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VOL. 198 NO. 4301

8 - 21 JUNE 2007

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ON THE COVER...

Derek Brown, of Anna Fame, at work on the Myford on the SMEE stand demonstrating some tricky turning to visitors at the recent Harrogate Exhibition. This year's exhibition was one of the best for many years, and we will be publishing a full report shortly on the great models on display.
(Photograph by Michael Jones)

TURN TO PAGE 707 FOR TICKETS FOR THE MODEL ENGINEER EXHIBITION.

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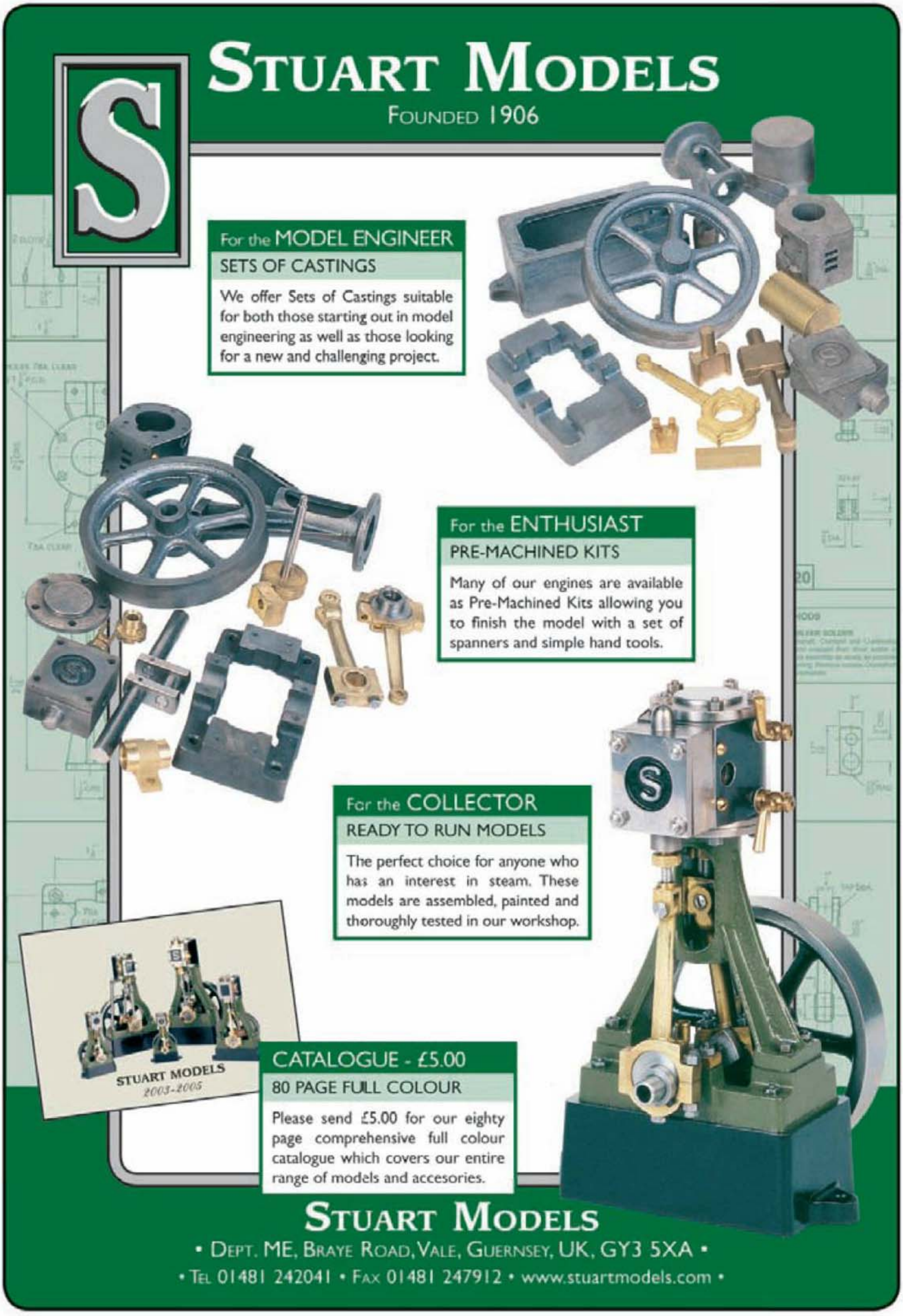
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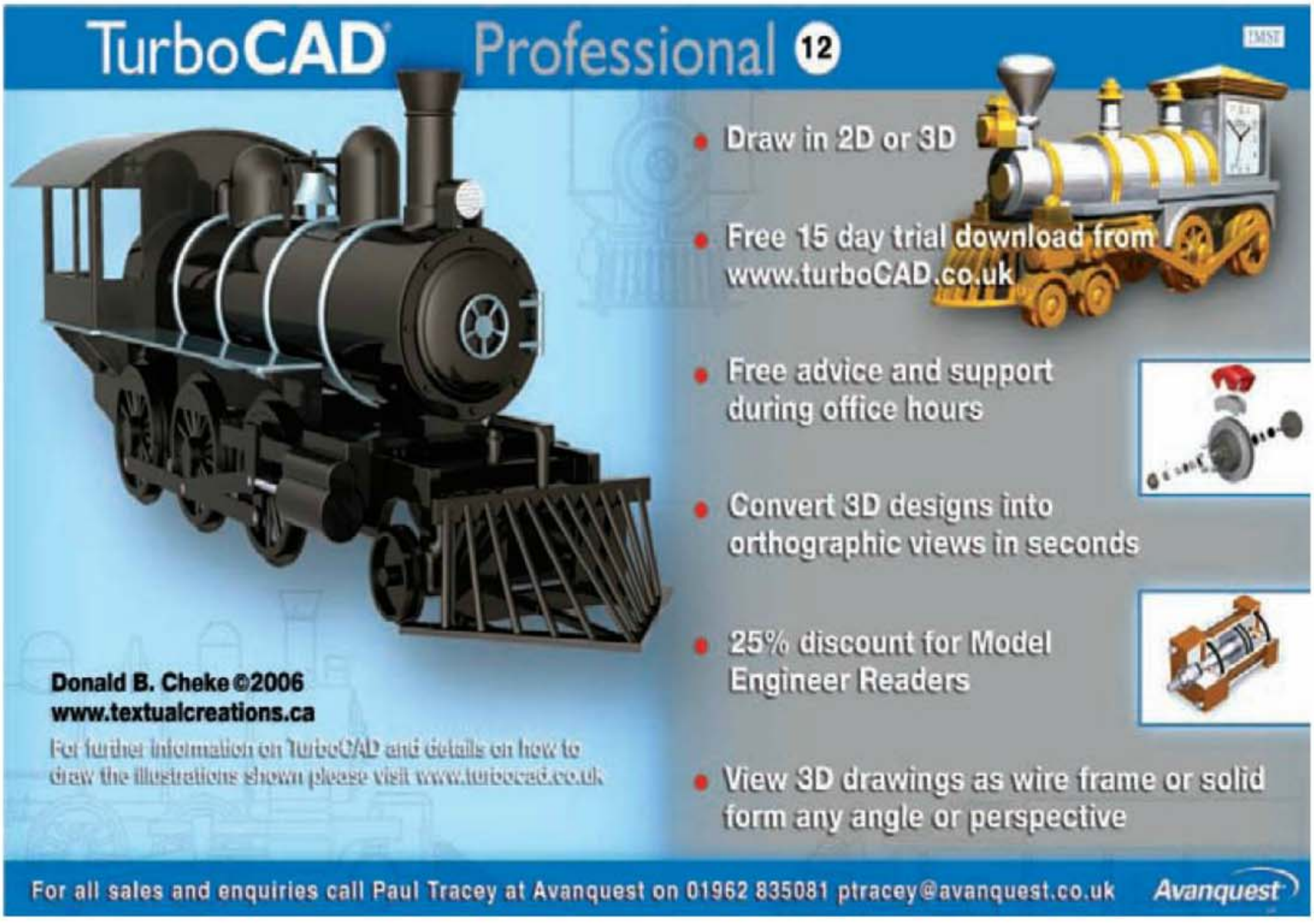
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Phoenix Locomotives Ltd

The story of Part No PHO52019

The Class 52 Western Diesel/hydraulic locomotives have distinctive "coach-built" styling which has the buffer beam incorporated into a valance at the front and rear of the loco.

At Phoenix in common with many locomotive manufacturers we have always used aluminium casting to replicate this feature. Aluminium is an ideal material for the strength and rigidity we require. However, we had always had a quality control issue with the castings. We rejected 30% of each batch due to faults such as porosity or inclusion. We also found that some of these faults would only become apparent when we machined the casting prior to despatch. The challenge was to maintain our quality standards and reduce the rejection rate. We investigated various ways of improving the casting process, moving away from traditional sand casting to investment casting and die-casting. We also looked at other methods of manufacture.
This led to a meeting with Birkdale Engineering Ltd. They have been our CNC suppliers for some time and have provided engineering solutions to some of our more challenging problems.

Meet Glenn.

We asked Glenn (that's him on the left) to look over the project He convinced us that it was possible (and affordable) to machine the whole valance from a solid billet of aluminium. We felt that this would be a tremendous solution as it would not only ensure we maintained our quality standards; it would raise them to a much higher level. Glenn's enthusiasm for the project meant that we could also take the opportunity to incorporate extra fine detailing which we couldn't achieve with a casting. Birkdale Engineering had just had a new machining centre installed and the Western Valance was to be its first major task.

Hurco VM2 is the latest in CNC Machining Centres (You can see it behind Glenn). 8000rpm and sixteen-way tooling bring the manufacturing time down to less than three hours. Repeatable accuracy to the order of +/- .0025mm means an amazingly high level of dimensional accuracy (shrinkage rates are now despatched to the dark ages).

You can see from the development pieces, the project was not a straightforward task. The valance is a complex shape and requires a lot of programming to get the CNC machining centre to produce the part we wanted.

We are very proud of Part No PH52019. It plays its part in delivering the quality and engineering excellence our customers expect. If you would like to own a loco with market leading detailing and accuracy, please contact us for a free brochure.

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SMOKE RINGS

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Also our ticket hotline is open from 8am until 11pm Monday to Friday, and 9am to 9pm on Saturdays and Sundays.

Call 0870 444 5556.

Tickets can be used on any of the three days of the event, for one day only. Those coming for more than one day will need a ticket for each day.

Children under 16 are admitted free of charge with a maximum three per adult, or in organised school parties.

Coach parties are most welcome, and coach parking is free of charge, as is the ample, extensive car parking.

If you pay on the day, tickets are £9 per day for an adult (concessions £8 or £12 for two days).

The ticket hotline will close on August 23.

Accommodation

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There are also self-catering flats for four people in four bedrooms and houses for six people in six bedrooms all with fully equipped kitchens, costing between £242 to £360 for a four-night stay.

The main campus of Royal Holloway is a hugely impressive red brick high-Victorian building. Indeed it is a landmark in the area. It can be reached from the M25, Junction 13, on the A30. It is just after Egham on the left-hand side. You can't miss it! By continuing along the A30 a short distance, signposts direct you to Ascot Racecourse.

Nearest station is Egham (about 1 mile) which has direct links to Ascot, Reading, Waterloo, and Weybridge. Buses from Heathrow stop outside the college gates.

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Arthur's models

We are fortunate in adding yet another wonderful collection of models to those to be displayed at Ascot in September, the models made by Arthur Bodily. Those who have attended the Model Engineer Exhibition in recent times will have been awe struck by Arthur's 1:4 working scale model of the 1936 Austin Twin Cam racing car.

Six years in the making this outstanding model was awarded not only a Gold Medal but also the Bradbury-Winter Memorial Challenge Cup which is awarded for the most outstanding example of amateur mechanical craftsmanship. For many this award is regarded every bit as highly as the Duke of Edinburgh Award, possibly even higher for those looking for the best in craftsmanship.

What people may not know is that Arthur has built many models to the same highest standards, including several locomotives and a number of aero engines. His current project is an 18-cylinder radial.

Choosing a lathe

Harold Pearson's article on choosing a lathe will probably open up again the debate about inexpensive imports versus home-grown high quality products. Harold argues the case for second-hand examples of machines that in earlier times were way beyond the pocket of the home workshop enthusiast.

That caused us to reflect on the wonderful choice now available to model engineers. For many our choice will be driven by cost. There, the Chinese have it. And we understand that quality has improved a lot in recent years.

However, as you would expect, things may not all be plain sailing. One of our current contributors reckons that at least 90 per cent are good. Of the remainder half are adequate, and the remainder should be sent back, he says. We understand that our advertisers are happy to exchange any machines that do not pass muster.

For those who do not have large amounts to spend on a lathe, there is an alternative. Sooner or later a Myford ML7 will come up for sale in your club newsletter. As everyone knows Myfords are almost unique in that they are designed for model engineers. The name is a byword for quality. No problems with maintenance, obtaining spares, or even a bed regrind at the Beeston factory.

New Myfords are, as they always were, relatively expensive. But a joy to own and to use, while taking up little space. You can do almost anything on a Myford (within size limits). Indeed you can produce great models using nothing else. The company also sells some nice refurbished machines at a fraction of the cost of a new one.

The alternative to all the above is, argues Harold Pearson, a second-hand toolroom or machine shop lathe. If you have been following Tony Griffiths' articles you will have a good idea on the merits and pitfalls of many of them.

If you are an experienced engineer, the prospect of maintaining an old machine will hold no terrors for you. Equally you will feel quite comfortable about tackling mods you might need to make to an import, and preparing a new one for use.

However, these old Colchesters, Harrisons, etc., have great appeal, especially if you have ever worked in a machine shop. And as Harold points out, this is one time when such machines are affordable, as they become surplus to company needs.

Whether you need one is a personal decision. If you do, this is a very good time to buy.

POSTBAG

Slate quarry locomotives

SIRS, - For a little while now I have been toying with the idea of building a freelance model of a vertical boilered narrow gauge slate quarry locomotive.

I remember visiting a small collection at, I believe, Penryn Castle, but I understand that the collection is now in private hands.

If any readers could help with information or photographs to enable me to get the general outline reasonably correct, I would be most grateful. I would of course defray any expenses incurred in this.

Tony Simons, Chippenham.

Three-phase power

SIRS, - Re Mr. Wells' letter *M.E.* 4291, 19 January 2007. I am sure that Mr. Wells will find that self generation of an electrical supply is highly uneconomic, apart from the capital cost, our highly taxed petrol and diesel for domestic use precludes this approach to the problem. He should if he is to establish a substantial workshop investigate the costs of modifying his supply to 3-phase. Failing that he would probably be better served with a solid-state 240 Volt 3-phase converter such as the Mitsubishi. Using 240 Volt 3-phase motors, he will then have the considerable advantage of variable speed, inching, etc. Of course if he starts with the highest horse power converter he is likely to need, he can arrange a change over system so that one converter can run more than one machine. He is unlikely to be able, as an individual, to run more than one machine simultaneously!

R. J. Hobdell, Croydon Society of Model Engineers.

Whitworth spanner sizes

SIRS, - I feel there is more to the question of Whitworth and BSF bolt and nut sizes than Mr. Kennedy gives in his letter (*M.E.* 4291, 19 January 2007) in answer to Mr. Hanley's query in *Club Chat.*

Joseph Whitworth's original formula for hexagon sizes was 1.68D + $^1/_8$in. This was an advance on the rule of thumb empirical methods previously used.

As engineering developed, bolts with finer threads were needed, hence the introduction of B.S. Fine threads in 1913. A hexagon head of the next smaller size in the Whitworth series was specified for a same diameter bolt, i.e. a $^1/_2$in.BSF bolt has a $^7/_{16}$in. Whitworth hexagon head. The larger Whitworth head was not in keeping with the finer BSF thread and the better quality steels then developed allowed the reduction in head size.

A war efficiency standard (BS.916/1940) was introduced to save metal during the war years. This specified that Whitworth hexagons be reduced to the BSF sizes, hence the two spanner sizes we see on them.

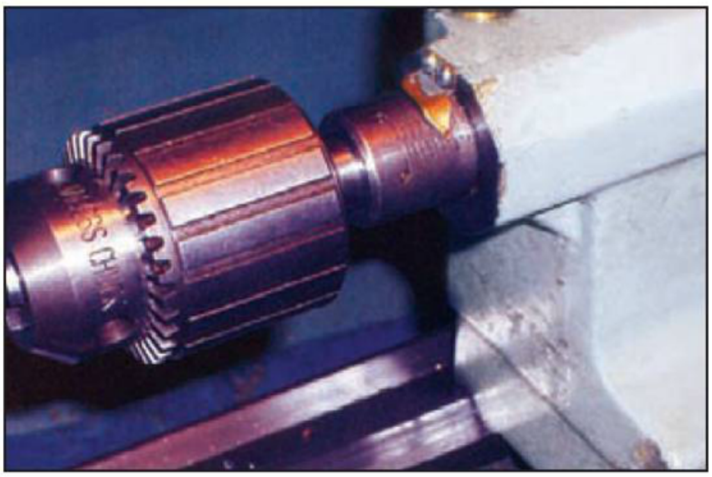
A. E. Oldham, Tyldesley.

Boxford tailstocks

SIRS, - Referring to Rex Hanman's letter on Boxford lathes (*M.E.* 4293 16 February 2007) regarding the tailstock ejecting his drill chuck before the graduations come into view, the answer is simple. I made a small pointer, see photograph, which is approximately $^1/_4$in. from the end of the casting. This has the added advantage of seeing the graduations coming into view before it is time to stop drilling.

I would agree with Mr. Hanman's comments on the lathe, a lovely machine to operate, I have the Mk. 3.

John Walker, Warwickshire.



John Walker's modification to his Boxford lathe tailstock.

Russian locomotive

SIRS, - I read with interest Mike Chernishev's letter published in *M.E.* 4290, 5 January 2007. I knew previously of Mr. Chernishev's model of the S class 2-6-2 locomotive which he brought to the *M.E.* exhibition, although I was not fortunate to be able to visit the exhibition. It was also good to see the work being carried out on the P class 2-10-0 freight locomotive. There were very few of this class constructed, at least by Russian standards, and this locomotive represents a prominent ancestor of the later L 2-10-0 and Lv 2-10-2 which along with the FD20 are also direct ancestors of the Chinese QJ class.

I have a long-standing interest in Russian steam dating back to a book I found in the library when I was at university. This was before *Glasnost*, and, at a time when the most detailed account of this vast rail network was that one solitary book by Le Fleming and Price. In this book was one very short chapter on the Su class 2-6-2 along with around three very grainy 'spy camera' style photographs and a three inch long and very simple general outline drawing with the basic overall dimensions. It was from this that I started to produce drawings in 1in. scale for 5in. gauge, the usual scale for 5in. is $1^1/_{16}$in. to foot but for a 5ft. gauge (1,524mm) prototype 1in. scale is correct. However, the staggeringly meagre information frustrated my attempts and the design

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never got past the profiling of a set of main frames, then other projects took over. However, even as the frames for my Su lay gathering rust in the workshop, the dream of driving what could possibly be the only large scale live steam Russian locomotive in the West was still as strong as ever. Despite some other engineering projects I kept coming back to the Su, but the big difference since my first attempt in 5in. gauge was not a better workshop or improved modelling skills, it was a change in the global political and technological environment. The Cold War was over and Russia was a more accessible resource for information, this coupled with the expansion of Internet based information meant for the first time the Su could potentially become a viable reality.

