large naval vessels were also moved. It is hoped the pictures selected give a flavour of the undertaking.

NEB sold his business in 1930 to Pickfords for £80,000, a very large sum in those days, with part of the deal being his retention as manager for five years. Just why he decided to sell is unclear, maybe it was due to unfavourable legislation incumbent on heavy road hauliers, or perhaps he could foresee the demise of his beloved steam engines and

preferred to act sooner rather than later.

The 'Edward Box and Co.' business was sold in 1925 on Edward Box's death, the company being sold to Marston Road Services. Inspection of the jib in photo 6, which shows one of Edward Box's engines, reveals the legend 'Marstons Road Services Ltd. in association with E. Box Ltd.' Shortly after Pickfords bought Norman's business they served a writ against Marston Road Services claiming they had the exclusive use of the 'Box' name, but Pickfords lost the case after a long court battle.

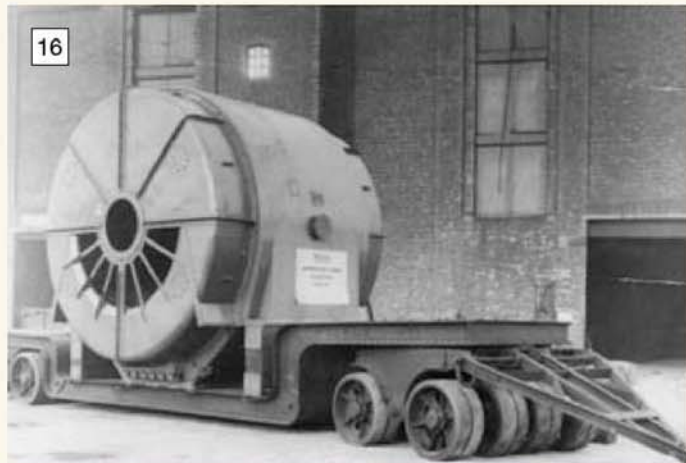
Further NEB pictures and an excellent narrative are to be found in T. McTaggart's book *The Big Box*, published by Alloway Publishing Ltd., ISBN-0-907526-27-6.

15



Vulcan and Titan haul a 90 stator destined for Manchester Corporation electricity works. Note that even on apparently level ground the trailer wheels have been scotched.

16



This Fowler double swan neck trailer built especially for NEB is seen here with an 85 ton generator loaded on it. The trailer was built in 1928, weighed 31 tons empty and had a capacity of 85 tons.

17



One of the six fabricated beams on Mervyn Greeves' fully detailed 3in. scale model of the Fowler double swan neck trailer.

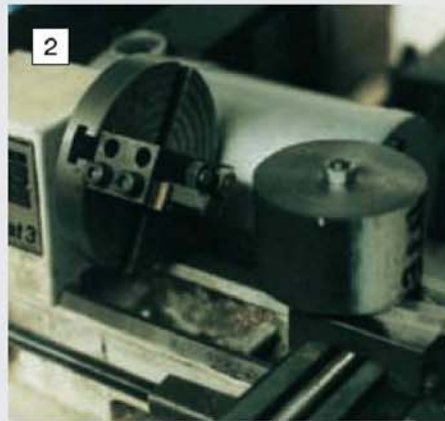
18



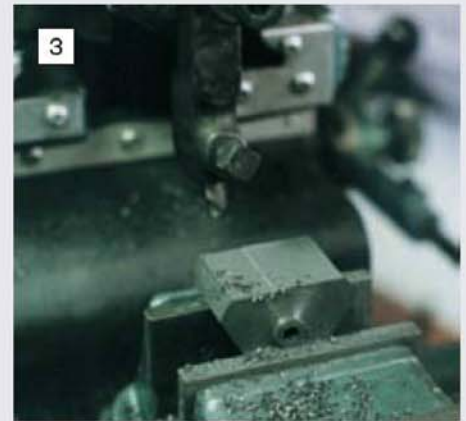
Mervyn's completed trailer. Note the multitude of rivets.



The Unimat 4-jaw chuck can just accommodate the cast iron bar for the toolpost to face its ends.



The method for flycutting the faces of the tool post before larger machines were obtained.



If a shaper is available the machining of the tool post is made that much easier.

A 'LAMMAS' TOOLPOST FOR THE UNIMAT LATHE

John Olsen

in New Zealand, describes a useful addition to this popular lathe.

Recently I came across an article about making the Lammas tool post. Castings for this are available in the larger sizes, but not for lathes as small as the Unimat. I decided to rectify the situation by making one out of a piece of round cast iron bar. This material is readily available worldwide at reasonable cost, and has the merit of being very nice to machine, apart of course from the inevitable black mess it makes. The design has not been checked against any of the other small lathes, but it should be possible to adapt it to suit any with a T-slot of similar size, possibly omitting the spigot if necessary. The height of the tool slots may need to be varied.

I already have a 4-way tool post for the Unimat, made from the description in Gerald Wingrove's book *Unimat Lathe Projects*. This has seen some use, especially for repetition projects like making hexagon headed screws and nuts. From this experience I was aware that it is not in fact usually necessary to have as many as four tools. On a small lathe like the Unimat the crowding makes it even more likely that you will have problems with the tools not in use fouling the job or the machine, and the argument that there is one less tool to snag yourself on is quite compelling too. An additional argument in favour of making one is that the unusual shape makes it an interesting machining project.

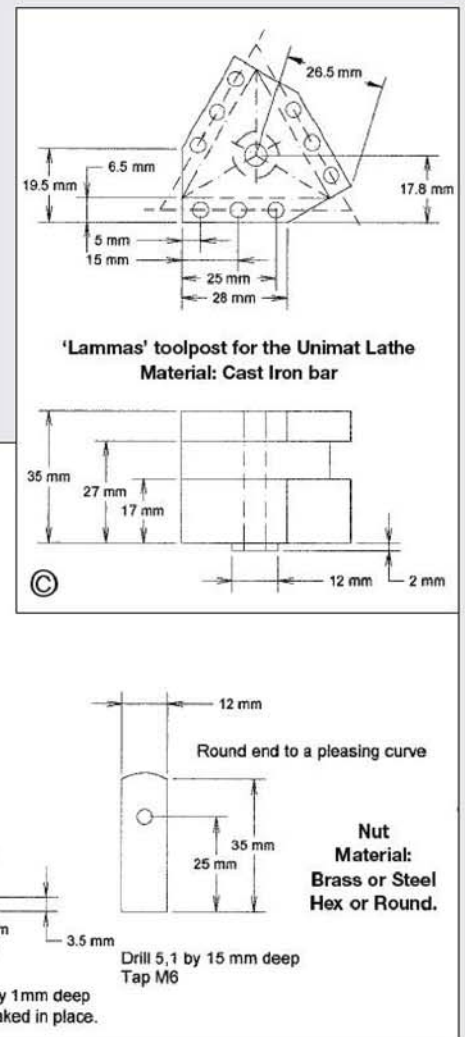
A lump of metal of this size is quite a challenge for such a small machine. I made the earlier 4-way post from some free cutting mild steel, and although it was a large task for the lathe, it copied and gave good results. This time around I had things a little easier. At the time of making the tool post, there was a Myford in my workshop, and a pair of shapers, a 6in. AMMCO machine and a 10in. Alba. These have since been joined by an 18in. Alba, and a Chinese mill-drill. Since others may not be so fortunate, I will describe how to carry the work out on the Unimat and some of the illustrations will show the kind of setup that would be used. However, I am not enough of a masochist to do things the hard way when an easier way is

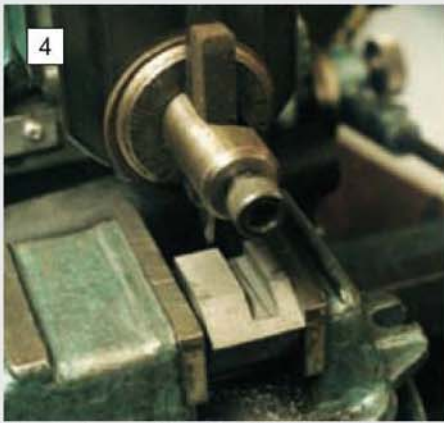
possible. So please forgive me if at least one of the photos was posed for the camera.

It is possible to make the tool post in two forms. The minimum is to just make the cast iron post. This is perfectly usable but with no indexing facility. Indexing is very useful for repetitive work like making screws and nuts since it allows the tool to be returned to the same position. The 4-way unit could be indexed accurately enough to be sure of turning a screw to size from just the index dials, and the parting tool would be lined up correctly. In order to incorporate this feature with the minimum of extra parts, I have arranged for the indexing holes to be in the bottom of the tool post while the index pin hides inside the T-nut. The recess provided in the Unimat saddle makes a fine pivot point for the tool post.

