MODEL ENGINEER

Vol. 190 No. 4197

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Further thoughts on the operation of live steam injectors, plus the principle of the polarised relay. Part LI.
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On the cover ...

Sprig is an agricultural engine, Works No.14400, Registration No.UP 6481, built in 1920 by William Foster & Co. Ltd. based in Lincoln.
In common with many such engines, this Foster has a single cylinder and two road gears. It weighs 11 tons.
When new, the engine was used by a threshing contractor in County Durham.
During the 1950s it was sold into Lincolnshire and preserved by K. Wright.
Sprig was purchased by present owners J. & D. Bosworth of Smalley, Derbyshire in 1970 and was the winner of the 'Steam Class' at the Coppice Rally held on 16 June 2002.

(Photograph by Michael Boulton)

FINE TUNING A WARCO BH600G LATHE
An improved thread dial indicator, modified chuck keys, and a lightweight headstock cover. Part IV.
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TRADE TOPICS:
DIANE CARNEY NAMEPLATES
Notes from a company that can provide just the thing to give your model that superb finishing touch.
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KEITH'S COLUMN:
LOGGER & SLOGGER
AMERICAN TYPE 2-8-2 LOCOMOTIVES for 5in. and 7¼in. gauges.
Cylinder lubrication and brake gear components; all this and Wilson's Words of Wisdom too. Part XVIII.
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An initiative to provide basic training for newcomers to model engineering.
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SMOKE RINGS
With the Editors

Early season outings

We have just returned from an enjoyable day at the Summerfields Miniature Railway tracks of Bedford MES, slightly marred only by the typical British weekend weather featuring rain, rain and more rain. We consider ourselves fortunate that the rain held off for sufficient of the late Saturday morning and early afternoon to enjoy the extensive site and to ride on the ground level railway. There to judge the models in competition, it was a pleasure, as always, to renew acquaintances with friends only occasionally encountered, particularly in this instance with Ted and Mary Jolliffe. We are sure that readers will be pleased to learn that they both looked fit and well, and Ted seems to have settled comfortably into his retirement status. So many friends and colleagues we know are enjoying their retirement but have observed that perhaps they should get a job again because they had far more time to do things when they were working than they do now they have retired! We have the impression that Ted's days are also filled very full indeed.

It was specially pleasing to meet a number of young members during our visit, the older youngsters being very much involved with running the railway, and others who had entered some of their work in competition. We were able to examine Jack Soames' interesting steam turbine generator plant with a small horizontal boiler which he had devised and built with encouragement from his grandfather, and were pleased to learn all about the operation of a group of 'cyborgs' being built and programmed by Mark and Zoe Warner, a young brother and sister team with help and guidance from dad.

Perhaps even more gratifying was the opportunity to study *Impala,* a very fine 5in. gauge model of an LNER B1 locomotive to Martin Evans' *Springbok* design. What was special about this? Entered bt Mike Gibbs and members of the Vauxhall Motors Model Engineering Club, it had been built and finished to a very high standard by apprentices at the nearby company, a number of whom are, or shortly will become members of Bedford MES.

Our thanks to members of BMES for their welcome and hospitality, and for the opportunity to enjoy a fine collection of model engineering and associated work.

Our previous weekend had been spent at Harrogate for the 10th annual Model Engineering and Modelling Exhibition. Event Manager Lou Rex BEM, and his supportive family and friends put a great deal of time and energy into preparing and running this excellent show; it is a tribute to their efforts that it all seemed to run smoothly with no apparent hitches. Our thanks too, to Lou and all his team for their welcome and generous hospitality.

The Harrogate Show, as it is affectionately known, is very well supported by clubs and societies, and by our friends in the trade. Visitors come from far and wide, including all points of the UK. Barry Glover, President of the Australian Association of Live Steamers had travelled to the UK at a time to suit the show and Cherry and Ivor Hill had flown in from Florida to be there, too. One of our photographs with *Club Chat* in this issue shows Barry firing Walter Scott's model artillery piece. Readers need not worry, the public had left the hall before the gun was fired, it only fires blanks, and builder Walter Scott had taken police advice before proceeding with its construction!

Having mentioned young enthusiasts in the context of the Bedford MES event, it is good to be able to report that the Harrogate Show attracts a great many families as visitors, with a healthy proportion of youngsters. It probably goes without saying that this event provides us not only with a chance to enjoy some superb models but also with an ideal opportunity to catch up with friends and colleagues in the hobby. Our thanks to all, and we apologise if you passed us by because we were deep in conversation with someone else at the time. Maybe we can catch up at another event and another time…

Garden centre to host Colchester SMEE show

Two of the most popular weekend activities for the Great British Public will be combined at a single venue next month with a Model Engineering and Steam Show at Poplar Garden Centre, off the A120 at Marks Tey in Essex.

Members of Colchester SMEE have joined forces with the Garden Centre to put on 'An Event For All The Family' on Saturday and Sunday 5/6 July.

Amid acres of shrubs and flowers, 5000 square feet of covered space is being set aside for scores of models, ranging from locomotives and rolling stock, through clocks and tools, to stationary engines and boats; the output of Colchester SMEE's 120 members.

Outside, there will be rides behind 5in. gauge steam locomotives on the club's portable track, miniature traction engines alongside a full size one, all in steam, and a pond for model boats.

Main Organiser, CSMEE's Hugh Mothersole said *"With this sort of space we have the chance to put on something more than just your average club exhibition.*

"But we are aiming at the sort of person who'd like to get involved with the hobby but doesn't quite know how, rather than the 'hard-core' model engineer — although obviously the latter are more than welcome.

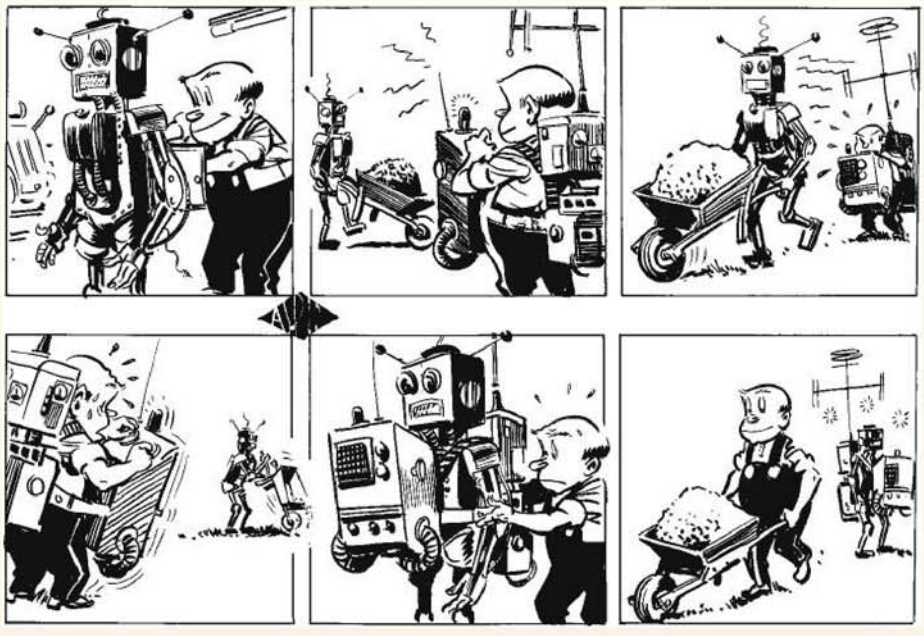
" So, alongside the usual display of completed models, we hope to have one or two trade suppliers of kits and materials, along with sections of 'Work in Progress' and 'How to Get Started'."

The Show was still in the final planning stage when this issue went to press, but Hugh added *"What with the Garden Centre for mums, and large numbers of models for boys of all ages, this should provide an enjoyable outing for all the family."*

Poplar Garden Centre has a cafeteria and free parking for nearly 4000 cars. CSMEE is setting admission to the Show at £3 for adults, with up to two accompanied children under 14, free.

This very fine version of Martin Evans' 5in. gauge LNER B1* Springbok *design was built by members of Vauxhall Motors MEC and was awarded the Eddie Lancaster Cup at the recent Bedford MES competition at the latter's Summerfields MR site.

CHUCK the MUDDLE ENGINEER **by B. TERRY ASPIN**



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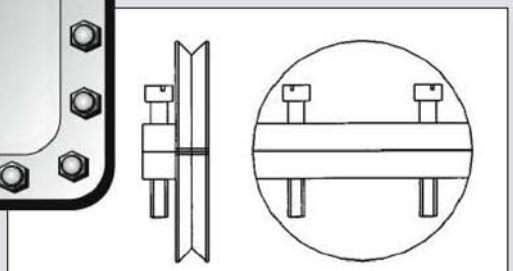
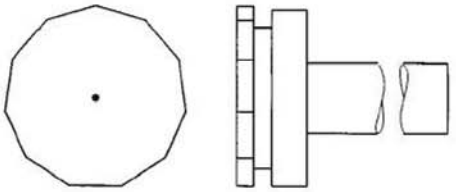




Mr. Ghadiyali's Jacot tool and attachment (left).

Jacot tool

SIRS, - I am a reader of your magazine, which I borrow from the British Council, of which I have been a member since my school days. By profession I am a second-generation watchmaker specialising in the restoration and repair of old, antique watches and clocks.

I am also a builder of miniature live steam locomotives with coaches which are custom built, indoor models of 'S' gauge to gauge 1 which run on rails. I also custom build outdoor model locos from 2½in. gauge to 7½in. gauge, stationary engines and marine engines. Residents of the UK have bought some of my models, either when they were in Mumbai, or through my friends in the UK.

One of the tools with which I work is 'turns' similar to those shown in the picture in *Post Bag* in *M.E.* 4156, 16 November 2001. There are special attachments for use with these 'miniature lathes' and which are mainly used to make precision items or horological instruments. One of the most important is the Jacot tool. My father and I use the Jacot tool regularly. We still prefer this tool to the modern lathe for balance staff polishing and other such precision work.

The photograph of the equipment published in *M.E.* 4156 does not show the Jacot attachment and I attach some drawings illustrating the one I use, together with a split ferrule used to drive the work.

I will be glad to correspond with your readers, through your magazine or directly, about this tool and with those who are interested in custom built, miniature live steam locomotives, stationary engines or marine engines.

Raju S. Ghadiyali, Mumbai, India.

Unusual two-stroke engine

SIRS, - I was very interested in Dr. Robert Kisch's account of his two-stroke engine in *M.E.* 4193, 18 April 2003. An identical engine, as far as can be ascertained from the photographs, was described by Edgar T. Westbury in *M.E.* 3357, 15 November 1968. Westbury wrote that A. P. Stone of Elfers in Florida, USA had sent him a photograph of an engine built by himself. Mr. Stone's engine was fitted with the standard type of cylinder lubricator for open crank engines, obviating the need for petroil and consequent pollution from unburnt oil.

There is a space for the lubricator on the cylinder casting between the end of the cylinder and the first fin (from the crank end). This is clearly visible in the photograph of Dr. Kisch's engine.

The design originated in France and was known as 'System Loyal'.

Mr. Stone's drawings were published in *Model Engineer* with construction details and completed in *M.E.* 3358, 6 December 1968.

In 1989 I purchased an identical set of castings with drawing from H. D. Bowers, Heath Road, Woolpit, Bury St. Edmunds. The engine was completed as a period gas engine with hot tube ignition. I forged the connecting rod from genuine wrought iron and polished it to reveal the fibrous nature characteristic of that material.

It is difficult to get the engine to run on propane as this gas does not have the flammability range of coal gas. Surprisingly the exhaust has the same pop, pop, pop note of a typical two stroke with piston controlled exhaust opening.

I made both valves from turned down pre-war Austin 7 valves of the pin collet type. The exhaust valve has its seating face on the outside because this valve works in the opposite way to normal.

The only British manufacturer of this type of engine as far as I know was Hardy & Padmore of Worcester, probably better known for their expertise in casting very long columns for Victorian iron framed buildings such as exhibition and market halls. As soon as the Otto patents expired Hardy & Padmore concentrated on conventional 4-stroke engines.

With a two stroke engine it should be possible to utilise the partial vacuum produced by the exhaust pulse to draw in a fresh charge via the transfer port modified to take a carburettor and possibly a reed valve, the transfer passage being sealed from the crank case.

With a tuned pipe the returning pulse would push back the fresh charge, which followed the exhaust, to be trapped in the cylinder by the rising piston cutting off the port. This is known as the Kadenacy Principle after Michel Kadenacy, a Frenchman who used the action to scavange two-stroke diesel engines. The sole rights for this invention were owned by Armstrong Whitworth Securities Co. Ltd.

The phenomenon was known in the 19th century with slow speed gas engines with long exhaust pipes and was first used by another Frenchman, Emil Capataine, in an engine built in 1884.

Brian Harfield, Lancashire.

Tiny steam engines

SIRS, - I was delighted to see and read about Mr. Bernard Walker's tiny slide valve steam engines in a recent issue (*M.E.* 4190, 7 March 2003). He is to be congratulated!

Here then is a challenge for us all, the only excuses being clumsy fingers and failing eyesight! Stefan Gasparin and others have proved the feasibility of making a CO_2 motor with a swept volume of less than a cubic millimetre, but what about tackling some more traditional model engineering projects in miniature?

Dockleaf was a small spirit fired 00 gauge engine, with slide valves and double acting cylinders described in *Model Engineer* in the 1940s. Can someone make a true-scale version? On the other hand, is the ¼in. to the foot traction engine an impossible dream?

We can all aspire to modelling on this scale; the cost will be very small compared with the outlay required for most projects, and simply getting it to work will be reward enough. But think of the possibilities for sensible detailing; how small can a working governor be?

LBSC was scornful of 'wristwatch-works', but perhaps this light-hearted task is one for which many of us can find room, and new horizon for the boundless creativity of model engineers.

Neil Wyatt, by e-mail.

Injectors

SIRS, - Watching a 'science' show two days ago I saw what looked like 'new' applications of the steam injector principle. The firm involved is Pursuit Dynamics in the UK **www.pursuitdynamics.com**

In one case they showed how the principle might be applied to small boat propulsion, and in another case they show it being used for pumping water containing all sorts of objects that would jam a conventional pump. My nozzle theory is not good enough to tell from the documents on the website whether their principle is very different from the injector principle; that is probably a good question for a person more expert in the field. However, I have read in *Model Engineer* of steam-driven water lifters.

Whatever the technical details, I am bringing this to your attention in case it might lead to further correspondence or even an article in *Model Engineer*.

I should perhaps admit that I put 'scientific' in quotes at the beginning of this note simply because I am getting somewhat tired of the confusion between science and engineering in the mind of the average media person.

John Bauer, via e-mail.

Motor torque and character kerning

SIRS, - In reply to Mr Gowan's letter (*M.E.* 4190, 7 March 2003) there is a simple relationship between power (in watts), work done by a machine, and torque:

Power output
= power input x efficiency
(N.B. Efficiency may be, say 70% for a small motor.)

Power output
= torque x angular velocity
= torque x 2π x Speed
(Speed expressed in revolutions per second.)

So, transposing these figures for Mr Gowan's benefit,

$$\text{Torque} = \frac{\text{Power output}}{(2\pi \times \text{speed in rps})}$$

As an example a 250W motor running at 1440rpm will develop a torque of

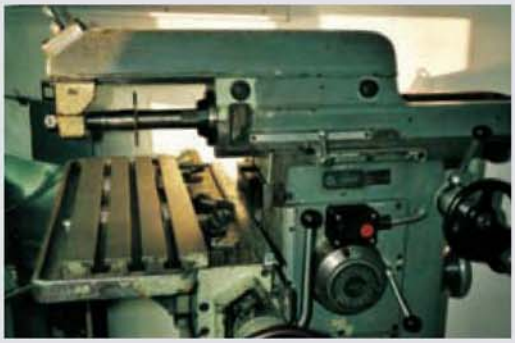
250 / (2 x π x 1440 / 60)
= 250 x 60 / (2 x 3.142 x 1440)
= 1.66Nm

If you prefer your torque in Christian units, 1.66 Newton metres
= 1.66 x 0.738
= 1.22lb.ft!

Further to Mr. Verney's letter from Sussex (*M.E.* 4190, 7 March 2003), the matter of character spacing in lettering is purely artistic and indicates why Eric Gill was paid a large sum of money by the LNER for designing their house style.

Rely on the computer to space the letters for you: it is programmed so to do. Unless you have a degree in graphic arts, my advice is do not try to alter things yourself unless you want to make a mess!

D. A. G. Brown, Rutland.



Mr. Plowright's Russian milling machine in various modes.

'Snap'

SIRS, - I have been meaning to write to ask if any reader has information concerning a Russian milling machine which I have recently purchased when lo and behold, Mr. Bishopp has beaten me to it!

My machine came into my hands via a similar route to that of Mr. Bishopp's. My machine does have its compound table, though, plus its horizontal milling spindle, vertical head and dividing head.

The dividing head fits in place of the table and can be used in the horizontal or vertical axes. However, the gears which provide a power feed to it are missing.

The proprietor of the engineering company from which I bought my machine told me that he purchased it from a sale of surplus machinery at Loughborough University, some time in the '70s.

Apart from cleaning it and converting it to suit a single phase power suply, it is in as-purchased condition.

Like Mr. Bishopp, I have no service information and would therefore be very grateful to any reader (or Mr. Bishopp) if they could help me to obtain a copy of the operating and maintenance manual. I would, of course, be happy to cover any costs involved.

M. R. Plowright, Leicestershire.

(We have introduced Messrs. Plowright and Bishopp to one another and, as we suggest to all seeking information concerning such equipment, we suggest making contact with Tony Griffiths, Wardlow, Tideswell, Buxton, Derbyshire SK17 8RP; tel: 01298-871633. Tony runs a comprehensive website at ***www.lathes.co.uk*** *which is well worth a visit. If he doesn't have it, it probably isn't available! We also though that readers would like to see the photographs sent by Mr. Plowright which demonstrate the versatility of this remarkable Russian milling machine. - Ed.)*

Brotherhood

SIRS, - Thank you for publishing my letter concerning my Russian milling machine; the replies have been quite incredible.

At the time of writing, I have contacted everybody who has contacted me, and have enjoyed some splendid conversations.

It goes without saying what a truly marvellous 'Band of Brotherhood' model engineers enjoy; so refreshing in this modern and cynical world.

Les Bishopp, Norfolk.

Scale rules

SIRS, - A more elegant way for Mr. Glanville (*M.E.* 4190, 7 March 2003) to measure his drawings using a CAD program, is to scan the drawing using say, Paintshop Pro, and save it. Then go to his CAD program and start a new drawing. He may then insert the saved drawing into the CAD drawing.

Using the dimension tool, a component whose size is known (the larger, the better to minimise error) is measured. It will be the wrong size, but the size of the inserted drawing can be modified by a percentage, tiny if need be, until the chosen component measures correctly for the chosen scale, then all other dimension can be taken from the drawing directly.

If the subject has a reasonably large circular component, it is as well to superimpose a matching circle to determine if the scanned image is truly circular. If, say the flywheel is slightly squashed vertically, then so are all the other vertical measurements. It may be the original which is at fault, or it can happen during scanning. This is readily corrected as the height and width of the insert may be varied independently, until circular components are truly circular.

If, during measurement, one finds odd sizes for things cropping up, then the size of the insert will have to be refined. One has to bear in mind that some of these old illustrations are neat pictures rather than engineering drawings, were never intended to be worked from, and are sometimes none too accurate.

The above assumes access to a more than basic CAD program. I use IMSI TurboCAD (usual disclaimer).

Maurice Cox, Buckinghamshire.

Long division

SIRS, - In his letter about mils (*M.E.* 4193, 18 April 2003) Mr. Bloomfield remarks, jokingly, that dividing something into 6283.185... is not easy, and I would agree with that. I have a sneaking suspicion though, that he thinks it can't be done, so here's how to do it; in theory, anyway. Always remember that an ounce of theory is worth a ton of practise. First of all you must have a dividing head with facilities for differential indexing and it must have a worm gear ratio of 400 to 1, (yes, that's two noughts). You will also need an index plate with a circle of 16 holes.

On the wormwheel shaft fit the first differential gear with 165 teeth, this meshes with a gear with 20 teeth keyed on a sleeve together with a 100 tooth gear on the first stud. This latter gear meshes with a gear with 113 teeth on a shaft which drives, through bevel gears, the sleeve on which the index plate is mounted and this revolves on the wormshaft to which the indexing handle is fixed.

The index required is one hole on the 16 hole circle and after 6283 indexes you will find you are left with a gap which is very undersized and that the accumulated positional error is 0.108 seconds of arc or 0.000524 mils (in theory) and you will have been able to graduate 6283 lines at an angular spacing of one mil. Note that if the spacing of the graduations is about 0.031in. they will be on the edge of a circle of about 30in. radius. Finally don't forget that these are real mils, a thousandth of a radian, not those mongrel artillery mils that anybody can divide.

H. D. Turner, West Yorkshire.

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The car kit provided by Jaguar includes a balsa wood blank.

Each and every entry was carefully scrutinised.

A GENERATION GAP

Stephen Atkinson attended the Northern Ireland regional finals of the Jaguar F1 Team in Schools competition which prompted thoughts about the future of model engineering as a hobby.

In our model engineering society we often seem to discuss the same topic: *"Where are all the young enthusiasts?"* I am certain that the same subject is often talked about at your club meetings. Conclusions are difficult to arrive at. Answers are certainly not cut and dried, yet it is a fact that, to put it mildly, the vast majority of members of model engineering clubs are mature. Perhaps we concentrate on steam too much, many of us were reared in a steam age. I certainly travelled by steam during the war years, more than I have ever done since then by diesel. So, we have lived with steam when it was a reality. Perhaps this is one reason why the youngsters of today have little or no affinity for steam and all its trappings.

I suggest that another and probably greater factor for the dearth of young entrants to our hobby is the present curriculum in secondary schools. No woodwork or metalwork is taught in our schools today. Yes, it is true that there are still workshops but the sort of craft and engineering that we learnt at school is non-existent. There is a very good reason for this, one that is often not considered when our contemporaries complain about these omissions. When I learnt my woodwork, we had a village carpenter who made my mother a chest of drawers to her specifications and produced handmade joints —the ones I was making at school. We had a village blacksmith who would produce many articles for the home, similar to the forge work going on at school. Today there is no such similarity between school metal and woodwork and the outside world; we must not teach an anachronism in school.

Please forgive my extended preamble but having just returned home after an enjoyable afternoon in our clubhouse, talking about current locomotives under construction, etc., with the same *old* happy members, I wonder about the future. I suggest that the school curriculum is up-to-date. Perhaps we too should start looking around at the outside world. Let's look at what enthuses young folk. Can we harness some of their keenness and encourage them to join us? Perhaps *they* can teach *us* a thing or two!

Chips with everything

I must say that whenever I read our magazine and turn to the offering by M. J. H. Ellis, *Letters to a Grandson* (now up to his fiftieth letter!), I really do wonder what sort of boy Adrian is? I have three grandsons, ranging from 14 to 18 years old. Yes, they have all ridden and driven my locomotives but have not chosen to follow up the experience. What all three spend many hours doing is sitting in front of a computer monitor, either playing games or even performing more interesting activities, thanks to the wonders of modern technology. It really is chips with everything these days, and they are not deep-fried!

I, and many of us, will continue to enjoy making what we are making, but I really do not think that there are many Adrians who will take over from us when we depart. However, it does us no harm to look at and appreciate what those apart from Adrian are enjoying at school, using their new skills and, at the same time, being relevant to the world outside school, the world in which they will live and earn a living.

Emulating industry

I was recently invited to the Northern Ireland regional finals of the Jaguar 'F1 Team in Schools'. This is a CAD/CAM (computer assisted design/computer aided manufacture) challenge. High tech stuff indeed! I attended the first day of the event (Thursday) and was so impressed that I returned on the final day (Saturday) to witness the presentation of awards and to take some photographs to record the event.

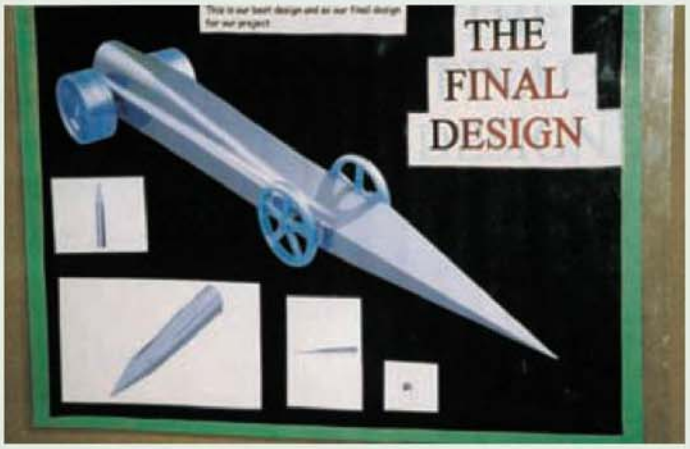
The starter lines up the next pair of cars to race.

This is the second year that schools in Northern Ireland have competed in this event. We had 26 teams from 15 schools involved which, I was informed, was an increase from the previous year. As the word spreads I'm sure that future numbers will increase. Each team comprises four pupils and both boys and girls were equally involved. Let me try to explain what the competition is all about.

I was introduced to Andrew Denford whose brainchild it all was. Many readers will remember the name of Denford in relation to machine tools.

Girls are equally enthusiastic.

Computer Aided Design equipment.



A presentation of one of many interesting design outcomes.

One of the Denford Microrouter CAM machines used for profiling the body.

Enthusiastic onlookers watch a race in progress.

An example of some of the excellent display graphics created by the pupils involved.

The Denford Viceroy woodturning lathe was quite a favourite in many school woodwork rooms. Denford no longer manufacture wood turning lathes or many of the machines that used to come from their factory in Yorkshire. Instead, Denford make computer controlled equipment including computer-controlled routers, lathes and milling machines, most of which is aimed at the education sector. Feed in a computer programme, press 'start' and the object is automatically produced before your very eyes. Many of these machines are small versions of what industry is employing in factories worldwide. So, the initial idea by Andrew Denford was to have pupils in school, design a car on a computer and then have it produced in a CAM machine. From that has grown the Jaguar F1 Team Challenge.

The competition is open to all UK-based secondary schools and colleges, to design and manufacture a CO_2 powered model racing car. Teams compete against each other in various heats working up to a final in their region. Regional finalists go forward to the national finals, which took place in January 2003 at Olympia in London. It follows that Denford are the main sponsors of this competition, but Jaguar have also been pleased to be associated with the initiative, along with BAE Systems, Deep River Rock and a number of other firms. Some local companies tend to help schools in their own area.

The recording table.

A proud team pose for the camera.

Awards are given for various categories, 1st to 3rd being given in each category, as well as awards for the fastest car and best engineered car.

Kits and controls

When a school enters its one or more teams, they are provided with a kit with a clear brief and a blank of balsa wood, from which the body of the car has to be shaped. A hole in the rear end is pre-drilled to take a small CO_2 bottle, the kind used to put the fizz into soda water siphons. A set of wheels and axles is also provided.

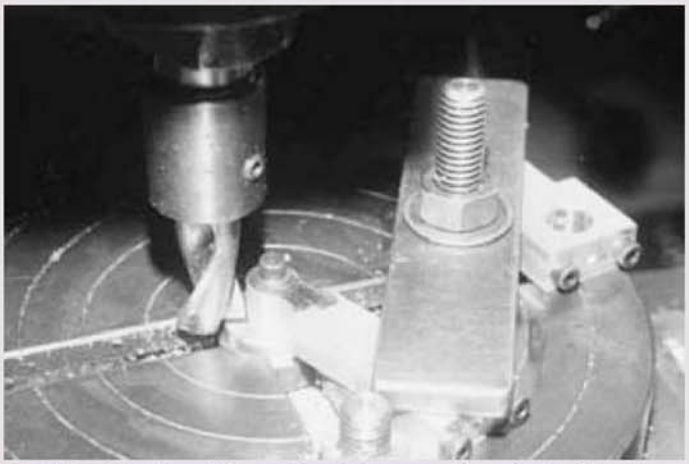
The school gains initial assistance from the CD-ROM, which is posted out when they register to enter the competition. This gives teachers' notes, a design brief and other guidelines, together with entry forms etc. A design package for the computer such as 'Solid Edge' or 'Pro/Desktop', is used to produce the designs. Students and pupils must also make up a design portfolio of their work, which is displayed at the competition venue. Testing of designs may be by wind tunnel or smoke tunnel equipment, which is available. The finish of the cars is an important aspect, once the body has been shaped on the computer-assisted machines.

I witnessed a very large room at the Belfast venue, where many teams had their display areas neatly set out, together with their cars, awaiting their turn to race against the other teams. I saw pupils enthusiastic about their work and some of the display ideas were most praiseworthy. They could talk animatedly about their work and the results they had obtained. Some schools had even approached local firms for sponsorship and had provided their teams with personalised sweatshirts from the funding.

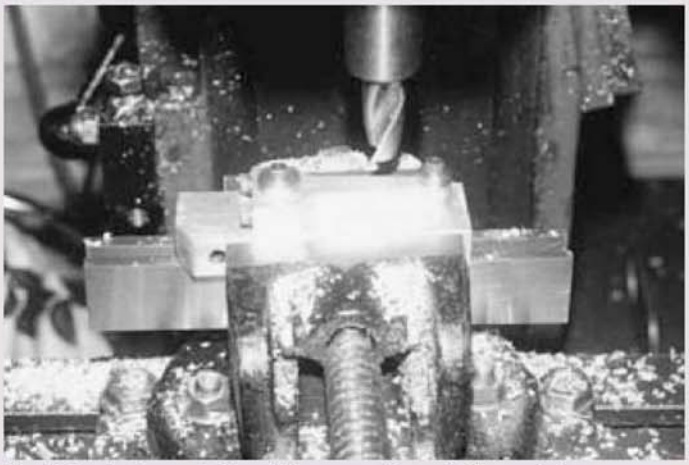
The region has its own racetrack, which has been purchased and is a standard for all regions. Two cars race at a time with electronically controlled starting and timing. Scrutineers carefully check every detail of every car, some of which were unfortunately disqualified due to underweight problems.

We in Northern Ireland had a number of very proud pupils looking forward to their trip to London to compete in the National finals. Last year *Tornado Temple* was one of the overall winners. It came from Archbishop Temple School in Preston, Lancashire. Whatever the outcome this year, I was impressed with some of the local entries.

All this may seem far removed from what you are producing in your workshop. Nevertheless, it could be seen as model engineering of today! Who knows what influence it may have on some of our societies, more so than the impact *we* are having on the youth of today!



Machining the radius at the small end of a connecting rod using the rotary table mounted on the milling machine.



Machining the tapered sides of the connecting rod. The workpiece is mounted on a fixture held in the machine vice.

AERONCA E113 AERO ENGINE in 1:4 scale

Les. Chenery

continues construction with the connecting rods, camshaft and cylinders for this attractive engine.

●*Part VI continued from page 562 (M.E. 4195, 16 May 2003)*

Turning now to the connecting rods, machine two pieces of aluminium alloy bar to 0.383 x 0.875 x 2.625 inch. Cut 3/8in. off the end of each and machine across the cut ends. Mark out the small piece and drill the 4BA clearance holes offset 0.020in. from the centre line. Profile the bottom shape and spot face the 4BA holes. Clamp firmly to the main bar and spot through. Drill and tap the main bar 4BA. Clamp the two pieces together and mark out the centres of the two holes, drill and ream to the sizes shown on the drawings.

Most of the rest can be machined on a fixture made from a block of metal 3/8 x 1 x 3 1/2in. with two 4BA tapped holes on 1.812in. centres, and a 0.375in. dia. shouldered plug with a 4BA clearance hole in the centre to clamp the big end with a similar 0.250in. dia. plug for the small end.

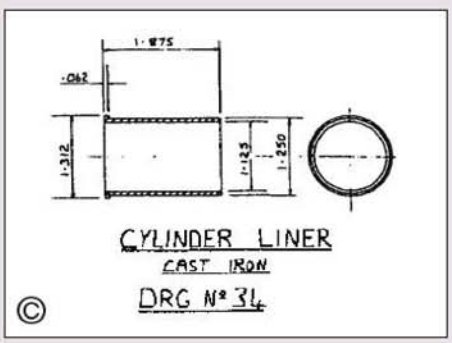
With the connecting rod clamped to the block and the block held in a vice, the 3deg. angles can be machined, etc. The block can also be held in a 4-jaw chuck and, after setting one of the 4BA holes to run true, face across the block then clamp the con rod back on and turn to the measurements shown. Take care to get the offset on each end properly positioned. The small end can be machined in a similar way and rounded off with a file using the turned diameters as a guide. If available, a rotary table could be used for this job.