So, armed with some photographs from the web and a basic thumbnail general arrangement diagram copied from that original book I started the Su for the second time. The current project is a late series Su, which I have numbered Su251.53 built to 1½in. scale for 7¼in. gauge. The project was started in 2003 and is currently around 50% complete. The tender is finished; the locomotive is up to a rolling chassis with the cylinders currently under construction. Progress, whilst not brisk, is steady, and I hope to have the chassis air tested within one year. Completion around 2009 is planned.

Chris Marshall, Edinburgh.

Valve gear accuracy

SIRS, - Judging from both exhibition and track, the pursuit of fidelity to prototype in model steam engines has progressed considerably in recent years and this is reflected in the commendable efforts of those serialising projects of quality. I wonder how many model engineers realise that apart from faithfully reproducing working miniature locomotives they are, since the demise of steam on our railways, almost the sole custodians of advancing the genre? After all, these days a thoroughly 'modern' locomotive is in fact over half a century old!

Nor can we pretend that all prototypes were a success; if we model a relative failure we don't expect to put up with impaired performance in the miniature version and we might well expect a small tank engine to haul more passengers than it ever countenanced in full size. Relative to this, using updated technology to pursue my own particular field of study, valve gears, I have unearthed several full size horrors. In view of the fastidious attention to good valve events expended by Swindon on most of their familiar classes I was surprised to discover the dismal cut off characteristics of the ubiquitous Pannier tanks (see **Table 1**). Although originating from an old design they were still coming off the line in BR days.

Adding a mere 2in. to the length of the lifting arm, with no further alteration, the gear then produces the results in **Table 2**. Foregear in particular is now able to perform perfectly well and begs us to query why on earth nobody thought it fitting to investigate properly before continuing a massive building programme! Of course, the computer simulator was unavailable at the time of design, though the direct equivalent in the form of a full-size model certainly was. Some of the old designs were immaculate in equality of events and some much more modern ones deficient.

In the model world LBSC produced a finely proportioned valve gear in 1937 for his 2½in. gauge Purley Grange. During the "words and music" he professed to know little about valve gears and this is evident in the omission of the offset trunnion for the expansion link and a lifting arm 3/16in. (a massive 4.5in. in full size!) too long. With these corrections the gear is among the very best - any new builders in the currently quite active 2½in. gauge brigade please note.

Sensible design is the first step and my design programs for Walschaerts' and Stephenson's gears are freely downloadable from www.avocetconsulting.com.au/modeleng Thereafter, a simulator has important advantages in optimising valve gears and these are being recognised in serialised miniature locomotives: Simon Bowditch is to be congratulated on his dedicated efforts in this respect. Far too many original designs have failings and there is little point in inheriting these features. Sometimes the process proves straightforward in a good simulator but often there is much head scratching to overcome inherent difficulties whilst maintaining close fidelity to the prototype. Together with better and more accurate methods of valve setting model engineers can look forward to increasingly superior performance.

Don Ashton, Manchester.

GWR 8700
Cut offs

FOREGEAR			BACKGEAR		
FRONT	BACK	DIFF%	FRONT	BACK	DIFF%
77.09	77.08	**0.01**	80.63	82.79	**-2.16**
72.01	73.86	**-1.85**	77.09	80.09	**-3.00**
65.48	69.18	**-3.70**	72.81	76.99	**-4.18**
58.24	63.64	**-5.40**	67.62	73.40	**-5.78**
50.29	57.19	**-6.90**	53.80	69.24	**-15.44**
42.14	49.86	**-7.72**	45.04	64.42	**-19.38**
34.30	41.90	**-7.60**	35.55	58.78	**-23.23**
27.14	34.75	**-7.61**	27.22	52.15	**-24.93**
20.89	26.99	**-6.10**	18.77	44.28	**-25.51**
15.66	19.12	**-3.46**	12.50	34.96	**-22.46**
11.47	13.48	**-2.01**	8.07	24.44	**-16.37**

TABLE 1 - GWR 87XX 0-6-0PT CUT OFFS

GWR 8700 Lifting arm 2" longer
Cut offs

FOREGEAR			BACKGEAR		
FRONT	BACK	DIFF%	FRONT	BACK	DIFF%
79.68	76.35	**3.33**	81.63	79.63	**2.00**
75.57	72.32	**3.25**	78.30	76.48	**1.82**
70.55	67.54	**3.01**	74.26	72.83	**1.43**
64.54	61.90	**2.64**	69.31	68.63	**0.68**
57.59	55.36	**2.23**	63.20	63.76	**-0.56**
48.95	48.00	**0.95**	55.61	58.13	**-2.52**
40.92	41.10	**-0.18**	46.27	51.60	**-5.33**
33.15	32.84	**0.31**	35.42	44.05	**-8.63**
26.02	25.17	**0.85**	26.43	35.44	**-9.01**
19.85	18.55	**1.30**	18.13	26.16	**-8.03**
15.52	18.55	**-3.03**	12.10	17.44	**-5.34**

TABLE 2 - LENGTHENED LIFTING ARM

Valve gear tables one and two.

Tough machining

SIRS, - In September I raised the question of quality with particular regard to drills, end mills etc. There were two most comprehensive replies from Anthony Mount (*M.E.* 4287, 24 November 2006) and Roger Castle-Smith (*M.E.* 4288, 8 December 2006) and I am very grateful for their practical and detailed advice.

Further technical wisdom is now sought! I have some >>

usefully sized off-cuts of metal which from weight and appearance I assumed to be an aluminium alloy, but when I came to use the first piece I was surprised at how tough it was to machine. It seems to cut much more slowly than mild steel on my band-saw and reacted similarly to slot drills on my vertical mill.

Could it be a titanium alloy?

In an old workshop manual I have seen a method for determining types of steel by observing the sparks which the metal creates when applied to a grinding wheel. Are there similar dodges for identifying non-ferrous metals such as the various bronzes?

After some experimentation with speeds I managed to complete the job using the 'Dural?' and achieved a very high finish, but I would certainly welcome some comment.

Dennis Randall, Oxfordshire.

The material may, in fact, be an aluminium alloy. Some grades are heat treated and are extremely difficult to machine. – ED.

Spelling

SIRS, - I note, with alarm, that an incorrect spelling has crept into these most readable pages ('Sifbronze and boilers', *M.E.* 4295, 16 March 2007); the ninth element in the periodic table is Phosphorus. The other word, Phosphorous, refers to an ion containing the element, as in Phosphorous Acid, which itself is not to be confused with Phosphoric Acid. I trust that you will correct future spellings in the magazine.

By the way, I do approve of the new layout; it makes things very much easier to read.

D.A.G. Brown, Rutland.

Tramway models

SIRS, - I read with interest the letter (*M.E.* 4294, 2 March 2007) from W. S. Hands on tramway models and would like to offer a few additional comments.

Mr. Hands is quite correct in saying that $^3/_4$in. to 1ft. modelling began because maker's drawings are often in this scale, although the original models were to 3.5in. gauge, representing British standard gauge as used in most cities rather than the narrow 3ft. 6in. gauge used at Great Orme (although Mr. Hands native Birmingham was also narrow gauge).

The first working tram models in 1:16 scale are usually attributed to the late Frank Wilson, who using London County Council Tramways drawings, started to build them and exhibit them at the Model Engineer Exhibitions of the late 1920s. He went on to found with others the Tramway & Light Railway Society (TLRS) which still exists today to cater for tramway modellers. The TLRS is the publisher of the book *An Introduction to Tramway Modelling* as mentioned by Mr. Hands, and this book is in print and still available from the society. The TLRS has also established sets of modelling standards for various scales.

Also for the tramway modeller is the Festival of Model Tramways, an annual exhibition held alternately in the north and south of England, at which model trams in all scales can be seen. The next one is at the Kew Bridge Steam Museum, Green Dragon Lane, Brentford, on 21/22 July 2007.

Further information on the TLRS, including its modelling standards and book sales, and on the Festival of Model Tramways can be found on my website at www.tramways.freeserve.co.uk

John Prentice, Essex.

Engineering training and youngsters

SIRS, - Peter Black is not the first new graduate to wonder where his career might best lay (*M.E.* 4296, 30 March 2007) nor will he be the last. It is indeed sad that the university he went to had no workshop experience to offer, fortunately this is not universally the case. It is also very sad that his university is getting rid of what, I assume from what he says, is the experimental laboratory equipment, again I am sure that this is not universal. Also sadly many companies no longer offer post graduate apprenticeships; his present interests might suggest he should seek out one with a manufacturing bias.

However, in the broader scheme of things he mistakes what a university training is all about. It is surely to implant the basic principles, in this case engineering, and to teach students how to think for themselves. If learned well these basic principles will last him the rest of his life and he will never stop learning.

I have to say that, even in the best of circumstances, just how a professional engineer's career pans out can be a lottery and that is perhaps ever more the case given the way that, over the latter part of the last century and into this, engineering expertise has been lost in the UK. To be part of a large engineering project is magical. However, I understand that currently there is a shortage of engineering graduates and the best he can do is to seek out that which interests him and to change if it turns out to be the wrong choice.

Mr. Black denigrates the mathematical and theoretical nature of his degree but why? In model engineering I am reminded of the remark, a good friend of mine, the late Professor W. B. (Bill) Hall, made "that model engineers were only interested in how and not why". So often in these pages we see reference and blind adherence to full-size practice and yet by no means is all of it relevant. There seems to be a belief that the full-size masters were mere artisans whereas they were, in their day, brilliant engineers fully aware of machine dynamics, thermodynamics, stress analysis *et al*. Indeed there is much yet to understand about our hobby in which a theoretical approach has and will continue to provide answers. Chief engineers of the past would have given a great deal to have had access to the valve design programs that are available to us, let alone the thermal and structural analysis techniques available in engineering today.

I take great exception to the reference to a CAD monkey, if by that he means a draughtsman. First-class draughtsmen are rare and it is to their credit that they have taken Computer Aided Drawing to heart along with Computer Aided Manufacture (CAD/CAM). The really good ones have taken what can be done with a drawing to new heights and require graduate skills. Draughtsmen are and always have been grossly undervalued, the success or failure of projects is largely in their hands and you underestimate them at your peril.

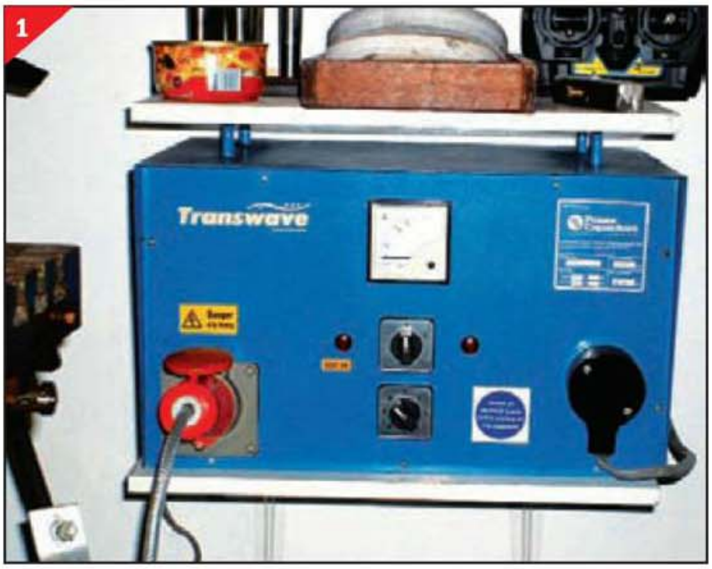
To Peter Black, your degree can do nothing but enhance the enjoyment of this hobby of ours and I wish you luck in the next phase of your career. As for the title of your letter I think that everyone in the hobby is only too aware of its fragility unless we can encourage youngsters and not so youngsters into it. Club experience is that they are out there and we must do all that we can to foster their interests. The club I belong to is large and occupies a prominent place in the borough yet it is surprising that so many members of the public are unaware of its existence; perhaps there is something to be followed up for us all here?

Finally, I can't resist taking a poke at your final paragraph on statements made when you started your degree, yes some students will fall out, yes some will end up as accountants (accountants should know something about engineering and vice versa) but what do they know about professional engineers!

Don Broadley, by email.

Inverter or Converter?

Steve Sparrow compares the properties of variable frequency inverter drives (VFDs) and static converters and explains their benefits for model engineers wishing to run three-phase motors.



1. Converter with Lewden socket and plug on lower left of front panel.

Health and Safety rules should be adhered to by anyone installing electrical equipment. If you live in England or Wales, you should read and understand the recent Part 'P' legislation and its implications for you. All readers should check their local electrical codes and regulations. Use the services of a qualified electrician to install the equipment for you if you have any doubts or if required by local regulations.

I use both variable frequency inverter drives (VFDs or inverters) and static converters in my workshop; they have quite different properties. My experience with buying, installing and using them prompted me to write about these differences primarily to help those who have limited funds or space, or those who only wish to buy one unit to cover all their needs. I have kept things relatively simple technically in order to get the general principles across.

For simplicity's sake, I refer to UK voltages as 240 and 415 Volts. This is shorthand for writing 220-240/380-415 Volts. Dual voltage motors will also show two amperage ratings on their identification plates; the higher is associated with 220-240V while the lower amperage applies when the motor is wired for higher voltage. Motors on machinery, depending on their age, might show 440V as their maximum voltage.

Converter Benefits

Converters will run 415V three-phase motors, or a dual-voltage 240/415V three-phase motors when wired for 415V in 'star' (or 'Y') mode from a single-phase 240V supply at close to their full power rating.

In contrast, inverters normally can only run a 415V three-phase motor at around 60% of its rated power (although the rpm would be the same at 50Hz) from a 240V mains supply. They can run 240V motors at nearly their full power.

When considering the above, buying a converter may help you avoid having to change the 415V - only motor on a machine. This could influence your choice if that motor is specially mounted and/or awkward to get to and replace.

Converters are usually built into a cabinet and can be simply plugged into a 240V outlet (**photo 1**). You may not need the services of an electrician to install one.

Converters are inherently quite robust and easily portable. They often have a 'Lewden' plug fitted to allow easy connection to different machines.

In older models, an ammeter is often provided to show the input current demand being made. Newer units may have voltmeters to show the 'synthesised' phase voltage being supplied.

Converters are often capable of running two-speed 415V motors.

Converter drawbacks

Converters (static) in reality only provide $2^1/_2$ phases, not a full three-phases. The third 'phase' produced by a converter is synthesised and not the same as a full 415V 3-phase mains supply.

Converters do not give you inherent speed control, you need to change speeds mechanically with belts or gears in the normal way.

Nor, do they give you programmable capabilities such as jogging, reverse-running, soft-start (ramp-up) and soft-stop (ramp-down) as VFDs can.

They are also quite bulky and are tuned to run a specific motor to give the most suitable, normally the quietest, results.

Converter controls are placed on the front of the cabinet and are not designed for a remote control box to be used or fitted to a particular machine.

The cabinet of a converter includes air vents for cooling and these should not be blocked. Adequate space should be available for the entrance and exit of air which means do not stack the cabinet amongst other things on a shelf to save space. This is such a common model engineer trait!

Converters are relatively expensive. Even when bought second-hand, my three-horsepower converter cost £250, whereas a good second-hand three-horsepower inverter might sell for £165. The Lewden plugs and cabling I bought to install my inverters were not more than about £10 per machine.

The converter is quite bulky although it often has an integral Lewden plug socket outlet as seen in **photo 2**.

A dual-voltage motor connected in 'delta' for 240V operation should not be connected to a 415V converter until it has been rewired for 'star' 415V operation. If this is forgotten, the workshop will be full of smoke pretty quickly! >>

2. *One HP Variable Frequency Drive (Inverter) used for smaller machines.*

A three horsepower converter may not run a three-hp 415V motor (either single or dual voltage) satisfactorily. It may not even have enough 'grunt' to start a 3hp motor, especially if the machine, say a lathe, is in a high speed gear. If you are faced with this situation, you may need to buy the next, more powerful, model of converter, which might be a bit more expensive.

If you buy a new converter the supplier should provide advice to make the correct choice between motor size and converter.

VFD basics

The speed of a motor is directly proportional to the frequency (Hz) supplied to it. In the UK the standard 50Hz line frequency will give roughly 1440rpm from a four-pole motor and 2880rpm for a two-pole motor. The variable frequency drive (inverter) provides speed control by varying the 'Hertz' supplied to a motor; higher frequencies, greater speed, lower frequencies, lower speeds.

In contrast, a converter supplies the power at a fixed frequency (normally 50Hz).

Inverter benefits

Most inverters have a feature for 'jog' and reverse-running. 'Jog' can be a help for setting-up a machine. Reverse running is useful on machines, such as Bridgeport mills, which use backgears in combination with motor reversing to achieve their lowest speed.

Other benefits include 'soft-start' (ramp-up) and 'soft-stop' (ramp-down). These functions are usually programmable. Both features can save your nerves as the motor is gradually ramped to speed and back down to a stop.

To setup the functions of a VFD, familiarity with setting modern menu-based electronics like TVs or video recorders is an advantage, as is access to a computer to read the instruction manuals that that so commonly come on CDs these days.

Note that inverters will only run 230V three-phase motors (connected 'delta') at close to their rated power. 415V three-phase motors would run at reduced power due to the reduced voltage (240V) supplied by the VFD. However, most three-phase motors made after the 1970s can be rewired, at the winding connections inside the motor, and will run in 240V mode ('delta').

You need to check that the motor you want to run is dual voltage (240/415V) which is normally shown on the motor's label. Dual-voltage motor connection capability is not the same thing as a dual-speed motors which should be avoided if you wish to use an inverter.

Inverters can greatly reduce the time spent making spindle speed changes by moving belts or changing gears. With a VFD, you can change the motor's speed to your requirements by changing the frequency, up or down. Speed changes by the 'old' methods, i.e., with belts and gears, still need to be made now and then, often to keep the motor running at a suitable speed to keep it properly cooled and to provide sufficient torque.

Photograph 2 shows a one horsepower inverter which runs my drilling machine and also other machines with motors up to one horsepower via the added Lewden socket outlet. To be strictly within the law, blue Lewden plugs and sockets should be used with the 240V three-phase power from an inverter. These differ from the red ones, which are for 415V applications. These blue plugs and sockets have their earthing pin at 9 o'clock, again differing from those for 415V operation.

The inverter's remote control box can be a huge bonus, **photo 3**. It can be connected by a cable long enough for the box to be positioned close to the machine, perhaps on a bracket of some kind, and then moved to another machine easily. This way you only need one control box to run any number of machines from one inverter (one at a time).

The control box to the inverter wiring is low voltage and presents no significant safety risk, save the ordinary care required where rotating machine spindles are concerned.