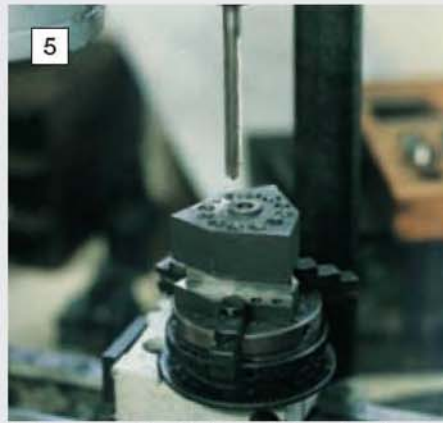
Begin by sawing off a suitable length of 55mm dia. cast iron bar. If you are buying it for the job, you may be able to get it cut to size. I usually prefer to buy a longer length, since it is such useful stuff and I now have several sizes in stock. If you have to cut it to length with a hand hacksaw you at least have my sympathy. I have

been there and done that, on larger sizes of bar too. Scribe a line right around using, for example, a band of paper tape to help to get a 'square' line to work to. Work around the bar, taking it down to the depth of the blade then turning a little. This helps to get a reasonably square cut. The squarer the better since whatever excess is there will have to be machined off.

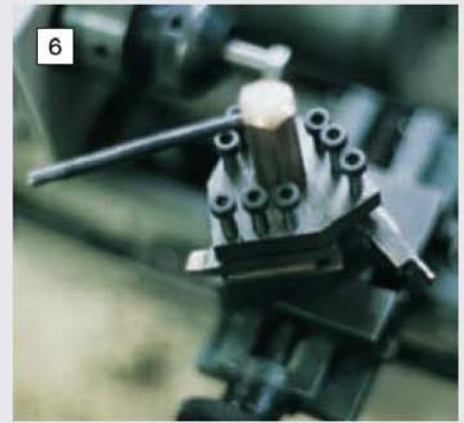




The shaping machine, if available, can also be used to machine the tool slots.



Drilling the optional indexing holes using the Unimat milling head and dividing attachment.



The tool post in use. It is a most useful accessory for repetition turning.

Chuck the squarer end in the Unimat 4-jaw chuck (photo 1). This chuck is bigger than the 3-jaw chuck and will give a better grip with less overhang of the jaws. You will of course need to centre the job, but this does not require dial gauge accuracy. The 3-jaw chuck would probably suffice if it is all you have. Another expediency that I have sometimes had to adopt for large jobs is to drill the hole through the centre first and then use that to bolt it to the faceplate but that makes facing difficult to complete.

Face the end, reverse the job and face the other end. Reduce to leave a 12mm spigot to fit the cross-slide. It is a nuisance trying it for size since you will have to disturb the tool to get at the slide, but it is better than finding you need one more light skim as I did. Do not disturb the work in the chuck but leave the job in place while you do so by unscrewing the chuck. Centre and drill through with a 6mm dia. drill.

Now, for those who have no heavy equipment available, mark out the lines for the three main faces and use the Armstrong shaper, otherwise known as the hacksaw, to take off as much material as you can. Start the marking out by scribing a circle of the correct size. All three faces should be tangential to this and at 60deg. to each other. You could cut one to the circle first then use this to set up to the correct angle in the machine. This could be done by means of a 30-60-90deg. square, say from a faceplate screwed onto the tailstock to provide a reference. Then set it up in the Unimat as shown in photo 2 and, using a flycutter, machine down to the line.

Naturally it is good practice to work to the best accuracy you can, but you will be happy to know that none of the dimensions here are very critical. This should provide you with a triangular shape with the round bar stock still showing at the corners.

Next you need to machine the faces on the working corners. There is a potential snag here. The Lammas tool post can be made left or right handed, so that it suits a knife tool working towards the chuck or towards the tailstock. The unit you are most likely to want is the one for working towards the chuck, so take care that you make the right angle face on the correct end of each face of the triangle. Again the hacksaw could be used to remove some of the excess metal first. Remember that the spigot is at the bottom of the post, so then with a long side at the left, it should have a right angle face machined at the far end. This then means that a tool held in the long side projects past the right angle face and can turn into a corner near the chuck.

If this sounds confusing, check the picture if

you are in doubt. Note too that you are not fully committed until the slot is cut for the tools. If all else fails, you could turn the spigot off, turn the post over, and machine a recess for a new spigot to be fitted underneath.

Cutting the slots will probably be the hardest part on the Unimat. You cannot really use the milling attachment because the job is an awkward shape to clamp on the table or hold in the vice. Not all readers will have the milling attachment anyway. My advice would be to hold it down inverted on the saddle block using packing to raise it to the correct height, and use a slot drill gripped in the chuck. The Unimat probably will not manage the full width with one slot drill — at least I have never been game to try a 10mm dia. slot drill, so two settings with a 5mm cutter will do the trick.

I will refrain from making it sound as if you will knock them out in an evening. When I did the 4-way tool post many years ago, I seem to recall taking a considerable time over it. Several evenings, I think. Part of the time is best spent doing something else while you give the motor a chance to cool off. Milling seems to heat the motor up more than turning. An old idea that helps when milling (or shaping) to a line is to provide some light centre pops along it. These are easier to see when the job is under way and cast iron dust and graphite are being flung about. Since you will take all the edges off later with a light rub with the file, they should not show on the finished job.

You can get the depth right by marking out a line on the right angle face at the correct depth. When all three are done they should meet nicely at the corner. Try a piece of tool steel in each one and run a file along as necessary to clean them up. Now mark out the holes for the screws and centre pop. A trick here is to sit the spigot in the hole of the saddle block, get one hole set up under the drill and drill it 3.4mm dia., the tapping size for an M4 thread. You do not need to clamp it down. Now turn the tool post around 120 deg. to the next side and do the corresponding hole. If your work is nice and accurate, it should be just under the drill ready. Repeat for all holes on all sides. So you only need to fiddle with the setting three times instead of nine. Yes, I did do this bit on the Unimat myself.

Tap the holes, making sure you start the tap nice and true. The Unimat does make a good sensitive tapping guide if you make a suitable tap wrench with a tail on it that can be guided by chuck with its jaws open. Now this piece is finished, unless you have visions of exhibiting it, in which case you will want to scrape it all over with decorative hand scraping. A finish I use

quite a lot myself is gun blue, a chemical blackening compound usually available from gun shops. Use disposable gloves and a swab to rub it on since you do not really want to get it on your fingers. If the finish appears uneven afterwards, just give it another treatment.

The T-nut is made from steel. The two sides must be recessed to make it fit the table, another job for the slot drill. Next make the holes. I did the mounting hole by inverting two jaws of the 4-jaw chuck and catching the T-section end for end between them. The two side jaws were then brought up to support it in the middle with a scrap of brass packing each side to prevent the boring tool fouling the jaw. Boring with slot drills is needed to make the hole for the index pin and its spring. This is delicate work, but then that is what the Unimat shines at, and is why it still finds an honoured place in my workshop, despite the presence of the larger machines. Incidentally for some years I had the Unimat and the smaller of the two shapers and found it a good combination. You can do more with a small lathe and a medium shaper than you can with only a medium size lathe.

The small top hat section should be turned on the end of a longer piece of bar and then parted off. The spring I used was a small one of the type used in locks to hold the pins down. This is retained in place with a small disc, which can be parted off the end of a piece of bar. It is retained in place by staking. I also put a tiny drop of Loctite on the outside, staking it as extra insurance. Do not overdo this, as it will wick in through very tiny holes and gum things up that you wanted free.

Now, if we want the index holes it is time to drill them. It may seem that we should have drilled them when the job was chucked earlier, but this would have required machining the faces to match. This way, we can drill the holes to match the previously machined face. Set up in the 3-jaw chuck with the spigot out. Use a centre in the tailstock to make sure it is centred accurately! Transfer to the dividing attachment and drill the 12 holes. They do not need to go in more than a few millimetres. Make sure that the first hole is accurately set on the line between one of the tool faces and the centre hole so that the tool can be indexed parallel to the chuck plane as will be required for a parting off tool. If you do not have the dividing attachment, do not worry about the indexing for now. It could be added later.

Use the T-nut piece to ensure that the distance from the mounting hole to the locking hole is correct before drilling. Very lightly chamfer the edge of each hole by hand with a countersink to help the pin to find its way in. The 12 holes give you 30deg. choices of position for indexing, ►

although you can still set it up to any angle between. The indexing is useful for repetition jobs. It is important to remember to take up the backlash in the same direction each time you set it, as there is sure to be some, even with the most careful of work.

The mounting stud may be made from a 55mm length of mild steel threaded M6 at each end. Alternatively, a piece of M6 studding may be used. This is always useful stuff around a Unimat since it can be used to make hold-down bolts, just the right size for any job you need to mount on the faceplate or milling table. The top nut is turned from brass. This could be a ball type of handle if you want to go to the trouble, but must be high enough to clear the screws for the tools. The latter should be cap screws as these are of better material than cheese head screws.

Now, a final bit of setting up. Screw it down on

the cross-slide block and see where the handle ends up pointing. You want it to point outwards away from the tool in use. Note how much of a turn it needs to move in the clockwise direction. Re-chuck the brass piece and remove that proportion of a millimetre. For example if we want to move the handle one quarter of a turn, we should skim off 0.25mm since the pitch of an M6 screw is 1mm. Later, with wear, it may come further around, so do not try to put it at the end of the desirable arc but nearer to the start.

You have obviously earned a beer, so take a break and have one, making sure it comes in a can. If beer is not to your taste, any of the popular canned drinks will do instead. Having emptied it, take a pair of good sharp scissors and cut the aluminium alloy can into strips about 6 x 28 mm. This will give a good supply of shims for adjusting the tools.