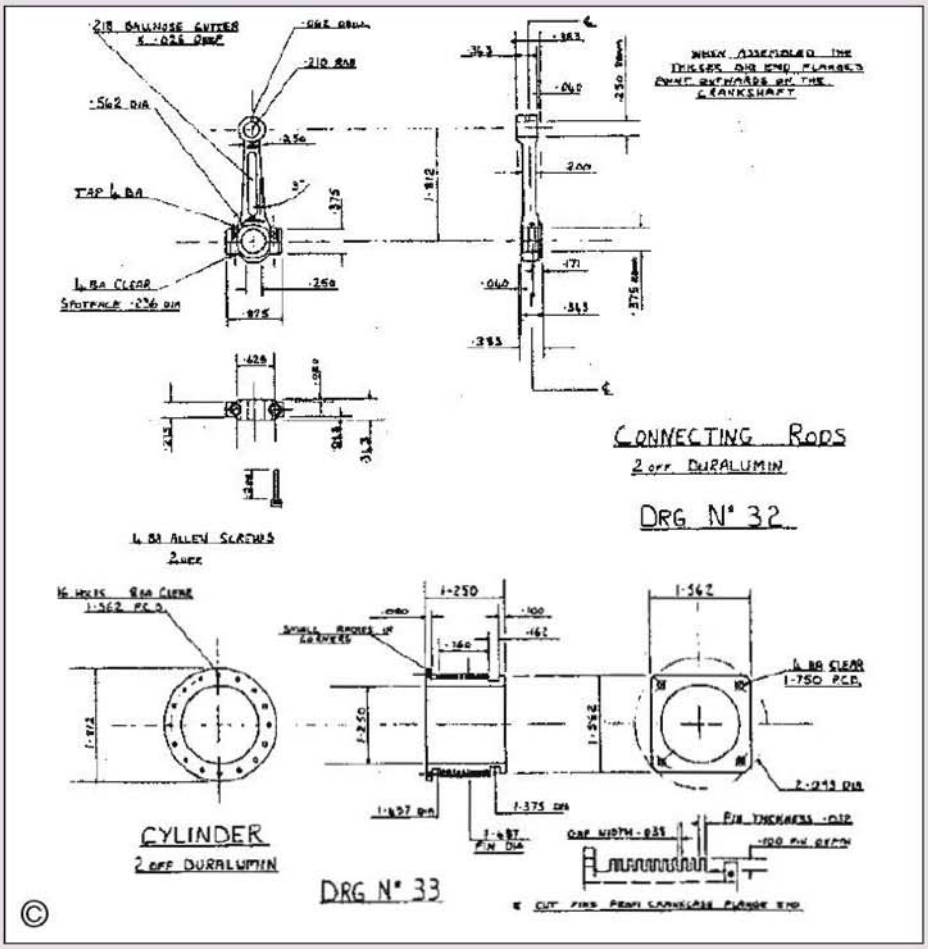
Keep accurately to the measurements around the big end as the heads of the 4BA Allen screws come close to the camshaft when revolving.

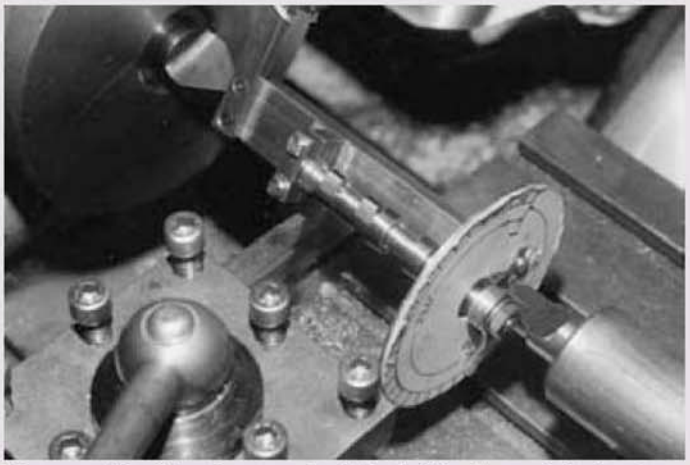
Camshaft

First make the camshaft turning fixture. This is a straightforward milling and turning job. A piece of card can be fixed onto the disc with the timing marks drawn on. Make the camshaft blank from silver-steel rod (drill rod) to the measurements shown on the drawings and place in the fixture. Follow the instructions on the drawings.

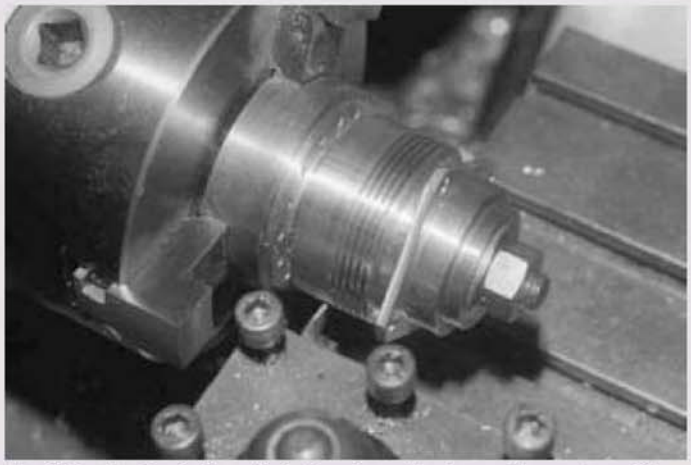
When assembling the camshaft and tappets, the tappet guides can be entered into the casting and the tappets entered into the guides from inside the crankcase casting. Ensuring that the 7deg. angle on the tappet face is vertical, slide the guides fully into the crankcase and insert the camshaft into the front bearing. Rotate the camshaft by hand making sure that the tappets do not come out of their slots when fully extended onto the base circle of the camshaft, and do not foul on the







The cam cutting fixture in use on the Author's lathe. The card disc bearing the timing marks can be seen adjacent to the tailstock.



Machining the fins in the cylinder barrel must be done with care to avoid distortion.

casting lugs when pushed fully out by the camshaft lobes. If they do touch the casting lugs, the lugs can be machined away slightly with a back facing counterbore.

When everything is correct push the tappet guides out about 0.032in. from the casting. Put a very small amount of Loctite behind the shoulder of the tappet guide and push the guide home into the casting, aligning it with the small locating screw. With the back plate in place, any end float in the camshaft can be taken up with phosphor bronze washers.

When the engine is being assembled the timing of the camshaft is done with the gear train assembled on the back plate. Fit the gear cover casting. The contact breaker and distributor can be adjusted later.

The finished Duralumin cylinders awaiting fitting of the cast iron liners.

Cylinders and liners

The cylinders can be made from Duralumin rod and are a straightforward turning job. Bore the central hole and face across with the rod held in a 3-jaw chuck. Turn a brass mandrel onto which you can wring fit the cylinders, and face the unmachined ends down to size. Using a dead smooth file, bring the diameter of the mandrel down to a sliding fit for the cylinder blanks and drill and tap 3/8in. BSF.

Hold the blanks on the mandrel with a large washer and bolt and machine the outside diameters to size. Shape the flanges on both ends using a parting-off tool with the corners slightly rounded. You will now have a central portion for the fins. On the full size Aeronca engine there are thirteen fins on each cylinder which would entail a rather thin parting tool and the almost certain possibility of it breaking when going to the 0.100in. depth. I have settled for eleven fins with a 0.038in. wide parting tool.

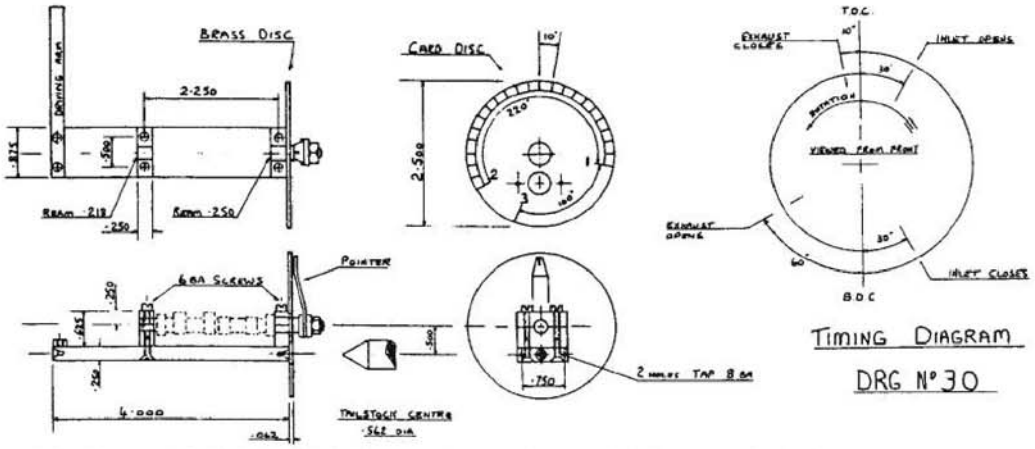
Starting at the crankcase flange end, touch the edge of the central portion, move the tool along 0.070in. and cut the slot 0.100in. deep. Move along 0.070in. and repeat. On reaching the eleventh fin the tool will cut away some surplus material on the central portion, which I made slightly longer to encompass any accumulation of errors. I ran the lathe at 200rpm and used plenty of cutting fluid while cutting the fins. Remove from the lathe, machine the 0.100in. thick square end of the cylinder and mark out and drill the holes at either end.

The cylinder liners should be made from good quality cast iron. Turn to length, drill and bore the centre hole to size, taking fine finishing cuts with a round nose on the tool. Turn the outside of the liners on a brass mandrel, the outside dia. being a press fit in the cylinder. After fitting the two pieces together the bore can be lapped.

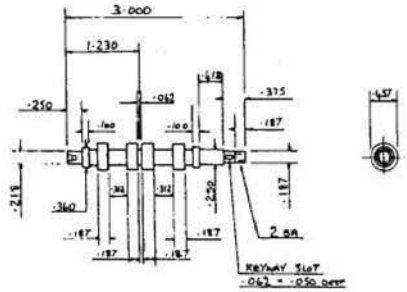
The piston diameter should be down on bore size by 0.002in. to allow for expansion.

●*To be continued.*

Castings and drawings for this and other engines are available from **Les Chenery**
18 Orchard Grove, Edgware, Middlesex HA8 5BH. Please enclose SAE with any enquiries.



CAMSHAFT JIG DRG N° 29
BRASS



CAMSHAFT BLANK
SILVER STEEL (DRILL ROD) 1 OFF DRG N° 31

1: Clamp the camshaft blank between the two blocks on jig.
2: Set pointer at position No. 1 on disc.
3: With the jig between centres on lathe, revolve carefully by hand to make sure of clearance.
4: With the jig rotating at around 200rpm, touch the tool on the outside diameter of No. 1 cam blank and with light cuts, machine across blanks 1 and 2 to a depth of 0.080in.
5: Slacken four screw on clamping blocks and move pointer anti-clockwise to the first 10deg. mark on the disc. Tighten clamping screws and take light cuts approx. 005in. deep to a 0.080 setting. Take care not to cut into cam No. 3. Repeat cuts at 10 deg. intervals for 220deg. around the disc to position No. 2.
6: Remove jig from lathe, slacken the four clamping screws and move camshaft and pointer clockwise right around to position No. 3 on disc. Tighten camshaft clamping screws and loosen the pointer. Move pointer on its own back anticlockwise 100deg. to position No. 1. Tighten pointer and replace jig in lathe.
7: Commence the same procedure of cuts around the 10deg. segments starting with the 0.080in. deep cut across No. 3 and 4 cams taking care not to cut into No. 2 cam.
8: When finished, remove from lathe, round sharp edges on the nose of cams and smooth base circle with a fine file and emery paper. Harden and temper to dark blue.

15 Passenger hauling at a school fete (1943); the Author with his Maisie and his friend behind with his Henry Greenly Pacific.

16 Tools made and sold for the Food Parcels Fund (1942).

WHAT MAKES A MODEL ENGINEER?

Don Unwin,
'Maker of Things', continues with his recollections of the various projects to which he has turned his hands.

●*Part II continued from page 543 (M.E. 4195, 16 May 2003)*

Together with two other locomotive owning friends, we persuaded a local firm to sponsor a portable track on which we used to give rides at local functions (**photo 15**) for a penny (one old penny) per child and tuppence per adult, all proceeds being given to the Red Cross. Yes, passenger hauling with 2½in. gauge and 3½in. gauge locos! Folk were not so affluent then and these gauges were the norm for all except the well-to-do.

During the war, the home workshop was used to make various tools which I sold to workmates, giving the proceeds to the firm's 'Food Parcels for the Forces' fund. Included were six small surface gauges, six automatic centre punches and four depth micrometers (**photo 16**). Apart from cutting the micrometer threads on the works precision screw-cutting machine, and the heat treatment, all were made at home.

One of the many assignments given to me while working for Unicam was to set up a department to make optical lenses and prisms as a back up should any of our normal suppliers be bombed; a wise precaution as it turned out. As I knew little about working glass to gain experience I obtained a little book called *The Amateur's Telescope* and built a very successful 6in. reflecting telescope (**photo 17**), grinding the parabolic mirror and the flat by hand. Production reject lenses were used in the eyepiece.

Passenger hauling every weekend was heavy work and caused considerable wear to the locos. Working all the hours between finishing one Saturday evening and starting again the next Saturday morning, we fitted the Greenly Pacific with new LBSC size cylinders, LBSC regulator, mechanical lubricator, and re-bushed everything, including making and fitting my own design of Walschaert's valve gear. The only trouble with *Maisie* was a blown superheater tube although by the end of the war the big ends were beginning to knock badly! This engine was one of LBSC's best; it was an excellent steamer, able to pull a hefty load like the prototypes, easy to service and gave little trouble. It would comfortably handle a load of driver plus seven adults.

However, it was obvious that if the war continued much longer, another locomotive would be needed, so I began to give it some thought. It was to be a very basic tank engine to save transporting a tender, with six coupled driving wheels, three cylinders with piston valves, three sets of valve gear and a very large firebox. The prototype eventually chosen was the Stanier 2-6-2 No. 2500 as I had a copy of an excellent drawing of the full size locomotive. However, only very little work had been completed when the war ended. Although we continued to be asked to run at fetes, we soon found the proceeds of our efforts were going to local causes with most of which we had no connections. As we had made many friendly contacts during the war years, and as the equipment was getting worn out, we decided the best way to avoid offending anybody was to pack up completely.

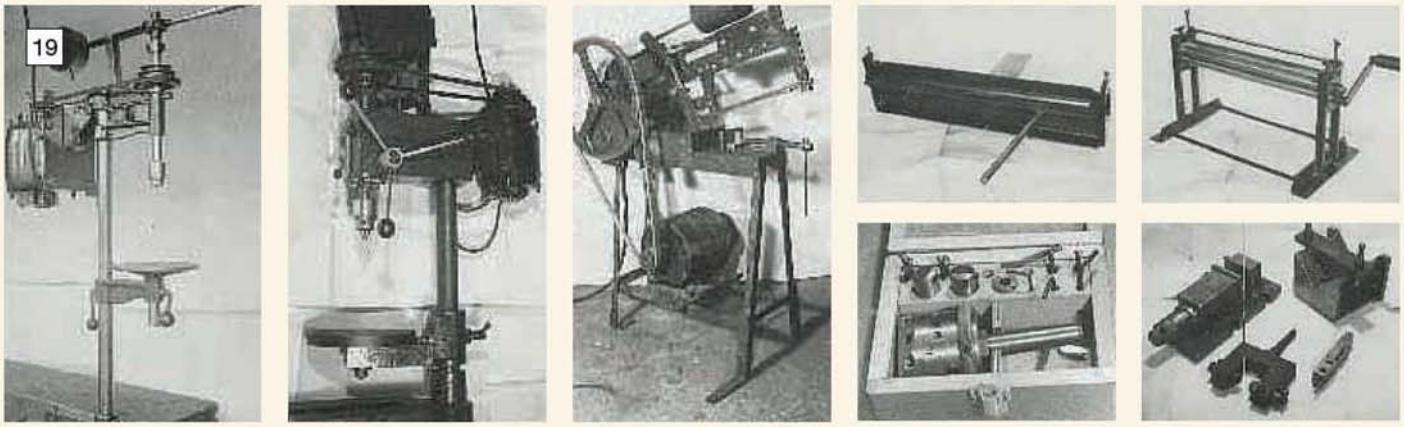
17 6in. Newtonian reflecting telescope (1943).

By this time, I was courting. I had changed jobs as soon as the war ended and a friend had shown my wife to be and me his very nice trailer caravan. He also lent us a pile of *Caravan* magazines to browse through. All this whetted our appetites for the pleasures of caravanning which we felt we would like to experience. As the need for the next loco had vanished, I decided the next project would be to build our own trailer caravan. Following my usual method of designing by reading and looking at everything I could and then formulating what to include, a design for a four-berth caravan was evolved.

The parents of my wife-to-be lived in a large farmhouse with a barn and other buildings, one of which her father allowed me to use. The only snags were that they lived 8 miles from my home and there was no electricity there. However, all these problems were overcome and by the time we were married in January 1947, the caravan was completed (**photo 18**). I made everything, all the woodwork, I fitted out the interior, and made the chassis, dropped axle, corner jacks, hitch, and even the ball and tow bracket to go on the back of the car. Over the next eight years it was towed many miles behind my 1934 Austin 10 car.

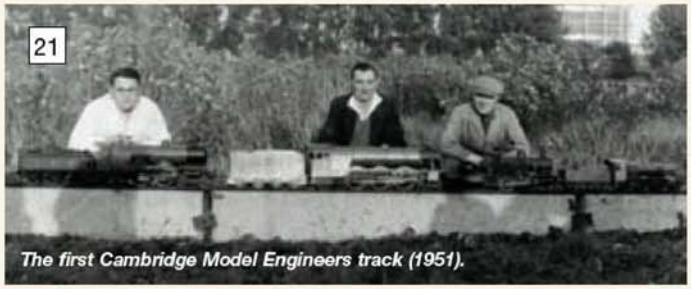
Model making was not neglected though, as I was allowed to use the garage of the flat where we lived as a workshop. However, equipment was required as up to now I had been using father's. As well as my little 60mm lathe a larger machine was not a problem, as at the end of the war the boss had given me one of the 5in. centre instrument

18 16ft. 4-berth trailer caravan (1947)



Home built workshop equipment (1947-51): small vertical drill, large bench drill, power hacksaw, sheet metal folder and rolls, boring head and small tooling.

3½in. gauge 3-cylinder tank locomotive (1951).



The first Cambridge Model Engineers track (1951).

maker's lathes that we had made at the time I was running the tool room. When working on the bench, personal small tools were preferred so I had been collecting my own ever since starting work. As my job changed to a supervisory and designing role, they were no longer needed at work so became available for use at home. Nevertheless I made several other useful pieces of equipment, a collection of which is shown in **photo 19**.

Once the workshop was useable, the dust was blown off the bits of the 2-6-4 tank locomotive and it was completed in a more detailed form than had originally been intended (**photo 20**). It was a very successful and powerful engine but never had a great deal of use, my first love being the old *Maisie*.

I was press-ganged into taking over as secretary of the C&DMES and we ran the first exhibition for three days in 1948. We were honoured to have J. N. Maskelyne of *M.E.* as the judge and W. J. Bassett-Lowke also paid us a visit. The judge for the show in the following year was Mr. Bowness, the editor of boat subjects in *M.E.* while Edgar Westbury, also of *M.E.*, D. H. Chaddock and J. N. Maskelyne judged at a later exhibitions.

The owner of a local boat building business became our President and allowed us to build a large track with 2½ and 3½in. gauges on a piece of land adjoining his boat-yard. He also gave us enough old concrete air raid shelter sections to use as the base members. Rails were of steel strip with tubular spacers and my main contribution was to calculate the centre distances of the holes for the curve sections and the entry and exit transition curves (**photo 21**).

Cycle Master engine (1950).

Goods were in very short supply for some years after the war, so making domestic equipment was a priority and the arrival of a family involved even more non-model engineering work, including toys!

At that time, like almost everybody in Cambridge, I used a bicycle, which gave me my only venture into the IC engine world: a Cycle Master (**photo 22**). It wasn't used for long, however, as I preferred the exercise of pedalling.

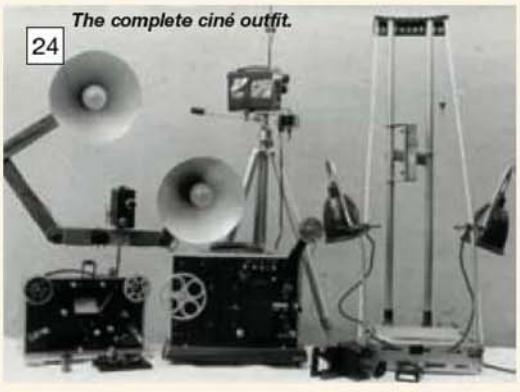
Another hiccup occurred in 1950 when we moved into our new house. Building restrictions meant that there was a lot of constructional work to do. This included garden paths to be laid, workshop and garage to be built, not to mention digging and planting the garden and making a lawn, not my favourite activities! Eventually most of this work was completed and the workshop set up for business again.

At the firm where I worked as the experimental engineer leading a group of instrument makers in the Research Department, I heard that a small horizontal milling machine in the instrument shop was to be scrapped; I was able to buy it. It needed a lot of reconditioning, an interesting task that occupied me for 12 months. The result was a most valuable piece of equipment that is still with me. This reconditioning was described as the *Milling Machine Story* (*M.E.* 3561-3563, 20 May, 3 and 17 June 1977).

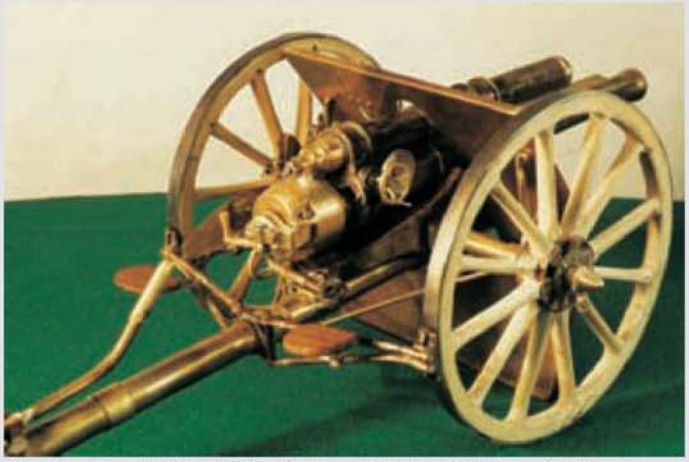
Around this time a friend took some 9.5mm ciné film of my young children on the track and I felt we must be able to take our own. Another friend gave me the bits of a 9.5mm camera which I was able to repair and get going. The results prompted me to make something better so I set about designing and making a standard 8mm camera (**photo 23**). It was not until it was completed that I discovered that its facilities were far in advance of contemporary amateur cameras. The accessory equipment, projector, editor, tripod, lighting bar, etc. followed the camera (**photo 24**). It was used for many years, capturing on film among other things many model engineering subjects, until standard 8mm film was superseded by the then new super 8 format.

●*To be continued.*

Standard 8mm ciné camera (1960).



The complete ciné outfit.



This photograph of the finished but unpainted model shows details of the closed breech, the shield and well detailed wheels.

The carriage minus the gun, sights, elevation mechanism and shield during final assembly after painting.

18pdr QUICK FIRING GUN

David Wilcox

continues with his description of construction, commencing with the trail.

●*Part IV continued from page 548 (M.E. 4195, 16 May 2003)*

The trail is made from a 6 25/32in. length of 1 1/32in. dia. thin walled brass tube. Several brackets or bands are fixed to the trail, beginning at the front end:

1: A flanged band turned from brass rod, which is bolted to the bottom of the shield
2: The axletree connecting bracket: a square U-shaped yoke silver-soldered at right angles to the axis of the band to fit under the square section axletree. A 12BA bolt secures the yoke to the axletree.
3: The traversing bracket. A rectangular piece of brass 1/8in. thick is first silver-soldered to a band and then the undercut sliding guide, centred on the notional pivot point, is milled to shape. A 1/32in. Woodruff cutter may be made up from silver-steel or alternatively the 1/32in. wide guide may be cut out using high speed abrasive discs.
4: The brake band: two pairs of lugs cut from 1/8in. thick brass plate are silver-soldered to a band and then filed to shape. One pair will provide the hinge points for the brake arms and the other pair the rear attachment points for the tensile stays.
5: A plain locking band which protects the trail from injury by the limber wheels.
6: Tow eye, spade and lifting handles. Angle brackets are riveted to either side of a sleeve which fits over the trail tube and which are in turn riveted to the spade and spade brackets, strengthened by a riveted rear bracket. The tow eye is cut and filed from 1/8in. thick brass strip and silver-soldered to a solid brass rod insert in the end of the trail tube. The brass rod insert should be about 2in. long in order to ensure that the gun is trail heavy. The various brackets are fabricated from 0.015in. brass sheet.

The traversing bracket dismantled to show the method of construction.

Top carriage

The two side brackets or cheeks are formed from 0.015in. brass sheet annealed and flanged over a 1/4in. thick Dural former. The trunnion bearing pieces are cut and milled from 1/8in. thick brass and then silver-soldered to the cheeks. At 1:15 scale it was judged too difficult to model the sliding cap squares and instead plain cap squares, each secured by two 14BA studs were substituted. The stud ends were silver-soldered into holes in the trunnion bearing pieces.

A rectangular sliding bearing bracket is riveted over the rectangular hole cut in the cheeks below each trunnion. These sliding bearing brackets are silver-soldered up from brass sections and filed to shape so as to form a close sliding fit over the square section axletree. The two side brackets are connected by the front and rear transoms using 1/32in. rivets. The centre transom was omitted in the model.

Rear of the trail showing the tow eye, spade, lifting handles and traversing handle.

Trail brackets: left for the shield front support, right for the brake arm and tensile stays.

The well detailed axle brackets for the tensile stays and shield stays.

A close up of the two brake arms and brake blocks complete with the layer's seats. The seats were carved from close grained hardwood.

The barrel, breech, cradle and buffer/ recuperator sub-assembly. Note the mounting trunnions and the holes for the elevating and range gear spindles.

A traversing slide is silver-soldered to the rear end of the cheeks having first formed an undercut groove to work in the traversing guide fixed to the trail. A pivot is formed in the right hand rear corner of the traversing slide to anchor the end of the traversing nut.

A small cylinder of brass is silver-soldered to the left-hand side cheek to act as a bearing support for the lower elevating gearbox. When all this has been done, the trunnion bearings are filed to shape, ensuring that they are aligned at right angles to the fore and aft axis of the top carriage.

Barrel

The recoil guide ribs (sometimes referred to as wings) run almost the full length of the barrel and clearly they have to remain perfectly parallel throughout the varying thickness of the piece. Beginning with a 6 1/4in. length of 9/16in. dia. brass bar, the ends are faced and drilled through 7/32in. diameter. One end of the bar is carefully marked out, as per the drawing in the previous article in this series, in order to fix the position and angle of the guides, and the bar clamped to the milling table, laying it lengthwise in one of the longitudinal slots. Using a 1/16in. end mill, the slots for the wings are very carefully milled out to a depth of 1/8 inch. The guide ribs are made up from 1/16in. brass plate, 1/4in. wide and 5in. long, ensuring that they are a snug fit in the slots and exactly parallel.

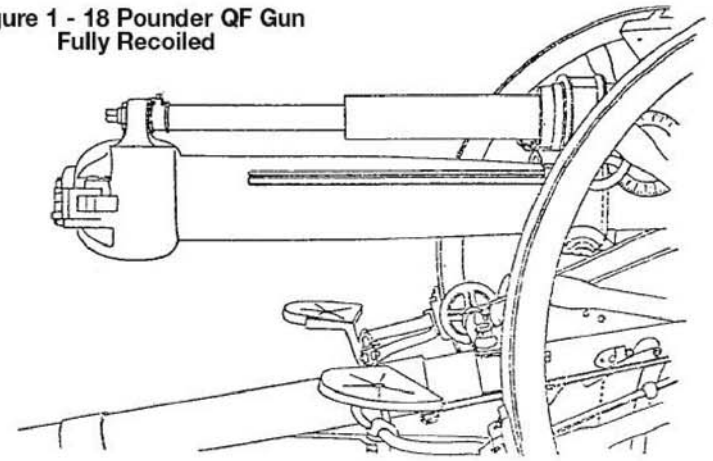
Next, the barrel is turned to the profile shown in the drawing and only then the guide ribs silver-soldered into their slots, forming a fillet at the join. Returning the barrel to the milling table an end mill is used to ensure the correct width across the ribs, i.e. 9/16 inch.

Then, with a 1/32in. slitting saw, a slot is cut in the edges of the guides to a depth of 1/32 inch. A very thin high-speed abrasive cutting disc could also be used for this task. This slot may be omitted since there were certain variations in manufacture where these slots did not appear.

Breech

The breech ring is first turned up from 13/16in. dia. brass bar and bored out to a 1/4in. depth to accept the rear end of the barrel (tight fit). The remainder is drilled through prior to tapping 9/32in. x 32tpi ME thread for the breech screw. Another piece of brass is filed up and the lug which protrudes from the top of the breech ring drilled and silver-soldered in place. A generous fillet is formed and care taken to achieve the correct spacing between the axis of the bore and the axis of the buffer/recuperator.

Figure 1 - 18 Pounder QF Gun
Fully Recoiled



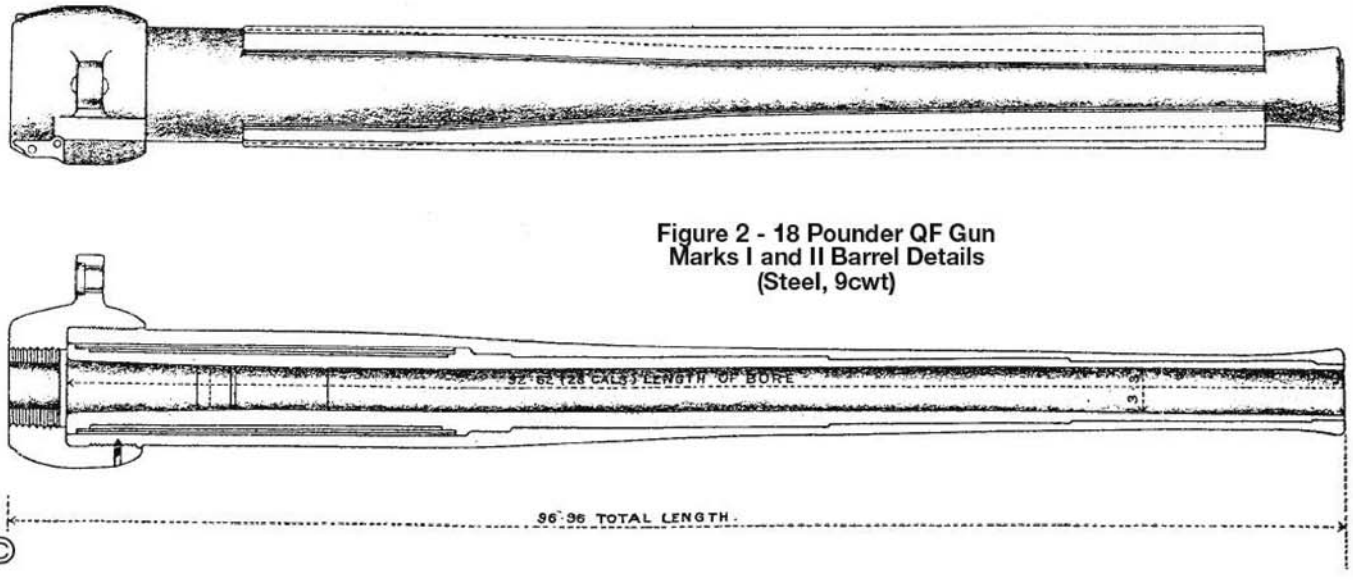


Figure 2 - 18 Pounder QF Gun
Marks I and II Barrel Details
(Steel, 9cwt)

The breech ring with interrupted screw mechanism. The thread used was 9/32 x 32tpi ME thread.

The screws, spindles and gearboxes for the elevating and range gear of the model. The gearboxes are not functional.