Inverter drawbacks

Inverters do not run a motor at the same power level as a converter would, unless set to supply at 50Hz. This becomes especially clear at lower speeds where torque can be reduced. Also note that the benefit of being able to reduce the running speed of a motor can bring new problems - lower rpm can mean less cooling from the integral fan, resulting in potential overheating. When running a motor at low rpm, it is wise to ensure short-duty cycles and good ventilation.

Two-speed three-phase motors are not suitable for inverter operation.

Inverters are much harder to wire up and set up initially and may require Part 'P' compliance if installed in the UK.

Inverters are not robust and do not like vibration. They are best wall-mounted to remove any risk of vibration damage to the delicate electronics within.

Like converters, they need airflow for cooling; larger sizes have built-in fans.

They do not come with a Lewden socket outlet because they are designed primarily to be in industrial applications dedicated to run one motor.

Inverter hints and tips

The good news is that you can get around most of the inverter's shortcomings. All of my inverters are wall-mounted and are wired to a Lewden socket designed for three-phase output. My machines have suitable Lewden plugs fitted on the end of their power cables so I can connect to them to the inverter.

As long as the inverter's output is greater than the maximum requirement of the motor then you can run any motor or any number of motors (one at a time of course) from one single inverter. It is not necessary to change the settings on an inverter, even if the last motor it ran was $^1/_2$hp and the next to be run is 3hp. The existing settings will give similar results for any motor up to the maximum rated power of the inverter.

When doing this, you should be aware that you might need to change the current limit parameter in the software for the inverter. This will ensure that the motor remains protected. For example, if you set up an inverter for the current protection based on a 3hp motor, this will not provide any protection if you then change the inverter to run a $^3/_4$hp motor.

My 3hp inverter runs a Colchester Student with 3hp motor (**photo 4**). A simple plug swap allows it to run my $^3/_4$hp drill grinder which stands close by. Note that my 3hp converter did not run this machine anywhere near as well as this inverter does, although both units are rated at 3hp.

If replacing a motor which will be controlled from an inverter, get a dual voltage (240/415V) model with at least $^1/_2$hp more than the original. This will give much you better slow-speed torque.

Careful planning is required. If you intend to convert a machine to VFD control and you change the motor. For example, you have a 1hp motor and you wish to have better low-speed torque, you will need to buy both a 1.5hp motor and an inverter with a rated for at least 1.5hp.

Pay careful attention to the speed of the motor, too. Two-pole motors run at 2880rpm and four-pole at 1440rpm. This is a lesson I learned from experience by getting it wrong the first time.

Further notices

Make sure the equipment you are considering has CE marking, or similar, such as UL, depending on which country you live in.

Inverters can be supplied for use with a single-phase supply of either 415V or 240V (not both). The resultant output will be either 415V or 240V with three-phases. If you buy a inverter requiring a 415V supply in error it will be useless when connected to a 240V supply!

Some contactors in the switch boxes fitted to three-phase machines work on 415V only. Even if the machine's motor can be wired to 240V (in 'delta' mode), it does not follow that the contactor coils will work on 240V. I found this out when I wired up my Colchester Student's motor in 'delta' to run it from the inverter, only to find that it would not run from the lever operated contactor unit. In these situations, the contactor coils must be changed for 240V units or the motor wired direct, which disables the start-stop switches.

Whether you choose a new or used inverter or converter, get a full set of installation instructions (and programming instructions for an inverter).

A one-horsepower motor in 'old money' is the same as 0.75kW. Therefore a motor rated 1.5kW would have an output of 2hp.

Remember that whatever choice you make for three-phase generation, if the speed or power combination you need is not attainable, belt or gear changes may still be necessary.

If you intend to buy a dual-voltage three-phase motor from a supplier, you will likely need to order it in advance as they may not stock all the models listed in their catalogue or website.

Suppliers of new equipment offer warranties on their equipment. When buying new, their expertise might be invaluable if you have concerns about choosing either a converter or inverter to match your three-phase motors.

Conclusions

All things considered, if I could only have one kind of device to run a three-phase motor it would be the variable frequency drive (inverter). It has a host of extra features, as described, and its shortcomings can be overcome by fitting a more powerful motor or by using a Lewden socket and plugs. With the ease of moving a control box from machine to machine it is entirely feasible to have only one VFD mounted in a suitable place to run all of your workshop equipment, one by one.

However, only a converter can run a single voltage 415V-only motor at close to its full rated power. If you want the benefits of an inverter you may have to change motors to a dual-voltage model.

3. Remote control box for operating inverter from the machine.

4. Three HP inverter used with Colchester lathe.

However, then you get all the benefits of speed control, jogging ramp-up and down and reverse running.

I actually changed some of the motors on my machines from single phase to three-phase just to get the benefit of speed control which is simply marvellous for a lathe or drill press.

http://preview.tinyurl.com/2jo38w links to a 'pdf' file which contains a short overview of Part 'P' regulations. **ME**

CHOOSING A LATHE

Harold Pearson of Cambodia gives advice based on many years experience inspecting and selecting machine tools.

From time to time, *M.E.* receives enquiries concerning the choice of a suitable lathe. These enquiries come from various people involved in, or contemplating taking up, the hobby of model engineering. I have noticed a number of letters are from people new to the hobby. Those with limited engineering experience tend to give primary consideration to either a new or used Myford Series 7 lathe or one of the Far Eastern imports, with little consideration being given to the third option, that of a used ex-industrial machine.

Reading the letters I get the impression that, with the exception of the Myford, there is a lack of confidence or reticence when it comes to choosing a lathe. The Myford has justifiably earned a special place in the hearts of model engineers. Whilst the Myford is a first class machine tool it is not the only one. The usual reasoning behind the choice of a machine from the Far East, is that the machine is new, represents good value for money and can be operated straight out of the box. The trend in model engineering is towards larger models. Therefore it makes good sense to equip your workshop with a lathe that will accommodate larger jobs with comparative ease. Keep in mind that within reason smaller work can be accommodated on a larger/heavier machine but larger heavier work cannot be completed on a small machine. Now, I expect I have let myself in for it. There is bound to be someone out there who has built a $7^1/_4$in. gauge locomotive on a Super Adept treadle lathe!

With the unfortunate demise of British small industry and closure of workshops in schools, colleges and universities a large number of quality used machine tools, not only lathes, have come onto the market, some having had very little use and lots of 'TLC'. Many of these are of industrial quality but still of a suitable size for use in our hobby.

When comparing machines designed for hobby use and those designed for industry, the two major differences are in the build quality and weight of the industrial machines. Whilst the Myford has excellent build quality it is a lightweight machine. The all up weight of a Myford Super 7 is around 111 kilograms. A Colchester Chipmaster is 500kg the Bantam weighs in at 343 kilograms. However, the floor space or footprint taken up by any of these machines is much the same. Unfortunately, though heavy, Far Eastern imports can be lacking in build quality. Those that own one of these machines can argue as much as they like about accuracy, etc. but my 1960 vintage Colchester can still give a good account of itself and in the future can be expected to fetch a reasonable sale price.

Selecting a used lathe is not fraught with the same kind of dangers as, say, buying a used car. Cars, at least modern ones, are not built to last whereas production machine tools are. I would recommend those considering the purchase of a lathe to enlist the help of a friend or club member, preferably an experienced machine shop engineer who should be only too willing to assist when it comes to vetting the machine you have got your eye on, new or used. If you are not presently a member of a model engineering club I seriously recommend you join one.

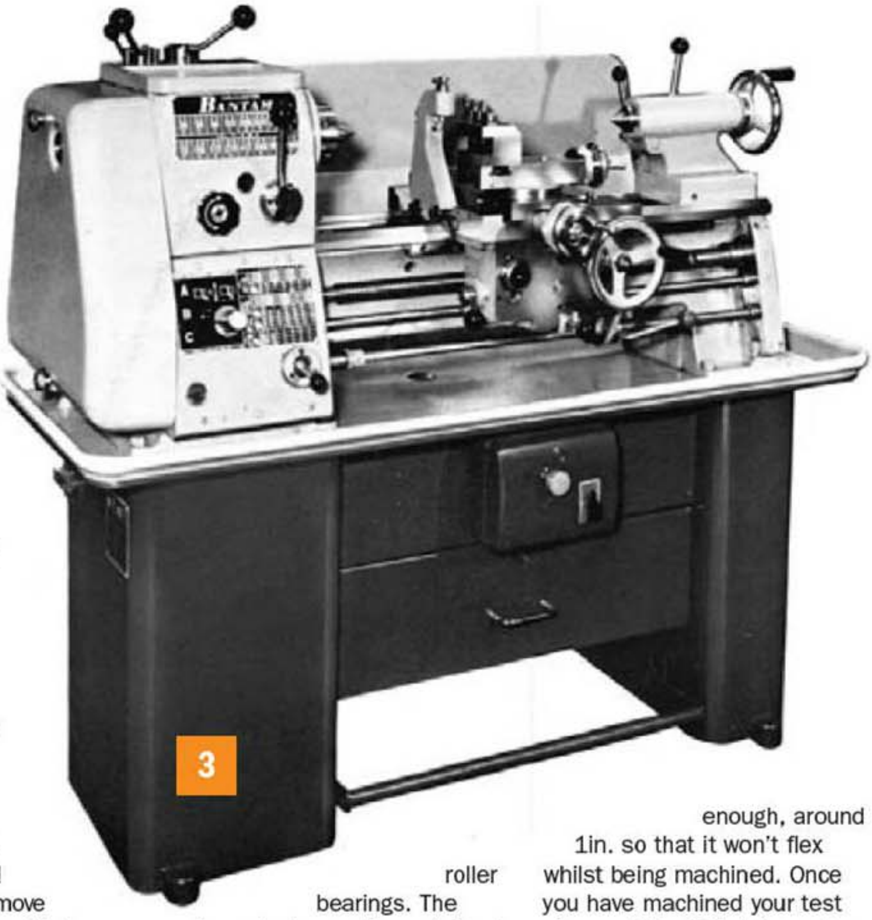
Time to write

I have taken the time to write to several dealers in used machine tools who regularly advertise in *M.E.* as well as a few who do not. All replied in full stating that prospective customers are welcome to make as detailed an inspection as they wish, to 'come and play' and check the machine/s out to their hearts content. If the lathe or other machine of your choice needs converting to single phase help is available for that also.

Part of my work involves selecting used machine tools for small-scale industrial development workshops in the third world. I can say that dealers I have come in contact with, often only by email, have all been very helpful and honest about the machines they were selling. Do not be afraid to ask for a full demonstration and if you want to inspect the gearbox ask for the headstock cover to be removed. Do not worry about chipped paint or dirt and grime. What you are looking for is evidence that the machine has

1. Testing headstock bearings.

2. Headstock alignment check.



3. Mk. 1 Colchester Bantam.

4. Mk. 2 Colchester Bantam.

not been abused such as:

1. Heavy damage to the tool post or top-slide, evidence that the tool post has been run into the rotating chuck on a number of occasions.

2. Impact damage or heavy pitting or rust to the bed or slide-ways.

3. Damaged/ loose/bell mouthed chuck jaws. Cracked chuck body or key locations.

4. Unreasonable backlash in the cross-slide screw.

5. The carriage and cross-slide should move freely over its full travel but have 'feel' to it. The same would apply to the top-slide.

6. Look for damaged bolt heads or cap head screws that would indicate the machine has been disassembled on more than a few occasions.

7. Inspect the leadscrew for undue wear, which is unlikely as most industrial machines use a traverse bar to move the carriage and cross-slide for normal machining operations. The leadscrew is usually reserved for screw cutting.

8. Checking the headstock bearings will require a dial test indicator (DTI) mounted on a magnetic base or a heavy duty scribing block base. Set the DTI with the spindle on the top of the chuck. If a chuck is not fitted ask the dealer to fit one. Using a steel bar or a stout bit of wood as shown in (**photo 1**) try to lift the chuck. Remember there is always likely to be a little give. Providing you don't get a definite rattle as the headstock spindle drops back into place then things are fine. Again remember almost all industrial machines use fully adjustable precision tapered roller bearings. The above test recently carried out on my Chipmaster gave spindle movement of less than 0.001 inch. I must emphasise that minimal force only should be applied, wrist power is quite sufficient.

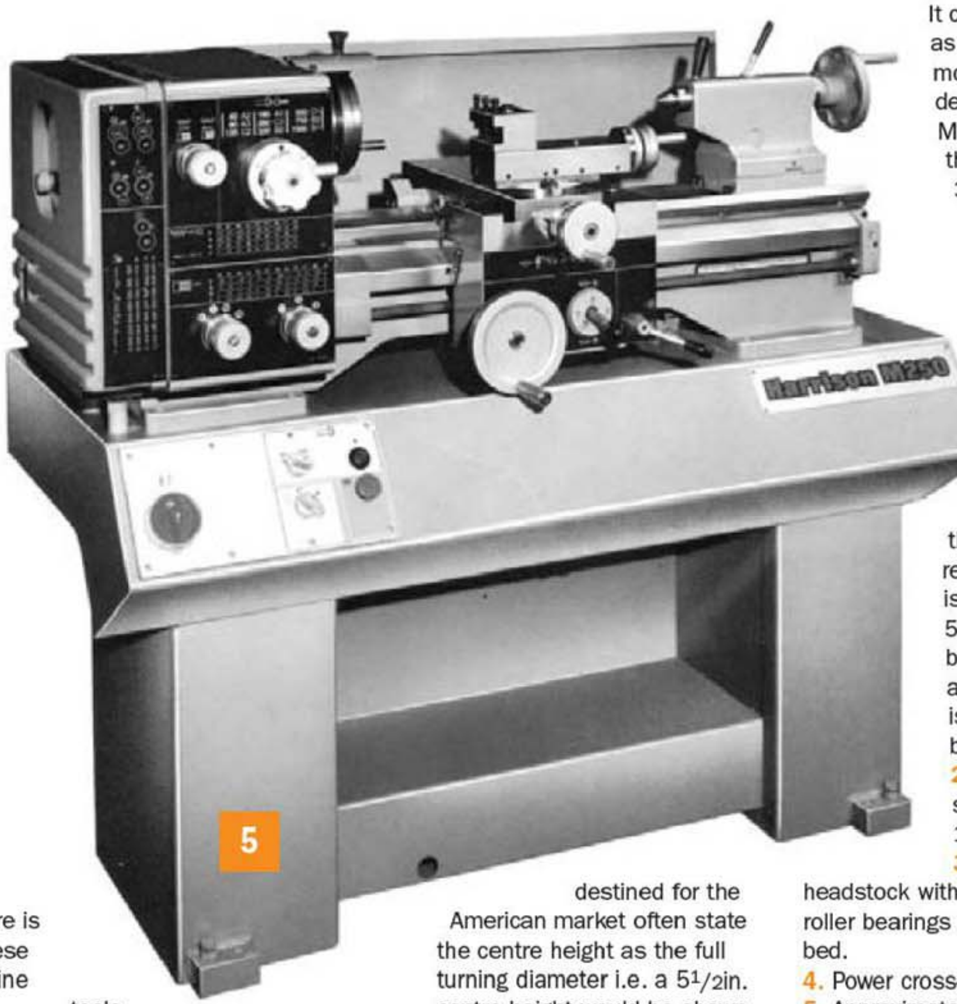
9. With the DTI handy its a good time to check how parallel the headstock is to the bed. You will need a 6 to 8in. length of accurate round steel bar as a test piece, a bit of 1/2in. dia., silver steel would do nicely (**photo 2**). As an alternative, whilst testing the machine you could machine a test piece. The diameter needs to be big enough, around 1in. so that it won't flex whilst being machined. Once you have machined your test piece set the DTI at its centre height, adjust the cross-slide to give a reading on the DTI. Make sure the carriage lock is off, and then wind the carriage backwards and forwards. There should be no movement of the DTI needle other than perhaps a slight 'kick' of the needle as the movement of the carriage is reversed. If this is more than a 'few thou' then the carriage slide gib strips need adjusting. The carriage should run smoothly from chuck to tailstock. It is not unreasonable, on a used machine, to expect the carriage to be a little tighter at the tailstock end of its travel. The headstocks on most of these machines can be adjusted to remove any inaccuracy. Incidentally the test on my Colchester produced a difference of less than 0.001in. over an 8in. length.

How long?

It may be argued by some that their imported lathe passes all the accuracy tests. That may be the case for now, but how long will it remain that way? The real bonus with owning a machine that was designed for production use is in its inherent build quality, rigidity and accuracy and these qualities are maintained over extended periods of heavy use.

The present situation is that whilst equipment from the Far East may be of low initial cost it can be of correspondingly lesser quality. I am sure this situation will change in the future. Equipment from the Far East will, in time, improve in quality but in direct proportion to a rise in cost. Those old enough will remember the uncharitable remarks directed at Japanese products entering the UK in the 1950s and 60s. Today Japanese products represent, in terms of quality, some of the finest available in the >>

5. Mk. 3 Colchester Bantam is almost identical to the Harrison M250 shown.



world, in particular motor vehicles, electronic goods and cameras. I would imagine the Japanese make very good small machine tools, probably not available in the UK due to their high cost.

Dealers selling used machine tools in the UK are not waiting for the individual model engineer to purchase a piece of equipment from them, they have businesses to run. They are exporting much of the equipment they have. I know this first hand as I have been responsible over the last three years for three, 20ft. containers filled with used British machine tools being imported into Cambodia. Here is an interesting fact; the Chinese attempted to sell their machine tools in Cambodia, at much lower prices than available in the UK and failed miserably.

The wealth of used equipment at present available in the UK will dry up. I would seriously recommend to anyone considering making a change or adding to existing equipment, or first time buyers of machine tools check out the used sector. Ladies and gentlemen of the model engineering fraternity you have the opportunity to own a piece of quality workshop equipment, until a few years ago only available to the well heeled or those operating in industry. In the past used machine tools tended to be passed down from the larger companies to the smaller ones, retaining good value on the way. This made these machines largely unavailable to hobbyists. By the time they were available to the private individual they were past their sell by date.

Typical used lathes

Readers will be aware of Tony Griffiths series on machine tools in *Model Engineer*, therefore I have restricted this article to two lathe models as samples using the Myford and Eastern imports as a guide to size. The best source for information on lathes that I have found is the web site: **www.lathes.co.uk** or email **tony@lathes.co.uk** and I would like to thank Tony for kindly allowing me to use some images and technical data from his website in this article. There is also good information concerning suitability for use by model engineers and advice on electrical conversion to single phase. The site is not limited to lathes but covers many other machine tools. In particular I would recommend accessing the site and reading the section on buying a lathe. A small but very pertinent extract related to cheap but doubtful quality machines reads as follows: "Regrets about the low-quality last far, far longer than the celebrations over the low price"

It is worth noting that American lathes or lathes destined for the American market often state the centre height as the full turning diameter i.e. a 5 1/2in. centre height would be shown as an 11in. inch lathe. The Harrison L5A/11 is one example.

Colchester Lathes

The Colchester Lathe Company was first established in 1887. Although officially known as The Colchester Lathe Company from 1907 the company was actually established in 1897 by John Ephrain Cohen. The company had its centenary in 1997. In 1992, Colchester moved production to Heckmondwike, West Yorkshire and now operates from the largest volume lathe factory in Europe. It is one of the few British engineering companies still going strong.