You may also want to make some shorter tools without too much overhang. I have never managed to find any way of cutting them to length better than the time-honoured method of nicking them all around on the corner of a grinding wheel and then smacking them with a copper hammer while held in the vice. Wrap it all in a rag first, otherwise you may never find the piece that comes off, and if it finds you first it may be painful. Grind a suitable set of little tools. I find that a knife tool, a chamfering tool and a dinky little parting off tool with a blade about 1mm wide and able to go about 4mm deep is quite a useful set to have in place.

Now that you have done such a heavy job, it is time to give the Unimat some work more in its size range. Perhaps you could turn out a batch of metric hexagon headed screws using the  new tool post.



The Author's own clock.

Ian Beilby

continues work with the rev/hour and minute wheel collet.

●Part VI continued from page 263
(M.E. 4216, 5 March 2004)

My original idea was to machine the rev/hour and minute wheel collet component from the solid in 1in. brass bar, and on my clock that is exactly what I did. However, this is wasteful of both material and time for such a small item. I therefore decided to make a second one, this time fabricating the component from 1in. and 1/2in. bar. It proved just as accurate as the first and much easier and quicker to make; this therefore is the process which I shall describe.

The outer sleeve of the collet is machined from a length of 1in. dia. brass bar. The stock is held in the 3-jaw chuck where it can be faced,

WORLD TIME DIAL CLOCK

followed by centre drilling to accommodate support from a revolving centre in the tailstock. The 1/8 x 3/8in. register is then turned as shown in **photo 41**. The work is then drilled and reamed 3/16 inch. Using tailstock support the sleeve is then parted off at 7/32in. (**photo 42**).

The centre of the collet is machined from a suitable length of 1/2in. brass rod, a 1/2in. length of which is reduced to just over 3/16in. diameter. Without disturbing the setting, the component is then drilled and reamed 1/8in., and parted off at 15/32 inch. The outer sleeve is now broached to accept the centre and the two components secured together with Loctite, observing the measurements shown in **fig 18**. **Photographs 43** and **44** show the completed collet.

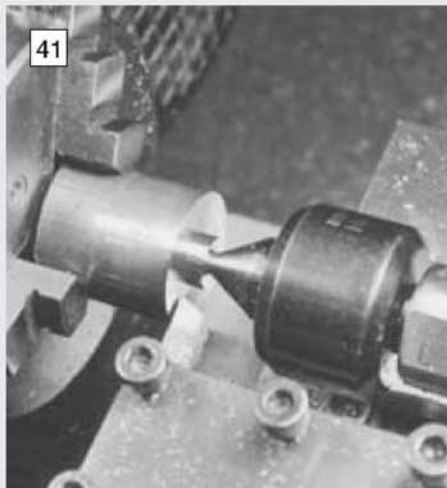
The 90-tooth reverse minute wheel and 20-tooth reverse hour wheel should be secured to the collet

with Loctite. The wheel centres should require slight attention with a broach to fit the collet seating (**photo 45**).

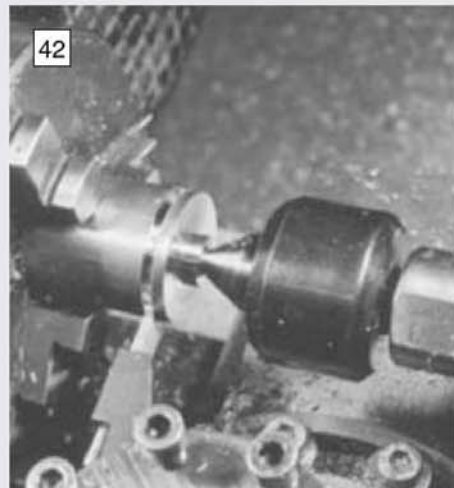
Bow spring

This item is cut from 22 gauge sheet to the dimensions shown in **fig 19**. A 1/8in. hole is drilled at the centre of the spring which is given a set of approximately 1/8 inch. The brass should be well hammered to work harden it and make it springy (**photo 46**). The tips of the spring should bear on the wheel rim while being clear of the wheel teeth.

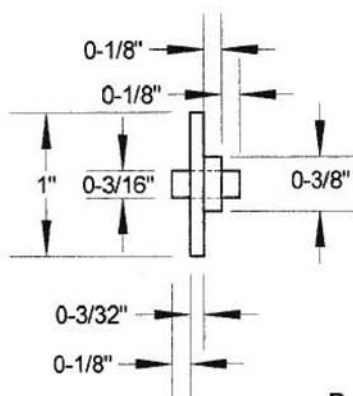
The bow spring and the motion wheel assembly can be fitted onto the great wheel arbor, and a 1/2in. diameter x 1/8in. domed hand collet, drilled 1/8in., can be fitted in place and secured with a tapered clock pin (**photo 47**). The bow spring should provide sufficient tension to the assembly



Machining the 1/8 x 3/8in. register on the outer sleeve of the rev/hour collet.



After drilling and reaming 3/16in., the collet is separated from the stock using a parting tool.

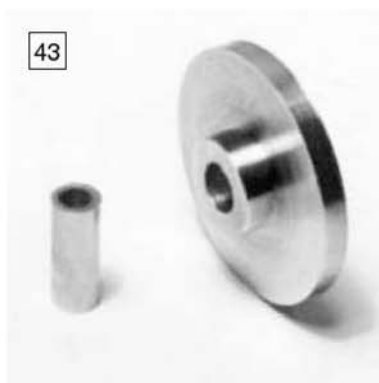


ream centre 1/8"

WORLD TIME DIAL CLOCK
Figure 18:
Rev/Hour and Minute
Wheel Collet

©

43



44



By fabricating the rev/hour wheel collet from two separate components, assembled using Loctite, both time and materials are conserved.

45

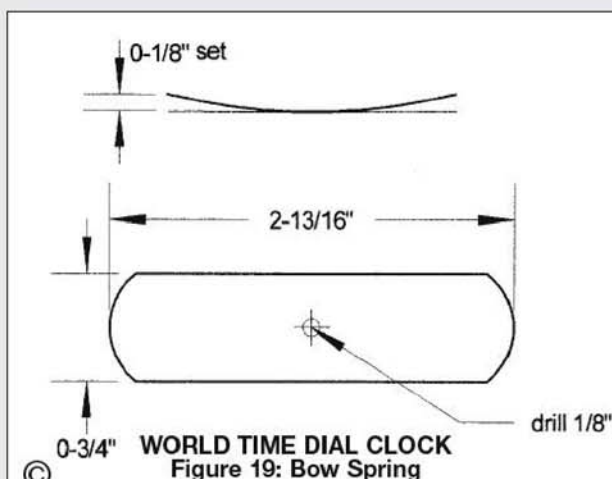


The reverse minute and hour wheels are secured to the collet using Loctite.

to enable the movement to drive the hands and prevent the wheels from slipping while at the same time allowing the position of the hands to be adjusted.

Minute wheel stud

The simplest way to make this item, which is detailed in fig 20, is to take a 2 1/2 in. length of 1/8 in. steel rod and thread one end 5BA for 5/16 inch. A length of 1/4 in. hexagon section



©

WORLD TIME DIAL CLOCK
Figure 19: Bow Spring

46



Work hardening the brass bow spring by hammering makes it springy.

steel is then held in the 3-jaw chuck, drilled, tapped 5BA, and parted off 3/16 in. long. This nut

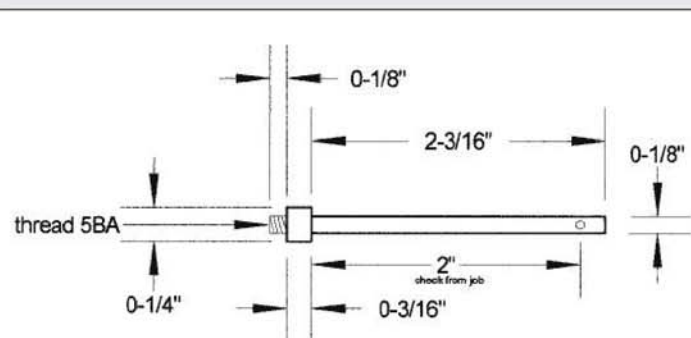
yet (photos 48 and 49).

●To be continued.



The group is retained on the great wheel arbor using a clock pin.

is then screwed firmly onto the stud and secured with Loctite. The root of the thread may require to be turned away with a narrow parting tool in order that the stud screws fully into the frontplate. The cross-hole for the hand-retaining pin should not be drilled



©

WORLD TIME DIAL CLOCK
Figure 20: Minute Wheel Stud

48



The minute wheel stud is fabricated from rod and hexagon steel ...

49



... and the two components assembled and secured using Loctite.

A CLOSE ENCOUNTER WITH E.T.

Ron Wallman

In France, whose treatise on stretching time caused such a stir a year ago, turns his attention to E.T. — Elliptical Turning.

At this time of the year European children celebrate Easter with hollow chocolate shapes in the form of chickens, rabbits, bells (in France) and especially, eggs. Model engineers are sometimes asked to assist domestic matters by making artefacts such as eggcups. What is made is invariably a traditional turned job. Why not present the egg as one would with an avocado pear? The reason is that most amateur turners do not know how to turn an ellipse.