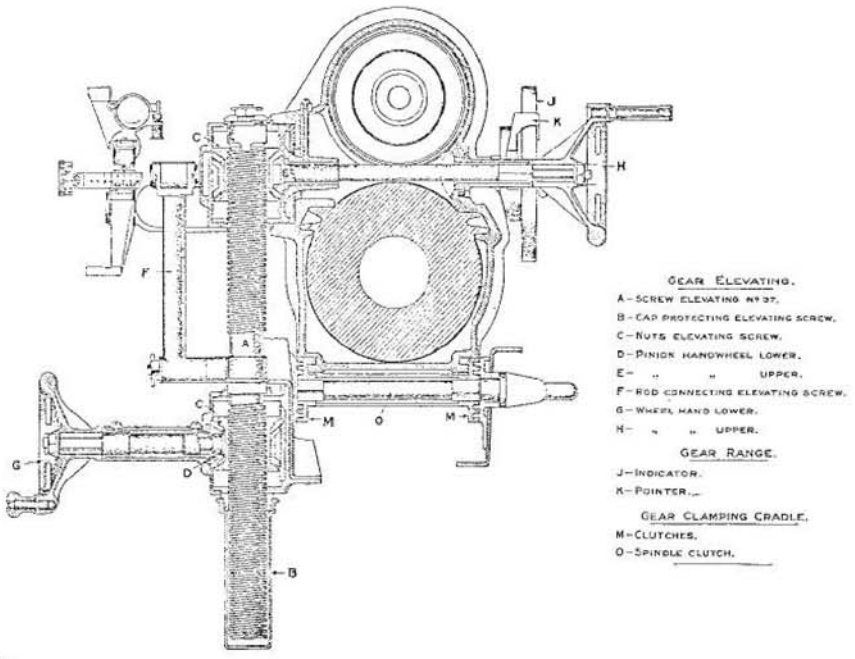
Having screwed the breech, the interrupted threads are cut away (90deg. segments covering 45-135deg. and 225-315deg.) with a sharp half round file bevelling the 45-135deg. segment out towards the rear surface of the breech ring. The milling machine is used to mill out the right hand rear corner of the ring to form the pivots for the hinging breech block carrier and the pivot holes drilled to clear 12BA for the 12BA bolt pivot pin.

The breech block carrier is cut and filed from a piece of 1/8in. thick brass angle to the profile shown in the drawings and to fit the pivot. The hinge for the breech lever is shaped and silver-soldered to the rear face of the carrier and also drilled to take a 12BA bolt as a hinge pin. The breech screw is turned up from brass rod, screwed 9/32in. ME thread and alternate 90deg. segments of thread milled away. Using an epoxy resin adhesive, it is then secured into a socket in the front face of the breech carrier, oriented so that it may swing into the breech ring. No attempt was made to model the bevel gear operated by the breech lever which would turn the breech screw through 90 degrees.

Cradle and buffer/recuperator

Before attempting to shape the cradle, the barrel with its recoil guides, and also the breech ring must be completed. One end of a short length of brass rod is turned to a tight fitting plug in the buffer/recuperator tube (13/32in. external diameter thin walled brass tube) while the outer end is turned to the profile shown in the drawing and screwed 6BA. This end is then bolted to the lug on the top of the breech ring. The rear end of the buffer tube is pushed onto the brass plug and a wooden spacer is made to fit on the front end of the tube in order to maintain the correct spacing and alignment relative to the barrel while the cradle is being shaped.

Figure 3 - 18 Pounder QF Gun
General Arrangement of Elevating, Clamping and Range Gear
Cross Sectional Elevation



The cradle is made mainly from a piece of copper sheet 0.015in. thick cut to the template shown in the previous article. This piece of copper is wrapped around:

1: the buffer/ recuperator tube
2: the square U-shaped brass channels running either side of the cradle and which support the barrel on the recoil guides
3: the underside of the barrel.

The copper is shaped by repeated hammering and annealing until the channels can be tack-riveted in place. When the correct shape has been achieved, the brass channels and the buffer tube should be silver-soldered to the copper sheet.

Three pairs of ribs now have to be cut and filed to shape from 0.025in. brass sheet. For each rib, a very snug fit to the copper cradle is required and when this has been achieved, the ribs should be silver-soldered in place. This is a delicate operation but it can be done with silver-solder paste, minimum heat and fine iron wire binding to keep the parts in position during soldering. Excessive heat may dislodge previous joints. The area where the trunnions are fixed should be reinforced with small rectangular plates of copper sheet silver-soldered in place, and finally the trunnions should be silver-soldered in holes drilled through these reinforcements. To obtain the correct alignment, a single brass rod of trunnion diameter should be soldered in position and the inner part then cut away with a high-speed abrasive cutting disc.

Elevation mechanism

The double-ended elevating screw is made from two lengths of 4BA thread silver-soldered together at the centre to a short piece having a pivot for the connecting rod to the sight arc bracket. No attempt was made to model the top and bottom bevel gear boxes, but instead the elevating screw is a tight sliding fit in what would otherwise be the gearboxes. An appropriate shaft is silver-soldered to the back of each 'gearbox', to attach the lower gearbox to the cylindrical bracket on the left-hand side of the top carriage and the top gearbox to the left-hand side of the cradle.

Three identical brass hand wheels were turned from 1/2in. dia. rod, which were then pierced and the spokes filed to shape. A 90deg. countersink bit was used to bore out the internal profile of each hand wheel. The hand wheels were secured by 14BA nuts on short lengths of 14BA thread silver-soldered into the ends of the various shafts.

●*To be continued.*

The 'Lowmac' driving car designed by the Author and equipped for use on ground level tracks.

Ray Dodds and his Metro trying the 'Lowmac' for size at a recent GL5 Main Line Rally at East Gilling.

SELF STEERING WHEEL SETS and SWING LINK SUSPENSION

David Hudson

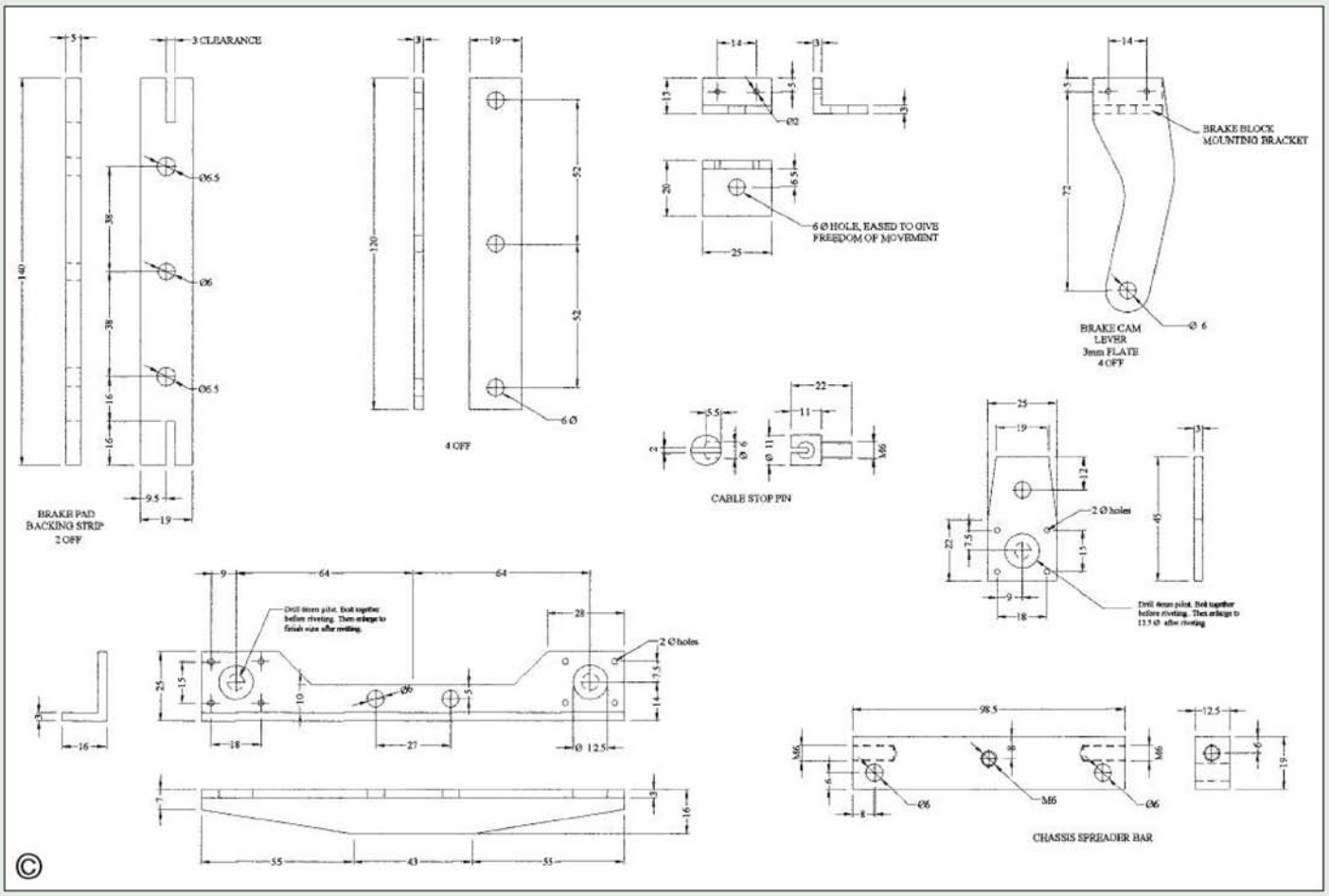
describes the construction of his 'Lowmac' driving car chassis.

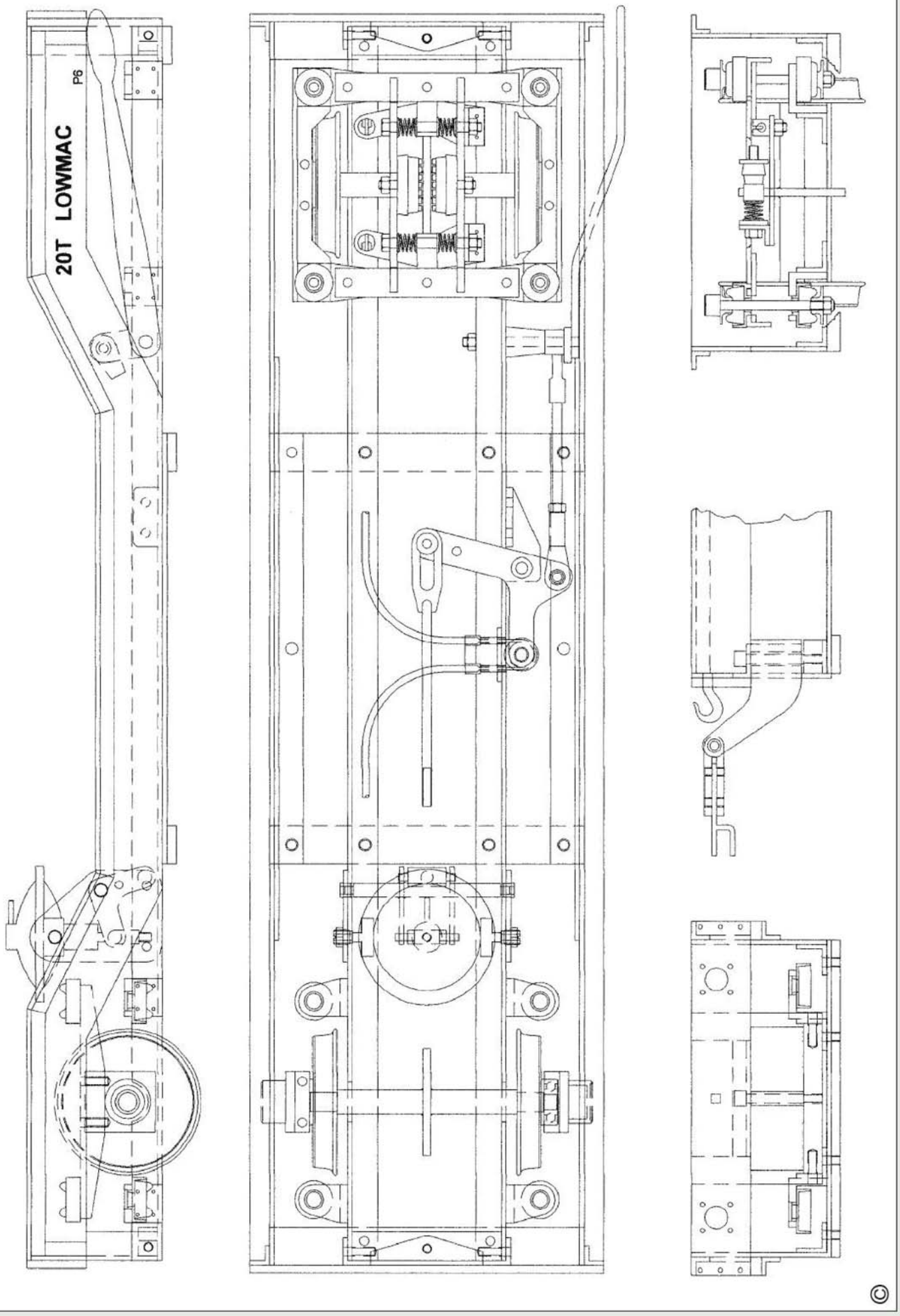
●*Part V continued from page 545 (M.E. 4195, 16 May 2003)*

The driving car I am about to describe is based upon a British Railways 'Lowmac' wagon, but the exterior design may be altered to suit individual requirements. I normally advocate the use of 4in. dia. wheel-treads, but I have had to reduce these to 3.4in. dia. to maintain the Lowmac scale outline.

The driving car is constructed on a central spine comprising two 3/4 x 3/4 x 1/8in. (or metric equivalent) lengths of mild steel angle iron set 3 7/8in. apart. These will support the lower suspension cups and brackets. A central steel plate, or strongbox, provides rigidity and support for the Lowmac outer chassis. Steel stretchers, fixed under the central spine by means of cap head screws, should ensure that, in the unlikely event of derailing, there will be no damage to the track. These stretchers may also be used to support the valances and foot boards. The main spine supports the brake actuating levers and a compensator. A vacuum cylinder may be fixed to this spine, or in a separate compartment that also houses the vacuum generator, control switch, etc.

A number of driving cars have been constructed using a folded sheet metal box form having four slots in the bottom for the wheel sets. I must admit that this is another satisfactory method, although it does not look very prototypical. ▶




20T LOWMAC
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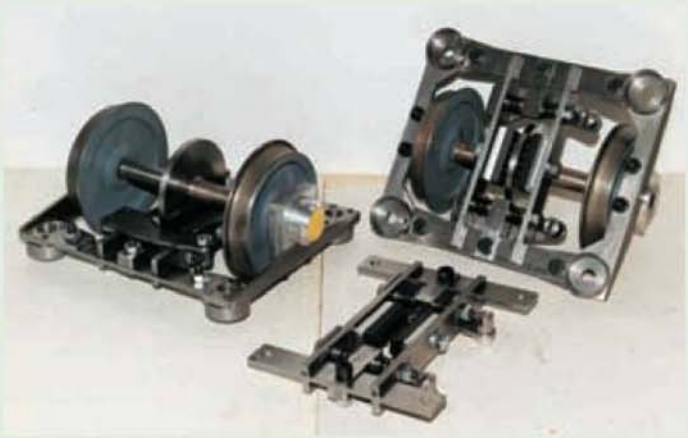


A group of wheel set components used in the construction of the Author's 'Lowmac' driving car.

A view of one wheel set showing some chassis details, the axlebox and suspension arrangements.

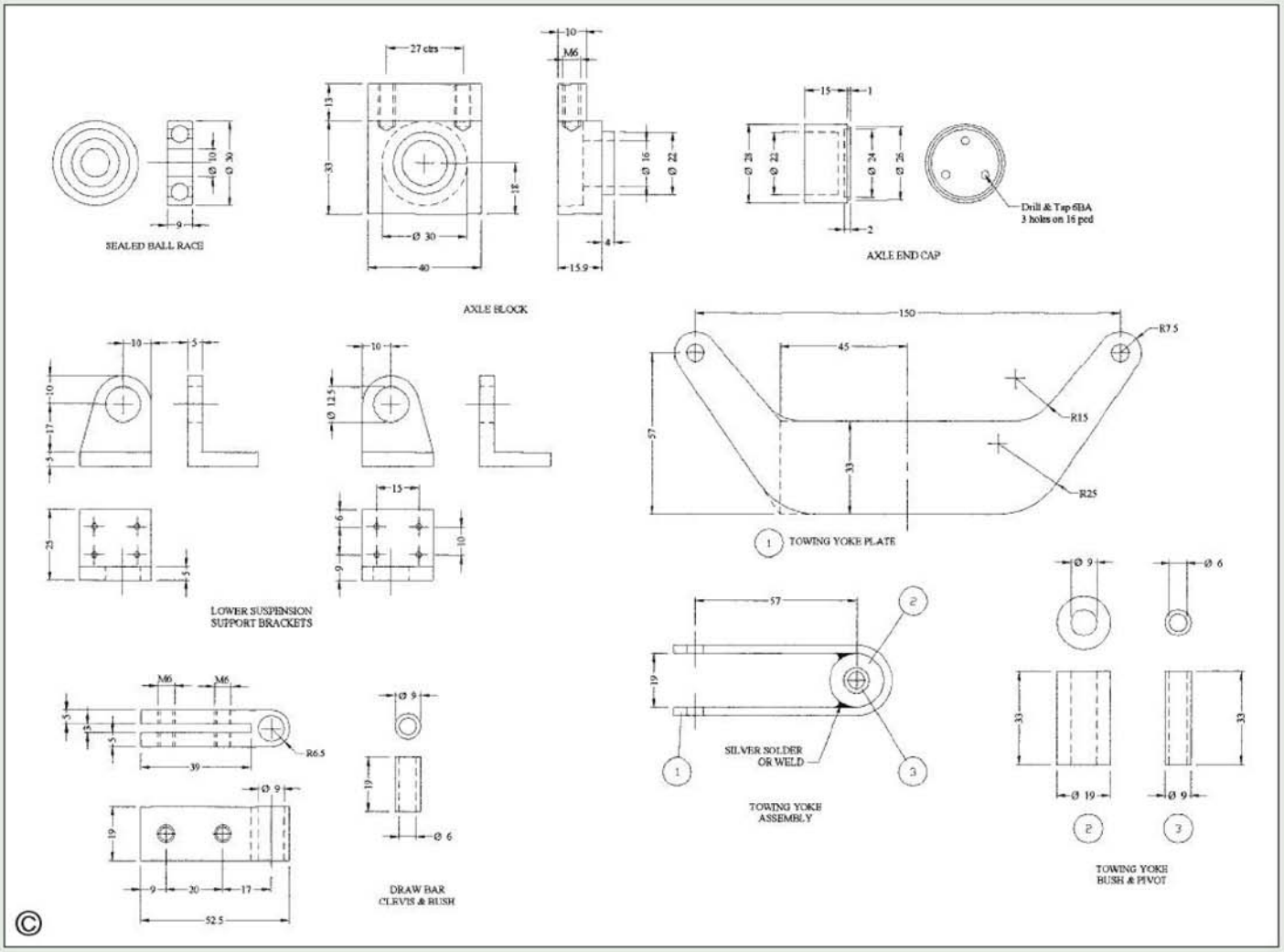
However, if any readers wish to use this method, then the self steering wheel set assemblies and spine may be dropped into the folded box chassis without alteration.

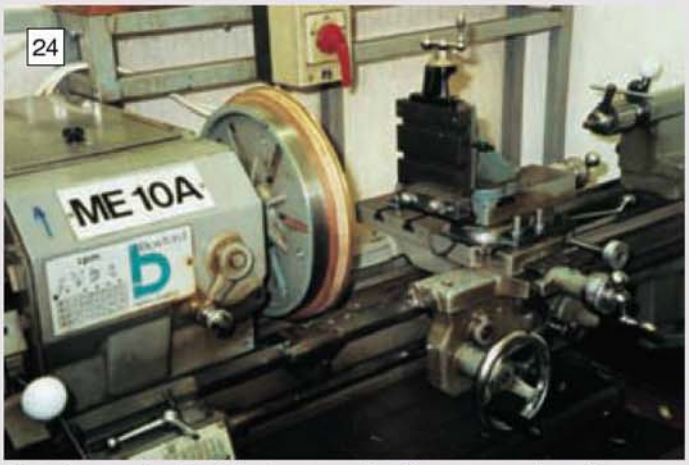
When the wheel assemblies are *in situ*, and the suspension loaded, it is essential that the wheels are in line. That is, there should be no bias towards curving one way or another. This may be easily checked as follows. Turn the driving car upside down and make sure that the wheel set assemblies are bedded down on their suspension links. Then place a straight edge against front and rear wheel flanges. If they do not line up, then the lower cup support brackets will have to be moved. If care is taken to ensure the accurate spacing of these cups, there should not be any necessity to move them. For those who are not quite so sure, I would suggest that the cup support brackets on one side of the spine are only temporarily secured, with one nut and bolt each. When you are satisfied with the alignment, they can be drilled and riveted in place.

There is nothing special about making the sub frames, as the photographs should make clear. The bearings can be made from any suitable ball races, and I made my housings out of scrap aluminium alloy bar. Steel would do just as well. The sides of the sub frame are made from 1 x 1 x 1/8in. (or metric equivalent) mild steel angle, cut to shape, with the fixing lugs riveted in place as shown on the photograph. The rivets are put in from underneath and hammered down on top and then filed flush. You may notice that the length of the stretchers is slightly less than the distance between the sub frames. This is to allow the brake assembly to be removed without fouling the top suspension cups when the wheel-set assembly is completed. The bearing housings are fastened with 6mm cap head screws; however, they may be made to look like full size if you like. In full size, Lowmacs had leaf springs, and the lower edge of the sub frame side may be profiled in steps to represent a leaf spring.

The brake assembly should be self explanatory, however, the throw-off springs should all be the same length. More detailed drawings will be shown next time.

● *To be continued.*





The set up used on the lathe to engrave the Roman numerals on the chapter ring. The work is held on a plywood disc fixed to the faceplate.

Transferring the numeral layout from the paper pattern to the brass chapter ring using ordinary blue carbon paper, a ball point pen and a steel rule.

MONTH GOING REGULATOR CLOCK

Peter Heimann

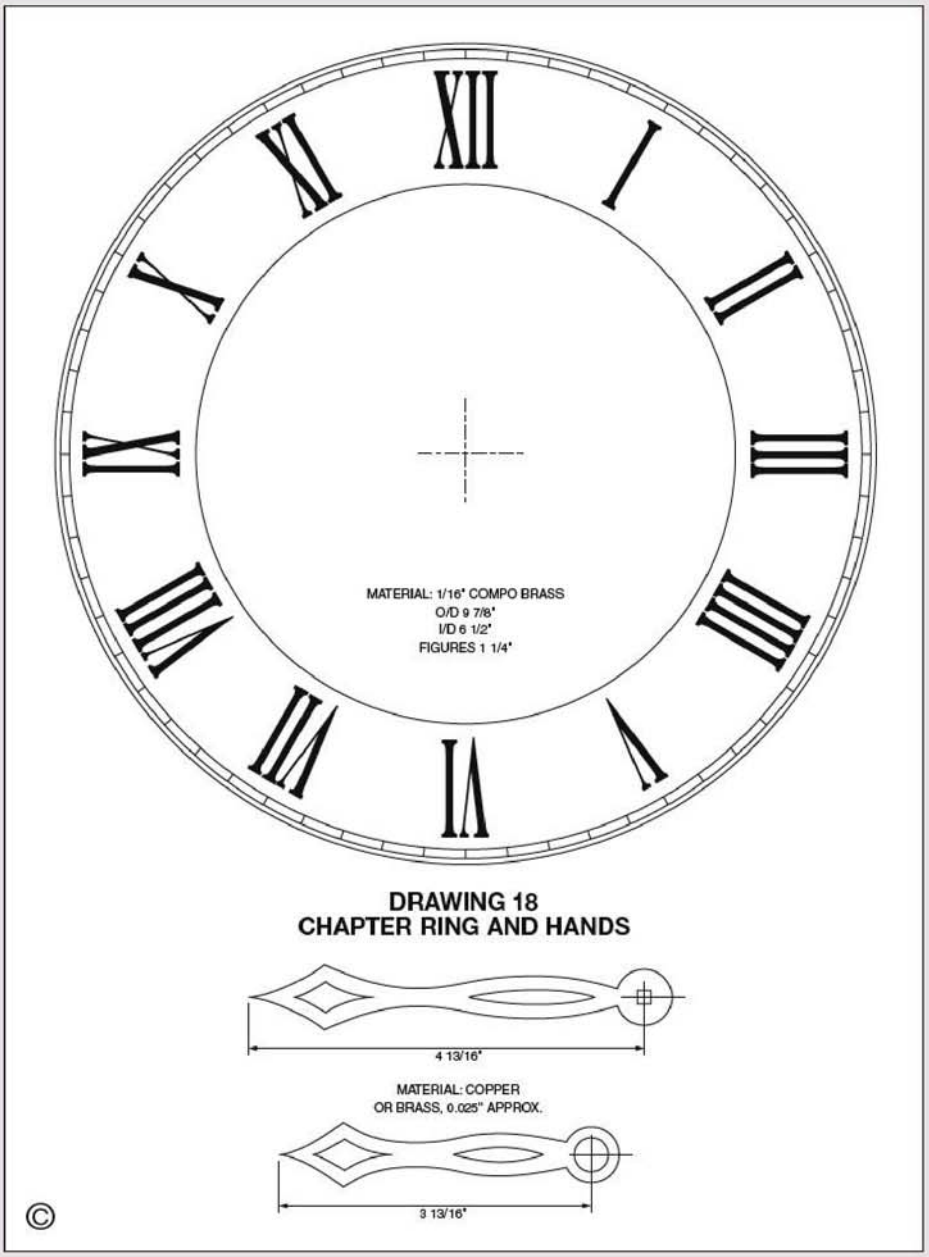
deals with the engraving of the chapter ring.

●*Part VIII continued from page 560 (M.E. 4195, 16 May 2003)*

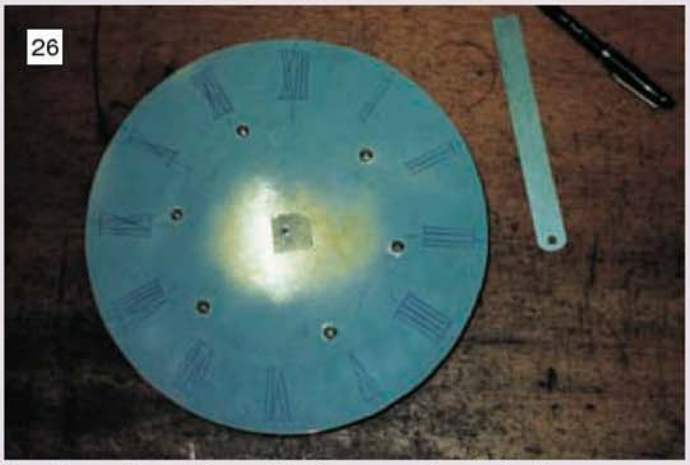
Now for something completely different! **Drawing 18** shows the chapter ring on my prototype. Whatever design you finally adopt is an important choice. The eye of the beholder will inevitably be drawn to this first. Personally, I like the traditional Roman numerals, particularly as engraving these on the lathe faceplate provides an interesting challenge. **Photogaph 24** shows my set up. The faceplate has an 18mm plywood disc fixed to it with wood screws from the rear. One needs to drill well fitting holes in the plate for the screws. The face of the disc should be skimmed to be perfectly flat. A 1/16in. thick compo brass disc has been screwed to the ply and turned to 9 7/8in. diameter. This is just about the maximum I can manage on my machine, which does not have a gap bed. A centre hole of 1/8in. has been drilled right through brass and plywood to accept a centre pin.

The faceplate was then taken off complete with disc and the latter given an aerosol coat of grey cellulose primer. This acts as a good base for marking out and is easily cleaned off with thinners later on. The assembly is then returned to the lathe. The vertical slide (actually a Myford unit) has a 3/4in. square mild steel block bolted to it which acts as the tool holder. The block is drilled and reamed to accept 1/4in. dia. home made silver-steel cutters which are locked in position by a cap head screw. The first cutter required is V-shaped with considerable back clearance. It should form a groove approximately 1/64in. wide. This is used to engrave the 'minute circles', the outer one being, say 1/16in. from the edge of the disc, and the inner one 3/16in. to leave 1/8in. between. The tool is, of course, set at centre height. I turn the lathe by hand on this type of operation and scribe the circles 0.008-0.010in. deep, which is sufficient for all the engraving.

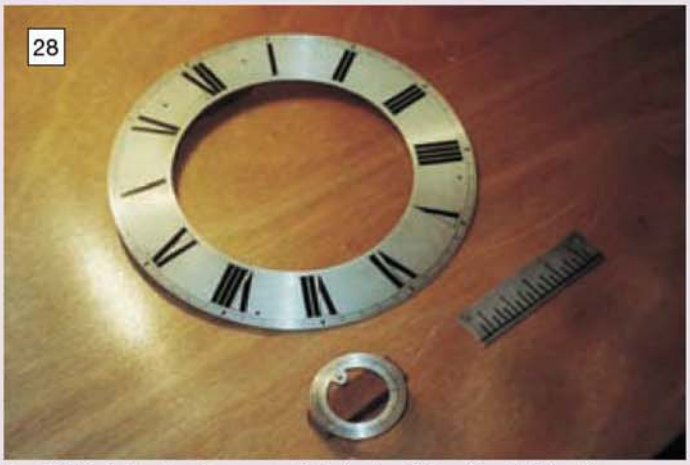
The dividing facility is now required, arranged for 60 divisions. The tool is set to cut horizontally



DRAWING 18
CHAPTER RING AND HANDS



Once the marking out is complete the paper pattern and carbon paper can be removed leaving the image on the grey primed surface.



The finished chapter ring, seconds indicator dial and beat plate after engraving, filling of the graduations with wax, silvering and lacquering.

at centre height in a planing action towards the operator. Both the rear and front stops are set to give the correct 1/8in. movement between the lines. When the 60 cuts are complete, the tool has to be substituted by one shaped like a miniature parting tool, 1/16in. wide. This is centred over one of the previous cuts and every fifth one is opened to the new width, leaving the minutes and five minutes engraving complete. Finally, it pays to revert to the original cutter and carefully clean out the two circles, which will have bits of swarf deposited in them.

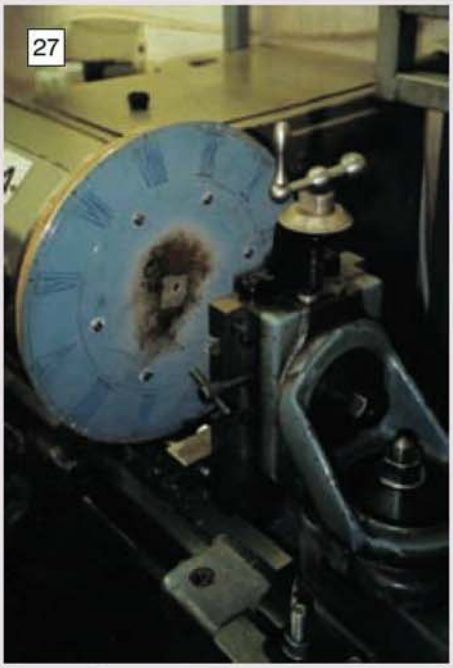
Front and rear limit stops are absolutely essential for the job in hand and in fact are extremely handy for all sorts of general work. I bolted a stop to the side of the saddle body using existing tapped holes. A simple bracket is fitted to the first and the last slots of the cross slide table (see photo 24). A length of 3/8in. studding protrudes from each of the brackets; this can be set to impinge on the fixed stops to set the limit of travel fore and aft. A lock nut on each thread prevents accidental movement. I have found this facility so useful that I have provided a similar arrangement on my milling machine.

The complete faceplate assembly is now removed for marking out on the bench.

Marking out and cutting the numerals

A paper template is required for the Roman numerals. It must be remembered that only the middle of each of these is radial to the centre of the dial. All other strokes are then aligned in relation to the middle line. One can make a drawing, beg a photocopy of someone else's drawing or buy a printed card dial from one of the suppliers mentioned at the beginning of the series and take a tracing from this. Whatever method is chosen, a full size paper pattern is required. This is laid over ordinary carbon paper (the blue variety designed for handwriting copies) and fixed to the metal with the existing screws (**photo 25**). The image is then transferred with very little trouble using an ordinary ballpoint pen. **Photograph 26** shows the result.