Colchester Bantam 5 x 20in. lathe

The Colchester Bantam features high on the list for model engineers. The Colchester Bantam is a well established model that has been around since the 1950s (**photos 3**, **4** and **5**).

It can be described as follows: 3 main models have developed from the Mk. 1 through to the Mk. 2 and Mk. 3. A compact but heavily built machine the basic configuration is:-

1. 5in. centre height by 20in. between centres though in fact the real centre height is closer to 5 5/8in. with 23in. between centres at a push (there is also a 30in. bed version).
2. Headstock spindle bore 1 1/4in. (32mm).
3. Geared headstock with precision taper roller bearings and hardened bed.
4. Power cross-feed.
5. Approximate weight 756lb (343kg).
6. The stand measures 53 x 23in. (1,346 x 584mm) a little larger than the industrial cabinet fitted to the Series 7 Myford lathes.
7. A comprehensive screw cutting and feeds range.

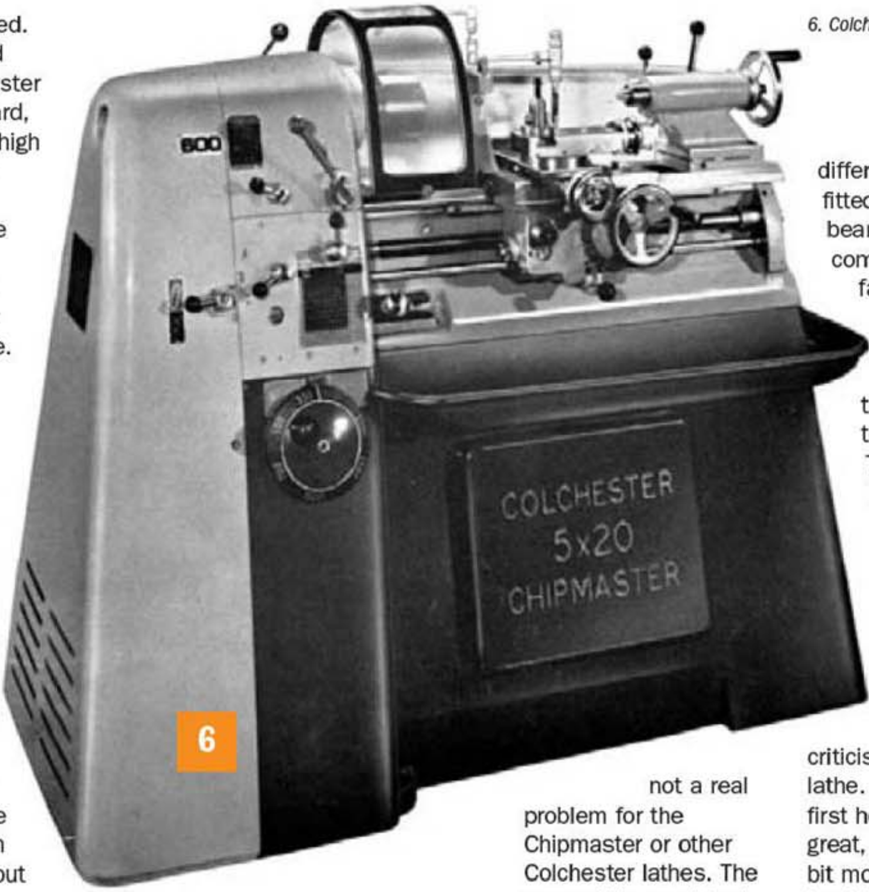
The top speed (rpm) is indicated by the model name, Bantam 1600 for example. I have operated Bantam models many times and found them a joy to use. The quality of this machine tool instills confidence in the user, expert or amateur.

The Colchester Chipmaster 5 5/8 x 20in. lathe

Dimensionally the Chipmaster is very similar to the later Bantam. The first 5 5/8 x 20in. Chipmaster, mounted on its distinctive, wide-base 'pyramid' shaped cast aluminium cabinet stand (**photo 6**), left the production line on 24 July 1958, though it had been announced as early as 1956. With its infinitely variable-speed drive and 3000rpm top speed. The design construction and detail finishing on a Chipmaster was of an exemplary standard, as it had to be with such a high top speed, and was heavily built. The Chipmaster was always a relatively expensive machine - in some years it cost over 46% more than a similarly-specified but larger 'Student' model for example. The Chipmaster came to occupy an important niche in the Colchester model range; it remained in the catalogue long after other models from the 1950s had disappeared - the last example being dispatched during 1983.

As I own a Colchester Chipmaster I am making it the feature lathe for this article (**photo 7**).

This machine is described as a high quality machine tool. With a spindle bore of $1\frac{3}{8}$in. the precision taper roller bearings are about 4in. diameter. This 45 year old machine will still part off a $1\frac{3}{8}$in. dia mild steel bar with the power cross feed engaged using a $\frac{1}{8}$in. wide parting tool. On the other hand with a top speed of 3,000rpm it is quite happy machining injector cones. I admit my Chipmaster is not a particularly good example, having seen some very hard use, but then I only paid £450 for it ten years ago. It's a lovely machine to use, easy to service and parts are still available.



6. Colchester Chipmaster.

Chipmaster specification:

Centre height	$5\frac{5}{8}$in.
Between centres	20in.
Spindle bore	$1\frac{3}{8}$in.
Spindle speeds Variable	35 to 3,000rpm.
Power cross feed.	
Camlock chuck mounting.	
Leadscrew pitch	4tpi
(The leadscrew has an O/D of $1\frac{1}{8}$ inch)	
Number of threads Whitworth	44 from 2 to 120tpi.
Number of threads Metric	14 from 0.5mm to 12mm.
Overall width	29in.
Overall length	$59\frac{1}{4}$in.

Accessories available for this machine include:

1. Two and three point steadies.
2. Taper turning attachment.
3. Quick change tool post with four holders.
4. Capstan attachment.
5. Duel dials - English and metric.
6. Bed stops.
7. Rear tool post with T-slotted base.
8. Eight index tool post.

A minor problem with the Chipmaster is that in its original form it is fitted with a Kop (speed) Variator unit that is both noisy and very expensive to repair. However, there is a simple way round the problem; Chuck out the variator and fit an electronic controller. My Chipmaster is fitted with a Newton Tesla converter with variable speed control, which gives almost silent running. The Chipmaster is fitted with a clutch which allows the motor to be left running.

One criticism of ex-production lathes is that they do not have a T-slotted cross-slide. This is not a real problem for the Chipmaster or other Colchester lathes. The cross-slide, machined all over, is 120mm wide and 22mm thick. The jib portion is 67mm wide. This leaves 26mm of solid metal each side. In industry Colchester cross-slides were regularly drilled and tapped to bolt on special fixtures. The rear tool post can be mounted on a T-slotted block (**photo 8**) that is screwed to the cross-slide. If you do not fancy doing that to your beloved lathe then make a bracket for your vertical slide and hold it in one of the quick change tool holders. Once again size counts, as the interchangeable tool holders on the Colchester are very robust and will accommodate tools with 25mm deep shanks.

On the subject of rear tool posts and parting off: One of the reasons given that it works better with an inverted tool from a rear tool post is that with solid bearing lathes the headstock spindle is pushed down into the more rigid and less worn lower bearing and housing. This may be so but I would think any advantage is lost with the potential for the carriage to lift. I don't think the above would make any difference at all on a lathe fitted with rolling element bearings. It may be a combination of several small factors that conspire to make things work better but to my mind the main advantage is that I can leave the parting tool permanently set up.

There were a couple of interesting letters (*Post Bag*) on the subject of lathes in *M.E.* 4279, 4 August 2006. One from a regular contributor Anthony Mount and one from Mr. Roger Warren representing Warco: Anthony voices his criticism of the Myford 254 lathe. I must admit that when I first heard of the 254 I thought, great, at last something with a bit more 'welly' than the ML7. I tend to agree with Anthony and feel Myford missed an opportunity.

Mr. Warren, in his letter attempts to show Chinese industry in a better light. Whilst China has a massive developing industry, conditions cannot be compared with those in the UK and some other European countries.

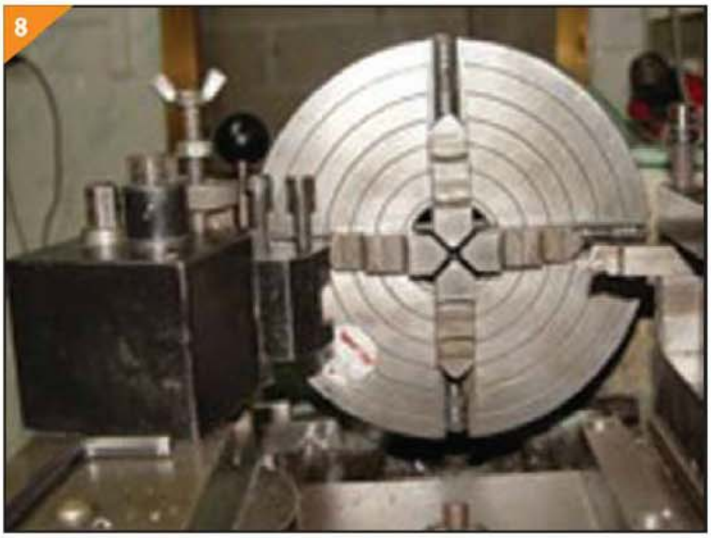
I am not particularly biased but I do have 35 years experience of working in such countries as a development advisor.

In conclusion

When selecting a lathe consider that the machine should not only do the job but will it do the job easily with spare capacity. Spare capacity not only refers to the size of work that can be processed on the machine but >>

Tip

A statistic often used to determine a quality lathe is that the width of the bed should be $1\frac{1}{2}$ times that of the centre height, or thereabouts. That is well worth checking on an inexpensive import.



also its ability for repeated accuracy over an extended period of use, coupled with low maintenance requirements.

Model engineering is not a hobby to be hurried but time does not wait and I see no reason for scratching away at a wheel casting or machining steps in a steel bar taking tiny cuts when, with the appropriate machine decent cuts can be taken with ease under power feed. Whilst carbide tip tools do work at low speeds and feeds they often perform better at high speeds and feeds but a rigid set up is a must.

Whatever lathe you select please, please make sure you equip it with quick-change tool posts. The days of the fixed tool post and bits of packing have long gone. Quality interchangeable tool posts are very accurate, when changed will repeat accuracy to within a 'few thou'. You will still need to put the 'mike' over the job on the last but one cut but interchangeable tool holders save an enormous amount of time.

Reluctance to purchase a used machine may not only be the fear of buying a dud but also a feeling that an industrial machine may be 'too much machine'. Nothing could be further from the truth. If you are new to the hobby of model engineering you must understand that to get a real feeling of fulfilment, the work you complete must represent your best efforts. To practice the hobby a lathe is a must and the quality of your finished model will largely be determined by the quality of the output from your lathe. There are enough challenges without trying to cope with inconsistent machine tool performance. As an amateur with perhaps very little machine shop experience you may well blame your own lack of knowledge and skill when you struggle for accuracy from the machine, can't get a good finish, or things just seem to go wrong. A poorly built machine tool with inherent accuracy problems, badly fitting slides and generally not user friendly will soon dampen your enthusiasm. I have operated some of these machines from the Far East and find them, at times, very unforgiving, but with 50 years machine tool experience I am able to compensate to some extent. This does not, however, stop me expressing a more than occasional expletive! Quite simple operations can become real chores taking far longer than they should.

Not 'anti'

I would like readers to understand that I am not 'anti' Chinese products. If I were to take that line it could prove hazardous to my health as I have a Chinese wife and there is an extensive Chinese community in Cambodia. I am told that the Chinese can do terrible things with little sharp knives, fire and bits of bamboo! Chinese cars are starting to catch on in Cambodia and recently a number of shops have opened selling electric bikes that will go 100km per charge, have hydraulic suspension and only cost £250, they are selling like hot cakes. Motor driven Mekong river transport depends on the super simple Chinese single-cylinder diesel engine. However, for the time being I do not believe their machine tools on offer to model engineers represent the best value for money when compared with used ex-production equipment at present available in UK.

Living in Cambodia I have an advantage as I can mooch as much as I like in the wonderful tool markets, believe me its not all junk with brand names such as Snap On, Gedore, Wurth, Vice Grip, Maketa etc.

Equipping your workshop should be part of the enjoyment and be looked upon as a prelude to a long and productive hobby. If you are of the mind that setting up a workshop is a chore, a set of hoops that have to be jumped through, then perhaps you should re- evaluate your reasons for taking up model engineering as a hobby.

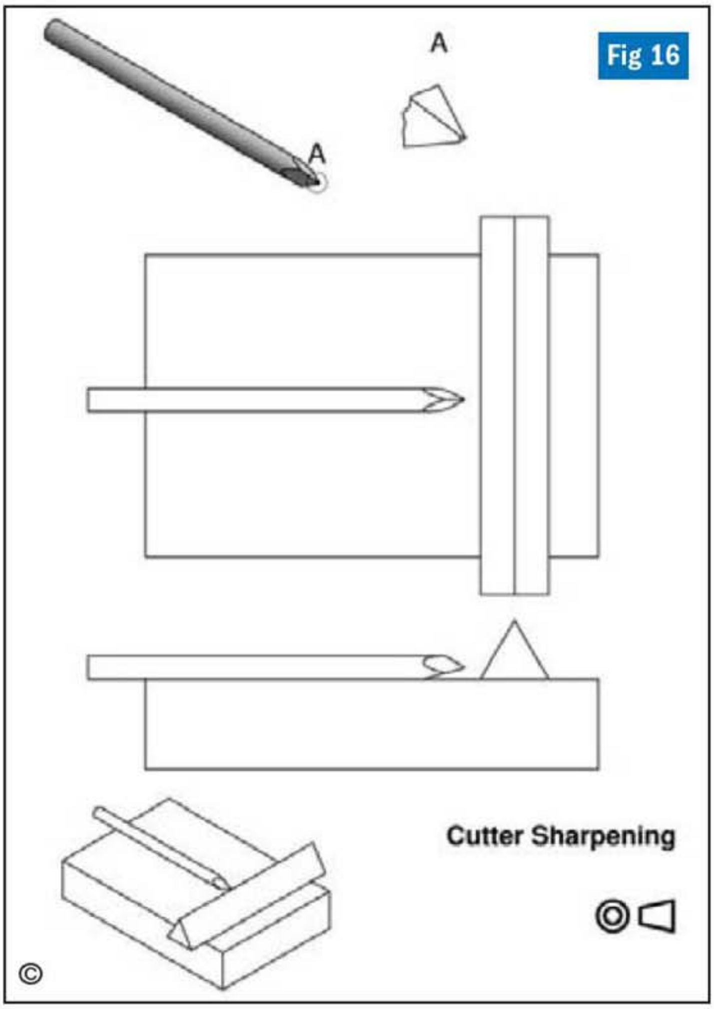
Go along to some of the used machine tool dealers or enquire round schools and colleges. Perhaps they are turning out some workshop equipment that could use a good home. I find such expeditions great fun. Entering a large warehouse full of used machine tools, to me is like going into Aladdin's cave. If you shop around quality used machines are available within the price range of £500 to £1,500 but don't be afraid to haggle!

7. The author's Chipmaster.

8. Rear tool post, T-slotted block and quick change tool post.

If conversion to single phase electricity is required remember you do not have to equip the machine with the equivalent of its original motor in terms of power. My Colchester, originally fitted with a 3hp three phase motor now sports a 2hp, 3-phase motor that runs through a Newton Tesla single phase electronic converter variable speed unit. I understand the actual power output is less than 2 horsepower. I have also removed one of the drive belts and have yet to stall the machine. I think it is dangerous to have too much power available, in particular when taking into consideration the isolated environment most of us work in within our home workshops.

Finally, careful inspection of the photo of my Colchester will reveal a small Buddha atop the Tesla control box. I regularly offer a little prayer and light a couple of incense sticks in the hope of keeping the gremlins and other mischievous inhabitants of the workshop at bay. I don't know if it does any good but as a close friend said "It don't do no harm, do it?" **ME**



MAGNETIC DRIVE CLOCK

PART 5

Continued from page 571 (M.E. 4299, 11 May 2007

Richard Stephen describes his CNC method of making the clock dial, and makes the hands from titanium.

The traditional engraving cutter is a D-bit ground from HSS. These do work very well. However, if you want to have fine lines the tips become very fragile. If the tip breaks before you have finished the job it is difficult, particularly if you are using CNC, to get the subsequent engraving the same as the original.

A far better profile for an engraving cutter is a 3-sided point, that is 3 facets at 120 degrees and ground to the desired included angle (30 deg. is an excellent choice). Readers may wonder if such a profile will cut very well. I can assure you these cutters cut very cleanly in engraving brass.

Grind the three facets at the end of a length of HSS and bring the facets to a sharp point. Remove all burrs and smooth the facets with a fine aluminium oxide stone. With the cutter on a flat surface turn the cutter until one edge is central, See **fig 16**. Using a 3-cornered slip stone, with one face on the flat surface, take a few gentle strokes with the stone. This will generate a relieved cutting edge on the point.

Engraving tool path

I have engraved quite a number of dials over the last few years. Each time I do one I change the procedure I use in order to improve the final result. For those readers who wish to use the file I used, a CD with the engraving file is available at a small cost. This CD will also contain all the .dxf and G-codes files required to engrave the dial. There are in all 12 separate files, one for each of the numerals.

For readers who want to generate their own set of engraving files the procedure is as follows. The dial has been drawn with the centre at the origin of the co-ordinates. Copy and shift the centre to the co-ordinate x = -50, y = 0 this will place the origin just to the left of numeral 3. Save this new drawing as Dial1.dxf.

The drawing now needs to be modified and two new versions of the dial produced. Using the erase option (object trim in Turbocad) remove all the lines that form the bars of the numerals and the 5-minute divisions. This will leave all the single lines and the minute divisions. Save this drawing as Dial2.dxf.