I must make my position clear: many are, but I am not into ornamental turning. Machining techniques interest me (see main photograph). I wondered if an ellipse could be turned on a classical model engineer's lathe. What I made is a prototype, a test bed, from material at hand at the time and therefore has features such as holes, and sizes that are meaningless. Having got the device to work, there was no point in making a clean version, besides I have other ideas I have yet to try out.

This device is a form of elliptical chuck based on Holtzapffel whose original design I have more or less repeated. The chuck can be adapted to simulate other chucks such as rectilinear, eccentric, and upright or spherical or dome. It is probably more correct to call the device a versatile ornamental chuck. I have ideas for another device that simulates a swash plate and rose engine. Readers can gather more information from the book *Ornamental Turning by Tubal Cain (nom-de-plume of the late, great T. D. Walshaw)* ISBN 0-85242-826-x. Tom did ask me to publish some ten years ago but embarrassment has been a sticking point.

I have compiled a description to aid others who might be able to improve on the idea.

The device consists of a ring that encircles the



Mr. Wallman's fascination with elliptical turning has resulted in the production of this intriguing pattern.

nose of a conventional lathe such as a Myford Super Seven. This is adjustable from on-centre to a significant amount of eccentricity to the lathe axis towards the turner. It is fixed and cannot rotate. A slideway fits onto the lathe nose and is orientated perpendicular to the lathe axis. This slideway presents the working surface and can carry other chucks via a second nose that fits into a nominally central hole. The second nose can be rotated and has an index plate. It is locked while turning. I can also lock the slide for eccentric turning and an upright work.

For elliptical work, two parallel strips are fitted to the ends of the slide. These entrap the ring so that they can slide and rotate on it. These jaws determine the position of the slide by compliance to the ring. The slide changes position as it rotates with the lathe spindle. The upright chuck can be simulated by addition of an angle plate like piece that fits into the slideway. It also has an index nose. In its most simple form this completes the description.

The action is not easy to describe. It is neither an

eccentric crank device nor a crank's eccentric device. If the ring is centric to the lathe spindle the device will have no action and the result is the same as conventional turning.

If the ring is set eccentric things start to happen. If you have followed the description so far it is now time for me to shake you off. There are now two centres. Oscillation takes place between the two. If a lathe tool is set on centre to face the work it will score a straight line. As the tool is withdrawn it will trace an ellipse.

A Tympan chuck is simply a paper pad perpendicular to the spindle and is used to assay traces. A pencil and a tympan chuck will show the device does produce an ellipse. One day I would like to show this at an exhibition but using two pencils set at lathe centre height but straddle each side of the nominal centre. I propose charging 1 euro to see what happens and 2 euros to see it again. No, I am not going to tell you what happens either, unless money for model engineering is involved or a suitable lubricant such as best bitter beer.

For those interested, the versatile ornamental chuck can impart an elliptical motion independent of other lathe features. Conventional turning using a single point tool including radius, spherical, taper and taper turning attachment are valid. Boring requires a pre-made hole to get the tool into. I do not see that turning between centres is viable thus length is severely limited. Tailstock tooling is not generally viable. A rear tool post is not useful. Overall there are problems with rigidity and moving parts. The finish is not perfect due to play and direction change. The entire operation has to be carried out at low speed. Care is needed to check clearances preferably by rotating without power using a spindle handle, for example.

The concept derives from days when people took responsibility and did not blame any one other than themselves for their own actions. I do not regard this device as dangerous. I suspect there are some who do and should try driving round Paris on a daily basis.

●To be continued?



This most complex chuck is not the subject of the Author's feature. (With apologies to the Society of Ornamental Turners)



These fascinated onlookers were not watching the Author at work. (With further apologies to the Society of Ornamental Turners)



With water, fire and steam all as they should be, we and our eager passengers await the 'off'.

Keith Wilson

describes the railway at the RASE Showground, Stoneleigh, and takes us for a trip around the track.

There are many ground-level tracks both here and over various ponds (Atlantic) and ditches (English Channel), but the 7 1/4 in. gauge railway in Echills Wood, Stoneleigh Agricultural Park, Warwickshire must come somewhere towards the top of the list. One cannot join, if you wish to become involved you may turn up and help and wait until you are invited to become a member – a favour which is not given lightly. On open weekends, visitors are welcome, even more so if armed with locomotives and boiler certificates.

The railway was started in 1975 and although complete, is not yet finished, but this applies to any railway; like housework, it is an on-going operation. The line is built with Vignoles section rails, 12lb. per yard, screw-spiked to heavy re-cycled plastic sleepers which are very long-lasting, and ballasted appropriately. Fully signalled, interlocked, etc., trains are passed along the single portion of the line by bell-codes and signals; at the time of writing, a train staff or token is used — rightly so.

ECHILLS WOOD MINIATURE RAILWAY



A glance forward reveals that the lower-quadrant home signal shows clear; we are on our way.

In theory at least, there are methods of interlocking signals to guard against head-on collisions. We have yet to have one that I know of, but there was a close call a couple of years ago. The token had been retired because of the signalling system, but it is an intriguing railway fact that if there is a potential flaw, sooner or later that flaw will bear unpleasant fruit. The old

Railways knew this, but nowadays with profit taking the upper hand, it is not so well realised.

One train (my 'Up' train) had passed the home signal at green (with two independent witnesses) when somehow or other a false electric pulse cleared the system and the signalmen involved understandably 'belled-up'. Getting the all clear, he pulled the signal off and the 'Down' train



Approaching the elegant entrance to the tunnel.



The tunnel is 6ft. wide and on a right hand curve.



The road crossing is protected by flashing lights and warning sirens.



The left hand road takes us on the long climb past Echills Wood station.



This view shows how the passenger stock keeps feet safely inboard.



Having reached the summit, we head toward another level crossing.

started. Our luck held however, for a bystander noticed what was happening and raised the proverbial Caine. Had he not done so, there would have been a significant chance of a headlong meeting in the tunnel. All brakes were hastily applied and I am pleased to state that the token was back in use before my train (the 'Up' train) reached the station. The flaw was detected and the system has since been altered to remove this possible causal factor in accidents.

The main signalbox is on the departure platform at Harvesters, in it or nearby resides the Controller, who makes the decisions (and carries the can). Telephone communication links the other two signal boxes, level crossings, steaming-up yard and mess room, to name but a few. It is bell-connected with the other two boxes, and the standard codes are carefully employed, although since the Middle Box and Control Box are only a few yards apart then there is no need for the codes. However, they are mandatory for the Wood Box, which is way out of sight. The single portion of the line is track-circuited by treadles, and there are two sets of Train-On-Line, Line Blocked, and Line Clear instruments to remind signalmen of the state of the line.

Signals and points are controlled electro-pneumatically; this is provided at Harvesters, the terminal station, by a small automatically controlled compressor. Other compressors are installed at the two remaining signal boxes.



This parting of the ways takes us around the wood or back to the station.

Down in the Yard, there are several 12 volt dc power supplies for raising steam by two methods, and compressed air. A large central vacuum cleaner aids in clearing smokeboxes, water is piped to the bays, and two sizes of coal are available. The steaming bays are raised above ground level — or rather the ground is lowered round the steaming bays. Experienced drivers will need no prompting as to the advantages of being able to get below or underneath steam locomotives!

On general open days, when many visitors are welcome, we try to give them as much running as possible, but sometimes a modicum of rationing could be necessary. I recall one

occasion when there were 13 locomotives in steam, all being catered for. After about four hours, I (the Controller at the time) was just about knackered, my son took over and lasted just over three hours by which time several locomotives had retired and life was considerably easier!

I don't think that a visiting locomotive has ever been 'sent empty away' but some are easier to cater for than others. We once suffered a long delay due to a derailment blocking the single line. At the front of the queue... (whoa! like bananana... it's difficult to know when to stop!) on the clear signal, the driver then decided to oil-up his engine; b*****y oaf! However, such happenings are rare.

Anyone deciding to visit us, with or without a locomotive, is made welcome. Advice for anyone needing locomotive aid is freely given, likewise assistance in raising steam, etc. To assist with unloading a locomotive from a road vehicle, a powerful lifting table is conveniently sited near our entrance. Considering that some 7¹/₄in. locomotives are not far short of the half-ton mark, this is not entirely surplus to requirements!

A track circuit

An illustrated trip around the track may be of interest and the brilliant sunshine we enjoyed last May Bank Holiday made this a reasonable prospect — although the sun was frequently in the wrong place for first-class pictures.



If we choose, we can go 'flat out' on our return across the road crossing.



We reduce speed and whistle up for our return through the tunnel.



This double signal indicates our route into/through the station.



Token relinquished, we make our way into the arrival platform.

On being given the line clear from the stock sidings, locomotives reverse over the single-slip diamond and couple up to the train, checking vacuum levels for safe brake operation. A small signal with a route indicator below gives the clear to pull the train into the departure platform or, if running is at an end, down into the locomotive and stock yard at the bottom of a 1 in 29 gradient.