The faceplate is now mounted back on the lathe, as shown in **photo 27**. You will note that the serifs have been cut using the V-shaped first cutter. It will be seen that the 'V's (number 5) do not have a serif at the bottom point. Also, I advise making the serifs shorter rather than longer at this stage, as the last operation of all will be to clean these out and finish to correct length. The cutters required are the V-shaped one previously used and parting tool shapes 1/32in., 1/16in. and



After marking out, the chapter ring is remounted on the lathe for cutting the numerals.

3/32in. wide. Cutters wider than these would prove a strain. All must have considerable clearance behind the cutting edge so that when starting a planing cut at a serif, the heel of the cutter does not dig in on the outside.

The desired cutter path is set by height adjustment above and below centre in conjunction with rotation of the faceplate. It is not as difficult as it sounds to bring the cutting tool close to the surface of the work piece and, by trial and error, sight the setting horizontally at the inner and outer end of the cross slide stroke. When satisfied, it is imperative to lock the faceplate against movement before attempting any cut. I find that locking can usually be achieved by engaging the dividing detent in any convenient hole on any circle in the dividing plate. A great deal of adjustment to the limit stops will be required so as not to over- or under-run the serifs.

With regard to the actual planing of the numerals, the 'V's are the tricky ones, but fortunately there are only a few of these. The problem of course is the sharp point at the bottom. I find it best to do the outline of the complete number with the 'V' tool — this requires only three strokes. With the same tool, I then very gingerly nibble out enough of the sharp bottom corner to allow the substitution of a wider cutting edge tool. Do not be put off by the somewhat messy appearance and variation in depth. At the end of the day the engraving is filled and, provided the outlines are sharp, any bits of brass showing through the filling are chiselled off by hand and then refilled. There is a limit to the amount of description one can give on this subject but suffice to say that common sense and a modicum of patience will result in a satisfactory outcome.

Filling and silvering

When the engraving is finished, the lathe is run under power at slow speed. With a medium abrasive over a piece of cork, all the burrs thrown up by the cutters and most of the grey primer are removed. Having marked its position as it will be returned later on, the workpiece can now be unscrewed. There is a choice of black filler for the engravings. Traditionally, this is black wax, which is available from the suppliers in stick form and is very easy to use. The workpiece is heated from underneath and the end of the stick applied; it will melt and run into the engraving.

One should try to avoid too much heat, which can cause the wax to bubble. While still liquid, most of the surplus wax is wiped off with the edge of a piece of cardboard. The only drawback of this wax is that eventually, when the chapter ring is spray lacquered, there is a slight possibility of the wax weeping under the influence of the solvent. This only seldom happens if there is an area where the lacquer is marginally thicker and thus slower to dry. But it does mean re-silvering and lacquering again.

As an alternative, which is not allergic to solvent, I have used carbon black (a soot-like material) mixed with Araldite resin adhesive. This works well but is a sticky, messy process. With this there is no need to remove the workpiece from the faceplate as no heat is involved.

Filling completed, the faceplate is returned to the lathe and, at a slow speed, the surface is cleaned with abrasive wet and dry to leave a circular grained finish. Every number is now carefully inspected. Any flaws found are rectified by hand using a little silver-steel cold chisel. The black filling is made good, and then it's back to the lathe. When completely satisfied, the 10BA countersunk fixing holes are drilled using the previously made plastic template.

The faceplate is returned to the lathe for the last time and the chapter ring machined from the disc. When the cutting tool is nearly through, I finish off by turning the lathe by hand. After so much work, it would be dreadful for the ring to come away under power and become damaged. ▶

Before silvering, there are two more items to deal with. Drawing 11 (see Part V, *M.E.* 4191, 21 March 2003) shows the beat plate and **drawing 19** here shows the optional seconds indicator dial, should you decide to make this accessory (to be described next). The beat plate has to be engraved by hand using a proper graver, or scraped out with a special home made silver-steel tool. The seconds dial is a simple job after the experience with chapter ring production. Both items can be made from the centre portion removed from the original disc. These are filled black.

It now remains only to silver the items chemically. Most of the material suppliers listed at the beginning of the series, will be able to supply the silvering powder and the finishing powder as well as sticks of black wax. Instructions are provided on the containers. The process is straightforward, absolute cleanliness of the material being the main requirement. One must be sure that they are perfectly dry before starting. The parts are now lacquered at once. **Photograph 28** shows the finished components.

The hands

The hands shown on drawing 18 were drawn around the outline of the prototypes so in fact they are, and should be rather more delicate. The material is copper or brass approximately 0.025in. thick. The finish is matt black cellulose. Traditionally, most hands are fashioned in steel (gauge plate), highly polished and blued by heating and quenching. This thin gauge plate is the very devil to work by hand and bluing, without the benefit of a controlled furnace is, to say the least, tricky. But it can be done. Do not let me put you off if you wish to go this route. In any case, the design of hands is a matter of personal choice, so do not hesitate to experiment.

The optional seconds indicator was devised as the author missed seeing the second hand going round in step with the ticks.

Optional seconds indicator

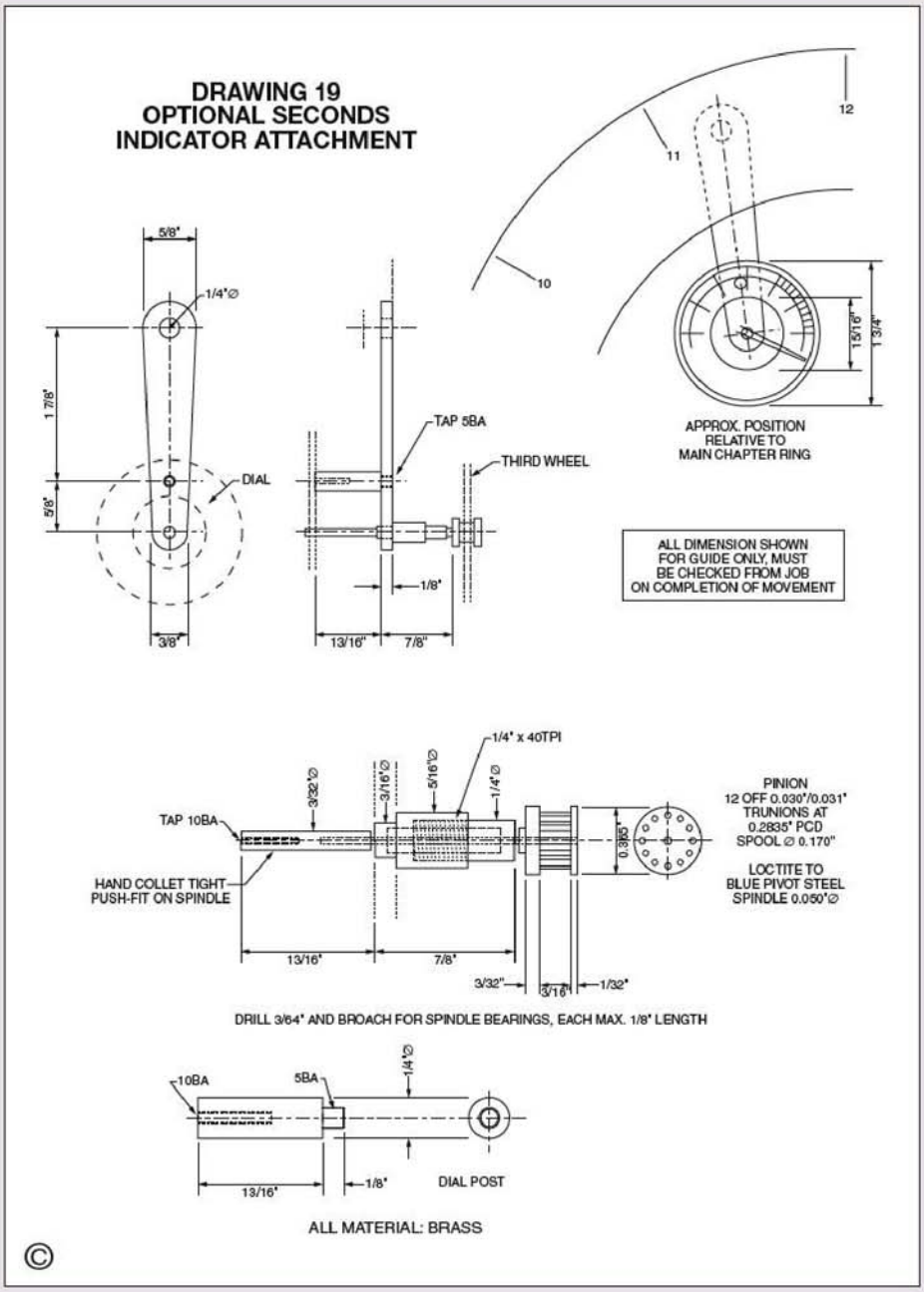
The last item of the movement is in fact an 'optional extra' — a seconds indicator. On a normal clock, the seconds hand is fitted to an extension of the escape wheel arbor. I wanted to avoid this for two reasons. First, it would have prevented the fitting of an 'end stone' at this point. Second, the seconds dial would obstruct the view of the escape wheel which is a feature of a skeletonised clock. In any case, one does not really need to read seconds in a domestic situation ... and so I thought that I would do without.

Having finished the clock, I then missed the seconds hand going round in step with the ticks — hence the optional extra! The complete unit is shown in **photo 29**. The dial can be seen in photo 28 together with the main chapter ring and beat plate. **Drawing 19** gives all the details. The unit is clamped to the front plate at the top left hand pillar position, simply replacing the original washer. It meshes with the third wheel so that engagement is simply adjusted by the position of the stem on the pillar.

It will be seen that the hollow body is in two parts, which screw into one another. The extremes of each part are drilled and broached to a good but free running bearing for the blue pivot steel arbor. A light lantern pinion is Loctited to this arbor at one end. The outward end is located by a tight fitting hand collet. The seconds hand is fixed to the other end of this collet by means of a 10BA screw. The body itself has a 3/16in. dia. spigot at one end which is Loctited into the main stem. Screwed to the stem is a small pillar to attach the dial with a single 10BA countersunk screw. The rim of the dial will come quite close to the hour wheel; if necessary, make the pillar a little longer.

The fixing hole in the dial will not be exactly vertically in line above the centre, but to one side as the stem of the unit is angled to suit the mesh. Therefore, the position of the lug in the dial, in relation to the graduations, will have to be determined 'on the job'. The device operates high up in the train, where there is minimum power and maximum revolution. It needs to be well made and lightly lubricated. As far as I know, it is a 'unique feature'. Observation of the hand will show clearly that the escapement is 'dead beat' with no recoil — proof of good workmanship.

●*To be continued.*



A SOUTHERN RAILWAY MERCHANT NAVY CLASS LOCOMOTIVE IN GAUGE 1

Roger Thornber
corrects a couple of errors and discusses the frame stretchers, axleboxes, wheels and rods.

●*Part III continued from page 555 (M.E. 4195, 16 May 2003)*

The stretchers are plain sailing. At the front there is the bogie bolster; this should be only temporarily fixed at this stage as it prevents access to the cylinder fixing bolts. Next comes a cross stretcher which carries the axle driven pump. The two slots are for the eccentric rods to pass through. The second cross stretcher can be made identical to the first except that there is no pump; the slots in this case give screwdriver access to the eccentric and pump straps.

The stretcher at the rear of the main frames carries the pivot for the trailing truck. This was made by bolting the pivot to the stretcher. The rather curiously shaped stretcher at the rear is for the trailing truck spring to bear on. On the real locomotive there is a spring pad on the outside frames of the truck hence the need for the 'outriggers'. These may be omitted without harming the design.

Axleboxes, hornstays and springs are simple, but note that the leading and trailing axleboxes require their outside dimensions to be reduced to give sideplay on these axles. The hornstays are shown as 1/4in. wide. This should be alright as the back of the wheels will have been relieved.

A surprising number of queries were raised on *Evening Star* on these items. Several readers had difficulty fixing the hornstays. It may be that builders have been trying to fit the stays with the flanges on the outside of the frames, so I have included a three-dimensional view which hopefully makes this clear. Two alternatives could be tried if preferred; one of my fellow members uses a flat plate and drills and taps down into the frame. Speaking for myself, I do not like tapping twelve 10BA holes into steel! Another suggestion is to cut a slot in the frame and silver-solder an 8BA nut into it so that a flat plate may again be used.

Other queries have concerned the springs. I have no proper method of determining the right strength, but have acquired a selection of different springs which I fit until I get something that feels right! This has to be done when the loco is finished, of course.

The wheels are machined from castings and made to G1MRA standards. which is another good reason for joining this association. Wheel castings can be obtained from Walsall Model Industries (tel: 01922-633718) or Mark Wood (fax: 01787-238458). There may be others, but, unfortunately, at the time of writing 'Locosteam' has ceased trading owing to ill health.

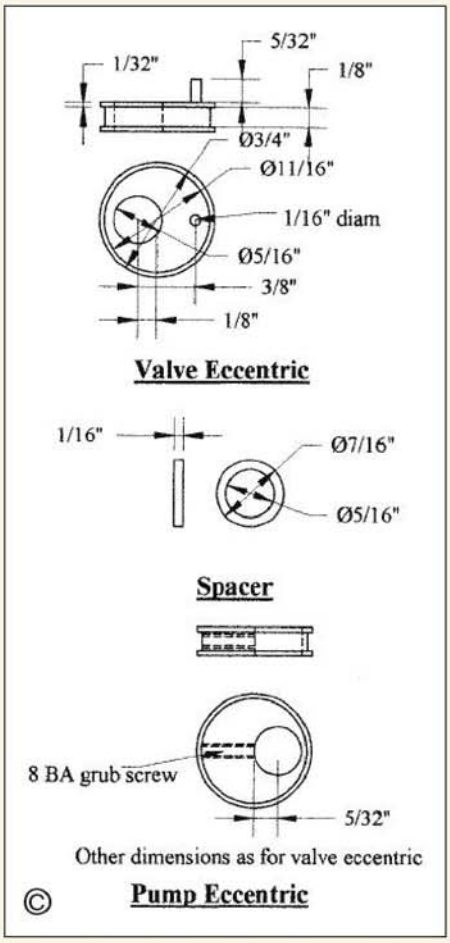
Connecting rods are always a bit of a pain as far as I am concerned. I usually put bushes in the axleboxes as use these as drilling guides to ensure that the wheel centres are correct. Having got these right, it is a straightforward, if tedious, sawing and filing job. The rods can be mounted on an angle plate fastened to a vertical slide to machine the flutes.

Before fixing the driving wheels to their axle, three eccentrics and two spacers are needed. The pump eccentric is in the centre of the axle. The stop collars (in a later article) come next but can be fitted later. The valve eccentrics are outside these with the little pins facing inwards. Note these are slip eccentrics, and so are free to rotate on the axles. Finally, spacers go between the eccentrics and the axleboxes.

Corrections

Roger Thornber writes: *"Two errors have occurred on the frame drawings. No dimension is shown for the position of the buffer beam; this should be 5/32in. above the bottom of the frames. The bottom of the slot to take the cylinders is shown as 5/16in. above the motion centre line; this dimension should be 3/16in. My apologies."*

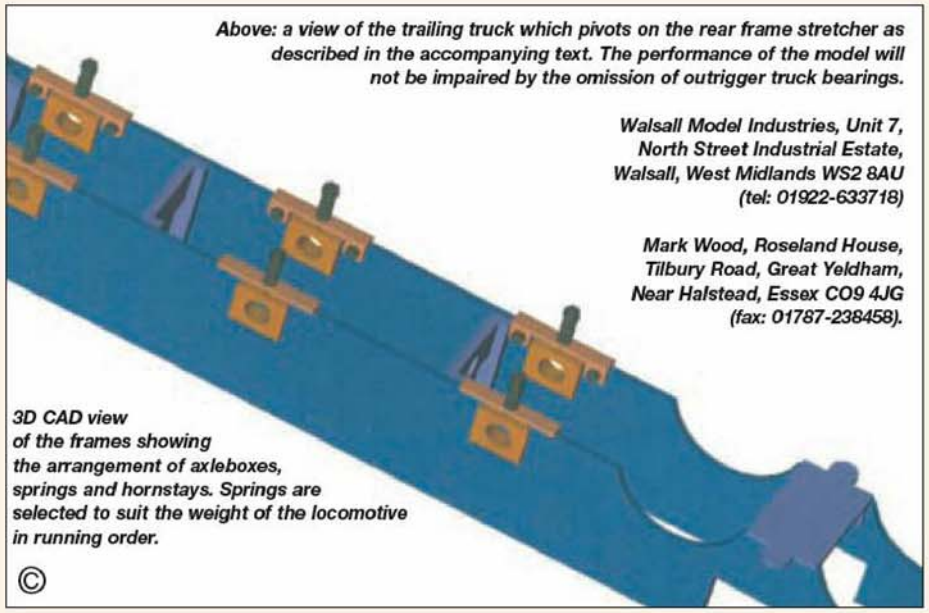
●*To be continued.*



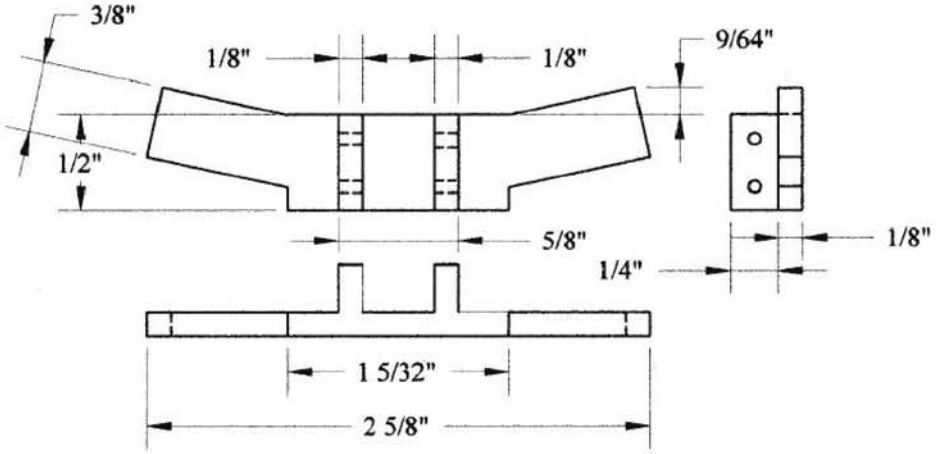
Above: a view of the trailing truck which pivots on the rear frame stretcher as described in the accompanying text. The performance of the model will not be impaired by the omission of outrigger truck bearings.

Walsall Model Industries, Unit 7, North Street Industrial Estate, Walsall, West Midlands WS2 8AU (tel: 01922-633718)

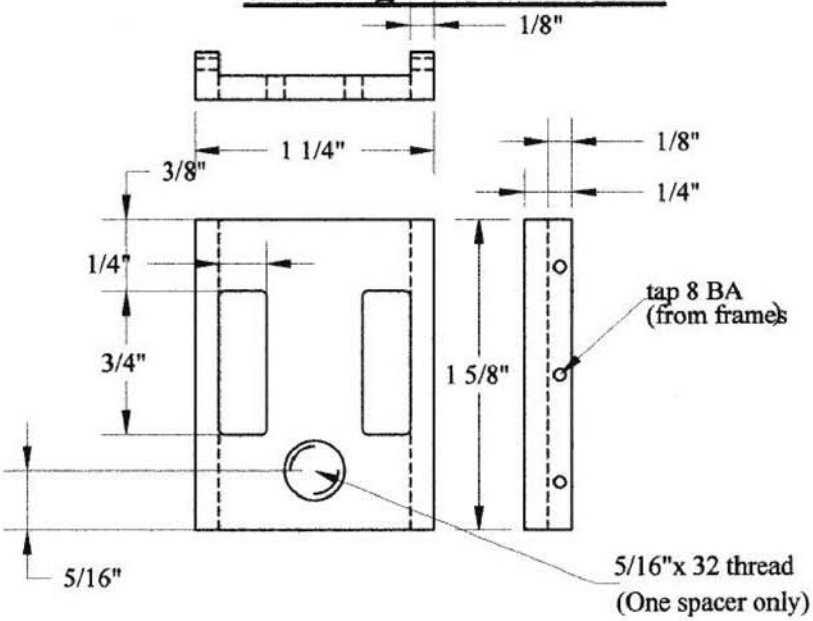
Mark Wood, Roseland House, Tilbury Road, Great Yeldham, Near Halstead, Essex CO9 4JG (fax: 01787-238458).



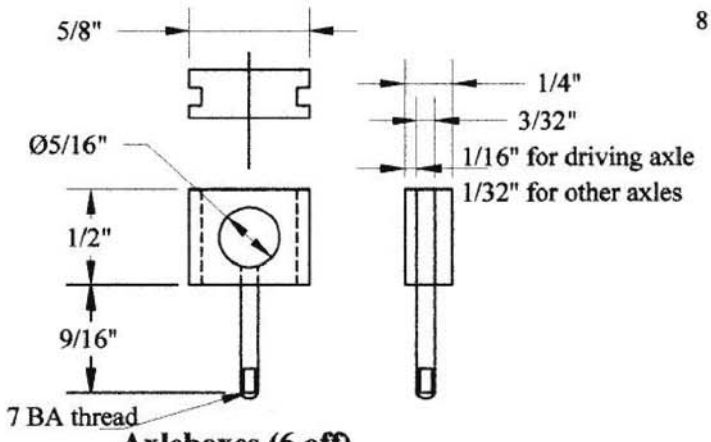
3D CAD view of the frames showing the arrangement of axleboxes, springs and hornstays. Springs are selected to suit the weight of the locomotive in running order.



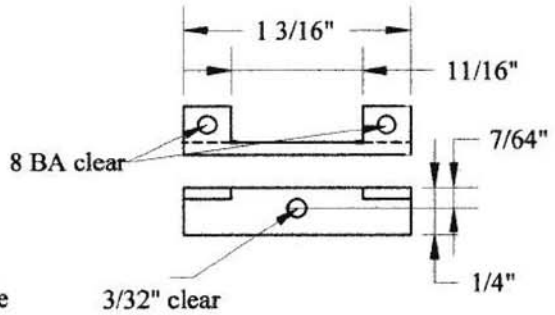
Trailing Frame Bearer



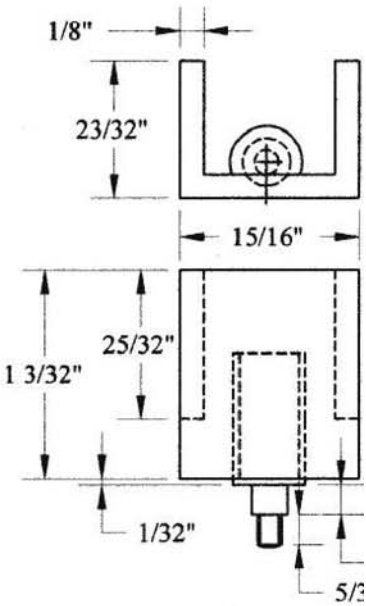
Frame Stretchers (2 off)



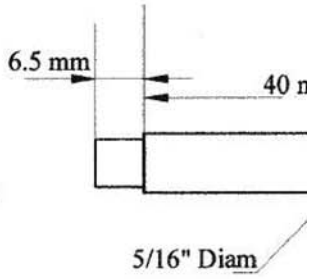
Axleboxes (6 off)

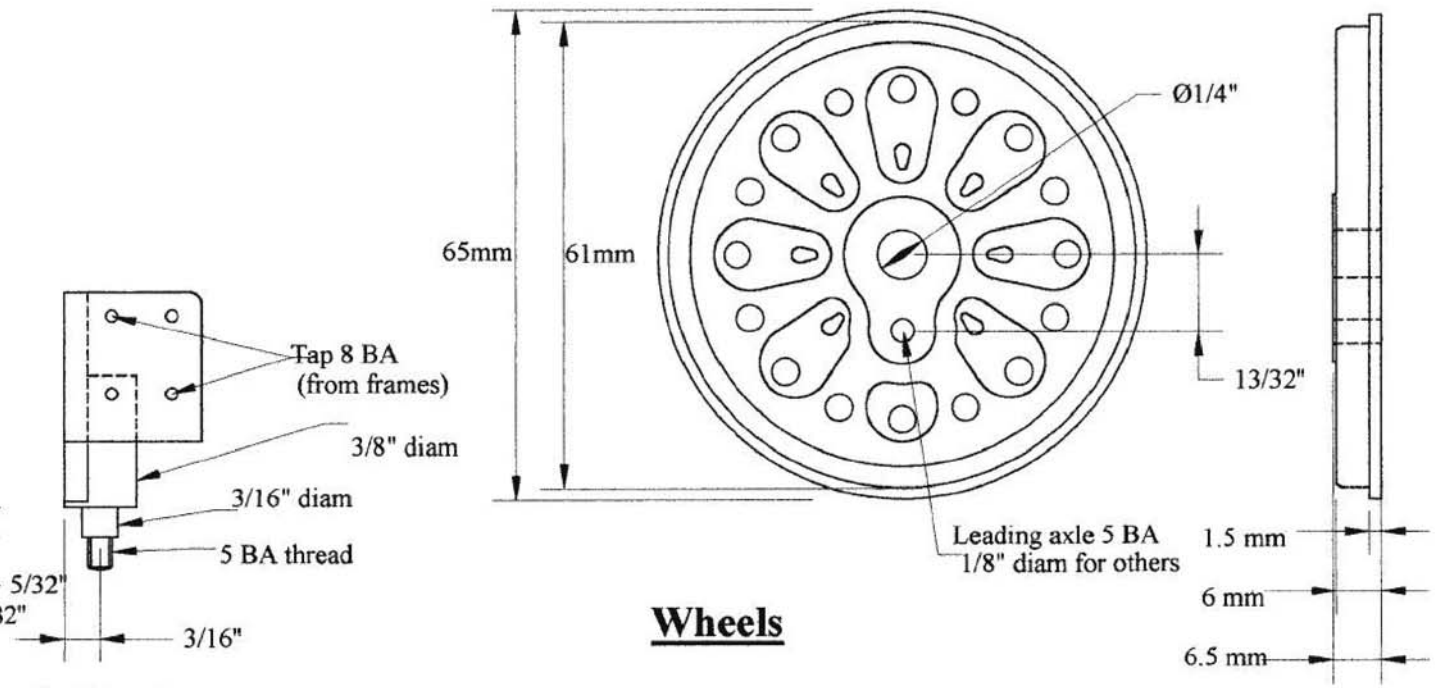


Hornstays (6 off)



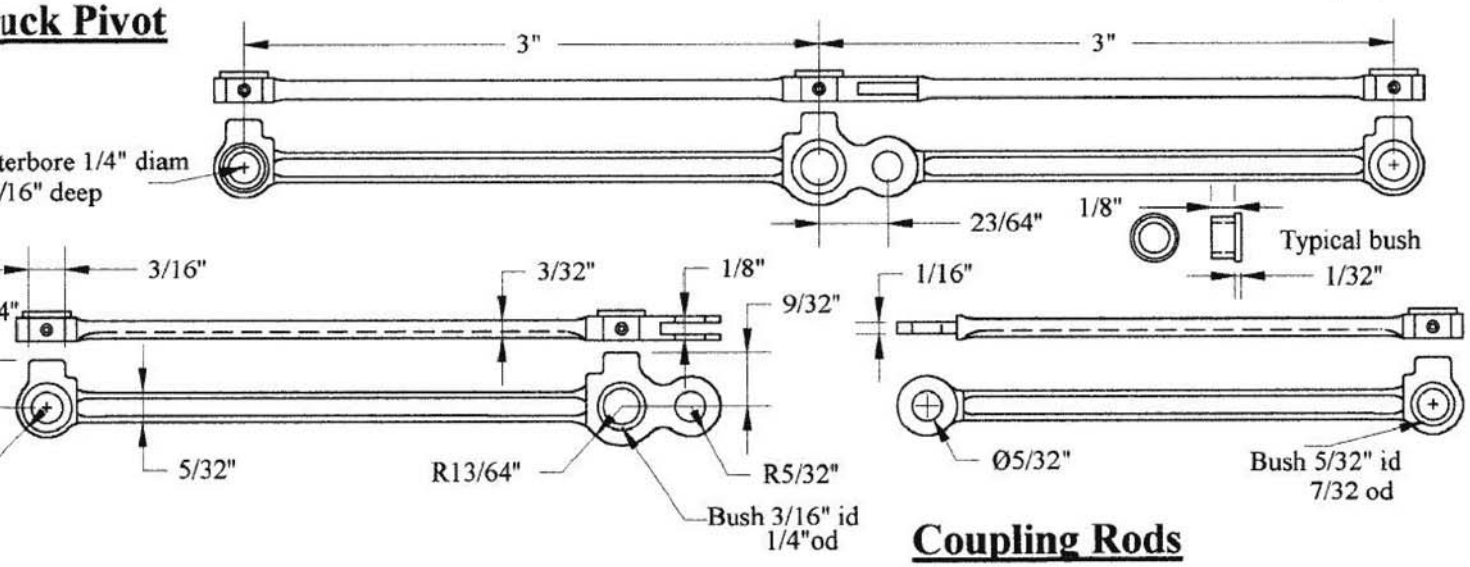
Trailing Tr



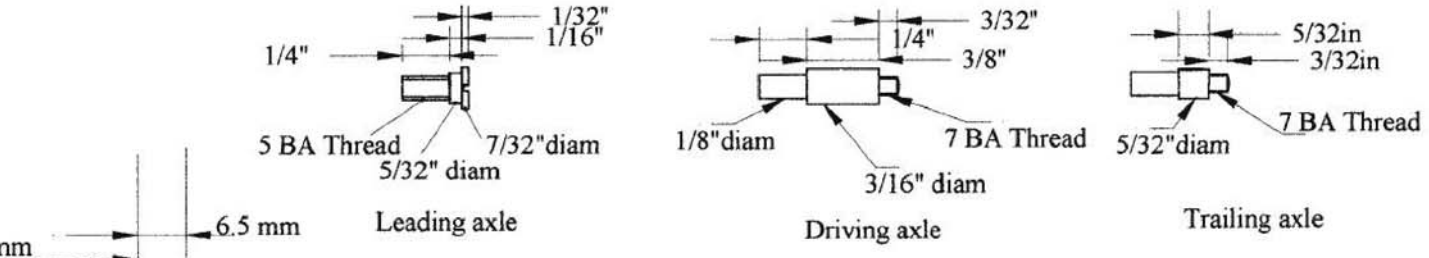


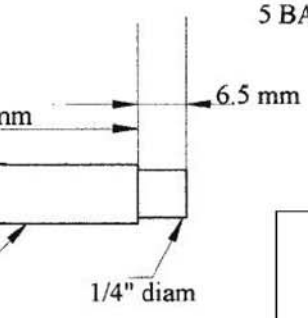
Wheels

uck Pivot



Coupling Rods

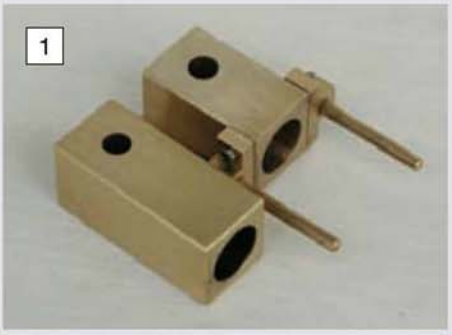




xles (3 off)

Crankpins

A SOUTHERN RAILWAY MERCHANT NAVY CLASS LOCOMOTIVE FOR GAUGE 1 BY ROGER THORNBER



Examples of a standard and a guided cylinder shown side by side. Note the reduction in cylinder length possible by the use of guides.

The short-piston guided-cylinder engine shown adjacent to a steel rule to give an indication of overall size.

A guided-cylinder, piston and big end assembly for the Boxer engine.

OSCILLATING ENGINES FURTHER REFLECTIONS

Colin Pape

describes his further experiments with these fascinating engines.

●*Part VI continued from page 557 (M.E. 4195, 16 May 2003)*

In previous notes, I described some engines that all used oscillating cylinders. All of those engines were steps along the way to building a four-cylinder self-starting engine.

During the design and build of those engines, I had some ideas for others and I mentioned some of them at the end of the first series. These ideas all proved to be feasible and several new engines have been produced. The new engines incorporate features that I have not seen before, but they remain simple and easy to build.