Open Dial1 again and again modify it by removing all the single lines (the ones saved in >>

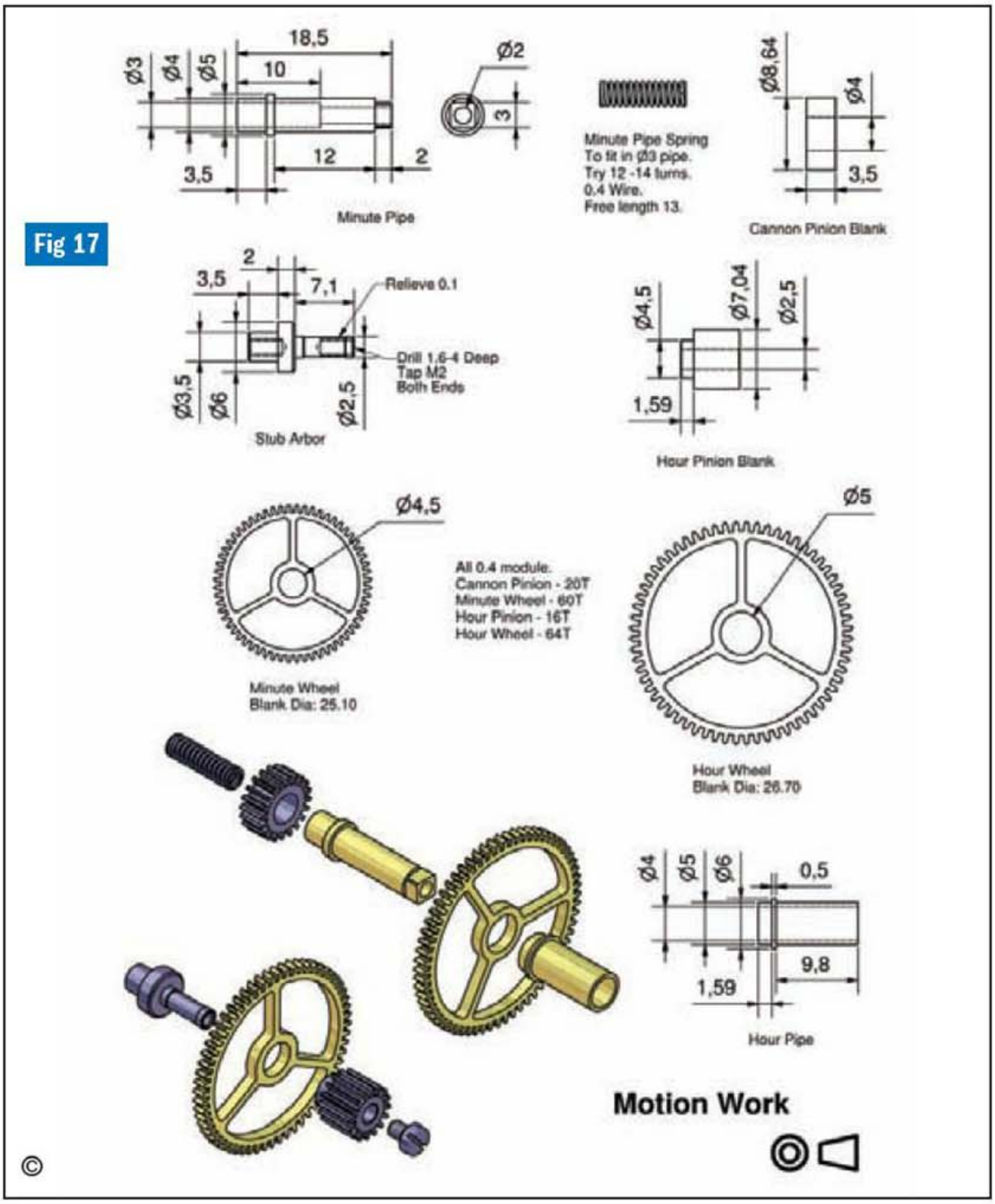


Fig 17

Dial2) and leaving just the bars and the 5-minute divisions. When doing this it is worth filleting all the corners with a 0.01 mm radius fillet. This will ensure that all the bars will form a closed entity. This is necessary as the pocketing routine (certainly the one used in DeskCNC) will only work with closed drawings. Save this drawing as Dial3.dxf.

Now comes the slightly tedious part. Open Dial2. Using the Select tool select and erase everything except the lines that are part of numeral 3 and the two minute divisions on either side. Save this as 3L.dxf (L for line). Using the step back command return to the drawing as opened. Select the whole drawing and rotate it 30deg. anti-clockwise. This will place the numeral 4 in the 3 o'clock position. Repeat the above and save as 4L.dxf. Repeat until you have saved all 12 L files. Close Dial2 and open Dial 3. Repeat the above procedure starting with numeral 3. The result will be the 3 bars and the 5-minute division. Save this as 3P.dxf (P for pocket). Repeat until you have saved all 12 P files.

The tool paths for the 12 numerals can now be generated from the L and P files. Generate the tool path for the lines for each numeral first and append the pocketing tool path. I used an engraving depth of 0.15mm for both the lines and the pocketing. Use no offset for the lines and a 0.1mm offset for the pocketing. The technique described above can be used to engrave dials of any size provided you can get the dial disc under the spindle.

Motion work and hands

The details of the components for the motion work are given in **fig 17**. Make the wheels and pinions using the same techniques as used for the train components earlier. The square on the end of the minute pipe for the minute hand is made 2mm long to accommodate a collet with a square hole to which the minute hand is fixed. This collet helps hold the hand more securely than a simple square hole in the hand. The motion work tension spring is also unusual in that it is a 2mm I/D compression spring fitted inside the minute hand pipe. The spring presses against the shoulder on the centre arbor that extends through the front plate. I was introduced to this way of tensioning the minute hand by Peter Bradley several years ago and have found it superior to the more usual leaf spring.

The stub arbor on which the minute wheel and pinion runs, is made of silver steel, hardened and tempered. The length of the arbor has been specified in fig 17 but measure the length of the completed minute wheel pinion and make the arbor 0.2mm longer than this. Drill and tap the holes for the 2mm screws before hardening the arbor.

When you have made all the components of the motion work depth the entire motion work on the depthing tool. To do this an extra long 2mm runner for the depthing tool will have to be made. Having depthed the motion work measure the spacing between the two arbors and make a note of the value. This is the distance between the centre arbor and the stub arbor. The hole for the minute wheel stub arbor can be drilled in the front plate. Centre the mill on the hole for the centre arbor and line up the centre line of the plate with the x-axis of the milling machine. Move the table by the measured distance and drill a 2mm hole through the front plate. Now expand the hole to 4mm from the front of the plate to a depth of 3.5 millimetres. The minute wheel and pinion are retained on the arbor by a 2mm screw. The arbor is secured to the plate with a 2mm screw.

Titanium hands

The hands are illustrated in **fig 18.** The design of hands is a real problem. After trying all sorts of design I finally settled on the simple but stylish Brueget form. I made my hands out of titanium. The advantages of titanium are

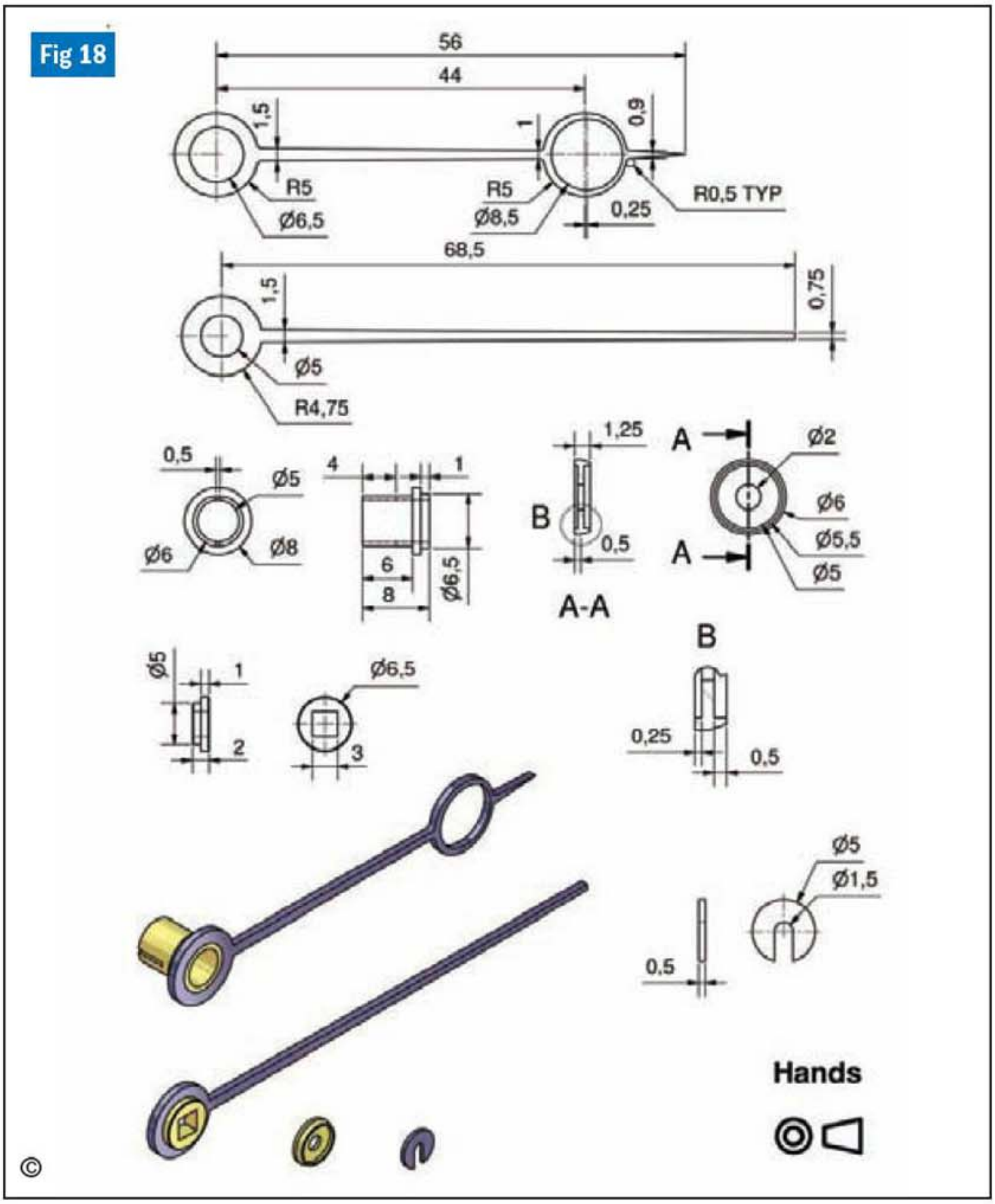


Fig 18

its density (4.5) compared to steel (7.9). Titanium is as stiff as steel. It is also much easier to blue uniformly. Titanium is no more difficult to work than carbon steel from, say, an old cross cut wood saw blade (very tough steel!).

As with steel hands the quality of the blueing one gets depends on the quality of the surface finish. This is particularly the case with titanium. I use wet and dry paper finishing with the very finest I can get (3000).

To carry out the blueing you will need a DC power supply giving 30V at 1A (the current required is much less than this) and about 1 litre of very dilute sulphuric acid (a small amount of battery acid added to a litre of distilled water). The strength of acid used is so dilute that there is very little danger of harm if you get a drop on your skin. Nevertheless sulphuric acid can be dangerous so be careful and protect your eyes and wear disposable vinyl gloves.

Use a glass or plastic jar deep enough to fully immerse the minute hand and a strip of lead for a cathode. The anode is the hand to be blued. All that is required is to turn on the power and fully immerse the hand for about five seconds and withdraw a blued hand. Wash several times in clean water to remove all traces of acid and rub over with a soft cloth. The resulting blue colour is slightly different from the steel blue, most people actually like it better.

A brass collet (fig 18) with a square central hole is fitted in the 5mm hole with Loctite. This makes the fit of the hand on the minute pipe a lot more secure. As in my previous clocks the hands are secured to the centre arbor using a 3mm diameter compression spring fitted into the lower end of the minute pipe. The front of the centre arbor extension is generally cross-drilled with a 1mm hole for a pin to retain the hands. A far superior method is to cut a groove as shown in fig 11b (*M.E.* 4297, 13 April 2007) and use a slotted washer shown in fig 18. Readers will find this a lot easier and it saves looking for the pin when you have dropped it.

The length dimensions of the centre arbor extension, minute pipe, reverse minute wheel stub arbor and hour pipe have been given. Readers are advised to use these lengths as a guide as they are best determined as the motion work is fitted to the movement.

Clock base

The clock needs to be mounted on a base, partly for appearances and to provide a housing for the circuit board and the drive coil. I made mine out of some pieces of English walnut that I had in my collection of hardwoods. Readers could use any nice close-grained hardwood. I get all my wood from small county timber mills. These mills often have some nice pieces of various local hardwoods tucked away. For the base you will need the following finished sizes:

For the sides:
Two pieces 50mm x 20mm x 300mm
Two pieces 50mm x 20mm x 200mm

For the base bottom:
One piece 250mm x 150mm x 20mm
For the mouldings
Two pieces 25mm x 20mm x 300mm
Two pieces 25mm x 20mm x 220mm

The base is assembled entirely with wood adhesive. I strongly recommend using aliphatic PVA wood adhesive and not the PVA available from DIY shops. Aliphatic PVA sets hard and can be sandpapered. The aliphatic PVA is available from most good model shops.

The construction details of the base bottom are illustrated in **fig 19**. Start by cutting the bottom to size. The edges of the bottom must be precisely square to the surface as well as the four corners. If you don't get these precisely square you will have a lot of problems

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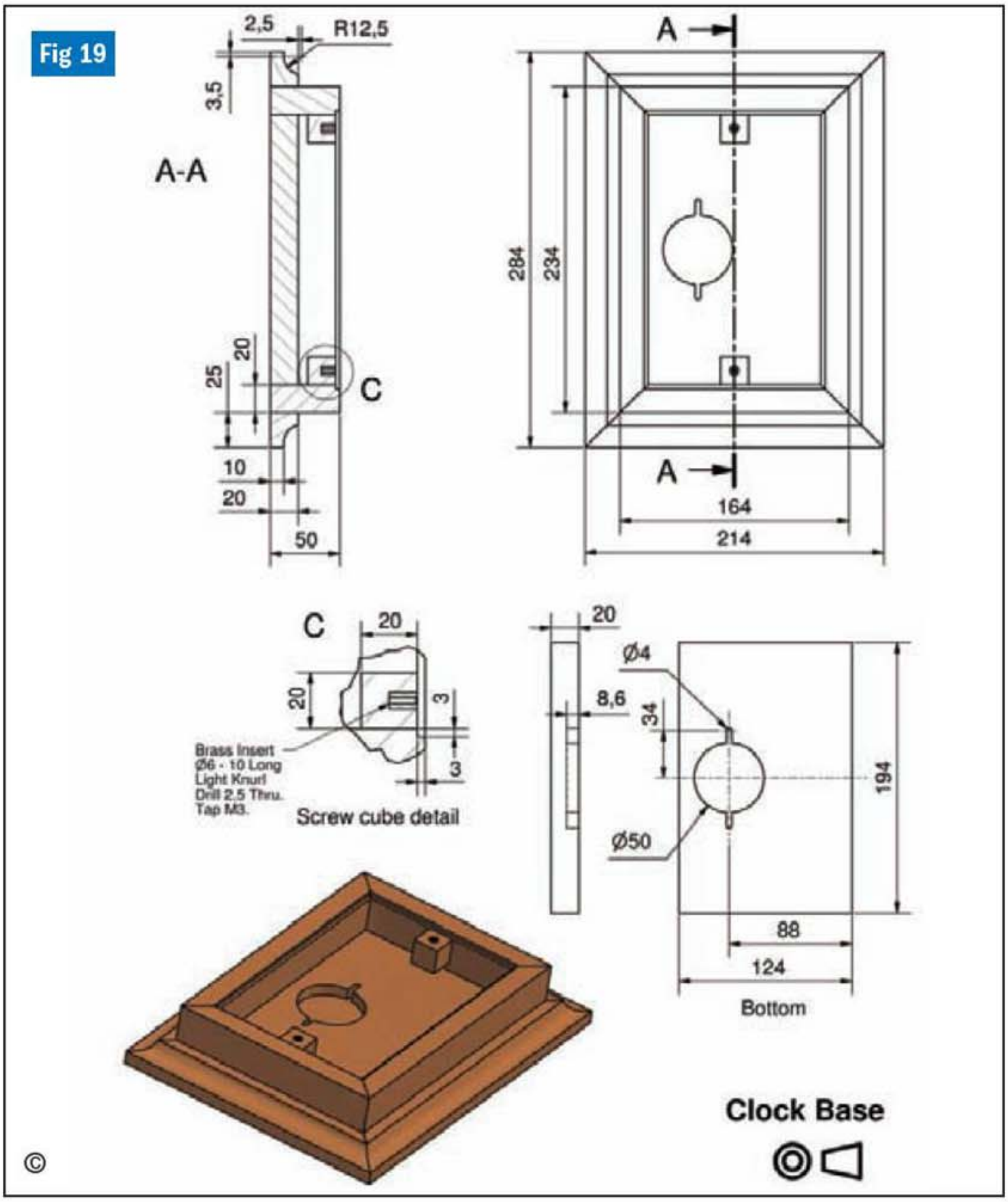
when it comes to gluing on the four mitred sides. The two end grain edges should be sized with adhesive diluted with an equal amount of water. This will ensure that the glue joint at these edges is strong. Apply the dilute adhesive with a brush and allow it to dry. Rub the edges smooth with fine aluminium oxide paper. A recess for the drive coil must now be cut in the bottom. This recess must position the centre of the coil directly under the magnet on the end of the pendulum. The brass base of the movement has been recessed to a depth of 2.5 millimetres. The sides are recessed to a depth of 3mm so that when the movement is fitted into the base the distance from the recess in the movement base to the base bottom is 29.5 millimetres. To fit the coil so that it is just below the top of the recess it is necessary to cut a recess in the base bottom that is 8.6mm deep with the diameter of the coil. When the recess has been cut mill two slots as shown in fig 19 for the coil leads.



The most difficult part of making the base is accurate cutting of the mitres. I cut my mitres on my milling machine using a sharp 10mm diameter extra long series end mill. If you are unsure about cutting the mitres you could have them cut by your local picture framer. They have a guillotine designed for the job.

The mitres must be precise so that there are no gaps at any of the joints. Give the framer the base and ask him to fit the sides for you but not to glue it together. Before gluing the sides in place cut a recess 3mm wide and 3mm deep in the inside edge of each side for the brass base of the movement. Size the end grain of all of the mitres using diluted PVA adhesive. When the glue is dry rub down the mitres with fine aluminium oxide paper taking care not to round off any of the edges.

The sides can now be glued in place. Before gluing the sides do a dry trial run to check that the fit is perfect and mark the edge of the base where each side is to be glued. Glue in the sides one at a time allowing each to dry before gluing in the next one. When all the sides are in place, rub down the sides with fine aluminium oxide paper to remove all traces of glue.

The mouldings can now be glued to the sides following the same procedure used to glue on the four sides. The final task is to glue two pieces of wood on the inside of the short sides to hold the inserted brass nuts that attach the movement to the base.

These nuts are made from 10mm long pieces of 6mm brass rod. Grip a length of 6mm rod in the lathe and lightly knurl the surface for about 25 millimetres. Drill 2.5mm through and tap the rod M3. Cut off two 10mm lengths. Fit the movement onto the base and using the holes for the two screws as a guide drill 3mm holes into the base. Expand these holes to 6mm to a depth of 10mm for the brass nuts. Apply super glue to the outside of the nuts before pressing in.

The base can now be sanded smooth prior to polishing with French polish. Before applying the French polish the surface grain must be filled. The best clear sanding sealer is a spray can of clear lacquer. Give the base several coats allowing each to dry before applying the next coat. When you have built up a good layer, rub the surface down with fine aluminium oxide paper.

The base is now ready for French polishing. Apply the shellac with a lint free cloth. Apply one coat and allow it to dry. Apply a second coat and immediately put a few drops of linseed oil on the cloth and rub the surface. The oil will prevent the cloth from sticking to the shellac as well as helping to produce a fine shine. What I have described is the most basic of French polishing. As with many things, I am afraid it is a case of practice makes perfect!