Photograph 1 shows the cab view of our locomotive as we await the 'off' signal; **photo 2** shows our forward view. Note the lower-quadrant home signal in the 'clear' position. Just below is a further 'R' signal, lit up when the guard has blown the 'Right away'.

The merry cracks of the locomotive exhaust are music to all as we get the train under way and approach the tunnel (**photo 3**). Said tunnel is about 6ft. diameter and if necessary can be lit, but it is normally dim inside. It is perfectly possible to 'notch-up' before reaching the tunnel, but I must confess that I usually give full gear and full regulator as we enter it, teaching the cobwebs a lesson or two.

The 'light at the end of the tunnel' (**photo 4**), shows a right-hand bend, just around which is a home signal and the 'SW' (Sound Whistle) sign, for the benefit of the crossing, for perforce the line crosses the road at this point (**photo 5**), and although it is protected by warning lights and sirens, vehicles occasionally ignore these to the danger of all. Given the choice of being struck by a train at 10mph, or a car at 20mph, I know which one I'd choose, and anyone with any respect for his car could well be extremely sorry. Steam locomotives are considerably more sturdy than cars, especially as the car would be sideways on. While I was taking these photographs, the driver of a very posh red car decided to stop on the crossing to watch the train, but I used a good bit of steam on the whistle and had some choice words (and how!) all ready to use. He seemed to think better of it.

At the far side of this crossing, which incidentally is 'manned' during big shows like the Royal, and the Town and Country, is a facing

point; we diverge here to the left and start the long climb past Echills Wood Station (**photo 6**). Just about here there is a nice signal gantry, controlled from the nearby signalbox and a trailing set of points brings in the crossover from the inner loop, visible to the right in **photo 7**.

This is the summit of the line and obviously from here it is downhill back to the single track



We take the opportunity to service the engine...

section. A long straight follows this curve with a level crossing normally closed against road traffic (**photo 8**). It leads only into the inside of the track, and is sometimes used by horses (and their leaders who, in theory, are expected to phone the signalbox and request permission to use it). Round the curve to the right we come to the 'parting of the ways' (**photo 9**) where the second point of divergence for the inner loop is located, the first being at the entrance to the wood itself. We can pass either side of the signalbox, for it is possible to have a train run over the crossing and go either round the outer loop or into the inner loop, Santa Specials for the use of.

Passing behind the signal box, with a good blast on the whistle, we pick up the token if it's there; if not the signal would be at danger anyway. Over the road crossing (**photo 10**) is one of three places where 'flat-out' is possible (the other two are up the gradient on either loop). Remembering to reduce speed for the curve back towards the tunnel (**photo 11**), we whistle for the tunnel and on emerging eye up the double signal, (**photo 12**). If the left arm is clear, then we go into the departure platform (usually Santa Specials only); if both home and distant are clear, then the line ahead is clear right up to the turntable at the far end of the arrivals platform. If the distant is 'on' or at 'caution', it means that the arrival platform is still occupied.

Dropping the token onto its horn, we take our train gently over the points (unfortunately diverging on the inner side of the curve, always the trickiest type, we now go straight into the arrival platform (**photo 13**), over the single slip diamond, stopping just short of the turntable.

Once uncoupled from the train, locomotives run forward onto the table and are turned round onto one of the two locomotive sidings where coal, oil, and water can be applied if needed (**photo 14**). Once replenished with these commodities, locomotives run past the Middle Box signalbox and onto one of the two stock sidings (**photo 15**) where they await their next turn of duty.



...and await out next turn on one of the two stock sidings. Time perhaps for a cuppa' and a natter.



SINGLE START WORMS AND SPUR GEARS

Cutting 150 equi-spaced divisions using a Myford Super 7B lathe with the dividing apparatus mentioned in the text. The attachment is secured to the lathe at two existing 2BA holes in the vertical plane of the large countershaft bracket casting, and by a special shouldered stud entered into an existing 3/16in. BSF hole in the horizontal plane of the headstock casting thereby providing a stable 3-point fixing.

Derek Oxley
discusses a complex topic.

Those of us who are not equipped for any form of helical gear wheel cutting sometimes have to resort to mating a worm with a spur gear such as a lathe change wheel. In some cases we have no choice in the matter, as when cutting a worm to mate with the bull wheel on a lathe spindle (see photo). It can be argued that a spring-loaded plunger engaging in the bull wheel will provide many of the commonly required divisions. However, such an arrangement is of no use at all for rotating the lathe spindle through a given arc while milling out a slot or groove from a motorised top-slide attachment. It is also of no use for the particular job shown in the photograph which required 150 equally spaced divisions.

Individual designers may intend the worm axis to be at right angles to the gear axis, in which case the axial pitch of the worm (Pap) should exactly match the circular pitch of the gear (Cpg), which is determined from (π/DP) . If they then use the traditional gear trains (drivers/driven and leadscrew):

40 x 55 / 35 x 50 x 8 for 20DP,
or, 55/35 x 8 for 16DP
(or equivalent trains)

they incur a slight overspeed error of approximately 1:2484, which may or may not be acceptable in service.

Alternatively, the designers may choose to seek to eliminate that small error by canting the worm from the right angle by an amount equivalent to its lead angle, with the worm's normal pitch (Pnp) and not Pap being equivalent to Cpg (see Sketch A). I will digress here for a moment because I have seen articles in which the author has confused the terms lead and helix

angle in respect of worms. The authoritative work *Gears* by P. S. Houghton (3rd Edition - 1970) gives the following precise formulae in Chapter 7, Table 7.1:

Tangent of worm lead angle = $L/(\pi \times PDp)$

Tangent of worm helix angle = $(PDp \times \pi)/L$
where L = number of starts (S) x Pap

Calculation applied to any known case will show that while the sum of those angles is (obviously) 90deg., the lead angle is substantially the smaller of the two.

Some years ago I saw an article (not in *Model Engineer*) in which the author had advocated the canted worm arrangement in a 20DP set-up, but the dimensions given for the worm were incompatible with the specified gear train. Before commenting, I took the precaution of consulting the late Professor Chaddock. He, in his usual generous style, outlined three examples of the 'working backwards technique' from the worm thread of an axial pitch as actually cut by a given gear train to arrive at a worm pitch diameter and, therefrom, lead angle. This is a technique that the author of the article could have used to check the validity of his proposals. It is arithmetically much simpler than starting with the finished product pitch diameter (or outside diameter) of the worm and its lead angle to find out if the gear train used was valid.

Having recently had cause to re-read all my notes on this subject I thought Professor Chaddock's tip well worth passing on and the table was

Single Start Worm used in conjunction with a Spur Gear with worm axis canted from perpendicular to gear axis by $Lp < e$

Worm: Normal pitch (Pnp) to be as circular pitch of gear (Cpg)

Gear: DP = 20; Circular pitch (Cpg) = $\pi/DP = 0.157079632in.$

Addendum (A) = $1/DP = 0.05in.$; Dedendum (D) = $1.157/DP$ (min) = $0.05785in.$

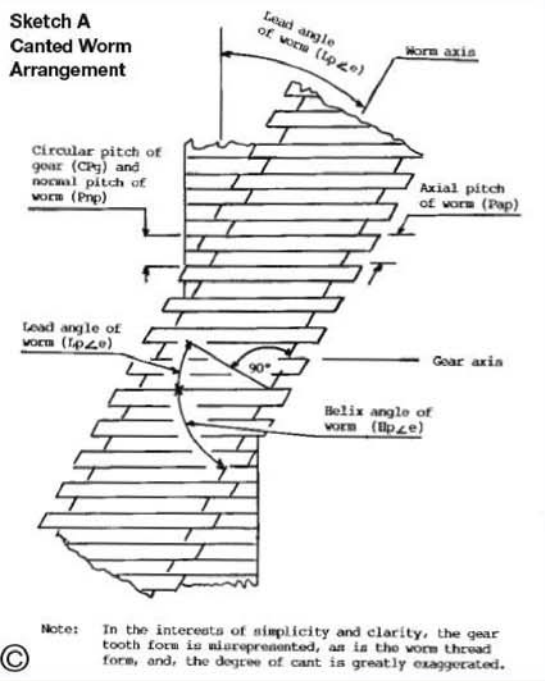
Symbol	Definition	Formula	Calculation	Calculation	Calculation
Pap	Axial pitch of worm as cut by standard gear train	<u>Drivers</u> (Driven x leadscrew)	$\frac{(40 \times 55)}{(50 \times 35 \times 8)}$ = 0.157142857in.	$\frac{(51 \times 40)}{(20 \times 81 \times 8)}$ = 0.157407407in.	$\frac{(60 \times 40)}{(38 \times 50 \times 8)}$ = 0.157894736in.
Cos $Lp < e$	Cosine of worm lead angle	$\frac{Pnp}{Pap}$	0.999597662in.	0.997917666in.	0.994837673in.
$Lp < e$	Worm lead angle (Decimal)	scientific calculator or tables	1.625352042deg.	3.698181058deg.	5.824348678deg.
	Worm lead angle (Sexagesimal)	- ditto -	1deg. 37min. 31.27sec.	3deg. 41min. 53.45sec.	5deg. 49min. 27.66sec.
PDp	Worm pitch diameter	$\frac{Pap}{(\pi \times \tan Lp < e)}$	1.762801637in. Say: 1.763in.	0.775186252in. Say: 0.775in.	0.492712403in. Say: 0.493in.
ODp	Worm outside diameter	PDp + 2A	1.863in.	0.875in.	0.593in.
Rdp	Worm root (core) diameter (maximum)	PDp - 2D	1.647in.	0.659in.	0.377in.

constructed using the mathematical logic and gear trains he had quoted in his outlined examples. Because, for our purposes the lead angle should be contained within three to five degrees, only one of those examples is usable. However, by substituting (as a pencil and paper exercise), other gear trains such as 63/50 x 8 can be used to vary the lead angle and pitch diameter. Obviously the same pattern of logic can be used for other DP values too.