New engines

I began the first series with a fairly extensive list of the characteristics of the ordinary oscillating cylinder engines which I had seen or read about. It was quite a long list. At the end of the series I provided a list of the characteristics that were common to all the engines. There were just six:

1: A cylinder that oscillates.
2: A flat face on the cylinder for the ports.
3: A matching flat face (port face) on the backplate.
4: A spring system to keep the cylinder face in close contact with the port face.
5: A long piston.
6: A rigid assembly of piston, connecting rod and big end.

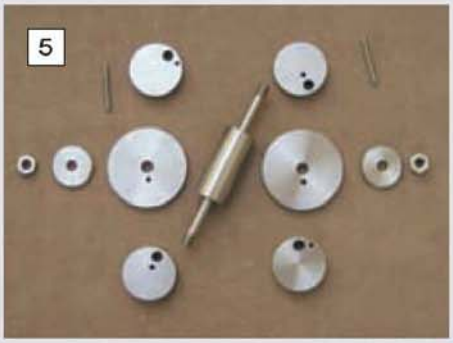
With these latest engines I will show that it is possible to build oscillating cylinder engines that have none of the above characteristics except the last. This new series describes five new engines as follows:

1: Short piston, guided-cylinder engine.
2: Four-cylinder Boxer based on the above.
3: Double-acting end-pivot engine.
4: Port-in-the-pivot engine.
5: Inside-out, surprises engine.

All of the engines in the first series had a common cylinder bore of 13mm and a common stroke of 14mm. I have continued to use these basic dimensions in these new engines so all of the engines have a common scale. I have carried on with the same numbering system, which reflects the order in which the engines were developed.

One side of the backplate for the Boxer engine after machining.

The other side of the Boxer engine backplate.



The parts for the Boxer engine crankshaft prior to assembly.

The assembled crankshaft for the Boxer engine. Power take off is from either end.

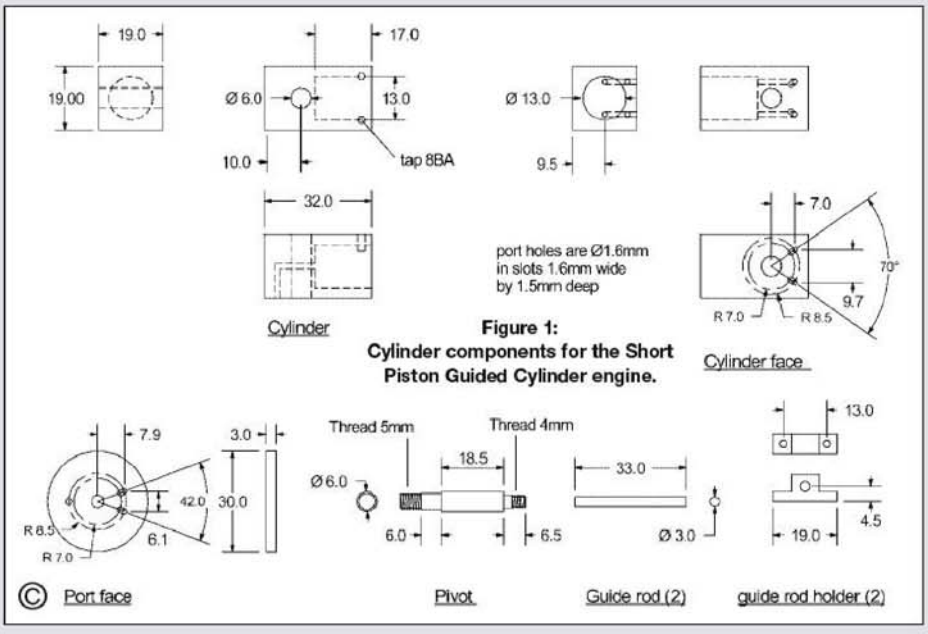


Figure 1: Cylinder components for the Short Piston Guided Cylinder engine.

The common cylinder with two varieties of port face for the boxer engine.

The fully assembled Boxer engine. The straight-line crankshaft and guided-cylinders are clearly apparent as is the means of introducing air into the cylinders via the reversing valve.

T7: A short-piston, guided-cylinder engine

The piston in a typical oscillating cylinder engine does two jobs. The most important of course, is to apply a turning force to the crankshaft. The other job is to turn the cylinder. Since the piston, piston rod and big end form a single solid entity, the cylinder must pivot in order to allow the big end to follow the crank pin. In the absence of any guides for the cylinder or the piston rod, the only means available to turn the cylinder is to use the piston itself. For this reason the piston needs to be quite long. A short piston will tend to turn about a diameter and bind inside the cylinder.

A long piston means a long cylinder and this in turn means that the cylinder pivot has to be further away from the crankshaft than it would otherwise need to be. As we have seen, this creates some problems, especially if an end-pivot design is used.

The reason this engine was developed was to show that the piston in the oscillating cylinder engine could be used for just its primary job, which is to turn the crankshaft, if some other means could be found to turn the cylinder.

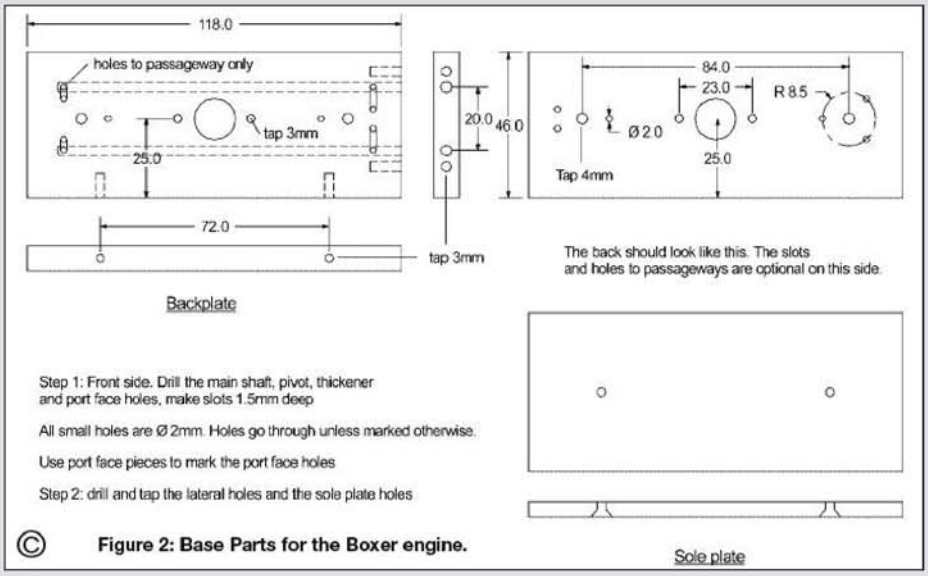
The cylinder can be guided by other means than the long piston. In this engine, two rods guide the cylinder. The rods are inserted in two holding blocks, and screws attach these two blocks to the cylinder. The two rods are applied, pincer like, to the big end. If we start in a condition where the big end is directly in line with the axis of the cylinder, the two guide rods will ensure that it always remains in this condition.

If the piston is only used to apply force to the crankshaft it can be short and the cylinder can also be short. **Photograph 1** shows two cylinders, one is from the end-pivot engine (T2 in the first series) and the other is from this new engine. The two cylinders have the same bore and the two engines have the same stroke. In the guided cylinder engine the piston is only 2mm thick instead of 12mm as in all the previous engines.

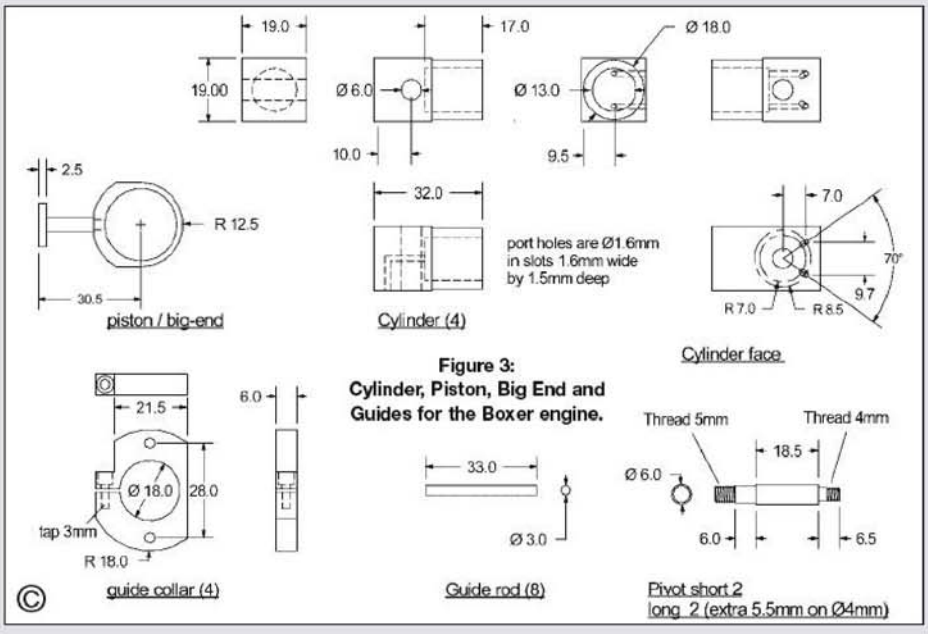
The whole point of guiding the cylinder was to bring the pivot closer to the crankshaft, so I spent some time optimising some other parts of the design with the same objective. This included moving the ports from the crankshaft side of the pivot to the far side. The new cylinder design is shown in **fig 1**.

The guided cylinder engine is shown in **photo 2**. It is an end pivot engine but the pivot is now almost as close to the crankshaft as it is in the centre pivot engines and the angle turned by the cylinder is almost as big. The main dimensions are:

Bore: 13mm
Stroke: 14mm
Distance pivot to crankshaft centre: 42mm
Angle turned by cylinder: 19.2deg.



© **Figure 2: Base Parts for the Boxer engine.**



© **Figure 3: Cylinder, Piston, Big End and Guides for the Boxer engine.**

T8 - Boxer engine

The previous engine worked well. I decided to build a multi-cylinder version and to make it self-starting.

This engine is a four-cylinder unit based on the short-piston, guided-cylinder engine. It is a Boxer because I wanted to lower the centre of gravity. Simply flattening the V-four engine would have produced a low engine, but it would have been quite wide. With the short piston design this engine is barely wider than the V-four described in the first series. I managed to drill the two long internal passageways in the backplate with my stretched drill without any problems.

A new method of attaching the guide rods to the cylinder was developed. The attachment block system used in T7 was satisfactory as long ▶

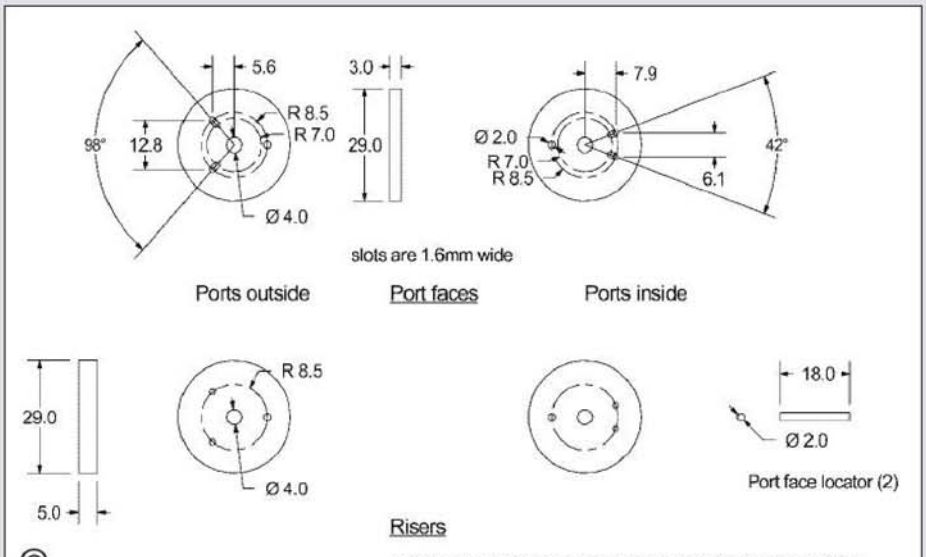


Figure 4: Port Faces and Risers for the Boxer engine.

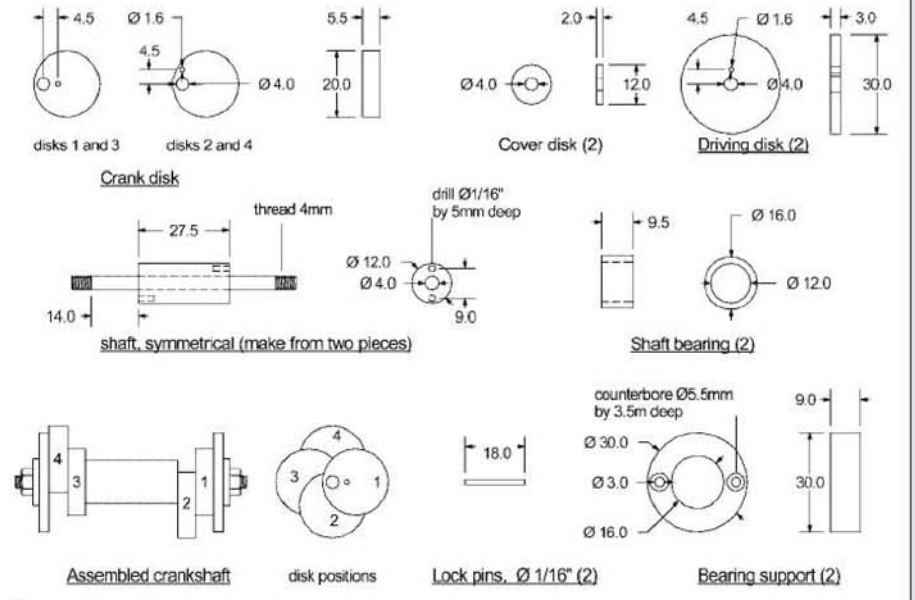


Figure 5: Straight-line Shaft design for the Boxer engine.

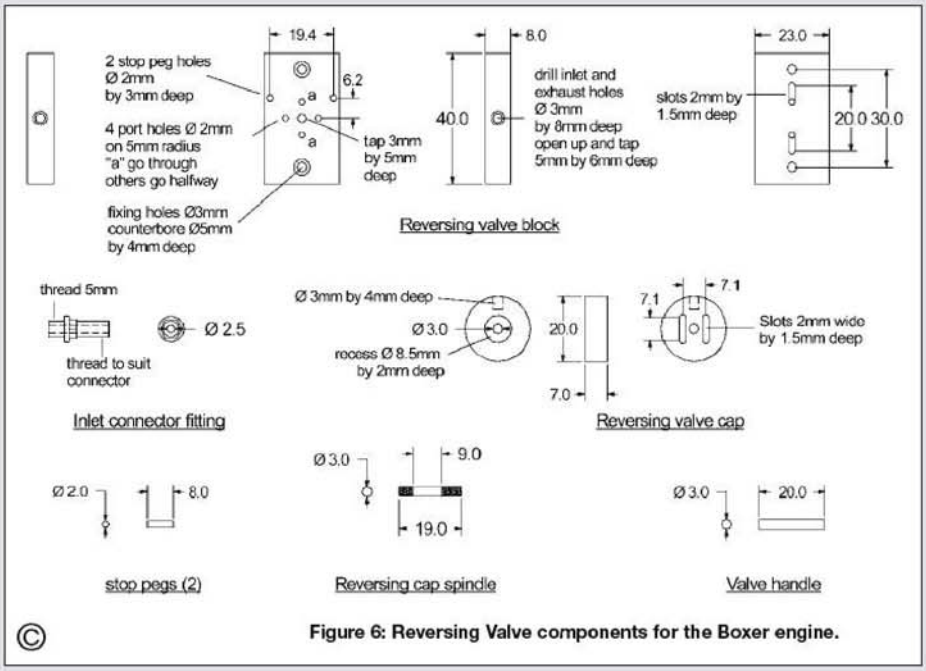


Figure 6: Reversing Valve components for the Boxer engine.

as the cylinder had two flat parallel faces, but I wanted to improve the cylinder shape and to reduce its weight. This improvement meant adopting a circular cross-section over as great a length of the cylinder as possible. In the new system the rods are mounted diagonally opposite each other in a collar clamped to the round section of the cylinder. **Photograph 3** shows a Boxer cylinder with its guide rods mounted. The collar is in aluminium alloy.

The four short-piston cylinders are mounted as two horizontally opposed pairs mounted back-to-back on a common backplate. The backplate is the simplest of all the self-starting engines and is shown in **photos 4a** and **4b**. The same drilling operations that produce the front face produce the rear face of the backplate. It is similar to the front face but has no slots and connecting holes to the internal passageways.

I wanted this engine to be self-starting, so I could not use the same straight-line shaft as the V-four in the previous series. In a Boxer engine, it is necessary to have four lobes on the crankshaft and these have to be 90deg. apart. **Photograph 5** shows the components of this crankshaft and **photo 6** shows the crankshaft assembled. As for the V-four crankshaft, no flywheel is required.

As with all the other multi-cylinder engines, this engine uses mirror ports, but it has only one type of cylinder. After I had finished the other series I asked myself why I had not used just one cylinder port layout in the V-engines but I could not remember if indeed there was a valid reason! In the case of the Boxer I have made just one cylinder layout and the port face layouts are designed with the port face holes inside the cylinder holes in one set, and in the other set, the port face holes are outside the cylinder holes. **Photograph 7** shows the common cylinder with the two types of port faces.

Apart from the four-lobe crankshaft, the engine uses the same features as the V-four. Overall, this engine is simpler than the V-four, especially the backplate. Owing to the horizontal layout, the port layouts are symmetrical about a horizontal line so the port face locating pins can be on this horizontal line and we do not need a heads and tails mounting scheme as was used in the V-four.

The Boxer engine is shown in **photo 8** and a complete set of drawings is given in **figs 2** to **6**. Some care is necessary in mounting the lobes on the straight-line shaft and I have shown the sequence in the drawings.

The curious 'spring' arrangement to hold each cylinder against the port face consists of two neoprene O-rings which are sandwiched between steel washers. I introduced this arrangement early on in the first series because I had no source of small springs. The system works well, at least with compressed air, and I have continued with these O-rings ever since.

This is a powerful little engine so take care when operating it. Keep your fingers well away from the working parts! The main dimensions of this engine are as follows:

Bore: 13mm
Stroke: 14mm
Distance pivot to crankshaft centre: 42mm
Angle turned through by cylinders: 19.2deg.

●*To be continued.*

LETTERS TO A GRANDSON

M. J. H. Ellis

reflects on the operation of an injector and calculates some interesting results using the once common 'fps' system of units.

●*Part LI continued from page 563 (M.E. 4195, 16 May 2003)*

Dear Adrian, I am going to begin with the 'further observations' on the subject of the injector which I foreshadowed in my last letter. I have the greatest admiration for Sir Isaac Newton, one of the most illustrious scientists who ever lived. In particular, I want to draw your attention to his perspicacity in differentiating between momentum and kinetic energy.

You may well be clear on the point already, but in case you are not, the deficiency cannot be rectified too quickly. Momentum is a vector quantity, represented by the product (Mv) where M is the mass of a body and v is its velocity. Depending on its direction, v can be either positive or negative, and so can momentum. On the other hand, kinetic energy is a scalar quantity, defined as ($^1/_2$ Mv^2), and as there is no such thing as negative energy it is bound to be positive, since $(+v)^2$ and $(-v)^2$ are alike positive. Newton's law of impact states than when two bodies collide, momentum is conserved, that is to say, the algebraic sum of the momentum of the two bodies is equal before and after the collision takes place.

If momentum is conserved when impact takes place, kinetic energy cannot be, apart from the special case of bodies which are perfectly elastic. In every other case, part of the kinetic energy is converted into heat. What is conserved in this case is the total energy, so that what was lost in the way of kinetic energy is made up precisely by the increase in heat energy. When wooden piles were driven by a pile-driver, it was not unknown for so much heat to be produced that the head of the pile actually caught fire. The rate of exchange is exact, 778 foot-pounds being the equivalent ('Joule's equivalent') of one BTU (one 'British Thermal Unit' being the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit).

There is a snare for the unwary in calculations relating to kinetic energy, and when acceleration is concerned. Practical engineers such as James Watt worked happily and reasonably in terms of foot-pounds, the amount of energy expended in raising one pound weight one foot against gravity. It was the obvious unit to use, when the work of the early steam engines was raising water from a mine. But foot-pounds are less appropriate where the business is not raising a weight, but imparting an acceleration to a body, so endowing it with kinetic energy.

In such matters it is customary to deal in another energy currency, the foot-poundal; the Poundal being defined as the force which, applied to a mass of one pound imparts to it an acceleration of one foot per second per second (ft./sec.^{2}). Since the body's own weight would impart an acceleration of g (32ft./sec.^{2}) it follows that a Poundal is equal to $^1/_{32}$ pounds weight, or $^1/_2$ an ounce weight.

This line of thought has caused me to reflect on an interesting point in connection with the injector, which I have never seen mentioned in any textbook, and inspires the vain-glorious thought that in his humble way Grandpa may even have thought of something which the pundits have missed. The point is this: we know that impact occurs in the combining cone of the injector between the high-speed steam jet and the feed-water. Therefore, part of the kinetic energy of the steam must be converted into heat, which is not wasted, but goes to heat the feed-water. The point is, how much? Well, here is my calculation, and you will be surprised by how much it is.

Using the figures from my last letter and considering arbitrarily 1lb. of steam, the kinetic energy before and after is:

Before impact:
Steam 1lb.; velocity: 2263ft/sec.
Kinetic energy = $^1/_2$ x 1 x 2263^2
= 5121169 / 2,
= 2560584 foot poundals
Water: 9lb.; velocity: 6ft./sec.
Kinetic energy, $^1/_2$ x 9 x 6^2
= 162 foot poundals.
Total kinetic energy before impact
= 2560584 + 162
= 2560746 foot poundals

After impact:
Feed water: 10lb.; velocity: 231.7 ft./sec.
Kinetic energy = $^1/_2$ x 10 x 231.7^2
= 5 x 53685
= 248424 foot poundals.

It follows that of the original 2560746 foot poundals only 248424 remained to force the water into the boiler, and this amounted to 248424 / (2560746) x 100 = 9.7%.

The remainder, 2312322 foot poundals, equivalent to 231232 / (32 x 778) = 93 BTU, is converted into heat, whereby the 10lb. of feed water has its temperature raised by 9.3deg. F.

The heat equivalent of the 248424 foot poundals used in forcing the feed-water into the boiler is 248424 / (32 x 778) = 10.0 BTU.

In point of fact, however, since a cubic foot of water weighs 62.5lb., 10lb. of feed-water would occupy 10 / (62.5) = 0.16ft.^{3}, and this is equal to the volume of water in a pipe with a cross-sectional area of 1in.^{2}, 23ft. long.

The pressure in the combining cone falls well below that of the atmosphere, so let it be assumed that the water-jet has to work against a pressure of 100lb./in.^{2} absolute. Then the work actually performed in getting the water into the boiler is therefore only 23 x 100 = 2300ft.lb., of which the heat equivalent is 2300 / (778) = 3.0BTU, and the rest of the energy of the water jet will eventually degenerate into heat by way of turbulence in the boiler.

To sum up, we start off with a pound of steam, endowed with 1182BTU relative to water at 32deg.F.; this gives rise to a steam jet with kinetic energy equivalent to 2560584 / (32 x 778) = 103BTU; the water-jet in the injector is worth 10BTU, but this was in excess of the actual requirement of 3BTU. It all sounds very much like 'The Rake's Progress', but happily, in this case practically all the rest of the heat energy merely left the boiler through one hole and returned by another.

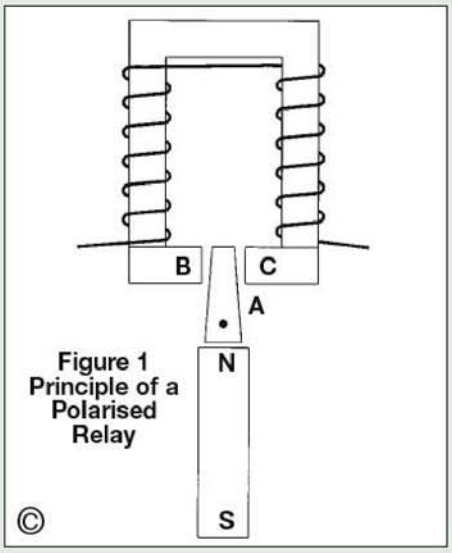


Figure 1 Principle of a Polarised Relay

It's been pretty heavy going so far, so I'll lighten the tone by saying that this reminds me of Alexander Pope's (1688-1744) *Dunciad* in which he delineates unkindly various characters whom it is not difficult to identify with some of his acquaintances. One couplet so tickled my fancy that it has stuck in my mind for at least 60 years. Describing one very portly character, Pope concludes with: *"And yet of all this bulk, not a jot wasted goes, for every ounce that is not fool is rogue!".*

Polarised relay

Reverting to telegraphy, you are quite right in pointing out that I never explained how one relay can be polarised while another is not. It is quite simple. The electro-magnet of a non-polarised relay attracts a soft-iron armature equally well, whatever the polarity of the electro-magnet.

The armature of the polarised relay is also made of soft iron, but in this case it is endowed with a polarity of its own by magnetic induction from a nearby permanent magnet. The principle is shown in my sketch (**fig 1**). The pivoted armature A, magnetised by the permanent magnet N-S, in its state of rest is in unstable equilibrium between the poles of the electro-magnet B and C.

When the electro-magnet is energised, either B becomes a north pole and C a south pole, or *vice versa*, depending on the direction of the current. Consequently, armature A is attracted to one side or the other. Because the armature is itself magnetised, in general a polarised relay is more sensitive than one which is un-polarised. In actual practice, while the same principle was used, the Post Office polarised relay had two armatures on a single vertical arbor, and two vertical electro-magnets, which could work differentially.

Correction

The height of a column of water which produces a pressure of 85lb./in.^{2} at its base is 195.5ft. as correctly indicated in my last letter. The two subsequent references to 199.5ft. are incorrect and should have been 195.5ft. My apologies for any consternation which this may have caused.

Your affectionate Grandpa.

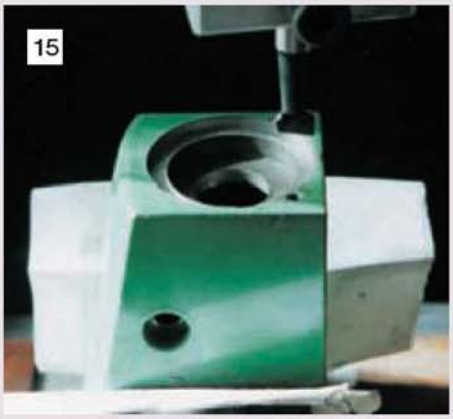
●*To be continued.*

FINE TUNING A WARCO BH600G LATHE

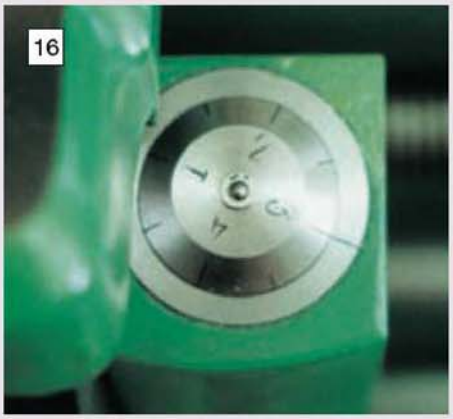
Anthony Mount

continues his account of the modifications made to his Warco lathe, starting here with the thread dial indicator.

●*Part IV continued from page 552 (M.E. 4195, 16 May 2003)*



Counterboring the thread dial indicator body for a ring with a new index mark engraved on it.



After re-assembly, the modified thread dial indicator is neater and easier to read.

The thread dial indicator looked quite okay upon first inspection, but a closer look revealed a couple of oddities. The fit between the spindle and bearings was sloppy, and the marker for dropping in the clasp nut was a rivet painted red. It all seemed a bit crude. I took the whole thing apart, and set up the body casting in the machine vice on the vertical mill, using thin card to protect the painted sides. The bore was aligned such that it was concentric with the spindle. This was done by dropping a drill the size of the bearing bore down inside the body. The body was then bored out to take sintered bronze bearings.

The counterbore at the top was enlarged to 40mm diameter by 3mm deep (**photo 15**). The bore below was enlarged, as it was not concentric with the bearings. It does not matter that it is oversize as it does not need to act as an additional bearing. The rivet was filed flush and the top repainted.

A 40mm dia. ring was turned to a push fit into the counterbore, and bored out to clear the spindle top. While it was still in the chuck a radial line was cut about 0.005in. deep with a V-tool.

The graduated dials all have nicely engraved lines and figures black filled against a satin chrome background. The thread dial indicator is the same except that the figures and lines seem to have been punched in, which has raised the material around them, and the lines were not black filled.

The dial was chucked in the lathe and, running at moderate speed, the lines and figures were dressed down with a fine file. This improved the appearance but removed the satin finish and revealed the copper plating below. I think it looks quite nice in copper finish but if it is not to your taste continue until you reach the cast iron base material. The figure and lines can be filled with black wax.

While you have the spindle set up in the lathe you can centre the top and drill down with a 3mm drill to the level of the bottom bearing. Two holes can be cross-drilled to the central hole to align with the bearings. Now you can oil the spindle from the top of the dial. To avoid ingress of swarf the top can be counterbored and a little oiler pressed in.

Press in the new bearings, and re-assemble the unit. Clamp back onto the saddle and engage with the lead screw. Incidentally, a little cheating has gone on with the gear. It is straight cut and not angled to suit the angle of the thread on the lead screw. To overcome this, the gear has been kept up and only touches the lead screw with the bottom of the teeth.

The ring can now be placed in its groove and twisted around until it lines up with one of the marker lines. This can be any position that suits you (**photo 16**). However if you want it in a vertical position, the whole unit will have to be packed out from the saddle until it coincides with a suitable position on the lead screw. Once you are satisfied with the position of the ring it can be fixed in place with Loctite. A possible alternative, giving the opportunity of moving the ring at a later date, is to use double-sided adhesive tape.

One point concerning the lever which operates the clasp nuts needs to be mentioned. This has a spring-loaded detent for the open and closed position. I found on my lathe that in the closed position the lever needed to be moved past the detent position to fully close the nuts. I also found that when screw cutting left hand metric threads, where the nuts have to be continuously engaged and the motor reversed to run the saddle back, the reversing operation partly opened the clasp nuts.

A closer look revealed that a spring-loaded ball in the cone boss of the handle engaged with detents in the apron. The handle was removed and the spring, ball and screw behind the detent removed. With the handle back in position it was clear to see that one of the dimples in the apron had been drilled out of position.

The hole through the handle was 7mm diameter, so a drill this size was used with a hand brace to re-drill the dimple. Going to the full diameter of the drill I was able to almost lose the wrong dimple. With everything reassembled, all seemed to work okay. If the dimple had been too far out, I would have drilled the hole in the handle to a larger size and used a bigger ball, spring and screw. As it was I used a 1/4in. dia. ball instead of the original 6mm.

Inside the end cover

On opening the end cover the change wheels are revealed. The largest is a 127 tooth wheel which gives exact conversion for metric screw cutting. The 8tpi lead screw is imperial. On a dual machine it is easier to convert from imperial to metric. Nearly all the common imperial and metric threads can be cut, but when cutting metric threads the half nuts cannot be opened or the thread dial indicator used.

Incidentally, there have been many articles giving change gear ratios for cutting all sorts of odd threads, but all have related to plain change wheel lathes, never to lathes with a quick change gearbox. Is there anybody out there who could submit an article on using additional change wheels on a quick change gearbox machine?

The change wheels are 1.25 module, but the gear on the lathe spindle, the tumbler reverse and wheel below it are 1.5 module. Gears can be a bit noisy so I replaced the tumbler reverse gears with Nylon ones (**photo 17**). This helps to dampen the natural resonance of the gears. Myford use Tufnol tumbler gears. At the time of writing, Nylon and Tufnol 25 and 30 tooth 1.5 module gears are available from HPC Gears (tel: 01246-268080). They needed to be bored out from 8 to 16mm and reduced in thickness by 2mm. To maintain concentricity, I used soft jaws in my chuck which I bored out to suit the gears.

I noticed that the large 120/127 gear was not exactly aligned with the gears above and below it. To line them up I put a 3mm thick spacer washer between the back of the gear and the quadrant.