NOTE: The editor will be happy to forward requests for engraving and .dxf files to the author.

To be concluded.

AYESHA II

PART 5

Continued from page 576 (M.E. 4299, 11 May 2007)

Tony Weale works on the cylinders of this classic locomotive.

1. *Rolling chassis, and cylinder castings.*

2. *Averill cylinder and steam chest castings.*

When the coupling rods are shaped to your liking, polish them all over to whatever degree you wish, and then make the retaining washers for the leading ends. These are simply turned, drilled, and countersunk in the lathe, on the end of a piece of 3/8in. diameter mild steel rod, and parted-off to 1/16in. thickness. They should be a clearance fit in the counterbore, and should sit flush with the surface of the rod. When secured to the leading crankpin with a 6BA countersunk screw, the rod should turn freely but without appreciable side play. Adjust if necessary by shortening the crankpin slightly, or deepening the counterbore.

The connecting rods can be made now, although they are not required until later. They require similar techniques to the coupling rods, and water-cut blanks will probably be available, but the lengths do not (or should not) have to be matched to either side of the engine, so it is preferable to clamp the two blanks together and pilot-drill them as a pair. The taper can either be sawn and filed, or produced in the 4-jaw chuck with the work mounted, as previously, on a piece of flat bar, angled as required. The big end, and its bush, can be made rectangular or circular in profile. Turn the bush to be a press-fit in the rod, and drill and ream it afterwards to be a running fit on the 1/4in. crankpin. If you like you can add a 12BA cotter pin, drilling a clearance hole, half in the coupling rod and half in the bush, but if the bush is pressed in tightly it should stay put anyway. The small end of the rod can either be hardened, or enlarged to 1/4in. dia and a bronze bush pressed in. Fluting, if required, is as described for the coupling rods. There is no point in trying to taper the flute, and LBSC did not do so on his Ayesha connecting rods.

Eccentric rod

The pump eccentric rod can be finished at this stage. Put the pump eccentric on front dead centre, and slide the pump ram in as far as it will go. Withdraw it 1/32in., and mark and drill the eccentric strap so that it will fit in that position. If necessary the pump can be moved forwards or backwards in its threaded mounting.

We now need a wrist pin to connect to the ram. Either use a short piece of 1/8in. silver steel rod, threaded each end for a 6BA nut, or turn up a clevis pin to a close running fit, and retain it with a 3/64in. split pin. This is easier to assemble, and similar pins can be made for the valve gear. Your choice will depend on the prospect of drilling 3/64in holes!

Check that the eccentric strap turns freely on its sheave. If it is tight the strap may be slightly too wide or too small in bore. The width is easily reduced with a file, and a tight bore can be 'corrected' by putting a thin shim, such as a piece of aluminium foil, between the bolting faces.

Cylinders and steam chest

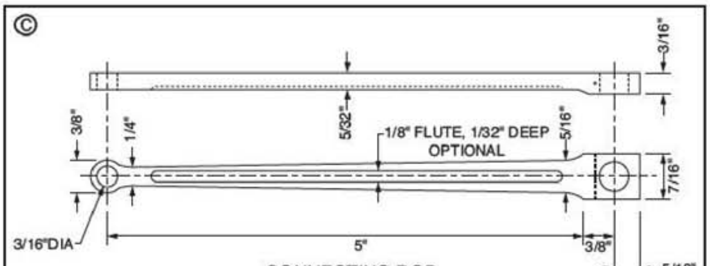
We are now going to leave the rolling chassis for a while, as we turn our attention to the cylinders and steam chest, so this is time to take out the wheels, clean everything up and give the frames and the wheel centres a coat of paint. Do not overdo the painting, and keep it away from the working surfaces. Make sure that you know where everything fits, and mark the eccentric straps, axleboxes, etc, with centre-pops or scribed or stamped numbers where necessary.

There is probably more work in the cylinders and valves than in any other part of the locomotive, and it is here that most accuracy is required, The task is made easier by the Averill design, since practically all the work can be done by turning in the lathe and there are relatively few separate components.

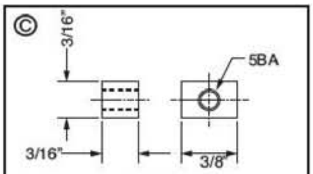
Let us start by looking at the castings. The steam chest is basically a thick-walled tube >>

1

2



CONNECTING ROD
2 OFF M.S.



NUT
2 OFF, G.M. OR BRASS

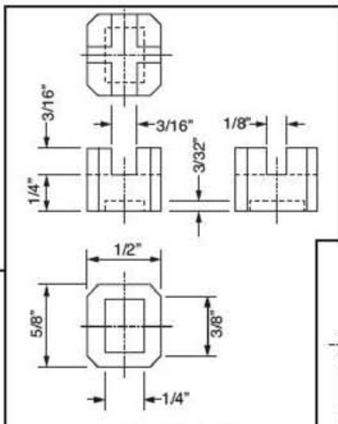
which fits between the frames, with a bolting flange on each end. Each flange has a circular register which fits into the $1^{3}/_{8}$in. diameter hole in the frame and is machined flush with the outside of the frame, forming a joint face for the cylinder. The cylinder casting has a $^{7}/_{8}$in. diameter spigot, which forms its port face, and is a hand push fit in the bore of the steam chest. Each cylinder is retained by four bolts passing through clearance holes in the frame, into the steam chest flange. Note that the centre line of the steam chest bore is located $^{1}/_{8}$in. below the centre line of the frame register. This is to allow for the exhaust passage leading to the blast nozzle.

Steam connections

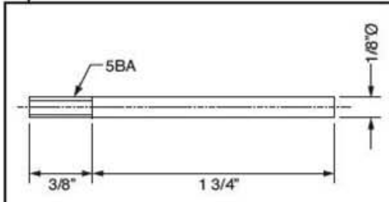
Steam, exhaust and lubricator connections form part of the steam chest, eliminating external pipework. Under the steam chest is a rectangular pad, which rests on the bogie, and is drilled to accept the bogie pivot pin. The ports, cylinder passages, and slide valves are conventional, although the valves are octagonal in profile to improve clearance in the circular steam chest. Historically, some Averill type cylinders, including those fitted to the original Ayesha, used circular slide valves and crescent-shaped ports. There were also versions where the steam chest was concentric with the frame register, but that is another story.

Start work by machining the steam chest. This looks fearsome, but is in fact a relatively simple task, using the 4-jaw chuck. First centre-pop the blast pipe boss and the lubricator connection as accurately as possible, to define the horizontal and transverse centre-lines. Chuck the casting with the lubricator boss facing outwards, and set it to run true. Square up the edges of the front flanges to finish 1in. from the blast pipe centre, and centre-drill the lubricator boss. Reverse the casting in the chuck, place the machined edges against the chuck body, and face across the valve spindle bosses. Re-chuck with the blast pipe boss facing outwards, and set to run true' referring to the newly machined front edges. Centre-drill the blast pipe boss, and take a cleaning cut across the top flanges: these parts are to be finished at a later stage. Reverse the casting, so that now the top flanges are against the chuck, and face the bottom of the casting, finishing $1^{3}/_{16}$in. from the centre of the lubricator boss.

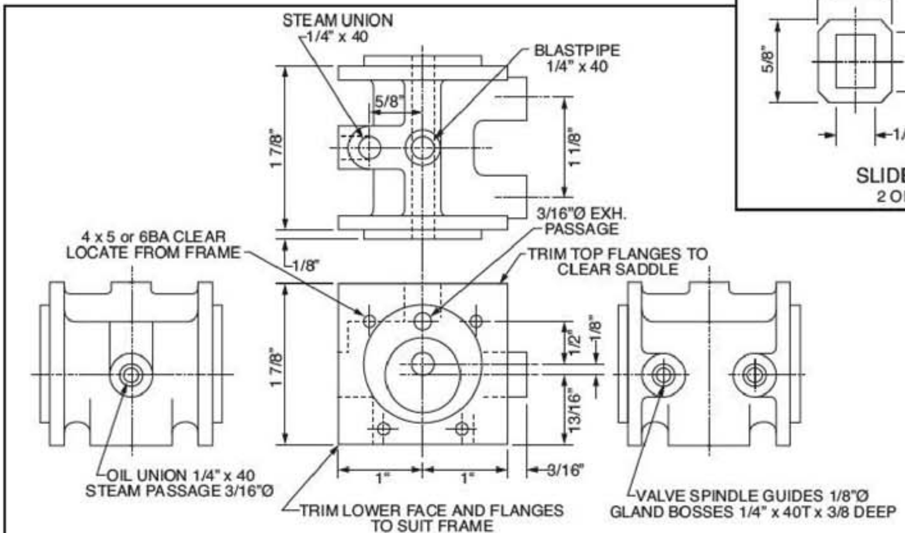
All this will provide clean edges from which to mark out the centre lines of the steam chest bore, the registers, and



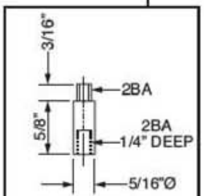
SLIDE VALVE
2 OFF,G.M.



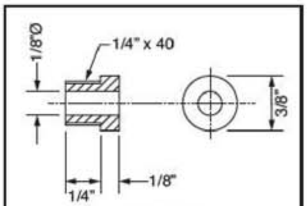
VALVE SPINDLE
2 OFF, STAINLESS



STEAM CHEST
1 OFF, G.M. CASTING

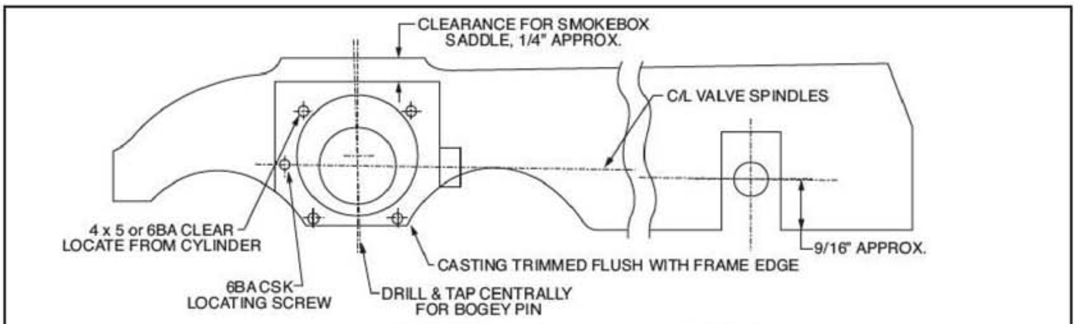


BOGIE PIN
1 OFF M.S. OR BRASS

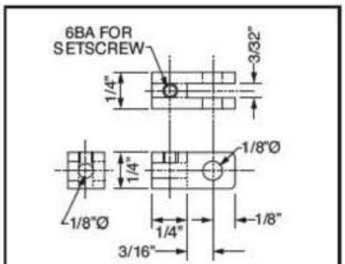


GLAND
2 OFF, G.M. OR BRASS

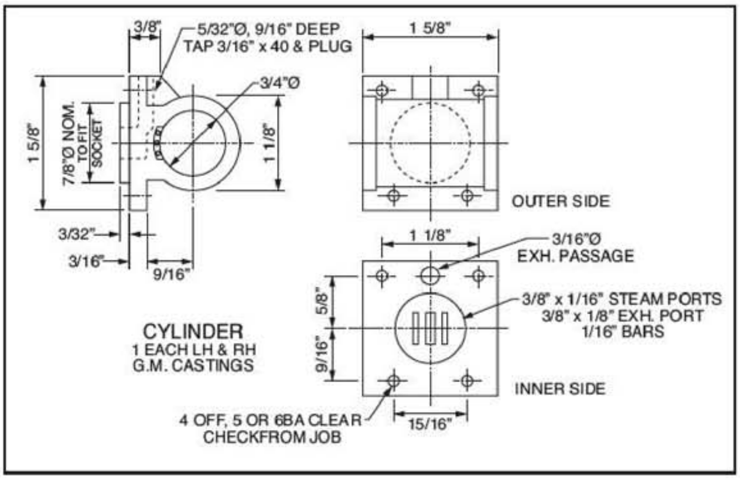
©

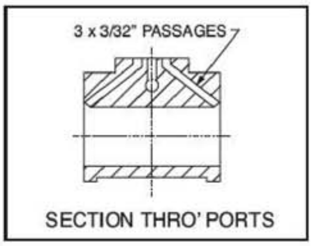


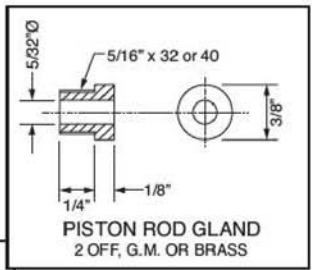
POSITION OF STEAM CHEST IN FRAMES

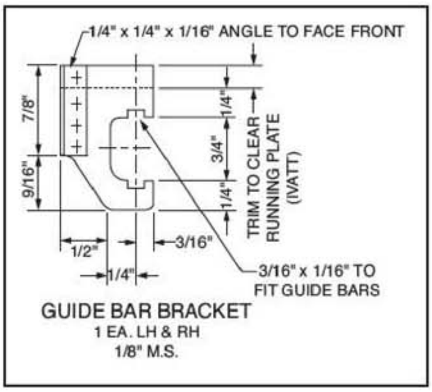


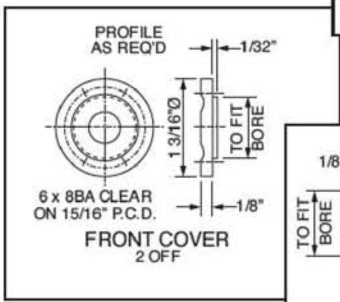
VALVE CROSSHEAD
2 OFF, M.S.

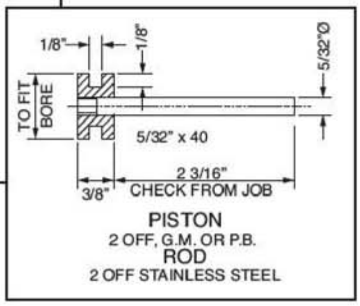


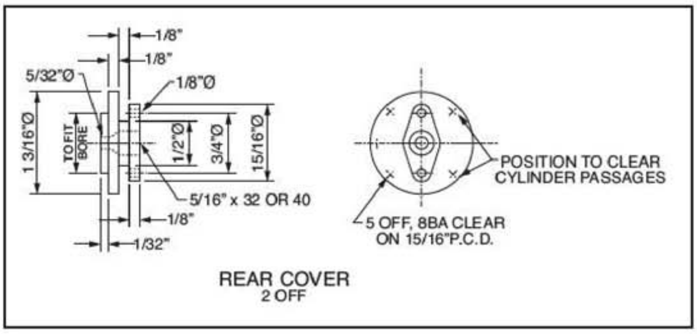












the position of the valve spindles. Then chuck the casting with the core hole on the lathe axis and set it to run true. It may help to put a wooden plug in the core hole and scribe the centre lines across it. The core hole can now be bored out to $^7/_8$in. Aim for a smooth finish, so that the cylinder spigots will fit well.

The best way to machine the flanges and the offset registers is to use a mandrel. If you do not have a suitable expanding mandrel, chuck a piece of $^7/_8$in. rod to run truly (or turn down a larger piece so that it does), so that the steam chest bore will just slide over it. Secure the casting by drilling and tapping the lubricator boss for a setscrew: 4BA is about right. Set the mandrel over in the chuck by $^1/_8$in. either by direct measurement or with reference to the scribed centre lines on the casting. The offset must be towards the bottom of the casting.

The registers and flanges can now be machined, If you have a large enough lathe both can be tackled at the same setting using a right-handed knife tool at one end of the casting, and a left-handed tool at the other. In a very small lathe it may be necessary to machine one register, then reverse the casting on the mandrel for the second operation. This will need some careful setting-up, with reference to the squared edges of the flanges, to ensure that both registers are aligned.

Try to remove an equal amount from each end of the casting, so that the exhaust and lubricator bosses remain central. The outer faces of the flanges are 1$^7/_8$in. overall to fit between the frames. This dimension will require adjustment if you are using a non-standard thickness of frame material.

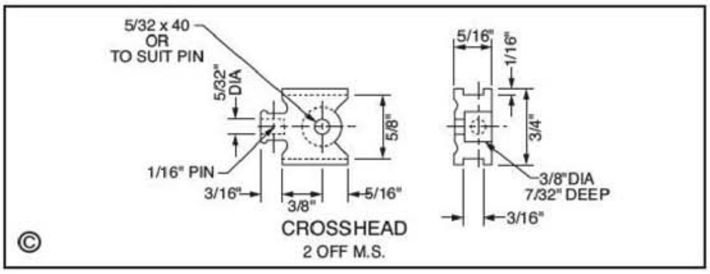
The length over the registers will be 2$^1/_8$ inch. Put a good finish on the end of the register, since it will form a steam-tight joint with the cylinder. Ideally it should stand just proud of the frame, so that the cylinder seals against it when bolted up. If ultimately it does not, a paper gasket or some sealing compound will assist.

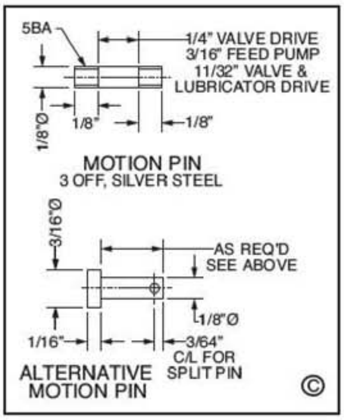
It is possible to bore the $^3/_{16}$in. diameter exhaust passage across the top of the steam chest with the casting on the mandrel, but it is a long hole and it is probably safer to do this in the drilling machine, working from each end to the centre. The blast pipe boss can then be drilled to meet the cross passages, opened out and tapped $^1/_4$in. x 40. Note that it does not go all the way through into the steam space! Open out and tap the steam pipe connection and the lubricator boss, also $^1/_4$in. x 40. Staying with the drilling machine, set up the casting carefully in a machine vice with the gland bosses vertical, pilot-drill through to the steam chest, then drill $^7/_{32}$in., $^3/_8$in. deep for the glands, Tap these $^1/_4$in. x 40, using the drill chuck as a guide when starting the tap to ensure a straight thread. Open out the pilot holes to $^1/_8$in. for the valve spindles, finishing with a reamer,

A useful finishing tool for holes like this is a piece of rod, say 3in. long of the required diameter. Grind one end off at 45 deg. to make a cutting edge. Grip the other end in a pin-vice, or a small tap wrench` and use as a reamer. Silver-steel is the preferred material, but in this case we can conveniently use a piece of the valve spindle material, $^1/_8$in. rustless steel. Aim for a tight sliding fit and the valve spindles will soon run themselves in.