The aforementioned propositions regarding the angular disposition of the worm and gear axes hold good in making up such aids as a cross-slide mounted dividing head or a rotary table because the angular relationship, once established, remains constant. They also hold good in making up a dividing attachment for the bull wheel, but only in so far as the angular disposition of the worm spindle within its bearing on the bracket and quadrant go.

The fly in the ointment is that in attaching the quadrant to the lathe, the plane of the attachment surfaces may not be parallel or perpendicular to the lathe axis and/or the disposition of the fixing holes may be out of kilter.

Photographs I have seen suggest that some have drilled and tapped additional holes in the headstock casting, and/or in the large countershaft bracket casting. Others like myself, have utilised existing holes (three for stability) which were provided by



the manufacturer for some other purpose. All are risky. In my installation I appear to have 'dropped lucky', in that when tested against the rim of a 9in. dia. faceplate, there is no perceptible error. However, engineering solutions should not depend upon luck, and it seems to me that risks of misalignment will not be eliminated unless and until the lathe manufacturers provide one or more machined surfaces and tapped holes which meet the required criteria for mounting the quadrant

with confidence. However, it is worth asking the question as to whether any other reader has already found a foolproof solution.

These notes are not intended to focus on the various aspects of actual worm design, but I take the opportunity to mention one feature. I have seen spindles produced on which the worm block was far too long, but conversely a model engineer's stockist supplied me with one which was far too short for its advertised dual purpose, after which event I now always cut my own. The design length (Fp) of the worm block is controlled by diametrical data from the mating gear and the standard formula is:

$$Fp = \sqrt{(ODg^2 - PDg^2)} + A$$

where (A = 1/DP) and the product of the formula can sensibly be raised to the nearest 1/8in. for our purposes.

The mid-point of the worm block should be coincident with the tangential point on the gear. However, if the worm for a dividing head is intended to be used alternatively with 60-tooth and 40-tooth gears, the distance from the worm bracket fulcrum to the tangential point on the gear is not the same in both cases. It is usually necessary to increase the length of the worm block to cover both cases. It was a failure to recognise that difference which resulted in the aforementioned supplier inflicting a useless worm block on me.



UK News

Amnerfield Miniature Railway, near Reading has announced its 2004 programme which opens 2 April with the first public running session for 2004. The Diesel and Electric Open Day will be on 5 June with the Steam Open Day on 10 July. Contact David Jerome (0118-9700274) for details.

An update from the **Ascot Locomotive Society (2003)** announces that following the final dissolution of the original ALS, the new society have decided to drop the '2003' suffix from its name. Members are currently in the throes of the planning application saga and are very grateful for the help provided in this area from the racecourse staff. Lifting the main line for the move has begun, as has the manufacture roof trusses for the new longer workshop and carriage shed. Members of the new society

Pinewood Miniature Railway Society was registered as a company limited by guarantee on 18 December last year. This society took on a large influx of new members from the old Ascot Society after the latter's dissolution. The Pinewood MRS secretary is Ivan Hurst who can be contacted on 01276-28803 or at ivanjuliahurst@yahoo.co.uk

Members of **Bradford MES** had a very well supported Bits and Pieces evening in January which included Donald Lucas and Jack Carradice making the tea for the first time. The President commented "... for first timers you did yourselves proud." Could it be that he wishes to encourage them for the future? An unusual item among the Bits and Pieces was a twin-cylinder oscillating engine which had been running on compressed air at a member's

place of employment (no names to protect the guilty!) for ten years continuously night and day without any attention. Is this a record or can anyone out there beat it? At the Mince Pie Steam Up, member David Hodgson took along his part finished 0-4-0 locomotive built around a discarded Pizza Hut motorcycle engine. This seems to have been named the *Flying Pizza*.

Members of **Bristol SMEE** report a very successful Santa Special event at their Ashton Court track. Bernard North was dressed up as the Fat Controller (complete with large pocket watch) and was informed that "... he looked like an out of work undertaker." Members Bob Lilley and Mike Keighley have re-engineered and restored the club 5in. gauge 4-8-4 diesel Fell locomotive. This is now powered by two Sinclair C5 motors and has covered 169 miles in use so far. The society had a talk on Pattern Making Made Easy by Joe Nemeth who suggested that a one-piece casting for the chassis, cylinders and saddle of a small size locomotive would be economic and time saving. One of the pictures in the newsletter shows Tony Newberry pulling away with 54 passengers on his train.

Alan Rose, webmaster for **Chingford DMEC**, reports that their new web site at www.cdmec.co.uk is now up and running. It includes information on the railway and other activities, together with full details of the track location and evening meetings. Alan asks that webmasters whose sites have links should please check that they now go to the new site as there are some with links to a very old Chingford site. The full URL for the new site is <http://myweb.tiscali.co.uk/cadmec> Just to demonstrate that I have visited the site, I can tell you that it carries a report that the club project *Nigel Gresley* ran under its own power for the first time on 15 February.

Apparently little happens down at the **Crawley Model Engineers** Goffs Park Light Railway at this time of year except that the daffodils are coming up in the track infield. Having said this, the band of workers has installed a new washbasin and water heater, given the refurbished *Simplicity* a couple of laps (until beaten by the cold), replaced two bogies on a riding truck and had a busy running day on 1 February after a small amount of precision work with "... the big hammer" on the traverser. This seems to me to be quite a lot of activity.

Elmdon MES, based at the Wythall Transport Museum near Birmingham, is another club with a new website: www.wythallsteamrailway.co.uk. This group is in the process of remodelling the viaduct with blue bricks to improve its appearance. The steel boiler of the club's Black Five locomotive has been re-tubed by Dennis Herbert, and the locomotive has now been passed as fit for duty. The club Hunslet is undergoing an intermediate overhaul ready for the summer season.

Harlington Locomotive Society reports a successful season including the opening of their Gauge 1 railway, a 200ft. circuit with seven points and two passing loops. This amenity is proving very popular on Thursday evenings prior to their weekly meetings. Some improvements to the club house are being financed by a local trust fund and PRO Peter Tarrant reports that the best news of 2003 was the delaying of the third runway at Heathrow until 2015. I am sure many others in the area will support that sentiment.

Kew Bridge Steam Museum is holding its 5th Stirling Hot Air Engine Rally and Competition on Sunday 4 April 11am-5pm at the museum in Green Dragon Lane, Brentford, Middlesex. Further information can be obtained from the website www.kbsm.org or by telephoning 020-8568-4757. The museum is also holding a Magic of Meccano Show on 24/25 April which will be opened by Christopher Awdry who will be on hand to sign copies of his new children's book.

The King's Lynn DSME track gang have had a ten week winter break before carrying on with various maintenance tasks once the better weather arrived. I shall have to put in a complaint — we don't get a break at Reading! The Kings Lynn Editor comments that in the 1970s the club safety instructions were "simple common sense" rules on two pages of foolscap. They are now 216 pages and about 60mm thick. I heard a comment on television recently which was to the effect that "all these rules and regulations are so that the bureaucrats can make our lives as miserable as their own." Some upgrades are planned to the riding trolleys before the running season to improve reliability.

Harry Carr reports that Lancaster & Morecambe MES enjoyed a successful 2003 season which included the Sweet Pea Rally, club Open Days and Playdays. The stalwarts who do public running



This fine photograph of Chingford DMEC's new loco., Martin Evans' 5in. gauge Nigel Gresley on its first appearance on the club track, 1 February 2004, when it had yet to be steamed, was sent to us by Robin Barfoot. He explains that, with the exception of the boiler which was professionally made, all parts were made by club members. Nearly everyone became involved, with almost all volunteering or being volunteered to make something depending upon their individual skills. In all it has been finished in about three years which is quite amazing when compared with the club electric loco. Dragonfly, which took closer to 23 years. Robin concludes his message thus: "We look forward to driving it and getting it run in before entering our passenger hauling service which begins at Easter. There were those that said the project would never get off the ground, let alone be finished. I'm glad they were wrong."

gave 19,000 rides in total on the Sundays and Bank Holidays. Various improvements have also been made to the track and site during the season. 2004 is the 25th Anniversary of the founding of the club and a celebration will be held during the year.

Leeds SMEE reports an influx of new members since August, who have become regular attendees at meetings and events. The group includes two juniors; it is good to know that there are still some youngsters interested in engineering 'things.' The society is holding a Running Day on May 16th where the emphasis will be on gaining driving skills and training in the club running procedures.