If you should want additional or replacement steel change gears with a boss to match the existing, these too can be supplied by HPC who will bore them out to your requirements and cut the keyway.

Chucks

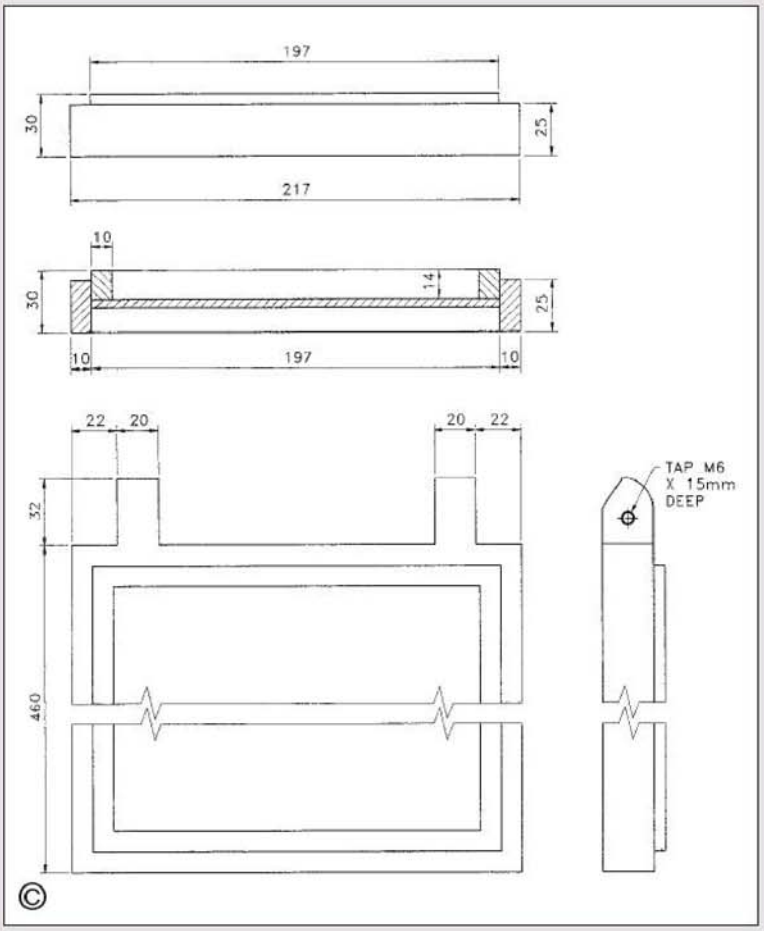
The lathe is supplied with a 150mm dia. 3-jaw self-centring chuck and a 200mm dia. 4-jaw independent chuck which seem huge in relation to the 100mm chucks I use on the Myford. For the type of work I usually do, smaller chucks are more sensible, and if possible I would add a 125mm, 4-jaw independent, a 125mm, 4-jaw self-centring and a 125mm 3-jaw self-centring chuck. These would provide a nice capacity balance for this size of lathe.

The chuck jaws in the 150mm self-centring chuck were numbered, but not their positions on the chuck body so, before removing the jaws stamp the numbers neatly on the chuck body.

One thing I do to all my chuck keys is to add file handles to the cross bar. I find that chuck keys, whatever the make, all have thin handles which press hard into the hand during use. With a lot of chuck work one's hands can soon get sore or even bruised. This is not caused by trying to over-tighten the chuck but just through working with the thin handles. Being even more alarmist, in the area leading from the wrist to the palm of the hand there is a tunnel that carries the nerves from the wrist into the hand. If this is damaged you can end up with permanent pins and needles in the fingers; even pain. My chimney sweep suffered this

Nylon tumbler reverse gears were fitted to give quieter running compared to the standard items.

The new headstock belt cover was fabricated from aluminium alloy and is much lighter to lift than the standard cast iron one.



problem through pushing the poles up chimneys all day; only an operation stopped the pain.

By fitting a file handle on both sides of the cross bar, the diameter is greatly increased and the handle now sits comfortably in the hand with a much greater area for the hand to push against. Polish the handles to keep them clean and pleasant to use.

The lathe also has a plastic chuck guard that fixes to an arm behind the chuck and incorporates a micro-switch. Lift the guard and the motor stops. I found the guard too small in diameter to fit over the 150mm chuck, let alone the 200mm chuck. The plastic can be spread about 50mm without breaking. So a piece of wood was used with two notches cut in it that spread the guard to the required diameter. A couple of clamps can be used, at each end, and the bars also clamped when the guard is spread to the right diameter. The whole lot was then placed in boiling water to take a 'set' to the new diameter. I left it immersed until the water went cold, took it out to see if it was right and repeated as required to achieve the required arc. A series of wider notches could have been used if necessary.

While playing with the chuck guard, it struck me that with its support arm in its original position it would not be possible to take full advantage of the gap as the work would foul the arm. The end of the arm carries a micro-switch which stops the lathe when the chuck guard is raised. After a few measurements, a way was devised to remove the arm but leave the micro-switch box in situ.

The first job is to electrically isolate the lathe; i.e. pull out the plug! Then remove the arm and box. Make a note of which wire goes on which terminal. Undo the screw holding the spring on the end of the arm, another job where care is needed as the spring is very strong and the screw can fly off. Remove the nut and grub screw on the outside of the case and the arm can be removed from the box. Undo the other screw and the end cap comes off. The arm can now be cut in half so that only 20mm will protrude from the box. Face off the cut end of the piece of bar that goes in the switch box, centre and drill through 10mm diameter. Then cross drill and tap M5 at 4 and 11mm from the machined end.

Now chuck the longer piece of bar, face off the cut end and drill 10mm diameter for a depth of 25mm. Make up a 45mm length of 10mm dia. mild steel rod; face and chamfer both ends. Along the bar, mill a flat about 6mm wide for a length of 20mm. This end goes in the bar in the box and is held in place by two M5 grub screws. The other end is fixed with Loctite into the longer piece of bar. Be doubly careful to remove any surplus Loctite as it is all too easy to try the arm in the other piece of bar and not to be able to get it out again.

Re-assemble the whole unit, and check that all is working correctly. Now in the event of a large diameter job, all that is necessary is to undo two screws and the arm and guard can be removed in one piece.

The lathe spindle has no lock, so removing chucks requires caution. The spindle can be locked by engaging the back gear without previously pulling the release pin in the bull wheel. However, this invites the possibility of broken gear teeth. I have always removed stuck chucks by engaging back gear normally and clamping a long square section bar in the chuck with the bar overhanging the rear of the lathe. A stout piece of wood is placed between the bar and the drip tray. The V-belt is pulled round by hand backwards so that the bar strikes the wood. This has always removed my stuck chucks.

A simple thing to make to protect the lathe bed when removing chucks, or sawing through a piece of metal held in the chuck, is a wooden board with legs either side that can be dropped over the lathe bed providing good protection. 18mm thick plywood makes a good substantial board.

Headstock cover (part no. 15)

The headstock cover is made from cast iron and weighs 'a ton'. I got fed up with lifting the weight, but I suppose it strengthens the left arm muscles. To ease the burden, I thought of making a wooden pattern of the cover and having it cast in aluminium alloy. But on second thoughts I fabricated the cover from aluminium alloy plate and bar. It saved two 100-mile round trips to the foundry and very little cleaning up was required. I took the opportunity to deepen the top recess and laid in a piece of black rubber sheet. A car mat is a good source of supply for the rubber. Now I can put micrometer/vernier and keys there without damaging the paint or having the tools rattle.

Construction was quite straightforward. I machined the ends of the long 25 x 10mm bars square and fitted the short ones between. They were screwed together with M4 cap head screws counterbored below the surface. All the holes were filled with car body filler, and when the cover was painted could not be seen.

The ears were also screwed on with cap head screws, after shaping. The external frame was placed in position on the lathe and a drill passed through the pivot holes to mark the position of the tapped holes in the ears. Only a scratch mark is needed, it can be deepened with a centre punch. Remove the ears from the frame and drill and tap M8. Cut the thinner bars to fit inside the main frame and this time use 6BA ▶

cheese head screws for fixing into counterbored holes. Again the holes are filled and rubbed down flush for painting.

The bits made so far can now be assembled permanently. You could use an epoxy resin adhesive such as Araldite, but I used car body filler, as it seems to stick well to metal.

Cut the 4mm plate to fit inside the frame and fix with 6BA countersunk screws. Finish the countersinks to allow for the screws to be just below to surface. Ideally, use a countersink that is only the diameter of the screw. Then the size of the hole to be filled will be smaller.

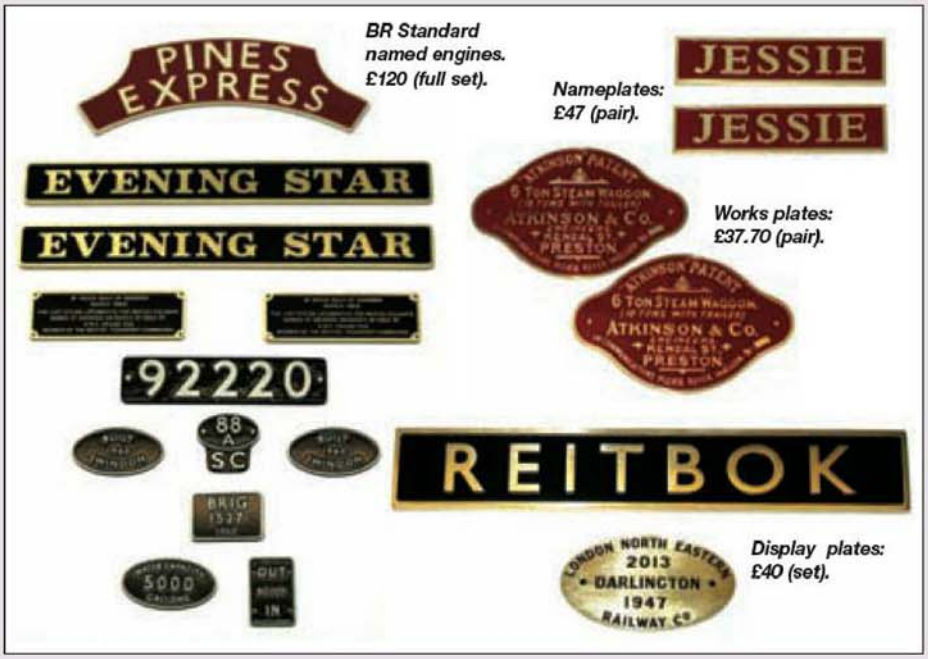
Try in position and check that all clears nicely, and that the weight of the cover is sufficient to operate the micro switch. It worked okay in my case. On fitting the cover you may find that the back edge fouls the tops of the pivot brackets. If your existing cover is like mine you will see that the back edge is cut back about 3mm left and right of the ears to give clearance. Instead of doing the same on the new cover I rounded off the ends of the brackets until they cleared the back edge of the cover. I also aim to screw on an angled piece of aluminium alloy with a recess machined in the front. The recess will hold a calculator, handy for all those little workshop calculations needed from time to time. Paint for the new cover came from Warco who hold it in stock. The completed cover is shown in **photo 18**.

If you are going to be changing speed often, removing any tools there to lift the cover will become a chore. A wooden tray can be made up with a rebate all round the base that will drop into the recess in the cover. Now all instruments can be removed from the top of the lathe in one movement by lifting the tray out. The block to take the calculator can now be in wood and fixed to the tray. Give the wooden tray a couple of coats of sanding sealer and a wax polish to keep it clean and looking nice.

●*To be continued.*

TRADE TOPICS

NAMEPLATES
from DIANE CARNEY



Now in our tenth year, we started production in September 1993 after taking over the business - very much a cottage industry - from Alan Gettings who was reasonably well known as one of the country's few suppliers of replica nameplates for model engineers.

We expanded the business somewhat by increasing advertising and attending trade shows, a move which we believe has done as much as any to establish us within the model engineering fraternity. While we are always available to chat on the 'phone, it is good to put a face to a name — we try to ensure that we are approachable, and provide a friendly and helpful service. Very often a customer may not know for certain the details of, for example, the works number or the allocation of his particular locomotive. Our hope is that he will feel he can place his order safe in the knowledge that the plates we produce will be correct. We certainly try — and almost always get it right!

On the whole, model engineers are people who appreciate quality, and one of the best parts of our job is receiving many letters from customers from around the world who have made extremely kind remarks about our work. However, it is fair to say that over the years we have, to say the least, struggled at times. This has invariably been due to variations in the quality of etchant and photo resist. We have put a lot of time into sourcing reliable products and we feel that we have now 'cracked it'. The chemicals have been consistently good for some time and we are now achieving very high quality, deep etchings. I think we have always had a name for reasonable depth of etch but it really is deep, sharp and clean now.

The etching process, of course, is only half the battle. Some time ago we made a substantial investment in computer equipment which has allowed us to put a large amount of artwork into digital form. This, however, is something of a double edged sword! It takes an immense amount of time to accurately transfer the hand-drawn artwork with all the associated alphabets onto the screen (and yes, all the alphabets *are* still hand drawn, just as they were drawn in ink) so we started with the most popular designs and during every batch of artwork we find we are adding more and more of the increasingly obscure designs. Ultimately (but it'll be a while yet!) this will save a lot of time as the previous processes of drawing artwork, photographing it, developing the film then printing it will become a simple matter of digitally printing from the computer. We do still have the old methods to hand, of course. However, the improvements in the quality of the artwork are very noticeable but the time and investment, naturally, has to be taken into consideration when pricing a job.

At the other end of the process, however, little has changed and it is here in the workshop that the care taken throughout the physical cutting out of the plates, the hand filing, scrubbing clean, painting, removing of the paint and ultimately the polishing that makes our plates what they are. The bandsaw and Linisher are the only power tools used. Tins of elbow grease are stacked high.

We firmly believe that our product is unique. The combination of well researched, hand drawn artwork, improved direct film output (for the technically interested we now output the majority of film using an image setter), a consistently good supply of chemicals, and old-fashioned hard work at the bench, make for good quality, accurate, deep-etched nameplates and, if you don't mind our saying so, we are proud of what we do.

It is still a cottage industry and we don't really see it changing much. While technology has its place, there is simply no alternative to manufacturing the plates by hand. Most of our customers do appreciate that the prices have to reflect this fact. We also ask customers to bear in mind that the plates are made in batches and to place their order in plenty of time.

We don't produce a catalogue simply because, creating all artwork in-house as we do, we have the means to etch *any* plate for *any* locomotive, or anything else for that matter! The list would be literally endless. This brings us back to the beginning: do call us any time for service with a smile!

Please address all enquiries to **Diane Carney Nameplates, 175 Glenbuck Avenue, Glasgow G33 1DT; tel: 0141-557-1948; e-mail loco.nameplates@ntlworld.com**

KEITH'S COLUMN

LOGGER & SLOGGER
AMERICAN TYPE 2-8-2 LOCOMOTIVES
for 5in. and 7¼in. gauges

Keith Wilson
deals with cylinder lubrication and brake gear components.

●*Part XVIII continued from page 567 (M.E. 4195, 16 May 2003)*

Oil lubrication in steam cylinders is of the utmost importance, unless you only want to look at your locomotive rather than operate it. There are two main types: displacement and mechanical. Now I have only one argument against the former; it is the fact that when empty it perforce takes more time to replenish than the plain mechanical. However, a friend of mine (one Larry Barker) has shown me that the best aspects of both can be combined; that is, an adjustable sight-feed device can be fed from a pump. It is merely necessary to fit an automatic control valve to the pump outlet set to a bit above working pressure, feeding back into the oil tank of the pump. It follows that while the locomotive is in motion, a supply of oil is instantly available at just above working pressure. If this be fed into the control valve at the bottom of the sight-feed in the cab … need I say (or write) more?

The finest mechanical lubricator that has come to my attention is the design of the late Jim Ewins. I have built a few, and they are not only easier to make than the oscillating cylinder type, but seem to be more effective; they work beautifully. I can, however, see a possible improvement, but I haven't yet tried it. Those who do not like the look of that little yoke (although it's not hard to make) might try a little flat disk on top of the ram and a light spring to raise the pump plunger.

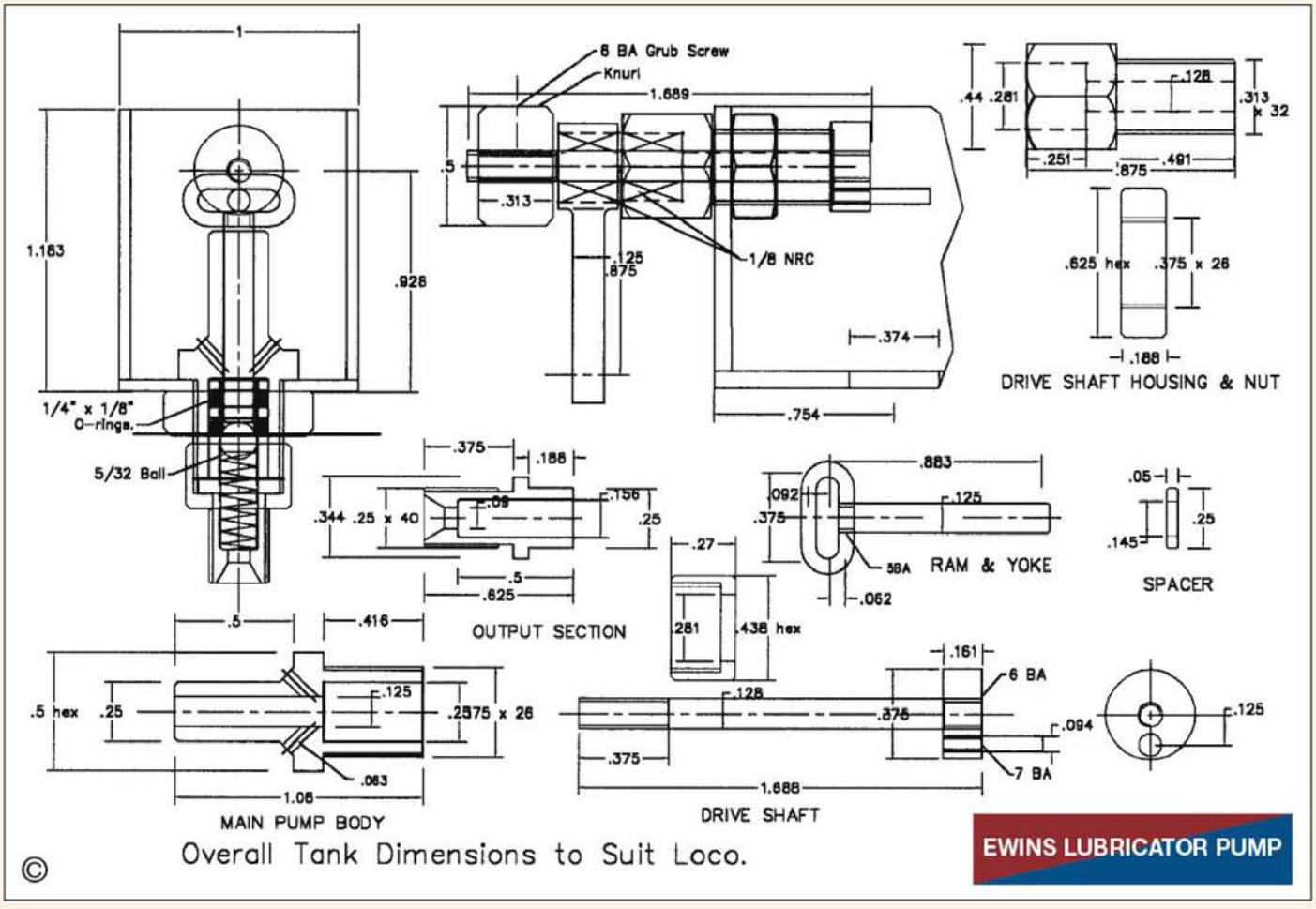
Wilson's Words of Wisdom:
The greatest journey begins with but a single step.

The working is absurdly simple, which is probably why no one noticed it before Jim. In the down position, the pump ram, which should be radiused a tiny bit and polished, just reaches through the lower O-ring seal. In the upper position, it must clear the top O-ring comfortably. On the way up, as soon as this happens, it will leave a near vacuum into which the oil will rapidly flow. Note, incidentally, the spring-loaded ball-valve below the bottom O-ring.

As the ram is forced down, some oil will be returned to the tank, but directly the ram hits the top O-ring it will seal and therefore a ram-diameter, spacer-length slug of oil will be forced through into the feed pipe.

Now virtually the only near perfect seal is a soft one that will easily distort, the slightest bit of grit or whatever can get into the wrong place with an 'all-hard' seal and in the case of lubricators, where the steam can 'fight back' so to speak, or vacuum brake systems where air-pressure can ditto, the soft seal is ideal. Bethink you; a car tyre valve, which is a soft seal, can keep pressure held in for years.

It matters not if the ram, at its lowest position, ▶



Ewins lubricator pump in situ.

Component parts of Ewins lubricator pump.

touches the ball at the bottom of the column. If it does, then the seal is not broken; its position is modified very slightly.

I have shewn the use of small non-return clutches rather than the double-pawl-and-ratchet type; it is a matter of personal choice. The clutches are not fantastically cheap, but are at least as good as the pawl-and-ratchet system. A minor problem concerns the fact that silver-steel is no longer obtainable (as far as I can find out) in twist-drill sizes. These clutches will work on 1/8in. silver-steel (with some backlash) but prefer 0.129in. instead of the 0.125in. of the 1/8in. size. However, some model shops sell 10 gauge steel wire, and 10 gauge is 0.128 inch. It is already hard, but can be heated to bright red and quenched to get maximum hardness, brittleness not being too much of a problem. As sold, it is easily machined, but take care. Use a very sharp tool, not too high a speed, and some 'juice'.

(At the time of writing, needle roller clutches are available from Arc Euro Trade for £4.75 each plus post and packing, tel: 0116-269-5693; e-mail: arceurotrade@btopenworld.com — Ed.)

A very good 'juice' for machining small items, especially threading and tapping, is good-old WD40. A quick spray aids wonderfully in cooling and lubrication.

If this lubricator is used 'plain' i.e. not combined with sight-feed, then the amount of oil fed will depend on the dimensions of the spacer between the two O-rings; this gives a good way of adjusting oil flow. A ring of oil appearing round the smoke stack is a good sign that all is well 'down below'. Better a little too much than much too little!

The actual making of these is mostly plain lathework. No need for super precision, although of course it's best not to be too far out! The bore of the pump body is best reamed. The gnurled gnob (knurled knob?) is easily done if the knurling is done before parting off from the stock material; 'twould be most difficult doing it afterwards! This ker-nobb is for hand priming and when a bit of extra might be needed.

The tank can be silver-brazed up or soft-soldered, preferably the former, from any scrap bits of brass or steel, 20 gauge (0.036in.) is quite strong enough although 18g (0.048in.) is equally suitable. Just about the ideal drive source is the valve rod which provides about the right amount of travel. An adjustable drive could be employed, but is hardly worth the trouble as the amount of oil delivered is easily adjustable as mentioned above by altering the size of the spacer.

When assembling the drive lever, make sure it goes on the correct way round or everything will lock solid; reversing the drive lever can easily rectify this. Do not omit the locking grub-screw in the hand-knob, or sure as fate it will unscrew. On the other hand, do not over-tighten or it might snap the drive shaft; recollect that it is dead hard and therefore brittle.

Don't break it!

The provision of power brakes is a must in 7 1/4in. gauge, most especially if to be used for passenger hauling, or indeed on the same track that is in use for passengers.

There was a time when dear old Curly did not bother too much about such matters, but of course he built and operated 2 1/2 and 3 1/2in. gauge locomotives exclusively, and even with full loads these sizes are well within the braking capabilities of a simple hand brake on the leading or driving truck. Five inches just about fits within this range, but with 7 1/4in. gauge the weight of the train is tons rather than hundredweights, and even with trails of smoke coming from the driver's shoes (Oh yes it can!) stopping is not to be taken lightly.

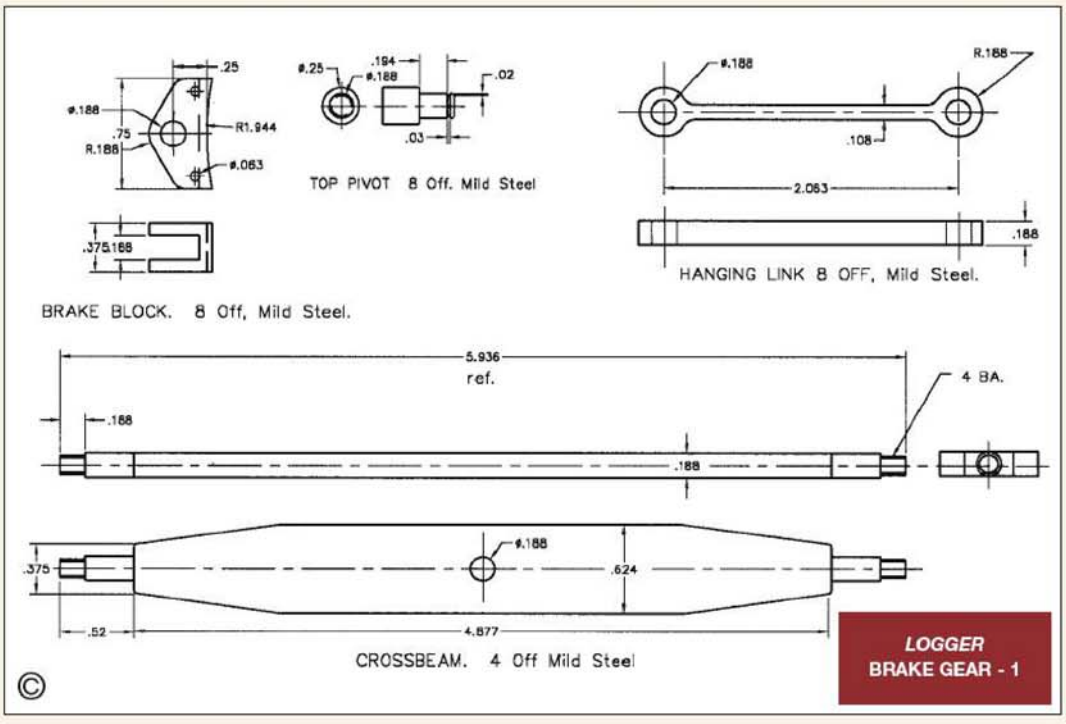
No matter how careful the driver, and how low the speed limit (absurdly so in some cases) emergencies can arise. I have known what it is to hear shouts of Stop! and looked back to see all the train on the rails, but one of the carriages completely empty and what is worse, no sign of the passengers from it at all! They had all lent over at the same moment — it happens — and with a little bit of backlash on the suspension the carriage had decanted all of them and returned to the upright position. Unfortunately, the side chosen had a sheer drop a few feet from the rails, and all had found this out the hard way! Admittedly, in this case brakes would have had no effect, but strange things can, do, and will happen.

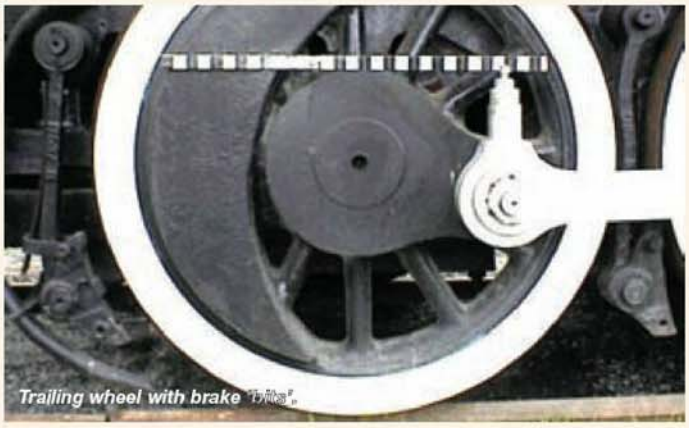
Now never have I driven or built an air-brake system, but I see no great problems. The brake gear and rigging will be the same as for vacuum systems, and we will need a donkey-pump for air anyway, let alone for the sake of appearance. But for the time being, let us deal with parts of the brake rigging.

The Suspension Links (hardly levers!) are quite slim, but since they have nothing to do apart from preventing the blocks and crossbeams dragging along the track, this is quite acceptable. Alas, there are no signs of any details on the drawings, but I can get some ideas from the numerous photographs.

The Top Pins need no machining guidance. They can be bonded into the frame brackets, or pinned in with a 1/8in. taper pin, or a ditto-size Seloc pin (Grover lock).

The Hanging Links are a bit thin so care will be needed in machining. Life will be easier if pairs are made in one long piece. They are best made from





Trailing wheel with brake fitted.

Pedestal drill foot switch.

1/2 x 1/4in. mild steel. Begin with the holes at each end; machining the first side is easy, then turn over and rest on two packing pieces of steel 3/16in. square where the cut-away parts need supporting. Round off the ends with file or Linisher.

Some minor notes on these bits might be useful. If the bore of your lathe headstock is not large enough to accept the brake crossbeams, then machining the ends can produce problems. It might be possible to use a small centre-drill in the end and then use a revolting steady, but there is not too much support in such a small piece and care will be needed. There are two obvious alternatives. One is to leave a bigger bit on the end, cutting this away after the turning to size is done, threading by hand. The other way is to machine up separate end-pieces from about 7/16in. dia. (3/8in. dia.) and slotting the 'inner' end; silver-brazing them to the 'plain' crossbeam.

Another hint refers to the top pin. I have shown them suitable for e-clips (circlips); it depends on what you choose, for the originals seem to have a: nothing, and b: washer and split cotter. Alternatively, thread the outer ends and use nuts. Once more, the choice is yours.

The Blocks can be made in two different ways. One is to get a flame-profiled ring of steel and to machine it clamped to the faceplate, the other is to do it in two 5in. long strips. The radius to more or less match the wheel is done with a fly-cutter (it doesn't take as long as you might think) then to turn the downside-up and cut the slot along the back with slitting saw if available, if not use a 1/4in. slot-drill. In theory, the radius should be set to about 3deg. to match the wheel taper. It does not matter much from a practical point.

The photograph of the right-hand rear driving wheel shows the bits described except for the crossbeam. Note that the main driving wheel looks like it has a flange, this is due to the rust on the tread and the precise position of the camera. Note also that there is a long springy strip mounted on the rearmost hanging link; it passes through a little steel loop and keeps the block from dragging on the wheel when the brakes are not applied.

Putting your foot down

A useful gadget that I may have mentioned some years ago came from a club bring-and-buy sale when I picked up a foot-operated switch, a simple treadle. It is connected across the starting contactor of the pillar drill, and while the treadle is pressed down, the drill revolves. On release (you'll never guess!) it stops. Very handy; also a good safety measure.

Some years ago, Myfords used to supply a two-speed motor for the standard lathes. I developed my own system of switchgear for this, based on a left-right mounted toggle switch, and a main vertically mounted 3-position toggle switch. There was a minor trouble with this system, for the contactors were of the make-before break contact type. Therefore, for a tiny fraction of a second there was a short-circuit when changing speeds or starting in reverse.

The 'horizontal' switch controlled (and still does) the motor speed, while the vertical or three-way one controls direction: up for reverse, horizontal for off, down for forward (normal) running.

The result of the momentary short resulted eventually in little clouds of smoke where contacts had recently been, but never a blown fuse. After some years the motor packed up and was replaced by a single-speed one. I tried to get the motor re-wound by a local firm, but they didn't want to know.