Now we can fit the steam chest to the chassis. If the buffer beam is removed the frames can easily be sprung apart to allow this. Put a straight piece of $^1/_8$in. rod, about 7$^1/_2$in. long, through one of the valve spindle bores and rotate the steam chest to align the rod with the running position of the driving axle, which is $^9/_{16}$in. above the bottom edge of the frame. Put a clamp round the frames to hold the steam chest in this position. Drill and tap a 6BA hole through each frame into the front section of the steam chest flange, where indicated on the drawing, for a countersunk locating screw.

The top and bottom edges of the steam chest flanges will now project above and below the frames, or at least they should! Scribe along the flanges to mark the position of the frame edges then remove the steam chest from the chassis. Scribe a second line parallel to the one on the top >>





flange and $^1/_4$in. below it, and return to the lathe and the 4-jaw chuck. Put the steam chest in the chuck with the bottom edge towards the tailstock, angled so that the scribed lines on the bottom flanges run at right angles to the lathe axis. The casting can now be faced back to the lines, finishing the bogie support pad to the same level. The job will be getting a little awkward to hold by this stage, so use soft sheet metal packing between the jaws and the machined faces and take very light cuts on the overhanging flanges.

When the bottom face is complete, reverse the casting in the chuck and locate it against the chuck body. The top flanges will now be in position for machining down to the second scribed line. When the steam chest is refitted to the chassis the top flanges will be $^1/_4$in. below the top edge of the frames, and the lower face will be flush with the lower edge of the frames. The remaining surplus of the lower flanges around the bogie wheel cutouts can be removed by sawing and filing. With the chassis inverted, the bogie pin location can be marked out, drilled and tapped. While it should obviously be on the centre line of the locomotive, the fore-and-aft location can be adjusted to provide optimum clearances around the bogie wheels. For simplicity the 2BA hole can go through into the steam chest, and the pin can then be fitted using sealing compound.

Bogie pivot pin

The bogie pivot pin is a simple job. Turn a length of steel or brass rod to be a sliding fit in the slot of the bogie stretcher, face the end, reduce $^3/_{16}$in. length to your preferred tapping size - 4mm or just over $^5/_{32}$in. for 2BA - and cut the male thread with a die, preferably in a tailstock holder. Reverse the piece in the chuck, face off to $1^3/_{16}$in. overall length then centre-drill, open out, and tap the 2BA female thread. A 2BA hexagon headed screw and a washer will be required to retain the bogie on the pin.

With this design of steam chest it has been found necessary to inject oil to provide initial lubrication, and one way of doing so is to drill through the bogie then remove the retaining screw when oiling. The other possibility, which avoids getting under the engine, is to drill and tap the steam chest, alongside the steam entry point, for a screwed plug, say $^7/_{32}$ x 40 which will be accessible from the front, under the smokebox.

The chassis should now be wheeled, reasonably free-running' and ready for the cylinders. Before tackling these it is advisable to check that your lathe will turn parallel. Turn a test piece of steel or brass bar of about 1in. diameter to a good finish for a length of 3in. Measure each and with a micrometer or digital calipers. We need an accuracy of about 0.001in. per inch, so the measurements must be within 0.003in. of each other. You may be pleasantly surprised, but if not, adjust the slides as necessary and repeat the test until matters improve. Most lathe slides do not wear uniformly, and since the workpiece is less than 2in. long the whole travel does not have to be within limits, only the part which you intend to use for the job in hand.

Starting the cylinders

The first job will be to measure-up the cylinder castings, and mark out. Determine how much will have to be machined from each end of the casting to produce the finished length of $1^5/_8$ inch. It will probably be around $^1/_{16}$ inch. Decide which will be the rear end of each cylinder - the guide bar end - mark for reference, and put a wooden plug in the core hole at this end. Mark the vertical centre line of the bore, and a parallel line $^3/_4$in. away to denote the bolting face that will mate with the frame. Add the horizontal centre line by measuring across the outside of the cylinder walls. Repeat this measurement at the other end of the casting, and produce the horizontal centre line across the face of the spigot. Measure the length of the casting and mark the vertical centre line on the spigot and centre-pop.

Now set up the cylinder in the 4-jaw chuck, with the plugged end of the core hole outwards and adjust until the centre mark on the plug runs true. Check also that the outside of the cylinder is reasonably parallel to the lathe axis, by using a set square against the face of the chuck. Use packing pieces where necessary and ensure that all the jaws are gripping properly. When satisfied, remove the centre plug - it should be possible to knock it (gently) right through the casting - and use a sharp boring tool, set at centre height or very slightly above, to open out the core hole. Check that the tool is long enough to go right through the bore, run the lathe fairly slowly - say 260-300 rpm - and take light cuts with a slow feed. Clear the swarf frequently and use a lubricant. WD-40 is a good alternative to cutting oil. When you are approaching $^3/_4$in. diameter and are ready for the final cut, re-sharpen the tool and put it through several times at the final setting. This should produce a good working finish without the need for reaming.

With the bore complete, change to a round-nosed tool and face off the end of the casting, keeping the overall length in mind. Take care with the overhang on the bolting flanges. This end of the cylinder will now be true to the cylinder bore, and should be marked as the rear and for accurate location of the rear cover, gland and guide bars. Now reverse the casting in the chuck, locate the machined face against the chuck body, and face off the other end to the overall length of $1^5/_8$in. Re-chuck the casting with the spigot outwards, and position it for machining the bolting face and port face. Set the centre mark to run true and use a square against the chuck body to line up the machined faces. Use a knife tool to clean up the bolting flange, finish it to the marked-out line, and turn the spigot to a tight push fit in the steam chest bore. Finally, face the spigot to $^5/_{32}$in. thickness with a smooth finish, to form the port face.

● To be continued.

● Drawings are available from:
PO Box 87
Leominster,
Herefordshire
HR6 6AJ

● Details of castings are available from:
Box 2500,
Model Engineer,
Berwick House,
8-10 Knoll Rise,
Orpington,
Kent BR6 0EL

● Membership details of the National $2^1/_2$" Gauge Association:
Peter De Salis-Johnston,
7 Tudor Court, Fulford,
Stoke-on-Trent ST11 9RX

PART 2

Continued from page 563 (M.E. 4299, 11 May 2007)

THE DAVIDE Mk.II STIRLING ENGINE

James G. Rizzo of Malta begins the construction of this exciting new design of Stirling engine and starts with some notes on the selection of the parts needed.

The first important consideration is the identification of the displacer unit and the power cylinders. The displacer unit is fairly large, in fact the largest I have ever used. It may not be easy for the reader to find both a pipe and a suitable light container for this item, however I will give the reader some ideas further on. I was probably lucky in that both were fairly readily available. Since I required a large unit, I looked for the displacer first. This I found in a household shop from where I bought two sugar canisters of different sizes. This was followed by a visit to the stockist of stainless steel pipes. I cannot describe the look of amusement on the faces of a couple of salesmen when they saw me taking out these containers and trying them in the various pipes.

The glee of finding the right one was somewhat tempered by the look of disgust on the face of one of them when I asked for a piece 12in. long - "is that all?". In the end I had to take a longer piece, which was a remnant of previous cuts but much longer than required.

With the displacer unit taken care of, it was the turn of the power cylinders, and here I wanted to use solid drawn honed pipes used in the construction of hydraulic units. I had a selection obtained from off-cuts from a local factory that had closed down and was selling these as scrap. These pipes are all in metric sizes, the larger diameter ones having a 3mm wall thickness, thus a 50mm pipe has a 44mm internal diameter, a 40mm pipe has a 34mm internal diameter. This latter one would have been quite suitable as, at that time, I required a 37mm diameter.

As luck would have it I found in the scrap bin an item which I had brought home from a visit to an engineering exhibition in London where, in the company of Roy Darlington and a gentleman whose name I do not remember, I brought some scrap items to show to Roy, all these being dismantled from medical and space instruments. My choice was the component, shown in **fig 5a, photo 4**, probably from a medical instrument and had inside long concertina-type discs on a spindle. With an internal diameter of $1\tfrac{3}{8}$in. (35mm) this was quite close and the shape of the ends with the connecting adapters was a bonus. The component was cut in two (**photo 5**) and internally bored to $1\tfrac{29}{64}$in. (37mm) as in **fig 5b.** The metal proved to be highly machineable and responded quickly to honing and lapping.

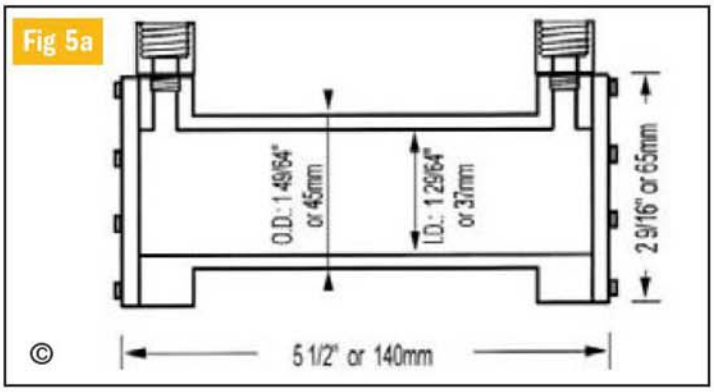
For those machinists who have access to stockists of hydraulic pipes, I would certainly advise the use of these, since apart from the fact that they are >>

4. The scrap bin provided just the thing to make the power cylinders for the model.

5. The rescued part was cut in two to form the cylinders.

6. The crankcase casting.

Fig 5a. Profile of the component from the scrap bin used to make the original power cylinder.



6

factory honed and only need a thorough clean to rid them of the grease that protects them, the mild steel is usually of a very high quality. Other sizes than those mentioned above may be suitable. Readers may be able to find master or slave cylinders used for brakes in cars or vans which can be adapted as power cylinders.

From previous experience I found that a type of 'stainless', soft drink containers (I think the make is Tango) make excellent displacers since they are extremely light, and being 'stainless' the problem of rust inside the cylinder is eliminated. I have found stainless steel pipes that fit these canisters and have used them on a couple of Stirling engines. Readers may wish to start with these.

Calculation of ratios

It may be pertinent to give (and maybe repeat for old-timers) the calculation of ratios for the ideal Stirling engine and that adapted for the revised *Davide Mk. II*. For newcomers to this hobby the formula shown below is the basis for the ideal Stirling Cycle.

The formula starts with the volume of air which the displacer shifts with each turn of the flywheel. There is a well-proven ratio of 1:1.5 between the volume of air displaced by the displacer cylinder and that displaced by the power piston (or combined pistons as in this model).

Taking the actual displacer of this model (O/D $2\frac{1}{2}$in. or 64mm), the volume works out like this:

π x radius x radius x stroke = volume of air shifted or displaced

3.142 x 32mm x 32mm x 20mm = 64,348mm^3 or 64cc.

Normally, to obtain the ratio of 1:1.5, the above figure is divided by 1.5 = 42,898mm^3; however the above ratio did not give a satisfactory power output and it was decided to change the ratio to 1:2, that is the combined volume displaced by the two power pistons is half that shifted by the displacer, given the same stroke.

Therefore to find the volume displaced by each piston, the above volume is divided first by 2 (power cylinders) = 32,174mm^3 or 32cc and divided by 2 again to obtain a ratio of 1:2, hence:

32,174/2 = 16,087mm^3 - the volume of air to be displaced by each piston.

By working the above formula backwards we obtain the square root which gives the outside diameter of the piston: 16,087/π = 5,119.98 or 5,120, divided by 20mm (stroke) = 256

The square root of 256 = 16, 16mm being the radius x 2 = 32mm diameter of each power piston.

To cross-check whether the calculations are correct one has to start from the last figure and work upwards, thus:

π x 16 x 16 x 20 = 16,087, then x 2 cylinders = 32,174 x 2 (ratio 1:2) = 64,348mm^3 or 64cc.

If readers decide to work on the premise that the ratio of 1:2 is more likely to give the same result as the author's, the power cylinders have an internal diameter of $1\frac{1}{4}$in. (32mm). If cylinder wall thickness allows, the cylinders can always be machined to a higher figure.

Crankcase

The crankcase used for the *Davide Mk. II* is one that the author had designed for a number of other engines (*Stirling Engine Manual Vol. 2*), and is one of two sizes. The patterns were made by John Tipton of Hollywood, Birmingham to the author's designs and dimensions (**figs 6a** and **6b**) and cast at a foundry selected by John. The shape of the casting somehow gives a more pleasing appearance than an ordinary square box, and since it was of a very high quality, very little work was necessary to give the crankcase a fine finish.

The crankcase was first drilled and tapped $\frac{1}{2}$in. x 24tpi (alternative 12 x 1.5mm) in the front face, then bolted to the face plate and the top bored and threaded $1\frac{1}{4}$in. x 16tpi (alternative 32 x 1mm), with a shallow recess for the flange of the displacer cylinder plug, **photo 6**. The bores for the power cylinders were left for a later stage.

Notes for the machinist:

1. In my engine the crankshaft bore is in the centre of the

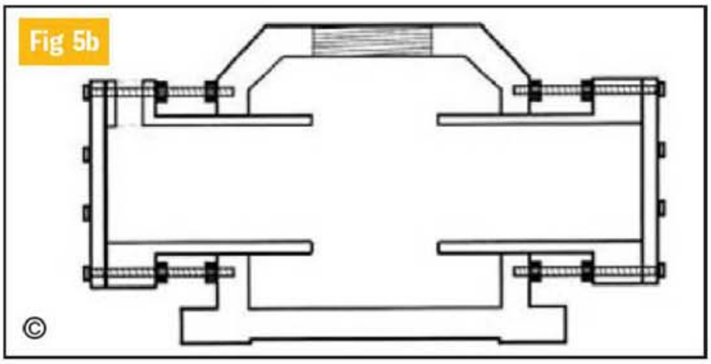


Fig 5b

©

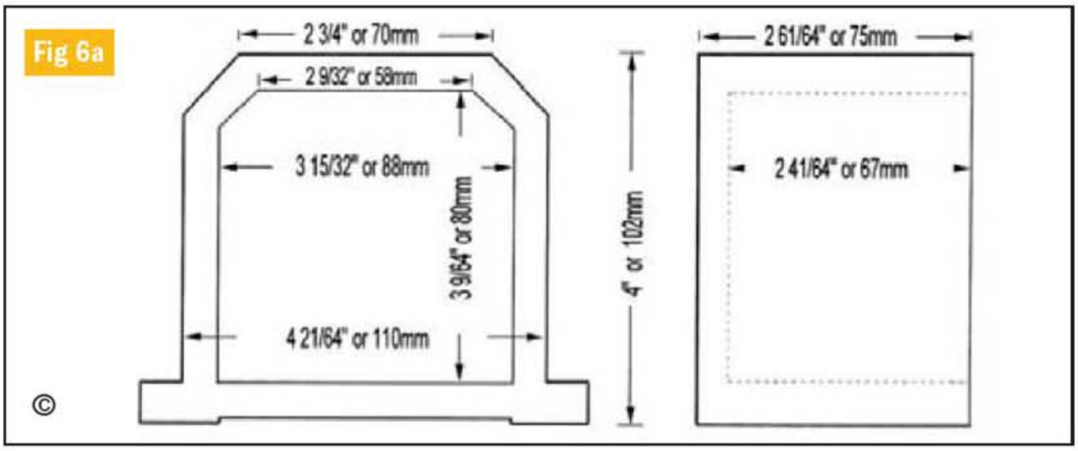


Fig 6a

©

Fig 5b. The two parts of the scrap component mounted on the crankcase.

Fig 6a. Front and side elevation of the crankcase casting.

internal vertical and horizontal lengths. With hindsight I should have drilled at least 1/4in. (6mm) or even more further down to allow more height for the displacer con-rod.

2. The position of the bore in the top surface has to be calculated by taking into consideration the thickness of the crank disc, any spacer washers and half the thickness of the displacer con-rod big-end.

An alternative crankcase (**fig 7**) can be assembled from aluminium alloy plate 8mm or 10mm thick to the same dimensions of the above crankcase, the internal dimensions being the more important. Actually a rectangular crankcase design will look well with a square cooling jacket.

Crankshaft housing, crankshaft, crank disc and crankpin

The crankshaft housing (**fig 8a**) was machined from 3/4in. (19 - 20mm) hexagon brass, 1 3/16in. (30mm) long, reduced for a length of 5/8in. (16mm) to 33/64in. (13mm) dia. and drilled right through to take a 1/4in. (6mm actual) shaft. The front end was then bored to take a 6 x 10mm (actual) roller bearing. The workpiece was then reversed in the chuck, the rear end first threaded 1/2in. x 24tpi (or 12 x 1.5mm), then bored to take a similar roller bearing.

The housing was inserted into the crankcase with an O-ring. Once the position of the hexagon faces was determined, a mark was made on the upper surface, the housing was removed from the crankcase, drilled in various thickness from 1.5mm (1/16in.) tapering V-shaped to 3mm (1/8in.) to provide a lubricating hole. Finally the piece was reamed either 6mm (or 1/4in.) right through.

The crankshaft (**fig 8b**) was cut from 6mm (actual) silver steel 4 21/64in. or 110mm long. No further work was necessary at this stage.

The crank disc was cut from brass bar O/D 2 3/8in. (60mm), 1/2in. (12mm) thick, drilled in the centre to take the crankshaft in a precision fit, again at a point 10mm or 3/8in. from the centre to take the crankpin, and then shaped as in **fig 8c**. The crank disc was cross-drilled and tapped to take 3mm (1/8in.) grub screws to secure the crankshaft and the crankpin.

(In the case of *Davide Mk. II* the thickness of the crank disc was later reduced in the lower part - as shown in fig 8c and in photo 3 (*M.E.* 4299, 11 May 2007) - to clear the power cylinders outside diameter. Readers may wish to take this into consideration when marking the area where the power cylinders will be installed in the crankcase).

The crankpin was cut from 6mm (actual) silver steel 2in. or 50mm long. No further work was necessary at this stage.

To be continued.

Fig 6b. Original drawing by the author of the crankcase produced for the pattern maker.

Fig 7. Front and side elevation of an alternative crankcase.

Fig 8a. Crankshaft housing.

Fig 8b. Crankshaft.

Fig 8c. Crank disc.