Llanelli & District Model Engineers are holding a Spring Rally 3/4 April. Visiting steam locomotives will require a spark arrestor and current boiler certificate. Further information from Mr. P. Dobson on 01792-884854. The track is set in a country park with beaches and forest walks available.

The North Wiltshire MES based at Coate Water in Swindon is yet another with a new website on www.communicate.co.uk/wilts/northwiltsmes. Although still in its infancy it is claimed that "it will get even more interesting." The club boasts a fine looking new battery electric locomotive which is now carrying out its share of public running. The society has recently featured in the local press and on local radio which has already resulted in one request for a membership application form. Members of the 'Tuesday Club' have been very busy round the site making lots of improvements. These include improvements to the station area, new track panels, a

much improved carriage shed and workshop, and many other jobs too numerous to include here.

The Norwich DSME 'Tuesday Gang' unearthed a "tremendous find" recently when working on their newly landscaped site. This was deemed more interesting than, among other things, a hoard of Roman coins and was in fact a piece of 1/2in. steel plate about 3ft. square. The plate showed evidence of being flame cut "hundreds of years ago, probably by a Roman Soldier, fashioning a new breastplate for his armour or a knight leaving on a crusade, making a new chastity belt for his wife or girlfriend." The find was eventually transported back to its current resting place in a wheelbarrow bearing a 'wide load' sign. Members wishing to acquire a piece of this plate were instructed to bring their own hacksaw and, if the demand was too great, then the size would be limited to that which can be cut using a junior hacksaw. It must be the Norwich water! On a more serious note, Norwich are another society making spark arrestors compulsory for public running.

David Murray of Staines SME has written in response to my request for readers who have had their locomotives featured on television. David's locomotive Great Northern to LBSC's Hielen' Lassie design featured in the opening credits of the film *Ali G in da House* which was filmed in Staines. David ran for about two hours pulling eight children and an adult Guard during which he covered about four miles for various shots of children waving and not waving, with hats and without hats. After this was finished, other club

members present who thought that they might then be able to play trains were disappointed when the film company asked everyone to leave as they had some more filming to do on the site. The result of all this: 2 seconds of film in the opening credits! Any other similar stories will be welcome.

Work is proceeding on the Romney Marsh MES clubhouse extension. The windows have been replaced with UPVC units and roller blinds are now fitted. Progress on the toilets continues and it is hoped that they will be finished this year. RMMES is another society with an anniversary this year, the 35th their case. By the time you read this, the planned March dinner to mark the occasion will have taken place. We hope everyone had a good time at the event. The secretary reports that he looked out of his back bedroom window early (9am) on Christmas Day to see the club house door open. He hurried across to investigate and found two members preparing locomotives in the steaming bays. His comment: "Some people are keen!" A tip in the newsletter suggests using pieces of gauge plate as a cheap alternative to parallels when setting work up in a milling vice, etc. The other suggestion is to separate out old car wheel bearings into inner and outer races and use those in a similar way.

Rotherham DMES reports a successful outcome to negotiations for the new lease. This has now been granted for a further five years with an increase in rent. Two grants have also been obtained to fund the survey work for a proposed track extension.

World News

Canada

Following the many reports resulting from the Los Angeles Live Steamers' unfortunate accident last year, we are pleased to report that they are now back open for business following the decision that they do not, after all, come under the control of the OSHA Fairgrounds and Amusement Rides regulations. This good news was reported in the British Columbia SME journal along with comment on the need for all clubs which undertake public running to be vigilant regarding safety issues. Bruce Wilson describes the fitting of his 'instant speedometer' which is designed to be easily fitted to any riding car truck.

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.

Maureen Andrew
Ted Cuckney
Ken Plummer
John Stammers

Bradford MES
Romney Marsh MES
Harlington Locomotive Society
King's Lynn DMES

South Africa

Durban SME reports a very quiet December public running day with only 12 teas sold and just the occasional family 'popping in'. Work on the site continues with the steaming bay awning nearing completion; replacement of the station roof and a rebuild of the main traverser is planned early in the year. Convinced that drastic action is needed, Chairman Errol Koch is concerned about the number of oversized trees on the site and observes that the gardener spends most of his time sweeping leaves and finding somewhere to dump them. Geoff Wilkinson proposes a perpetual motion machine which consists of a piece of toast strapped butter side up to the back of a cat. When dropped this combination will spin

just above the floor on an axis roughly parallel to the cat's spine. Why? because dropped toast always lands butter side down and a dropped cat will always land on its feet...

Tom Campbell, Editor of the **Rand SME** newsletter wonders if there is any interest in model ships in the society. These thoughts were prompted when Tom leafed through some old issues of *Model Engineer* and noted that such models were very popular. I wonder how many of our readers build ship models? The society has recently welcomed two new members who will no doubt enjoy the regular programme of events planned for this year.

United States

The **New Jersey Live Steamers** have already reported four snowstorms and two 'single digit' cold snaps by 18 January. This caused the January Business meeting to be cancelled although some 15 stalwarts managed to make the trip. They report that 23 people turned up for the New Year Evening Run with the Madlinger family's locomotive in steam. Several members also got together for an informal brunch on New Year's Day. The society has gone upmarket with a new set of matching dishware in the kitchen. The set replaces the assorted items donated to the club

over the years. The newsletter also comments that the "...offering of mechanical arts classes in local high schools is almost a thing of the past." The good news is that some local organisations are trying to reverse this trend. The club also reports recent mentions in newsletters. I would like to thank them, and all contributors, and look forward to more as time goes on. Chris Harding visited the **Maricopa Live Steamers** on one of their working days and notes that in the four years at their present site they have laid about 40,000ft. of 7 1/2in. gauge track which works out at just under two miles a year. Impressive efforts by any standards, perhaps someone would send us some information on their efforts?

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.