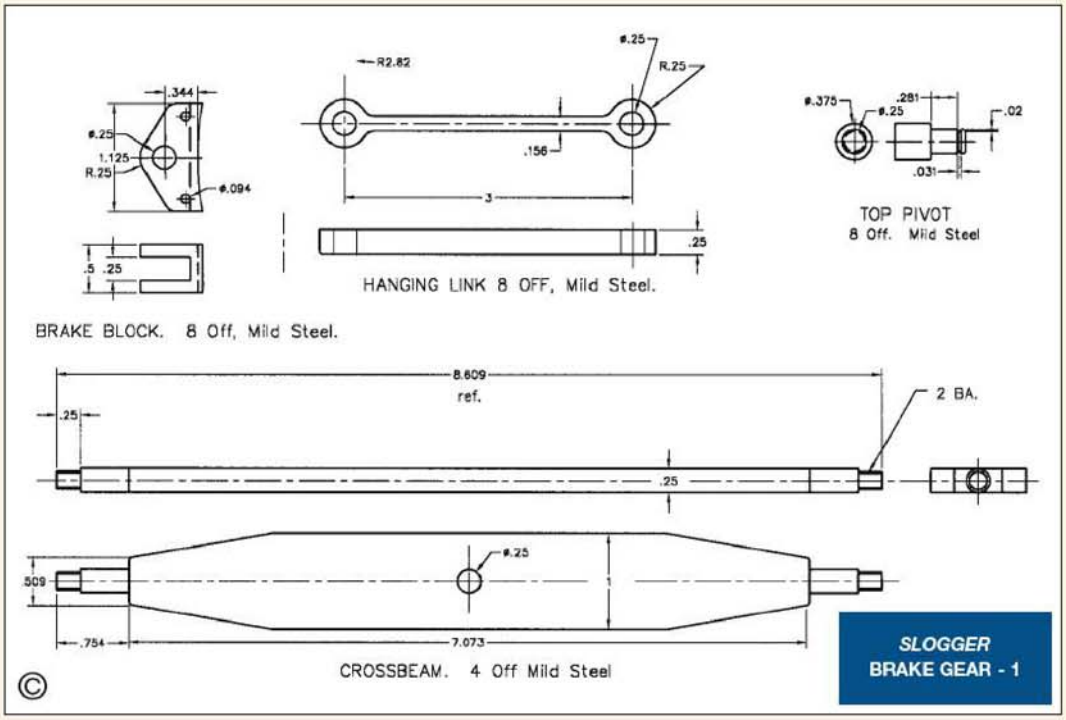
I tried Myfords again, and was informed that they no longer stocked this motor; however, they did have a hairy old one still in stock which they would sell me after testing but only on the clear understanding that it had no guarantee; a not unreasonable condition. I accepted, but found that my system of contactors needed revision. Each contactor had 4 make and 4 break contact sets. One took care of speed control, t'other reversed rotation. Incidentally, the normal single-phase motor has an automatic switch, which isolates the starting coils once the motor is running; hence reversal at speed is impossible.

I worked out that with another 'master' contactor, same specification, the short-circuit problem could be completely eliminated. On operation the starter switch in either direction, the 'master' contactor, which isolates the whole system, can only close when both the other contactors are at rest. The changing of speed does not produce a main short-circuit, but only produces one across the running coils of the motor for about 0.001sec., this is quite undetectable and the same motor and contactors still give perfect service.

But why a two-speed motor? Well, there are two advantages. The first is when making small parts (boiler fittings, lubricator bits and the like) the top speed of about 1800 revs is very useful, but if they need a thread then snapping over the speed switch and hoicking down the right-hand tri-lever lever then speed is perfect for threading. When tap or die is home, reversing to back off or out takes about 2 seconds. Incidentally, especially with small taps, I use the tri-lever lever as a clutch. Saves taps!

The second advantage is that for high speed, two sets of running coils are connected in parallel, giving twice the horsepower. Thus with carbide tipped tools, more 'oomph' is available when needed.

●*To be continued.*



Andrew Mawson discussed workshops and suitable working environments.

David Taylor talked about different types and sizes of popular and common models.

Mike Hall demonstrated some of the models brought to accompany David Taylor's talk.

THE SMEE MODEL ENGINEERING COURSE

Basic Training for Newcomers to Model Engineering

Identifying a distinct need for the training of model engineers, the Society of Model and Experimental Engineers has introduced a beginner's basic training course in the subject. Neophyte model engineer and SMEE member Mitch Barnes describes the first session and explains why he was among the first to sign up.

I've always loved the look of engineering models; I found the aesthetics of some models to be really inspiring, filling me with lots of ideas for work of my own. A fine model always looks impressive, and as a modelmaker in every material other than metal, to me engineering models always have some precise but indefinable mystique. This, I think is partly because the skills required for metalwork had always seemed to be an order of magnitude more advanced than I had ever mastered. After all, engineering models are not the same as wood or plastic models.

Without wishing to offend the expert kit modeller at whom this remark is not directed, anyone with a modicum of ability can tosh together a wood or plastic kit and fairly quickly get a result that's at least partly recognisable as the thing on the box. You need far more sophisticated tools, and evidently a far higher level of skill, and masses of time to engineer in metal.

Yes, but doesn't it therefore take donkey's years to get to that level of skill? In my case it took donkey's years even to get started!

Observing some of the finest work at exhibitions, I am always reminded of the words of Bob Symes-Shutzmann in a 1970s BBC TV series *Model World* when I was starting out on my modelmaking career. *"All the finest modelmakers were beginners once."* he opined. Yes, even Cherry Hill started out as a beginner!

Some people feel that when they see work of that calibre, it's time to give up. I have always thought that it's time to buck up! It never occurred to me that work of that standard was impossible to achieve, because people before me had done so and no doubt there would be many after me who would as well. Work of such exquisite standard is an inspiration for me, something to aspire to. I may never reach it, but at least if I aim for it, I'll possibly produce a better standard of work! I hope that if I ever produce anything approaching that quality, all viewers will look on it in the same way I do.

Where do I start?

Not being an experienced engineer, I looked forward with some excitement and trepidation to Day One of this course. But what could I learn from a course that I couldn't learn by picking up a book? Well, as it turned out, quite a lot actually. First, because more likely than not, you won't get around to picking up that book, certainly not as often as you want to, because other things need doing. But in the company of others, you have more incentive to actually do something, and even complete the course. With the support of others, you can start fulfilling your dream.

As far as model engineering goes, I am almost a complete beginner, and it is to people like me that the course is aimed. Sure, there could be things I already know; I've fiddled with a lathe a bit, and really enjoyed the results, but you can never know everything. There is always something which someone else knows that you don't, and you can never learn too much!

My living is earned as a modelmaker, producing such things as the perfect bar of soap or chocolate (usually several times up) for advertising, housing or office developments for architects, or joy of joys, working on miniatures for the movies such as *Outland* and *Lost in Space* and lately, the best job I've ever had, modelmaking on two recent series of *Thomas and Friends*. But model engineering hardly comes into this. The film and TV industries employ pure engineers for any engineering work, and to nearly all professionals, what we do for a living, (and this may surprise many readers of this publication), is just a job. I am one of a very few who also make models in my spare time, and consequently when I first started my model engineering, when pulling my Unimat III out from under my workbench at lunchtimes, I took more than a little good natured ribbing about it.

I'll be totally honest, I have worked in all sorts of plastics and woods and done a fair bit of etched brass work, but the idea of working on metal cutting machinery, largely because of the lack of opportunity for instruction on all those arcane knobs and switches, has been more than a little daunting!

All of those on the course were attending in order to help broaden their skills, both as a means to increase their employment potential and, of course, to help with their spare time hobbies. Several of us on the course had built machined kits, ranging in complexity from the Stuart 10H I started with (in 1989!) and a series of 'Unit' steam engines, to at least one 5in. gauge Modelworks locomotive. Building a machined kit really helped me break the ice, giving me a feel for model engineering. At least, assembly wasn't too daunting, but it didn't really help with machining skills on the lathe or mill.

Also in common with some other students, and it has to be said, many other model engineering club members around the country, I didn't actually do much model engineering but, with the best of intentions as an armchair engineer, I

Jim Lugsden looked at lathes and turning tools. In a second talk he dealt with milling machines.

Peter Haycock covered measurement and marking out equipment and techniques.

Gerry Collins wonders how anyone managed to complete a boiler with a five pint blowlamp!

bought a Unimat III lathe with piles of accessories from an elderly gentleman who was giving up. I had owned a Hobbymat MD65 lathe for four years or so with the same intentions, but circumstances had relegated it to storage where for the time being, it languishes. I have most of the accessories for both lathes, buying them as I gained a faint understanding of their use by reading articles in magazines and most of the Stuart how-to-build books, knowing that one day I'd be able to use them(!) So, I sort of made up in tooling and literature what I lacked in skill, experience and ability!

Join a club!

Years ago, someone said to me *"Join a club!"* Due to damaged eyesight, I don't drive, so most of them were out of my reach anyway, but many years later, at the Model Engineer Exhibition in their anniversary year of 1998, I decided to throw caution to the four winds and joined SMEE. My greatest regret about this, I have since learned, was not doing so earlier. I lived in London and Marshall House was easy to get to, so I decided that I could do worse than meet other people with my interests. Even if I'd be the only one who didn't know anything!

I'd felt before I joined SMEE that with my lack of skills and experience, I was hardly worthy of membership of such an established and respected organisation. In fact it was one of the things that made me procrastinate for so long about joining any club. That attitude was quickly dispelled at the first meeting I attended, and the same applied to some attendees I spoke to on this course. Any decent club wants beginners! I could attend monthly meetings and learn by asking dippy questions and watching, talking and absorb by osmosis, the feel of the subject.

Learning curve

My metalworking at school did not involve the lathe or mill (or much of anything for that matter) and apprenticeships have virtually gone; I was far too old anyway. So how do I learn to model engineer? I'd like to join a night school course but my working hours are such that this is impossible, even if it was available. Which it no longer is in my area, due to Tony Blair's 'Education, Education, Education' policy!

With these routes not open to me, my total experience was gained by reading from books and magazines plus friendly advice, and shoving a bit of bar in my lathe and having a go. I learned by bitter, expensive or painful experience, sometimes any two or all three of these at the same time!

I want to learn the skills necessary to create for myself the lovely aesthetic of engineered metal for my own artworks, and as I love engineered models, my method was to buy models that others had already made, and get the feel for model engineering by trying to improve on them. Okay, great, but how? Improving paintwork and cleaning up castings for me is easy; I do this kind of stuff in my work all the time but the machining, well that's a different story.

I should state that I have always found SMEE members very willing to show you what they are doing in the Society's workshops. Long before I joined SMEE, I also got to know two kindly and very experienced engineers, Owen Bird and Peter Slater. In common with an engineer with whom I have worked on a TV series for the last 18 months, they seem to have endless patience, and the work I can do is largely due to their kindness, encouragement and good-natured answering of my clueless questions. I meet lots of skilled artisans in my profession but engineers are almost the only ones who will show you how to do anything, sometimes really going out of their way to do so. I have always considered myself incredibly lucky to benefit from their priceless advice.

In my case, being freelance, the need to earn a living meant that lack of time was part of the reason for lack of progress. Somewhat frustratingly I learned rather slowly, and in thirteen years my total time on any lathe was less than 25 hours and on the mill, maybe 2 (thankfully supervised). It really has only been in the last six months that I have been able to spend any time at all on model engineering, basically on my Unimat III and a Bridgeport milling machine during lunchbreaks. At this rate I'd be 391 before I'd mastered the lathe at all, let alone any other model engineering skills!

The SMEE course

So last year, when the idea of this course was mooted at a SMEE meeting I leapt at the chance. Thankfully, some thirty or so others, some members, some not (but who had seen it advertised at the model engineering shows, in the SMEE journal and in *Model Engineer*), also did, making it economically feasible. SMEE Chairman Gerry Collins gave a fascinating 'test run' talk on silver-soldering and brazing to try out the format, and bingo!

The course consisted of six lectures, spread over three months, with two lectures per day on the second Saturday of each month, starting 8 February 2003.

The second session on 8 March would feature the basics of the Milling Machine followed by the Offhand Grinder and the third pair of two-hour lectures on 12 April would be covering the techniques of Marking Out, and finally, Silver-Soldering and Brazing.

I was surprised that many other regular members also turned out to lack the knowledge to model engineer, or to think they could learn something new, because there were many faces familiar to me on this first day. It was appreciated both by those lecturing and some of the students that some of the longer established members had also come along to offer moral support.

At first a few students were nervous but all were put instantly at ease by the overwhelmingly friendly and good-humoured atmosphere. Everyone enjoyed coffee, tea, biscuits and a get-to-know-you chat before the first session of the day got under way. Why, here were other people in the same boat! I think a lot of us thought *"Well, so it's not just me then."*

Properly produced

The standard was set right from the start — this course was going to be produced properly!

We were each given an impressive and highly readable set of notes contained within a very neat ring binder. Many comments were made that the cost of the course was worth it for these notes alone. Had it been commercially prepared, they alone would have hoovered up the whole course fee. Fortunately for us and future delegates, within SMEE is all the expertise and experience in every field necessary to produce such a course, but the difference here is that all those involved have given their time and skills for free. This is another advantage of joining any club, you have access to all the skills of the various members.

Sculptor Sue Heath and our contributor Mitch Barnes discuss the finer points of an intricate silver-soldered fabrication.

Right: you can't beat a practical demonstration; Gerry Collins demonstrates the basics of silver-brazing.

The speakers tied these notes in with their talks, using a newly donated audio-visual system which the Society had installed for this purpose. There is a distinct advantage to this. You read and re-read the notes, and of course, because the graphics, illustrations and examples are the same, you tend to recall more of what was said when reviewing the lectures later.

Some months previously, Andrew Mawson gave a most amusing talk to SMEE on setting up a home foundry, and his good humour and natural flair for public speaking instantly showed again with his talk on setting up a home workshop. As he pointed out at the start, the idea of model engineering is to have fun, after all!

Ably assisted by David Taylor, and starting with the basics — the kind of model you want to build, which has a huge bearing on the type and size of workshop needed, Andrew covered in depth topics which I'm sure would never have occurred to many people. This is where experience comes in. Where and how else other than through a club would you get the benefit of this experience from so many people? Andrew has set up and run three workshops in his time and we are the ones who will benefit from his knowledge! A question and answer session followed Andrew's talk, and attendees were also encouraged to share their experiences during the presentation, to the benefit of all concerned.

Expertise

After the excellent salad lunch provided, some of us gave the other students (many of whom were new members) a tour of Marshall House, the Society's Headquarters, showed them the well-equipped workshops, and answered questions. Another particular advantage of joining a club is that the buying power which comes from members' combined subscriptions means that a well equipped workshop is available, along with the expertise that comes from working with more experienced members. It is therefore possible to complete tasks such as larger turning jobs on machines that individual members may not be able to afford or justify purchasing.

Before the first day's afternoon session began, all of us gathered in the oyster light that passes for a winter's day (this was February after all) for a 'group photograph' on the steps of Marshall House.

Jim Lugsden has lectured in engineering related subjects for years, and his session was punctuated with amusing and informative anecdotes. One two-hour session is not enough to learn the use of a lathe; that would take months, and it is vitally important to understand the basics. So Jim started at the beginning, with how to select a lathe to suit your requirements. When confronted with any lathe, my first thought is *"What do all these knobs do?"* Jim's well presented talk answered this by pointing out the salient features of various types of lathe, illustrating the notes and the AV projection with photos of the society's range of machines. Having done so, he advised us which accessories we should buy for our machines, and what they actually do. This subject would be expanded upon later in the course. Meanwhile, I could see that there were going to be a few reductions in my bank balance as I purchase some more 'essentials'.

The overwhelming impression from this good hearted, well-attended and well-presented day's session was that it was well worth enrolling. Personally, I learnt more during this very enjoyable day than I had in my first few years of interest and inactivity in the hobby. It was also most gratifying to know that I wasn't the only one who had the enthusiasm but somehow hadn't got properly started before now.

Thanks

I really must thank the SMEE members who came up with this course, and all those behind the scenes who helped with producing the talks, and their associated notes. For the benefit of everyone other than those doing this hard work, a vast amount of effort was put into this project, all of it unpaid. This benefit will extend to everyone attending future courses. Work that had started behind the scenes weeks and months previously, continued during each day, especially that of our caterers, also members, putting in 110% effort to feed us and make new and established members feel at home.

In my four years of membership, I would have to say that this altruistic dedication and sheer hard work is pleasantly typical of the calibre of person that makes up the SMEE membership. I'm sure that this is also true of many other clubs around the country.

It was encouraging also to find that the trade was enthusiastic about the course. Many suppliers who regularly advertise in this magazine, kindly gave freely of their services, and technical advice to get the course under way. Special mention really must be made of Bruce Engineering, Chronos, Warco, Myford, Johnson Matthey, and Lister Gases.

Looking ahead

What of the future? Hopefully this is only the start, as far as SMEE is concerned. The course was very well received by all the participants. This was the first time the course had been held and would be as much of a learning experience for the society as for the students. To gauge their reaction and to take in some constructive criticism, a post-course discussion was held after the final lecture. All agreed that it had represented great value for money, and that it has tremendous potential.

Perhaps as time and space become available, it can be expanded upon, learning from the experience of this first set of sessions, and possibly making further use of the video equipment recently installed at SMEE HQ. Practical experience of the machines would be a huge help, but armed with the basics from this highly enjoyable and informative course, I personally feel so much more confident about chasing my dreams.

Rake's Progress

From time to time during the next few months, readers will hopefully be able to see for themselves how useful the course has been for me as I apply my new-found knowledge in order to modify and improve upon the Stuart S50 engine I have been tackling.

CLUB CHAT
With Stan Bray

Harrogate 2003: Roy Darlington (right) discusses his hot-air engine powered radio-controlled buggy car with Exhibition Manager Lou Rex. The Stirling Engine Society scooped Best Club Stand award at the Show.

Harrogate 2003: After the public had left the exhibition on Saturday evening, Barry Glover, Chairman of the Australian Association of Live Steamers fired a few blank rounds in Walter Scott's prize winning Naval Gun!

UK News

After a long wait and protracted negotiations **Taunton ME** have at last been given a lease on a new track site on part of the playing field at Creech St Michael. The official signing took place at the playing fields on 9 March in the presence of several local dignitaries and a local press photographer who recorded the event for posterity. The club now has the opportunity to fulfil a long held ambition to lay a ground level 7¼in. gauge track, much of the basic work having already been carried out. The existing track in Vivary Park will remain in use for the foreseeable future; club meetings will continue to be held there, and at Stoke St. Mary, as they have for a number of years.

Although members of **Bournemouth SME** have made rapid progress on the structure of their new track, laying the completed track panels is taking somewhat longer than anticipated. A call has therefore gone out for all members to make the effort to attend so that the track can be completed by the scheduled opening date. Several prominent people have been invited to this event and it would not do for the track laying to be incomplete at this time. Matters have been further complicated by the Chairman, Secretary and Treasurer all indicating a desire to stand down from their respective positions, which means that a search is on for replacements.

An annual highlight for members of **Staines SME** is their Great Egg Race and although sickness prevented a number of Staines Stalwarts from participating this year, there was still plenty of support for the two competing teams. This year's test was to construct a bridge from materials supplied that would support a pick-up truck loaded with eggs. We should hasten to add that the pick-up truck was a model, as indeed were the bridges! The winning entry was to be judged on its design, weight carrying capacity, decoration, efficient use of materials, and time taken for completion. It was also specified that the deck should be made of a piece of polystyrene sheet that was among the materials supplied. Team One built a cantilever design and took about half an hour to do so and, as points are awarded for appearance, it was adorned with lamp posts. Team Two used a pre-stressed arch complete with crash barriers and ramps which took an hour to build. Both bridges survived the test but viewed overall, Team One's entry performed best and was awarded the prize. Adapted to carry six eggs, the pick-up truck was a toy made from MDF; on the first test run only a single egg was loaded, but the next run saw the truck with a full load of six eggs. Finally, in an attempt to test the bridges to destruction, steel weights were added and it was at this stage that the second bridge collapsed, spilling its load onto the floor and breaking an egg. This is the first time an egg has been broken during the competition. The captain of the winning team was Stan Bishop who happens to have just taken over the position of club secretary and has therefore made an excellent start by showing how things should be done! It should be recorded here that doubtless due to a shortfall of entrants, this is the first time that wholesale cheating was not seen to have taken place.

After a great deal of hard work **Tyneside SMEE** completed their new track in time for their annual spring open weekend. Thoroughly tested and checked with both 3½ and 5in. gauge locomotives, the new track passed all tests with flying colours. A temporary arrangement for moving locomotives from the steaming bays to the main line was organised for the rally; a permanent set up is to be constructed later. The old track is no longer available for running, and parts have already been dismantled. However, there is still plenty to be done both on the raised track and the new ground level line, but it is all coming together nicely and the club can look forward with some confidence to a successful future.

We recently suggested that despite an impending enforced move to an alternative location, it was believed that **Ascot LS** would see out this year at its existing site. Indeed, at that stage members were planning for the season in spite of the possibility of having to move. The club has now been able to confirm that it was right to go ahead with its planning, and will be operating a full normal programme of events. By the time these notes are published, the visiting clubs day will have passed, but we can inform readers that the programme for the summer includes a 7¼in. gauge rally on 16 August. A recent change in the make up of the club committee sees Ivan Hurst now holding the positions of both Chairman and Secretary. Anyone, therefore, wishing to obtain more information about the rally, or indeed about any of the club activities, should contact him at 10 Hawkswood Avenue, Frimley, Surrey GU16 8LH; tel: 01276-28803; e-mail at **ivanjuliahurst@yahoo.co.uk**

Chichester DSME has recently signed a new 20-year lease for its Blackberry Lane site in Chichester and has also completely upgraded the railway tracks. Both of these are 188 metres in length requiring some 1500 sleepers, 9000 screws and a similar number of washers for their renovation. The new tracks were opened 17 April at an event attended by the Chairman of the local council and other distinguished guests. With the signing of the lease and refurbishment of the tracks it is hoped that new members might be encouraged to join the club and, in particular, the club would welcome some younger people. The society meets every Tuesday and Friday evening as well as on Sunday mornings in addition to public running on the last Sunday of every month. Anyone who would like further information about this go-ahead society is invited to contact Phil Hammond (01243-862176) or Brian Budd (01243-542266).

An exhibition will be held at the Lionel Road, Community Centre, Eltham, London SE9 on 29 June, to celebrate the 70th anniversary of the founding of **Kent MES**. Further information can be obtained from Secretary, Brian Greenstreet at 22 Wilks Gardens, Shirley, Surrey CRO 8UJ; tel: 020-881-777-1704.

A dedicated band of seven **Northampton SME** volunteers laid some 22 cubic metres of concrete (which, to say the least, is rather a lot!) just before the start of the running season. It has been used to transform the area around the workshop and steaming bays so that even in the wettest weather it is now possible to operate in comparative comfort. For a number of years, even a moderate amount of rain has turned the area in front of the clubhouse into ▶

In Memoriam

It is with the greatest 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.

George Gills	*Society of Ornamental Turners*
Cyril J. Goulding	*Newport MES*
Albert Mayer	*Society of Ornamental Turners*
Bruce Nordquist	*British Columbia SME*
Tony Williams	*Staines SME*

brown marshmallow, but this has now all changed. There is also a firm working area around the hydraulic lift used for loading and unloading models plus an area for preparing model road vehicles. The volunteers even managed to include a base for a new club flagpole. In addition to this, a (hopefully) vandal proof fence has been erected during the winter to separate the raised and ground level tracks. To inform those not aware that public running is taking place, a banner stating the fact has been made and will be displayed for all to see.

Although many items were on view at a Bits and Pieces evening in the spring, members of **Wigan DMES** seemed remarkably reluctant to enter for the annual club competition. The outcome of this was that the trophy was not awarded and it will now be for the committee to decide who should hold it for this year. An auction of the workshop effects of the late Norman Lowe raised a useful sum of money for his widow who wrote to thank all members and made a generous donation to the society. A new venue has been found for the annual dinner this year: the Prince William Inn at Dalton, and take it from us, the menu looks absolutely mouth-watering! The society open day at their track at Haigh will be held on 27 July and a large number of visiting models is anticipated.

The latest issue of the **Bristol SMEE** *Newsletter* features a photograph on the front showing two members carrying a heavy 7¼in. gauge passenger car from the station building to the track. This ritual which has been carried out nine times on every running day, and repeated as the vehicles were returned, for the last 30 years. Members insist that during those 30 years, not only have the passenger cars put on weight, but a local anomaly has increased gravity in the region. Views such as that depicted in the photograph can now be archived; the new passenger car storage shed has at last been completed and taken into service, and in future they can be simply rolled onto the main line. The next task is to build a signal box, work which will be done in tandem with the team fitting an extra rail in the ground level track so that 5in. gauge models can be run on it. The society is hosting this year's IMLEC 12/13 July, for which planning is well advanced. A marquee will be used for refreshments and additional car parking has been arranged. Judging by their past record on organising such events and, with a large number of entries anticipated, we can look forward to a great weekend. Before then the club has its own special day on 1 June when members will celebrate the railway's 30th anniversary. It will be very much a 'go as you please' day for members and families, with just a modicum of formality when the celebration cake is cut.

A very popular event held by the **Society of Ornamental Turners** takes the form of a seminar and, although there has not been one for a while, the offer by a member to hold one last year at his home was eagerly accepted. Keeping up with tradition, it was held over a weekend and those attending were given every opportunity to use and, if they wished, receive instruction on the operation of a wide range of machines. As well as machining techniques there was also information on tool grinding. The member's wife very kindly supplied buffet lunches as well as interim cups of tea and coffee for everyone who attended. As always, the Saturday evening was reserved for the annual society dinner which was attended by 27 members. Although it prevented the use of the machines, a two hour interruption in the electricity supply on Saturday afternoon was not allowed to spoil the proceedings: the time was used for a useful period of discussion. During Sunday a slide presentation demonstrated designs past and present, and a display featured work from members who had been invited to bring along items for the purpose. The society AGM attracted a good turnout and the opportunity was taken to award the annual prizes as follows: *Howe Cup* to Reg Hawthorne; *Cattell Cup* to John Anning; *Haythornthwaite Cup* to Mike Spencer; *A. V. Reed Certificate* to John Edwards; *A. V. Reed Medal* to Geoff Brandon; *Geoffrey Brandon Trophy* to Philip Holden; *President's Cup* to Geoff Brandon; *Anthony Award* to Frank Chambers. The meeting also provided the opportunity for the President, Philip Holden to step down and the new President John Edwards presented him with an illuminated address.

Good progress with their museum continues to be made by members of the **Northern Mill Engine Society** and as a change from erecting steam engines, the latest restoration work takes the form of a switchboard from Hick Hargreaves, one-time major builder of engines. With its large knife type switches, the board is apparently in itself a very impressive piece of engineering. A small Tangye horizontal engine has also been completed and is running on compressed air since at present, and for the foreseeable future, it will not be possible to use steam. Nevertheless, in anticipation of the future a main steam pipe is being installed around the walls, ready for such time as steam is available. It seems likely that the City of Bolton will convert an adjacent mill into an industrial museum which, it is hoped, will have a beneficial effect on the Northern Mill Engine Society set up. The society has certainly progressed since having to dismantle all its engines and move from its previous site. The current problem is a falling membership, and although it was hoped that opening the museum to the public would attract some new members, this has not happened so far.

We have received information about the Fort Nelson Model Show to be held 9/10 August at Fort Nelson, which overlooks Portsmouth Harbour. The organisers are inviting members of the trade and model societies to take part and should any society be interested in exhibiting they should contact Event Works (UK) Ltd. 42 Bluebell Lane, Poole, Dorset BH17 7YU; tel: 01202-692-999.

CLUB DIARY

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

JUNE

14 **Erewash Valley MES.** *Steaming Day.* Contact Jim Matthews: 01332-705259.
14 **Portsmouth MES.** *Families Day.* Contact John Warren: 023-9259-5354.
14 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
14/15 **Dockland & E. London MES.** *Belhus 'Mayhem' Track Run.* Contact P. M. Jonas: 01708-228510.
14/15 **Harrow & Wembley SME.** *Open Weekend.* Contact Dr. Roger Greenwood: 020-8427-2755.
14/15 **Hull DSME.** *Two-Day Event.* Contact Brian Rylance: 01482-647032.
14/15 **Lancaster and Morecambe MES.** *Sweet Pea Rally.* Contact Malcolm Ford: 01539-444726.
14/15 **Nottingham SMEE.** *Thomas the Tank Engine Weekend.* Contact Gerry Chester: 0115-9259096.
14/15 **South Lakeland MES.** *Open Weekend.* Contact Adrian Dixon: 01229-869915.
14/15 **Guild of Model Wheelwrights** at Acton Scott Farm, Church Stretton, Shropshire. Contact Biddy Hepper: 01492-623274.
15 **Andover DMES.** *3½in. Gauge Day.* Contact R. W. Hanman: 01980-846815.
15 **Bedford MES.** *Running.* Contact Ted Jolliffe: 01234-327791.
15 **Bure Valley Rly. (Friends of).** *Fathers' Day Special.* Contact Paul Conibeare: 01263-733858.
15 **Guildford MES.** *Open Afternoon.* Contact Dave Longhurst: 01428-605424.
15 **Hornsby ME.** *Sailing Day.* Contact Ted Gray: 9484-7583.
15 **Leighton Buzzard NG Rly.** *Fathers' Day Specials.* Enquiries: 01525-373888.
15 **N. W. Leicester SME.** *Running Sunday.* Contact John Elliott: 01455-847040.
15 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.
15 **Oxford (City of) SME.** *Running.* Contact Chris Kelland: 01235-770836.
15 **Plymouth MSLS.** *Running.* Contact John Brooker: 01752-671722.
15 **Romney, Hythe & Dymchurch Railway.** *Fathers' Day Event.* Information: 01797-362353.
15 **Saffron Walden DSME.** *Running Day.* Contact Jack Setterfield: 01843-596822.
15 **Sutton Coldfield MES.** *Car Boot Sale.* Contact Roger Timings: 0121-308-5875.
15 **Taunton ME.** *Running.* Contact Don Martin: 01460-63162.
15 **Wigan DMES.** *Diesel Day.* Contact John Chamberlain: 01744-882255.
15 **York City & DSME.** *Running Day.* Contact Ken Bateman: 01904-421445.
17 **Chesterfield MES.** *B. Metcalfe: Pleasley Pit.* Contact Mike Rhodes: 01623-648676.
17 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
17 **South Durham SME.** *Evening Steam-Up.* Contact B. Owens: 01325-721503.
17 **Taunton ME.** *Visit to Shute Light Railway.* Contact Don Martin: 01460-63162.

ENTRIES ARE INVITED FOR THE

INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

FOR THE MARTIN EVANS CHALLENGE CUP

FOR STEAM LOCOMOTIVES OF 3½ & 5in. GAUGES, TO BE HOSTED BY

BRISTOL SOCIETY OF MODEL & EXPERIMENTAL ENGINEERS

ON THEIR TRACK IN ASHTON COURT ESTATE, BRISTOL, ON

12/13 JULY 2003

CONDITIONS OF ENTRY

1: A locomotive new to the competition may be entered twice without restriction. 2: Locomotives which have previously run twice or more but have not been placed 1st, 2nd, or 3rd, may be re-entered after a lapse of 5 years from their last appearance. 3: Locomotives which have previously run twice or more and have been placed on any occasion may be re-entered after a lapse of 10 years from their last appearance.

ENTRY FORMS ARE AVAILABLE FROM KATE CANNER (0117-969-0022)

Early application is advisable since the number of entrants will be restricted to 27. Mrs Canner can also arrange pre-booked sites at the track for tents and caravans for Competitors and Spectators alike. Early application is advisable due to space restrictions.

Visit www.bristolmodelengineers.co.uk for further details

18 **Bournemouth DSME.** *Bits & Pieces.* Contact Mike Baker: 01202-383653.
18 **Bristol SMEE.** *IMLEC Update.* Contact Trevor Chambers: 01454-415085.
18 **Historical MRS (North West Area).** *Mike Turner: Point Operation.* Contact David Goodwin: 01224-880018.
18 **Leeds SMEE.** *Midsummer Steam-Up.* Contact Colin Abrey: 01132-649630.
18 **Maidstone MES.** *Members' Afternoon Playtime Run.* Contact Martin Parham: 01622-630298.
18 **MELSA.** *Meeting.* Contact Graham Chadbone: 07-4121-4341.
18 **West Wiltshire SME.** *Steam-Up.* Contact R. Nev. Boulton: 01380-828101.
19 **Leyland SME.** *Project Night.* Contact Mark Entwistle: 01772-422411.
19 **Sutton MEC.** *Busy Night.* Contact Mike Dean: 0208-657-5401.
20 **Rochdale SMEE.** *Quiz Night.* Contact Mike Foster: 01706-360849.
21 **Chesterfield MES.** *Running Day.* Contact Mike Rhodes: 01623-648676.
21 **Chichester DSME.** *Barbecue & Locomotive Inefficiency Competition.* Contact Brian Bird: 01243-542266.
21 **Harlington LS.** *Visiting Clubs Day.* Contact Peter Tarrant: 01895-851168.
21 **Hornsby ME.** *Family Day.* Contact Ted Gray: 9484-7583.
21 **Leyland SME.** *Summer Solstice Steam-Up.* Contact Mark Entwistle: 01772-422411.
21 **Nottingham SMEE.** *Evening Steam-Up & Barbecue.* Contact Graham Davenport: 0115-8496703.
21 **Romford MEC.** *Track Afternoon.* Contact Colin Hunt: 01708-709302.
21 **Saffron Walden DSME.** *Visit to Chelmsford CSME.* Contact Jack Setterfield: 01843-596822.
21 **SM&EE.** *Rummage Sale.* Contact David Boote: 01202-745862.
21/22 **Brighouse & Halifax ME.** *Sir William Stanier Special Weekend.* Contact Bob Durham: 0113-293-8524.
21/22 **Claymills Pumping Engines.** *In Steam.* Contact B. Eastough: 01283-812501.
21/22 **Hereford SME.** *Exhibition.* Contact John Arrowsmith: 01432-265151.
21/22 **Kinver & West Midlands SME.** *Open Weekend.* Contact John Campbell: 01384-891244.
21/22 **Nottingham SMEE.** *Thomas the Tank Engine Weekend.* Contact Gerry Chester: 0115-9259096.
21/22 **Surrey SME.** *Visiting Clubs Day.* Contact John Cook: 020-8397-3932.
21-25 **Nevil Shute Norway Foundation.** *International Conference 2003* at The Queens Hotel, Southsea. Contact Steph Gallagher: **steph.gallagher@bigfoot.com**
22 **Amnerfield Miniature Railway.** *Running.*Contact David Jerome: 0118-9700274.
22 **Birmingham SME.** *Members' Day.* Contact John Walker: 01789-266065.
22 **Cardiff MES.** *Steam-Up & Family Day.* Contact Trevor Jenkins: 029-2075-5568.
22 **Harlington LS.** *Open Day.* Contact Peter Tarrant: 01895-851168.
22 **Historical MRS (Scottish Area).** *Visit to Newliston 5in. Live Steam Line.* Contact Richard Crockett: 01896-750730.
22 **Lincoln DMES.** *Running.* Contact Paul Thompson: 01522-888228.
22 **National 2½in. Gauge Ass'n.** *Locomotive Rally* at Stockport SME. Contact Clive Young: 01233-626455.
22 **Staines SME.** *Running Day.* Contact Mike Kingham: 01932-788793.
22 **Worthing DSME.** *Running.* Contact Bob Phillips: 01903-700642.
23 **Bedford MES.** *Pop-Pop Boat Evening.* Contact Ted Jolliffe: 01234-327791.
23 **Hornsby ME.** *Meeting.* Contact Ted Gray: 9484-7583.
24 **Basingstoke DMES.** *Meeting.* Contact Ian Shanks: 01420-561741.
24 **Chelmsford SME.** *Steam-Up & Barbecue.* Contact D. Blake: 01376-324205.
24 **Historical MRS (E. Lancashire/N. Manchester Group).** *Laurence Wheeler: Modelling Irish Narrow Gauge.* Contact John Sykes: 01706-823989.
24 **Romney Marsh MES.** *Midsummer Track Meeting and Barbecue.* Contact John Wimble: 01797-362295.
24 **Surrey SME.** *Members' Barbecue.* Contact John Cook: 020-8397-3932.
24 **Sutton Coldfield MES.** *Morris Minor Club Visit.* Contact Roger Timings: 0121-308-5875.
25 **Guildford MES.** *Meeting.* Contact Dave Longhurst: 01428-605424.
25 **Hull DSME.** *Review Two-Day Event.* Contact Brian Rylance: 01482-647032.
26 **Sutton MEC.** *Evening Steam-Up.* Contact Mike Dean: 0208-657-5401.
26 **Worthing DSME.** *Dennis Marshall: Hudson's Railways.* Contact Bob Phillips: 01903-700642.
27-29 **Guild of Model Wheelwrights** at 8th Annual Chilterns Wood Fair, Open Air Museum, Chalfont St. Giles, Bucks. Contact Biddy Hepper: 01492-623274.
28 **Reading SME.** *Open Day.* Contact Graham Bustin: 01189-615450.
28 **Talyllyn Railway.** *Victorian Train.* Enquiries: 01654-710472.
28 **Wigan DMES.** *Visit by Butterly MRS.* Contact John Chamberlain: 01744-882255.
28/29 **Cambridge MES.** *Steam Rally.* Contact Andrew Clarke: 01223-880639.
28/29 **Cheltenham SME.** *65th Anniversary Weekend Celebrations & Running.* Contact Robert Lindsey: 01242-511436.
28/29 **Ribble Valley Live Steamers.** *Open Weekend.* Contact Mrs K. Avon: 01254-385170.
29 **Cardiff MES.** *Open Day.* Contact Trevor Jenkins: 029-2075-5568.
29 **Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243-542266.
29 **High Wycombe MEC.** *Running.* Contact David Savage: 01494-527402.
29 **Kent MES.** *70th Anniversary Model Engineering Exhibition.* Contact Brian Greenstreet: 00208-777-1704.
29 **Leighton Buzzard NG Rly.** *Vintage Vehicle Rally.* Enquiries: 01525-373888.
29 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.
29 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
29 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.
29 **Oxford (City of) SME.** *Running.* Contact Chris Kelland: 01235-770836.
30 **Canterbury DMES.** *Meeting.* Contact Granville Askham: 01227-463295.
30 **Historical MRS (Essex Area).** *Excursion to Mid Hants Railway.* Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.

JULY

1 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
1 **Stamford MES.** *Presentations.* Contact David Ash: 01780-751211.
1 **Taunton ME.** *Barbecue.* Contact Don Martin: 01460-63162.
2 **Bradford MES.** *Charles Friel: Railways in Northern Ireland.* Contact Gordon Eddison: 01943-864217.
2 **Bristol SMEE.** *Meeting at Oldown Railway.* Contact Trevor Chambers: 01454-415085.
2 **Tyneside SMEE.** *Jim Reef: The Building of the Steam Elephant.* Contact Ian Spencer, 39 Briardene Crescent, Kenton, Newcastle upon Tyne NE3 4RX.
2 **West Wiltshire SME.** *Steam-Up.* Contact R. Nev. Boulton: 01380-828101.
2 **Wigan DMES.** *Chernobyl Children Visit.* Contact John Chamberlain: 01744-882255.
3 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
3 **Sutton MEC.** *Bits & Pieces.* Contact Mike Dean: 0208-657-5401.
4 **Vale of Aylesbury MES.** *Track Night.* Contact Clive Ellam: 01296-623433.
4 **Maidstone MES.** *Evening Run & Hot Dogs.* Contact Martin Parham: 01622-630298.
4 **North Norfolk MEC.** *Mike Hayns: Lusitania.* Contact Gordon Ford: 01263-512350.
4 **Portsmouth MES.** *Fish & Chip Evening.* Contact John Warren: 023-9259-5354.
4 **Rochdale SMEE.** *Models Running Night at Springfield Park.* Contact Mike Foster: 01706-360849.
4 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
4-6 **British Columbia SME.** *75th Anniversary Meet.* Contact Sean Laurence: (604) 931-1547.
5 **Cardiff MES.** *Steam-Up & Family Day.* Contact Trevor Jenkins: 029-2075-5568.
5 **Historical MRS (Bristol Area).** *Visit to Avon Miniature Railway.* Contact Gerry Nichols: 0117-973-1862.
5 **Leyland SME.** *Just a Chat.* Contact Mark Entwistle: 01772-422411.
5 **Maxitrak Owners Club.** *Track Day.* Contact Eric Penn 0208-979-4335.
5 **SM&EE.** *D. A. G. Brown: Injectors.* Contact David Boote: 01202-745862.
5 **The Society of Ornamental Turners.** *Meeting.* Contact N. S. Edwards: 01234-359392.
5 **Talyllyn Railway.** *Victorian Train.* Enquiries: 01654-710472.
5 **York City & DSME.** *Summer Barbecue & Steaming.* Contact Ken Bateman: 01904-421445.
5/6 **Amnerfield Miniature Railway.** *Steam Open Day.* Contact David Jerome: 0118-9700274.
5/6 **Dockland & E. London MES.** *Track Run.* Contact P. M. Jonas: 01708-228510.
5/6 **Lancaster and Morecambe MES.** *Open Weekend.* Contact Stan Jackson: 01539-560278.
5/6 **Moors Valley Railway.** *American Weekend.*Contact Jim Haylock: 01425-471415.
5/6 **Stockholes Farm MR.** *Rally Weekend.* Contact Ivan Smith: 01427-872723.
5/6 **Guild of Model Wheelwrights** at Fire Rail 2003, St. Peters Collegiate School, Compton Campus, Wolverhampton. Contact Biddy Hepper: 01492-623274.
6 **Andover DMES.** *Members' Running Day.* Contact R. W. Hanman: 01980-846815.
6 **Basingstoke DMES.** *Running.* Contact Ian Shanks: 01420-561741.
6 **Guildford MES.** *Disability Challengers Day.* Contact Dave Longhurst: 01428-605424.
6 **Leighton Buzzard NG Rly.** *Model Railway Mania.* Enquiries: 01525-373888.
6 **Leyland SME.** *Ground Level Running.* Contact Mark Entwistle: 01772-422411.
6 **Lincoln DMES.** *Running.* Contact Paul Thompson: 01522-888228.
6 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
6 **Oxford (City of) SME.** *Running.* Contact Chris Kelland: 01235-770836.
6 **Rugby MES.** *Running.* Contact David Eadon: 01788-576956.
6 **Taunton ME.** *Running.* Contact Don Martin: 01460-63162.

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- Bilz Type 4-1211 Radius Turning Attachment £ 450.00
- Mitsui Seiki 450mm Swivel & Tilt Rotary Table,VGC £2500.00
- 12"x8" Swivelling Table,T-slotted £ 150.00
- Walter R-S 400TG (400mm)Swivel & Tilt Rotary Dividing Table £ 850.00
- Hofmann 300mm Rotary Table £ 300.00
- Alexander Inclinable Rotary Table fitted 4" Chuck £ 250.00
- Taylor Hobson 12" Rotary Table £ 350.00
- Criterion 8" Rotary Table £ 160.00
- SIP 350mm Rotary Table,Choice of 3 £ 500.00
- Hofmann 8" Rotary Table,VGC £ 350.00
- Vertex Horizontal/Vertical 6" Rotary Table,(New) £ 135.00
- Vertex Horizontal/Vertical 8" Rotary Table (New) £ 250.00
- Vertex Horizontal/Vertical 10" Rotary Table (New) £ 300.00
- Vertex Horizontal/Vertical 12" Rotary Table (New) £ 350.00
- 15" Rotary Dividing Table,Table Marked £ 250.00
- 12" x 9" T-Slotted Swivel & Tilt Plate £ 150.00
- Heavy Duty 8" Swivel Machine Vice £ 250.00
- Jones & Shipman 4613-013 4" Swivel & Tilt Machine Vice £ 175.00
- Jones and Shipman 4" Universal Vice £ 250.00
- Jones and Shipman 4" Sine Vice,immaculate £ 500.00
- Habit Sine Table 10"x15" £ 125.00
- Gressel 4" Swivel Machine Vice £ 500.00
- Abwood 4" Swivel & Tilt Machine Vice £ 325.00
- Abwood 6" Swivel & Tilt Machine Vice £ 350.00
- Abwood 8" Swivel Machine Vice £ 275.00
- Abwood 6" Machine Vice £ 150.00
- Abwood 6" Swivel Machine Vice £ 225.00
- Apex 4" Universal Vice (as new) £ 150.00
- GMT 3" Optical Dividing Head,Hori/Vert,Superb £ 750.00
- Elliott 4" Dividing Head & Tailstock,Excellent Condition £ 325.00
- Merlco Indexer and 7 collets (1.3/4" Cap) £ 250.00
- Merlco H/V Indexer Fitted 5" Griptru Chuck £ 350.00
- Carl Zeiss 130mm Optical Dividing Head and Tailstock £ 450.00
- Thiel/Ruhle Dividing Head £ 300.00
- 5" Centre Height Dividing Head with Chuck & Gears £ 500.00
- 5" Centre Height Dividing Head, No Chuck £ 250.00
- 4" Centre Height Dividing Head with Chuck & Gears (no tailstock) £ 350.00
- BSO Dividing Head £ 250.00
- Cooke Troughton and Simms Optical Dividing Head £ 500.00
- Nikken 50 INT Q.C Tooling Set,M.T. Adaptors,Drill Chuck,Collet Chuck & Collets £ 450.00
- Toolmex 30 INT S Type Autolock Chuck,4 Imp Collets,NEW £ 125.00
- Clarkson 30INT C Type Autolock Chuck,4 Imp. Collets £ 65.00
- Clarkson 30INT Autolock Chuck (small) with 4 collets £ 85.00
- Clarkson Dadlock 150 Chuck,30 INT Taper £ 75.00
- Clarkson 40INT C Type Autolock Chuck (lge)2Collets £ 65.00
- Clarkson 40INT Autolock Chuck (large) with 2 collets £ 100.00
- Clarkson 40INT Autolock Chuck (small) with 4 collets £ 80.00
- Clarkson 40INT Dadlock 200 Chuck £ 50.00
- Clarkson 40INT FC3 Holder £ 25.00
- Clarkson Large/Small Adaptor and 4 collets £ 100.00
- Clarkson 50INT Autolock Chuck (lge) 2 Imp. collets £ 100.00
- Clarkson 50INT Autolock Chuck (small) 4 Imp. Collets £ 85.00
- Clarkson 50INT Dadlock 200 Chuck £ 85.00
- Clarkson 50INT FC3 Holder £ 45.00
- Titanic 50INT Milling Chuck and 4 small collets,Imp £ 75.00
- Bristol Erickson Acramill 50INT collet chuck - large £ 125.00
- Clarkson 4MT Autolock Chuck (lge) 2 Imp Collets £ 80.00
- Clarkson 5MT Autolock Chuck (small) 4 metric collets £ 80.00
- Clarkson C Type Collet Chuck, (large) 2 collets,Thiel Taper £ 85.00
- Clarkson Autolock Chuck Collets... Large....each £ 15.00
- Clarkson Autolock Chuck Collets,Small,Imp.£15.00 Metric £ 20.00
- Modeloy 3MT Light Duty Milling Chuck,3 Imp Collets £ 65.00
- 30INT-3MT Adaptor £ 40.00
- 30INT-2MT Adaptor £ 35.00
- 40INT-4MT Open Ended Adaptor £ 35.00
- 40INT-1 & 2MT Adaptors Each £ 25.00
- 50INT-2,3,4MT Adaptor Each £ 30.00
- R8-2MT and R8-3MT Adaptors £20.00 - £ 22.00
- Precise 63 piece Spacing Collar Set,1" Bore £ 125.00
- Bristol Erickson No 10 Tenthset Boring Head, 30 INT £ 100.00
- Lushington No 3A Boring Head,R8 Taper ,Tatty But Working £ 75.00
- Lushington No.2 Offset Boring Head,40INT £ 50.00
- Lushington 40INT Boring and Facing Head £ 250.00
- GMT 40INT Boring & Facing Head,Boxed £ 325.00
- Elliott Model B Boring Head,3MT Shank £ 100.00
- D'andrea TS3 40INT Boring & Facing Head (not boxed) £ 550.00
- D'andrea TS3 50INT Boring & Facing Head,Boxed £ 850.00
- Narex VHU 2.1/8 Boring & Facing Head £ 850.00
- Archer No 1 Reversible Tapping Head,1 MT Shank £ 100.00
- 3MT Poliangular Attachment £ 175.00
- Chatwin Polygon Box,1" Shank £ 150.00
- Qty. Turret Tooling various types and shank sizes available £ POA
- Hampson Alamein No 1 Coventry Die Grinding Fixture,Boxed,Immaculate £ 150.00
- Coventry CHS 1/2" Die Head £ 100.00
- Coventry CHS 3/4" Die Head £ 100.00
- Coventry 5/16" Type DX Die Head £ 150.00
- Herbert 20 DX Die Head £ 200.00
- Coventry 8DX Die Head,3/4" Shank £ 150.00
- 5 x Landmatic 5/8" Die Boxes & approx. 12 sets Dies. LOT £ 150.00
- Coventry Type CHS 2" Die Head,VGC £ 250.00
- Coventry Type CH 1/2" Die Head £ 75.00
- Coventry Type CH 1" Die Head £ 75.00
- Coventry Type CH 1.1/2" Die Head £ 100.00
- Coventry Type CHS 1.1/2" Die Head £ 150.00
- Coventry Type CHS 3/4" Die Head £ 100.00
- Coventry Type CH 1.1/4" Die Head £ 125.00
- Landis Landmatic 5/8" cap.Tangential Die Head £ 75.00
- Ward 1" Shank Roller Box £ 50.00
- Fette F3 Thread Rolling Head with 4 sets Metric Dies £ 400.00

The following machines came from a Watch Manufacturer.

- Ebosa M32 Automatic Facing Machine (Choice of 3) £1750.00
- Elcomatic Twin Head Special Purpose Machine £1500.00
- Similar Triple Head Special Purpose Machine £1500.00
- Tourdiaments Facing/Milling Machine (Choice of 3) £1500.00
- ETS Gevoisier Slitting Machine £1500.00
- Old Watch Case Lathe £ 250.00

WORKSHOP EQUIPMENT

- 36" x 30" Cast Iron Surface Table £ 250.00
- Mezzanine Floor, Approx. 20' X 20',Good Condition,Chipboard Flooring £ 750.00
- 4" 1st & 2nd Cut Hand Files,NEW Each £ 1.00
- 4" 2nd & 3rd Cut Round Files,NEW Each £ 1.00
- 4" 1st Cut Half Round Files,NEW Each £ 1.00
- 4" 2nd & 3rd Cut Flat Taper Files,NEW Each £ 1.00
- 4" 1st & 3rd Cut Triangular Files, NEW Each £ 1.00
- 6" 3rd Cut Flat Taper Files,NEW Each £ 1.50
- 6" 1st & 2nd Cut Triangular Files, NEW Each £ 1.50
- 8" 1st & 2nd Cut Hand Files,NEW Each £ 2.00
- 8" 3rd Cut Round Files,NEW Each £ 2.00
- 8" 2nd Cut Flat Taper Files,NEW Each £ 2.00
- 8" 1st Cut Triangular Files, NEW Each £ 2.00
- 8" 1st & 3rd Cut Square Files,NEW Each £ 2.00
- 10" 3rd Cut Hand Files,NEW Each £ 2.50
- 10" 1st Cut Triangular Files, NEW Each £ 2.50
- 10" 3rd Cut Square Files, NEW Each £ 2.50
- 12" 3rd Cut Half Round Files,NEW Each £ 3.00
- 12" 2nd Cut Flat Taper Files,NEW Each £ 3.00
- 12" 1st,2nd,3rd Cut Triangular Files, NEW Each £ 3.00
- 14" 2nd & 3rd Cut Hand Files,NEW Each £ 4.00
- 14" 3rd Cut Round Files,NEW Each £ 4.00
- 14" 2nd & 3rd Cut Half Round Files,NEW Each £ 4.00
- 14"3rd Cut Flat Taper Files,NEW Each £ 4.00
- 14" 1st,2nd,3rd Cut Triangular Files, NEW Each £ 4.00
- 14" 2nd & 3rd Cut Square Files, NEW Each £ 4.00
- Shelton Micresine 10" x 5" Sine Table £ 150.00
- Crown 8" x 12" Compound Sine Table,T Slotted £ 325.00
- P V E No 2 Co Ordinate Table, 12" x 13" £ 350.00
- Norvic 3'x2' CI Surface Table £ 250.00
- 24" X 24" Cast Iron Surface Table,Cover,GC £ 225.00
- 36"x24" Cast Iron Surface Table £ 250.00
- 12"x18" Surface Plate £ 60.00
- 5.3/4" Dia. Lapping Plate £ 40.00
- Windley 10" Dia. Lapping Plate £ 50.00
- Windley 12" Dia. Lapping Plate £ 60.00
- 630mmx500mmx390mm Webbed T-slotted Angle Plate £ 250.00
- 9" x 7" x 6" Box Cube £ 75.00
- 12" x 10" x 9" T Slotted Box Cube £ 85.00
- M & W Metric Radius Gauge (new) £ 7.00
- Number Drill Gauges 1- 60 £ 5.00
- General 255M Screw pitch Gauge 9 - 40 TPI £ 7.00
- Craftsman 9 - 4030 Screw Pitch gauge 4 - 84 TPI £ 10.00
- M & W Metric Wire Gauge,New £ 6.00
- M & W 398M Feeler Gauge £ 15.00
- Preinme 3"x15" Sine Bench Centres £ 350.00
- Essex Tool and Gauge Co 10" Sine Bar £ 30.00
- Mercer Type 95011-451 Clock Stand £ 35.00
- 9 1/2" x 6 1/2" Compound Sine Table £ 250.00
- Crown Composine 12" x 8" Sine Table £ 200.00
- 22" x 8" Sine Table £ 150.00
- 6" x 5" x 5" Webbed Angle Plate,Rough £ 12.00
- 8" x 7" x 7" Angle Plate,Rough £ 20.00
- 12" x 12" x12" Webbed Angle Plate £ 50.00
- 7" x 41/2" x 5 1/2" Webbed Angle Plate £ 20.00
- 12" x 12" x 12"Angle Plate £ 40.00
- 10" x 8" x 6" Angle Plate £ 35.00
- Windley 6" x 6" x 6" Webbed Angle Plate, £ 30.00
- 6" x 6" x 6" Angle Plate £ 30.00
- 6" x 6" x 6" Angle Plate, Heavy Duty £ 45.00
- 12" x 6" Swivelling T-Slotted Plate £ 125.00
- Bridgeport Adjustable Angle Plate £ 250.00
- 18" x 9" Swivelling T-Slotted Plate,Damaged T-Slot £ 75.00
- 12" x 12" x 9" Angle Plate £ 175.00
- 6" x 5" x 41/2" Webbed Angle Plate £ 25.00
- 10" x 6" x 6" Angle Plate £ 25.00
- 12" x 9" Adjustable Angle Plate £ 75.00
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- Pair Toolmex V Blocks 40mm x 38mm x 45mm £ 40.00
- Pair Toolmex V Blocks 45mm x 40mm x 70mm £ 50.00
- Pair Toolmex V Blocks 90mm x 70mm 125mm and Clamps Unused £ 100.00
- Pair Toolmex V Blocks 63mm x 45mm x 70mm and Clamps Unused £ 65.00
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- Transwave 3 HP Capacity Phase Converter, New £ 300.00
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- 33" x 10" x 6" Ammunition Boxes £ 5.00
- Jones and Shipman 8612-001 Assembly Press £ 100.00
- Gabro BF620 Box and Pan Folder,Stand,Choice of 2 £ 500.00
- Gabro 2M2 Guillotine Notcher,Stand £ 350.00
- Gabro 4M2 Guillotine/Notcher,Stand £ 400.00
- Gabro 3M2 Guillotine/Notcher,Stand,VGC £ 450.00
- Flamefast DS130 Ceramic Chip Forge £ 275.00
- Flamefast DS200 Brazing Hearth £ 325.00
- Flamefast DS120F Combined Brazing Hearth/Forge £ 225.00
- Flamefast DS100 Brazing Hearth £ 100.00
- Flamefast Moulding Bench £ 325.00
- Flamefast Wall Mounting Fume Extractor, 240 volt,Very Good Condition, Choice of 3 £ 150.00
- Large Anvil, Worn £ 150.00
- Small Anvil & Stand £ 150.00
- Blacksmiths Leg Vice £ 75.00
- Blacksmiths Leg Vice on Tripod Stand £ 125.00
- Edwards No 4DB Flypress £ 350.00
- Denbigh No 6 Flypress £ 250.00
- Denbigh No 5 Flypress £ 250.00
- Denbigh No 3 Flypress £ 250.00
- Norton No.4A D/B Flypress £ 450.00
- Norton 5B Flypress £ 275.00
- Norton No 8 Flypress,Stand £ 425.00
- Herbert Bar Straightening Press on Stand £ 275.00
- Kingsland 36" Treadle Guillotine £ 450.00
- Kingsland 3' Treadle Guillotine £ 425.00
- Kingsland 4' Hydraulic Guillotine £1250.00
- Edwards 3' Foot Op Cast Iron Guillotine £ 450.00
- Edwards Hand Op Sheet Metal Circle Cutter £ 150.00
- NEW 6" Heavy Duty Bench Lever Shears £ 100.00
- Pryor EP34 Punching Machine £ 350.00
- Prior Interchangeable Type Set,1/4" £ 75.00
- Pryor Interchangeable Type Set 1/8" £ 75.00
- Prior Automatic Numbering Stamp,3/8" Letters,1" shank £ 250.00
- RS No.813-654 Wire Wrapping Tool,240v £ 75.00
- Cebora Puntatrice 20 KVA Spot Welder £ 750.00
- Nederman Welding Fume Extractor £ 275.00
- Double Jewellers Bench with Torch and Blower £ 325.00
- Unused Single Jewellers Bench £ 325.00
- Smart & Brown H3 Toggle Press £ 185.00
- Palmatic 2 Ton Engine Crane £ 250.00
- RMT Type 10VSO/9SB Air Press,Stand £ 350.00
- Plymouth EMK 1400 Mobile Welding Fume Extractor,1ph,VGC £ 375.00
- Mubea Cropper,Shear,Notcher £ 250.00

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- Mitutoyo PJ250 Profile Projector £1250.00
- Mitutoyo PJ300 Profile Projector £1250.00
- Vis 6"/150mm Vernier Caliper with Fine Adjustment, 1/1000/0.05mm £ 18.00
- OMT Toolmakers Microscope on Cabinet with many accessories £1500.00
- M & W 0-1",1"-2" Micrometers,each £ 20.00
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- KS 16"-20" Adjustable Micrometer £ 200.00
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- Mitutoyo 101-117 0-1" Micrometer £ 25.00
- Mitutoyo 101-111 0-25mm Micrometer £ 25.00
- Mitutoyo 101-118 1"-2" Micrometer £ 30.00
- Mitutoyo 103-180 3"-4" Micrometer £ 45.00
- Mitutoyo 103-186 9"-10" Micrometer £ 75.00
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- Mitutoyo 139-175 100-300mm Tubular Inside Micrometer £ 250.00
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- Mitutoyo 193-105 Direct Reading Micrometer 100-125mm £ 100.00
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- Mitutoyo 368-821 Holtest Internal Mic. 8-9" .0002" £ 200.00
- Mitutoyo 368-822 Holtest Internal Mic. 9-10" .0002" £ 200.00
- Mitutoyo 368-823 Holtest Internal Mic. 10-11" .0002" £ 250.00
- Mitutoyo 3046E Dial Indicator 1/10 0-100 .01mm £ 25.00
- Mitutoyo 527-301 Dial Depth Gauge 150mm .05mm £ 50.00
- Mitutoyo 1125F Dial Indicator .5 3.5 0-25-0 .005mm £ 25.00
- Mitutoyo 141-133 2-12" Inside Micrometer Rod Type .001" £ 75.00
- Mitutoyo 2947-10 Dial Indicator .01/.008 4-0-4 .0001" £ 30.00
- Mitutoyo 7218 Dial Thickness Gauge .4" .001" 1.2" Throat £ 35.00
- Mitutoyo 916-592 Engineers Square Grade B 41/100mm £ 10.00
- Mitutoyo 101-103 0-25mm Ext. Micrometer .01mm Std. Ratchet £ 20.00
- Mitutoyo 368-811 Holtest Internal Mic. 1.8-2" .0002" £ 100.00
- Mitutoyo 368-818 Holtest Internal Mic. 3.6-4" .0002" £ 100.00
- Mitutoyo 513-225F Dial Test Indicator 0-100-0 2"/.002mm £ 40.00
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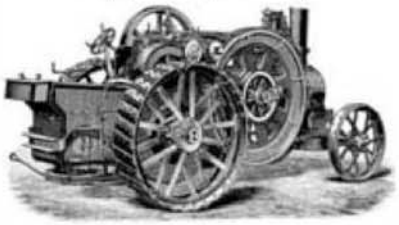

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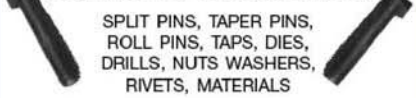

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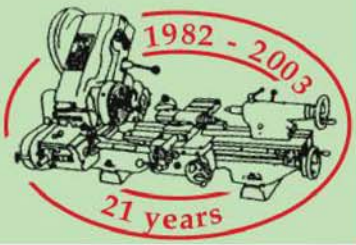

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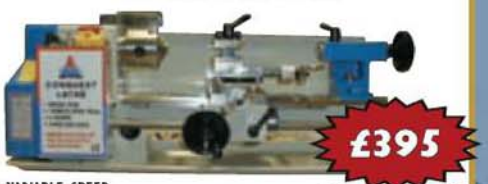

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- Cross slide travel: 200mm
- Motor: 2 x 3/4HP
- Net weight: 230kg

STANDARD EQUIPMENT

- 4" 3-Jaw chuck
- 2 dead centers
- 1/2 drill chuck
- Change gears
- MT3 chuck arbor

£1100

Price Includes VAT & Delivery*

Champion Mill

- Drilling Capacity: 20mm • End Mill Capacity: 25mm
- Face Mill Capacity: 63mm • Table Size: 150x630mm
- Number of Speeds: 4 • Speed Range: 400-1640rpm
- Spindle Taper: MT3 • Tilting Head: 90° Left & Right
- Motor: 1/2HP

From £585

Price Includes VAT & Delivery*

STANDARD ACCESSORIES

- 1-13mm Drill Chuck & Arbor

Eagle 25 Mill/Drill

- Mill/Drill Capacity: 25mm
- Table Size 190 x 585mm
- Fine Feed
- Number of Speeds: 12
- Speed range: 100-2150rpi
- Spindle Taper: MT3
- Spindle Travel: 100mm
- Motor: 1HP

Price £699

Price Includes VAT & Delivery*

STANDARD ACCESSORIES

- 1-13mm Drill Chuck & MT3 Drill Chuck Arbor • Eagle Face Mill Cutter • T3 Tilting Vice • M12 Drawbar • NVR Switch Gear • Interlocked Chuck Guard • Manual and Parts List

Eagle 30 Mill/Drill

- Mill/Drill Capacity: 32mm
- Table Size 210 x 740mm
- Fine Feed
- Number of Speeds: 10
- Speed range: 80-2300rpm
- Spindle Taper: MT3
- Spindle Travel: 130mm
- Tilting Head
- Motor: 1HP
- High/Low Gearbox

Price £899

Price Includes VAT & Delivery*

STANDARD ACCESSORIES

- 1-13mm Drill Chuck & MT3 Drill Chuck Arbor • Eagle Face Mill Cutter • V100 Machine Vice • M12 Drawbar • NVR Switch Gear • Interlocked Chuck Guard • Manual and Parts List

626 Turret Mill

- Milling Capacity: 25mm
- Drilling Capacity: 32mm
- Table Size 152 x 740mm
- Fine Feed
- Number of Speeds: 9
- Speed range: 190-2100rpm
- Spindle Taper: MT3 or R8
- Tilting Head
- Motor: 1HP

Price £1340

Price Includes VAT & Delivery*

STANDARD ACCESSORIES

- One Shot Lubrication • Halogen Work Light • Machine Stand
- Drawbar • Manual and Parts List

Craftsman Gap Bed Lathe

- Swing over bed: 300mm • Swing over gap: 450mm
- Swing over saddle: 170mm • Distance between centres: 570mm
- Spindle bore: 36mm • Spindle nose taper: MT5
- Cross slide travel: 150mm • Compound travel: 89mm
- Tailstock barrel taper MT3 • Tailstock barrel travel: 92mm
- Range of speeds: 50-1250rpm
- Motor: 11/2 HP
- Netweight 398kg

£1550

Price Includes VAT & Delivery*

STANDARD EQUIPMENT:

- 6" 3-jaw chuck with 2 sets of jaws
- 8" 4-jaw chuck
- Steady rest
- Follow rest
- Stand • Face plate
- Splash guard
- Threading dial
- 4-way turret tool post
- 3MT dead centers
- T-Slotted cross slide
- Halogen work light

Super LUX Mill

- Milling Capacity: 25mm
- Drilling Capacity: 32mm
- Table Size 240 x 800mm
- Fine Feed
- Number of Speeds: 6
- Speed range: 95-1600rpm
- Spindle Taper: MT3
- Tilting Head
- Motor: 1HP

Price £1500

Price Includes VAT & Delivery*

STANDARD FEATURES

- Powered Head Elevation • Cast Iron Stand
- Angle Tilting Head • Manual and Parts List

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