APRIL

- 2 **Canvey R&MEC. Speaker from Modelworks International.** Contact Brian Baker: 01702-512752.
- 2 **Colchester SMEE. Hugh Mothersole: Switzerland, an Engineer's View.** Contact L. G. Hammond: 01376-511686.
- 2 **North Norfolk MEC. N. Digby: My Modelling.** Contact Gordon Ford: 01263-512350.
- 2 **North Wiltshire MES. AGM.** Contact Les Stiff: 01249-521658.
- 2 **Romford MEC. Competition Night.** Contact Colin Hunt: 01708-709302.
- 2 **Vale of Aylesbury MES. Photo Competition.** Contact Clive Ellam: 01296-623433, Ian Meikle: 01844-291590 or Bob Jones: 01296-29468.
- 2 **Kinver & W. Midlands SME. Bring & Buy.** Contact John Campbell: 01384-891244.
- 2 **Maidstone MES. Guest Speaker.** Contact Martin Parham: 01622-630298.
- 2 **North London SME. On The Table: Work in Progress.** Contact David Harris: 01707-326518.
- 2 **Rochdale SMEE. John Hopkins: The Welsh Highland Railway.** Contact Mike Foster: 01706-360849.
- 3 **Maxitak Owners Club. Boiler Test Day.** Contact Eric Penn 0208-979-4335.
- 3 **York City & DSME. Allan Birkin: Preservation Permanent Way.** Contact Ken Bateman: 01904-421445.
- 3/4 **Dockland & E. London MES. Miniature Passenger Train Services.** Contact P. M. Jonas: 01708-228510.
- 3/4 **Llanelli DME. Spring Rally.** Contact P. C. Bassett: 01554-820294.
- 4 **Canvey R&MEC. Sunday Running Commences.** Contact Brian Baker: 01702-512752.
- 4 **Cardiff MES. Steam-Up and Family Day.** Contact Trevor Jenkins: 029-2075-5568.
- 4 **Frimley & Ascot LC. Public Running.** Contact Bob Dowman: 01252-835042.
- 4 **Great Western Soc. (Didcot Railway Centre). Didcot Steamday.** Contact Jeanette Howse: 01235-817200.
- 4 **Kew Bridge Steam Museum. 5th Stirling Hot Air Engine Rally and Competition.** 11am-5pm, Adults: £5.20; OAPs and Students: £4.20; Children (5-15 years) £3.00; Family: £15.95. Information: 020-8568-4757.
- 4 **Lancaster & Morecambe MES. Running Day.** Contact Harry Carr: 01524-411956.
- 4 **Leyland SME. Ground Level Public Running Day.** Contact Mark Entwistle: 01772-422411.
- 4 **Northampton SME. Boiler Testing Day.** Contact Pete Jarman: 01234-708501 (eve).
- 4 **Ottawa Valley Live Steamers. Meeting.** Contact John Bryant: 761-1109.
- 4 **Oxford (City of) SME. Public Running.** Contact Chris Kelland: 01235-770836.
- 4 **South Durham SME. Steaming Day.** Contact B. Owens: 01325-721503.
- 4 **Steam LS of Victoria. Public Run.** Contact Graham Plaskett: (03) 9750-5022.
- 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 **Vale of Aylesbury MES. First Steaming of the Season.** Contact Clive Ellam: 01296-623433, Ian Meikle: 01844-291590 or Bob Jones: 01296-29468.
- 5 **Frimley & Ascot LC. Evening Meeting.** Contact Bob Dowman: 01252-835042.
- 5 **Lancaster & Morecambe MES. Topic Night; Marking Out.** Contact Harry Carr: 01524-411956.
- 5 **Leicester SME. John Bailis: Video Evening.** Contact Raymond Wallis: 01162-858824.
- 6 **Auckland SME. Terry Boyd: Testing Materials.** Contact Gary Farquhar: 576-7025.
- 6 **Romney Marsh MES. Vintage Film Evening.** Contact John Wimble: 01797-362295.
- 6 **South Durham SME. Meeting.** Contact B. Owens: 01325-721503.
- 6 **Stamford MES. Bits & Pieces.** Contact David Ash: 01780-751211.
- 6 **Taunton ME. Steve Gosling: Vehicular Autobiography.** Contact Don Martin: 01460-63162.
- 6 **West Wiltshire SME. AGM.** Contact R. Nev. Boulton: 01380-828101.
- 7 **Bradford MES. Doug Hewson: Lost Wax Castings.** Contact John Mills: 01943-467844.
- 7 **Chingford DMEC. Bits & Pieces.** Contact Martin Masterson: 0208-989-5552.
- 7 **Guildford MES. Geoff Meekums: Engineering on the Mid Hants Railway.** Contact Dave Longhurst: 01428-605424.
- 7 **Harrow & Wembley SME. Auction.** Contact Dr. Roger Greenwood: 020-8427-2755.
- 7 **Leeds SMEE. Video Evening.** Contact Colin Abrey: 01132-649630.
- 7 **Tyneside SMEE. Bits & Pieces.** Contact Ian Spencer: 0191-2843438.
- 8 **Cardiff MES. Boiler Testing.** Contact Trevor Jenkins: 029-2075-5568.
- 8 **Sutton MEC. Meccano Night.** Contact Mike Dean: 0208-657-5401.
- 9 **Lancaster & Morecambe MES. Running Day.** Contact Harry Carr: 01524-411956.
- 9 **Surrey SME. Public Running.** Contact John Cook: 020-8397-3932.
- 9 **Toronto SME. Meeting.** Contact Art Gordon: (905) 820-1988.
- 9-12 **British Columbia SME. Easter Meet.** Contact Sean Laurence: (604) 931-1547.
- 9-12 **Leighton Buzzard NG Rly. Easter Fun.** Enquiries: 01525-373888.
- 9-12 **Vale of Aylesbury MES. Thomas Weekend (Easter).** Contact Clive Ellam: 01296-623433; Ian Meikle: 01844-291590 or Bob Jones: 01296-29468.
- 10 **Brighton & Hove SMLE. Public Running.** Contact Mick Funnell: 01323-892042.
- 11 **Annerfield Miniature Railway. Public Running.** Contact David Jerome: 0118-9700274.
- 11 **Bournemouth DSME. Official Opening.** Contact Mike Baker: 01202-383653.
- 11 **Harlington LS. Public Open Day.** Contact Peter Tarrant: 01895-851168.
- 11 **Hereford SME. Public Open Day.** Contact Richard Donovan: 01432-760881.
- 11 **Leeds SMEE. Easter Sunday Running Day.** Contact Colin Abrey: 01132-649630.
- 11 **Leicester SME. Public Running.** Contact Raymond Wallis: 01162-858824.
- 11 **MELSA. Easter Sunday Run for Life Line.** Contact Graham Chadbone: 07-4121-4341.
- 11 **North London SME. Easter Running Day.** Contact David Harris: 01707-326518.
- 11 **Pinewood MRS. Public Running.** Contact Ivan Hurst: 01276-28803.
- 11 **Romney Marsh MES. Easter Track Meeting.** Contact John Wimble: 01797-362295.
- 11 **Sutton MEC. Track Day.** Contact Mike Dean: 0208-657-5401.
- 11 **Wimborne & District SME. Season's First Running Day.** Contact Eric Basire: 01202-897158.
- 11 **Woking MRS. Easter Bunny Day.** Contact Ronald Dewar: 01932-343331.
- 11 **Wortley Top Forge ME. Forge Re-Opens to Public.** Contact Alec Butteriss: 07771-841168.
- 11 **York City & DSME. Easter Day Special Steaming.** Contact Pat Martindale: 01262-676291.
- 11/12 **Bristol SMEE. Public Running Days.** Contact Trevor Chambers: 01454-415085.
- 11/12 **Cardiff MES. Open Days.** Contact Trevor Jenkins: 029-2075-5568.
- 11/12 **Claymills Pumping Engines. Claymills Pumping Engine Trust.** Meadow Lane, Stretton, Burton on Trent, Staffordshire. Steaming. Contact B. Eastough: 01283-812501.
- 11/12 **Elmdon MES. Public Running.** Contact Chris Giles: 0121-458-1291.
- 11/12 **Lancaster & Morecambe MES. Running Days.** Contact Harry Carr: 01524-411956.
- 11/12 **Oxford (City of) SME. Public Running.** Contact Chris Kelland: 01235-770836.
- 12 **Brighton & Hove SMLE. Public Running.** Contact Mick Funnell: 01323-892042.
- 12 **Erewash Valley MES. Evening Meeting.** Contact Jim Matthews: 01332-705259.
- 12 **Frimley & Ascot LC. Public Running.** Contact Bob Dowman: 01252-835042.
- 12 **Melton Mowbray DMES. Steam-Up at Track.** Contact Phil Tansley: 0116-2673646.
- 12 **Northampton SME. Easter Monday Running Day.** Contact Pete Jarman: 01234-708501 (eve).

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- 13 Sutton Coldfield MES. Roger Hailwood: The National Memorial Arboretum. Contact Neal Harrison: 0121-378-3992.
- 14 Chingford DMEC. Phil Kingham: Building a 4F. Contact Martin Masterson: 0208-989-5552.
- 15 Isle of Wight MES. Monthly Meeting. Contact Ken Stratton: 01983-531384.
- 15 Leyland SME. Stationary Engine Evening. Contact Mark Entwistle: 01772-422411.
- 15 Rugby MES. Doug Hewson: Building 5in. gauge BR Mk.1 Coaches. Contact David Eadon: 01788-576956.
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- 16 Steam LS of Victoria. Gathering. Contact Graham Plaskett: (03) 9750-5022.
- 17 Leyland SME. Junior Members & Guests Afternoon Driving Session. Contact Mark Entwistle: 01772-422411.
- 17 National 2 1/2in. Gauge Ass'n. South Eastern Area Get-Together at Leatherhead. Contact Clive Young: 01233-626455.
- 17 Steam LS of Victoria. Club Run. Contact Graham Plaskett: (03) 9750-5022.
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- 18 York City & DSME. Running Day. Contact Pat Martindale: 01262-676291.

- 19 Lancaster & Morecambe MES. Martin Elson: Indian and Pakistan Railways. Contact Harry Carr: 01524-411956.
- 20 Chesterfield MES. Keith Wilson: Locomotive Construction. Contact Mike Rhodes: 01623-648676.
- 20 Northampton SME. Bits & Pieces Night. Contact Pete Jarman: 01234-708501 (eve).
- 20 Romney Marsh MES. Bits & Pieces. Contact John Wimble: 01797-362295.
- 20 South Durham SME. Afternoon Steam-Up. Contact B. Owens: 01325-721503.
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- 21 Leeds SMEE. Ron Redman: Leeds Locomotives Ran All Around The World. Contact Colin Abrey: 01132-649630.
- 21 Maidstone MES. Members' Afternoon Playtime Run. Contact Martin Parham: 01622-630298.
- 21 MELSA. Club Meeting. Contact Graham Chadbone: 07-4121-4341.
- 21 East Somerset SMEE. AGM. Contact Roger Davis: 01749-677195.
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- 23 North London SME. Workshop Evening. Contact David Harris: 01707-326518.
- 23-25 Guild of Model Wheelwrights. Midlands Woodworking & Woodturning Exhibition. Contact Biddy Hepper: 01492-623274.
- 24 Chesterfield MES. Running Day. Contact Mike Rhodes: 01623-648676.
- 24/25 Isle of Wight MES. 20th Loco Rally - Don Young 10th Anniversary Celebration Rally. Contact Ken Stratton: 01983-531384.
- 24/25 Kew Bridge Steam Museum. The Magic of Meccano Show. 11.00am-5.00pm. Adults: £6.00, Concessions: £5.00, Children (5-15 years) £4.00, Family: £18. Information: 020-8568-4757.
- 24/25 Sutton Coldfield MES. SCRS Exhibition. Contact Neal Harrison: 0121-378-3992.
- 25 Basingstoke DMES. Traction Engine Day. Contact Ian Shanks: 01420-561741.
- 25 Bristol SMEE. Public Running Day. Contact Trevor Chambers: 01454-415085.
- 25 Chichester DSME. Steam On Sunday. Contact Brian Bird: 01243-542266.
- 25 Great Western Soc. (Didcot Railway Centre). Didcot Tank Engine Steamday. Contact Jeanette Howse: 01235-817200.
- 25 Guildford MES. First Members' Running Day. Contact Dave Longhurst: 01428-605424.
- 25 Harlington LS. Public Open Day. Contact Peter Tarrant: 01895-851168.
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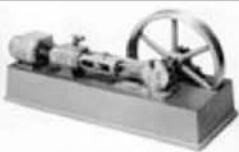
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