Fig 7

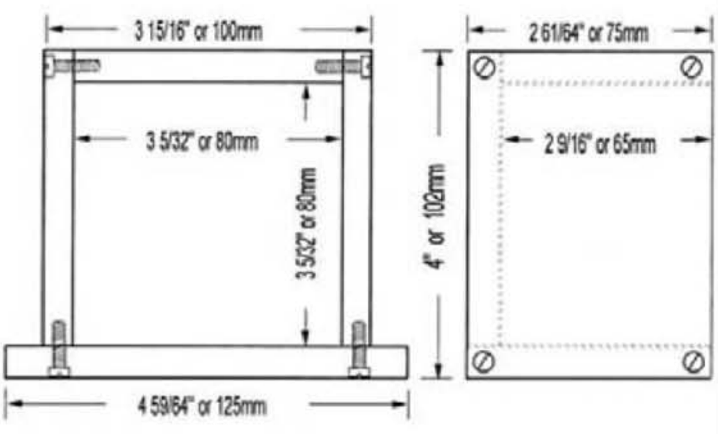


Fig 6b

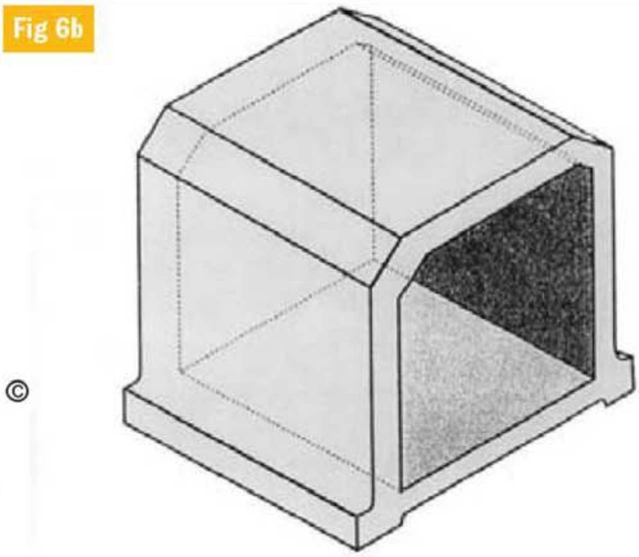


Fig 8c

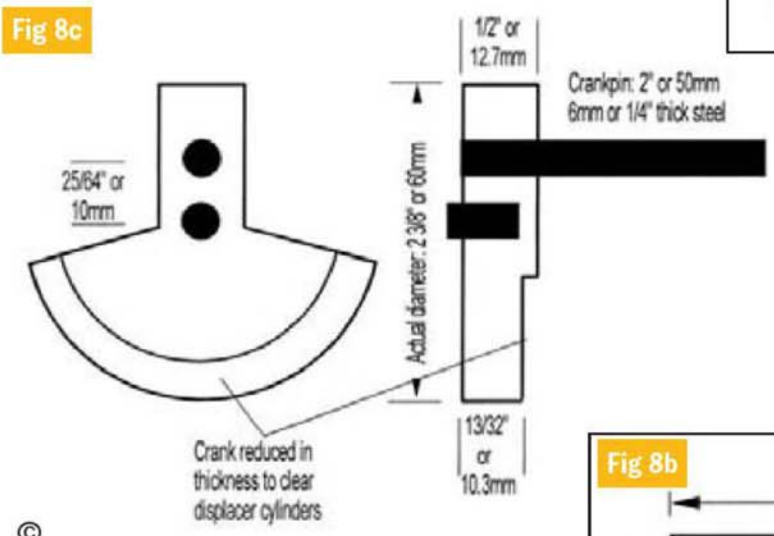


Fig 8a

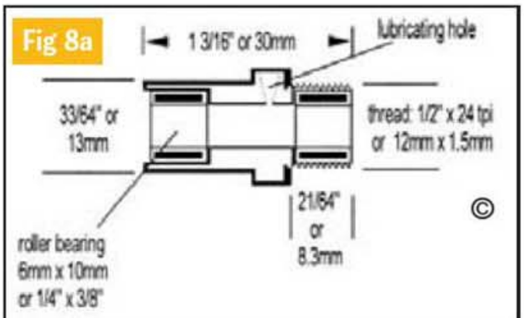
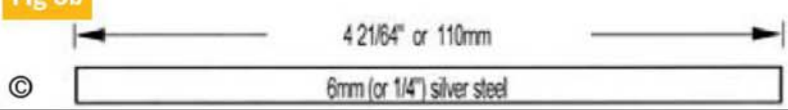


Fig 8b



I/C TOPICS

Nemett presents another mixed bag including a pair of fine stationary engines from the Netherlands, comments on the use of Loctite, and a request for information on the whereabouts of a Bentley BR2 engine.

1. The late Les Chenery's fine Gnome rotary engine (photo: Ron Moulton).

2. The slipper big end from the Gnome engine showing the method of construction.

3. Johan van Zanten's unusual Deutz D2 inverted vertical engine.

4. The cylinder detail on the Deutz engine.

I have received a note from one of our NE15S builders to say that he has had a problem with the cams coming loose on the shaft. Readers will recall that I use Loctite to secure the cams, and have done for many years on several engines (including a 15cc pushrod single and an Edgar Westbury Seal) without problems.

The first point to make is that the NE15S was designed so that if anything happened to the valve gear, even if the valves are held wide open, the piston crown cannot touch the valve heads (unlike most modern car engines).

There are several points to be made about the use of Loctite in such situations. The first is that the parts must be absolutely clean and oil free. This is not achieved by just soaking the parts in thinners or some such. Ideally the parts should be degreased using a proprietary degreaser and then wiped with cellulose thinners using a clean rag, avoiding touching the mating surfaces with the fingers. Pay particular attention to the bores of the cams. If the rag comes away dirty, the parts are not clean enough. Loctite produce special degreasers and cleaners for use with their products. Those with ultrasonic cleaning equipment can use that.

It may also pay to roughen the surface of the shaft with emery cloth before cleaning to provide a good key, but I have not found this necessary in the past.

When the parts are clean and dry, it is essential that the adhesive penetrates right through the joint. To do this, put the adhesive (Loctite 642 or 635) both on the shaft and in the cam bore and then slide the cam onto the shaft and move it backwards and forwards whilst twisting it slightly before setting it in the correct position and allowing to cure at room temperature.

If you do have a cam come loose, heat the camshaft assembly in the domestic oven (high temperature for 20 minutes) to loosen both cams and then clean everything thoroughly before re-bonding as above.

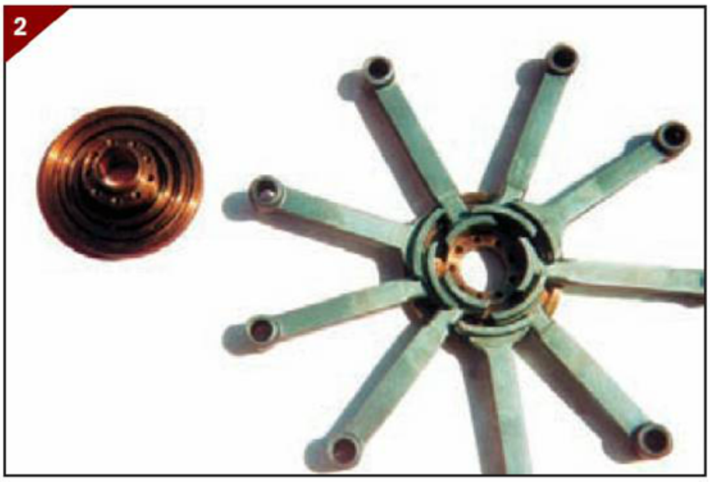
The other thing to check is that the valve clearance is not too great because this can result in excessive shocks to the valve gear. The valve springs must also not be too heavy for the same reason.

Lost engine

Following the sad passing of Les Chenery, John Chenery is keen to keep all of Les's engines together. One of the engines that Les built was a 9-cylinder Bentley BR2 rotary engine but this was no longer in his possession when he died. The engine was definitely around in 2001 but its whereabouts now are not known. If any reader knows anything of this engine John would be very keen to hear from you and we will pass on any information.

Slipper big-ends

Following my notes on the Zoche radial aero diesel engines with slipper big ends, I have heard from Ron Moulton who has sent photographs of a Le Rhone rotary engine (**photo 1**) built by the late Les Chenery. This method of bringing all big-ends on to a single crankpin was a distinguishing feature of the WW1 Le Rhone aero engines that few model engineers have attempted to reproduce. When



5. Another view showing the fine workmanship on the big end.

6. An overall view of the engine and pump showing the excellent presentation of this model.

7. Johan's second engine the 1910 American New-Way complete with generator.

8. A fine view showing the flywheel and long vertical intake pipe.

9. The exhaust side of the engine.

10. The belt-driven cooling fan and starting crank in the flywheel rim.

Ron was interviewing Les on his 1:5 scale version, Les described how the nine cylinders had three different con-rod lengths, each of which terminated with a T-shaped slipper to run in annular groves of two faceplates (**photo 2**) on the crank. This photograph shows one of the grooved plates removed to show how the crank is assembled.

This big-end arrangement is also known as the 'Manley-Baltzer' big-end after the inventor.

Ron has pointed me to a copy of the Air Board Technical Notes of 1917 where a much retouched illustration and brief description of what were then called 'shoes' appears. The Engine Notes concerned were reprinted by Camden Miniature Steam Services in 1997 as ISBN 0 9519367 6X and are to be recommended.

I am indebted to Ron for that information.

A pair of fine stationary engines from Holland

Johan van Zanten, from Holland, has sent me information on two of his superb and unusual stationary engines to share with readers of the column.

Deutz D2 vertical engine

The first engine (**photos 3, 4 and 5**) is a Deutz D2 inverted vertical engine from about 1900. The engine is in 1:10 scale and made from the solid (mostly brass and silver-soldered) no castings were used. The bore is 19mm and the stroke 24mm, which gives a displacement of 6.8 cubic centimetres. The engine runs on lighter gasoline. The plinth houses a water reservoir for the pump and the ignition. A small moped coil and three NiCad batteries (3.6 Volts, 4 Amp hours) are used for the ignition system. The breaker points are behind the flywheel. The battery charge is enough for eight hours of continuous running. The engine as built has no throttle or working hit and miss governor. The speed is fine tuned by retarding the ignition timing. The late spark gives a little hotter engine but the operating temperature is rather low anyway. The working speed goes down to 250rpm when warm. Johan says that over all it is a very reliable engine which can be run on the fire side.

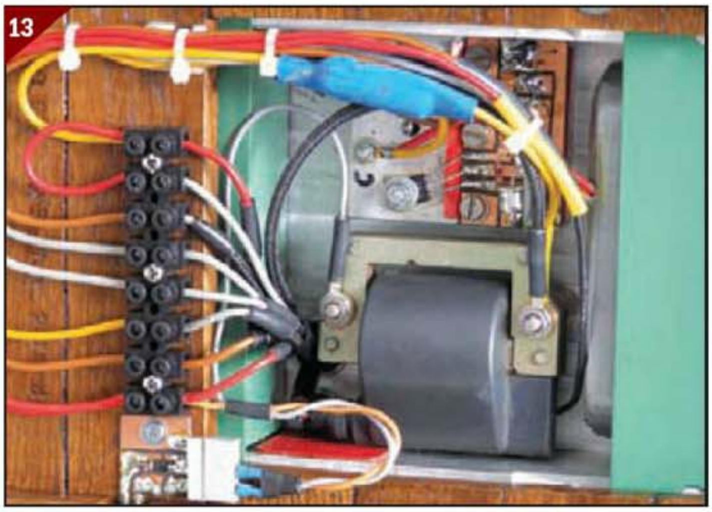
Johan's engine is set up to drive a vertical pump (**photo 6**) and the whole is very nicely displayed.

Castings of the same engine to 1:8 scale (25mm bore) are available from Classic Motors in Austria.

American New-Way engine

The second engine is a 1:5 scale American New-Way engine (**photos 7 and 8**) from 1910. The prototype is 6hp and drives a 110 Volt DC generator. They were intended to provide lighting on farms and at events.

The model was again made without the use of castings except for the flywheel. This is >>



a commercial one (**photo 9**) with a shrunk on rim. The crankcase is from aluminium alloy bar with some parts and fairings epoxied on. The crankshaft is built-up, silver soldered and runs in ball races. The big-end has a split bronze bearing with licker lubrication. The cylinder is of the L-head design and is made of brass with a cast iron liner and piston. The valves are facing each other and are made from stainless steel as are the valve cages. The bore and stroke are 30 x 50 millimetres.

The engine is air-cooled (**photo 10**) using a flywheel driven fan and a shroud round the cylinder.

The generator (**photo 11**) started life as an electric motor used as a reel driver in an old computer tape unit. It has a very strong four pole permanent magnet field and four brushes to pick-up the power from the rotor. Johan made new bearing shields and reworked the stator to improve the appearance. Tests provided the information that it generates about 12 Volts and 4 Amps at only 600rpm. A simple switch panel (**photo 12**) was made with a voltmeter and ammeter using VU meters from a discarded cassette deck. Initially the meters lasted only a short time because of the vibration of the engine. After Johan slowed down the meter action with the aid of some resistors and a capacitor they now survive with no problem.

The whole lot is mounted on an aluminium alloy base made from the solid. The inside houses the gasoline tank (front half) and the ignition coil (moped coil) and power supply (**photo 13**). The breaker points are in the dummy magneto (**photo 14**).

As Johan intends to use the set to power a string of lights, it needs a very sensitive governor to avoid blowing the bulbs. Like the prototype, mixture volume governing is used with an oil filled cylinder to dampen the action.

The carburettor (**photo 15**) is split in two levels, an air intake and fuel jet at tank level and an auxiliary air valve and a butterfly throttle valve at cylinder level. This butterfly valve is operated by the governor weights in the flywheel.

The engine is started with the fold-back crank (seen in photos 9 and 10) in the flywheel and will run unattended for about five hours on one tank (500cc) of lighter gasoline. Because some onlookers could not resist the temptation to hand operate the throttle and blow all the lamps, Johan added an over voltage protector in the output circuit.

I am indebted to Johan for sharing these fine engines with us and congratulate him both on his fine models and the excellent photographs.

ME

11. The nicely presented dynamo, a converted computer motor.

12. The switch panel showing the two meters.

13. The ignition coil and voltage regulator in the base.

14. The dummy magneto and the oil sight glass in the crankcase.

15. The throttle part of the carburettor.

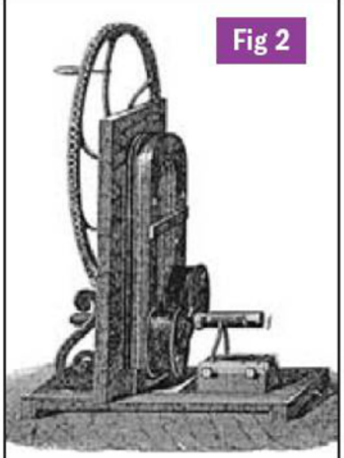
LETTERS TO A GRANDSON

NO.102

M. J. H. Ellis concludes his study on the fascinating career of Scottish inventor James Walter Robertson.

Fig 2. Clarke's machine.
Fig 3. Connections of armatures

Fig 2

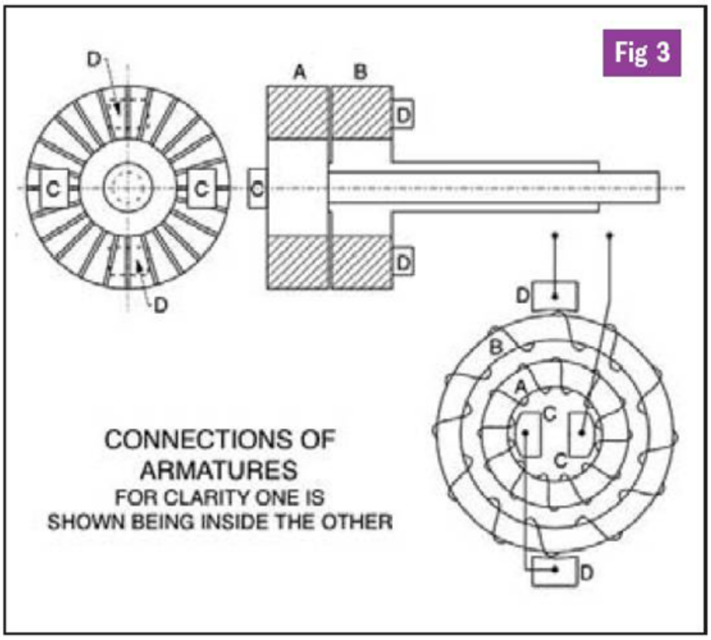


Dear Adrian, continuing from my last letter, the 'electricians' (as they were called) of the day were so pre-occupied with what they were achieving with direct current from batteries that nobody gave much thought to what the possibilities of Faraday's discovery might be. It was not until about 1860 that investigators began to take a renewed interest in the subject. Crude machines were constructed for use in the laboratory, in which coils of wire were rotated rapidly in front of the poles of a permanent magnet. I enclose an illustration of one of them, made by a gentleman named Clarke, **fig 2**. This engraving, by the way, was taken from a publication printed in 1887, entitled *The World of Wonders*. I take it to have been produced by those earnest Victorians with a social conscience, who sought to encourage the intelligent artisan to improve himself.

Within a few years important improvements were introduced, notably by means of an iron armature carrying the windings, so reducing the air gaps to be traversed by the magnetic lines of force and increasing the strength of the magnetic field. An intermediate step was the 'ring armature', which, by rights, should be ascribed to Pacinotti, who invented it in 1860, but is generally known as the 'Gramme ring'. In its earliest form it was simply a ring composed of iron wire round which the windings were wound.

This is as much as I need to say on the subject of armatures, because we have now reached the type which Robertson used in his motor. There are, however, a couple of things which can be mentioned, before going back to him. Firstly, it was pointed out simultaneously by Siemens and Wheatstone in 1867 that there was sufficient residual magnetism in the iron of an electromagnet to enable a generator energised by one to 'build up'. Originally, machines of this type were called

Fig 3



'dynamo machines' to distinguish them from earlier types which used permanent magnets. And secondly, it was not long before it was discovered that if a direct-current generator was connected to another machine of the same sort, the one could be made to drive the other as a motor. Professor Clerk Maxwell, celebrated for predicting in 1862 the existence of radio waves propagated with the velocity of light, is reputed to have considered this "one of the greatest discoveries of the age".

My sketch (**fig 3**) shows the principle of Robertson's motor, which consists of two 'Gramme ring' armatures, A and B, the shaft of A being coaxial with that of B, and passing through it. The concept is, so far as I know, unique, since there is no stationary field magnet, such as forms the carcase of all conventional machines. Instead, each of the armatures produces the field for the other. In fact, all the body of the motor does is to provide the bearing for the shafts, and to carry the brushes. The pair of brushes, C, serving A are shown at right-angles to those, 3, serving B, but Robertson mentions that the number of brushes could, in each case, be increased to 4, 6, etc., provided that those serving the two rotors were set at 45, 50, etc. degrees to one another. He also says that the motor will run on alternating as well as direct current. The two armatures would normally be connected in series, but could also be in parallel. In Robertson's design there are no separate commutators, as the armature conductors are sufficiently substantial to serve the same purpose.

I have to say that in my opinion these two inventions, the engine and the motor are inspiring examples of the very best in inventive genius, and I think that the City of Glasgow, which, to its credit, has already erected a statue of Lord Kelvin, should do something to commemorate Robertson as well.

I have just paused to reflect on the number of eminent engineers and men of science which Scotland has produced, I found it difficult to decide whom I would place first, but finally chose Thomas Telford (1757-1834), who rose from humble beginnings to become the foremost civil engineer of his age.

His magnificent aqueduct, the Pont Cysyllte, which carries the canal to Llangollen 125ft. above the River Dee astounds me afresh every time I see it. I save no space to do more than mention the names of James Watt, the Rev. Robert Stirling, John Rennie (his eminent sons George and Sir John were born in London), Alexander Graham Bell, Sir William Ramsay, there's no end to them. Not bad for a country the size of Scotland!

Your affectionate Grandpa.

James Beggs and Co.
BOTTLE FRAME ENGINE

PART 8

Continued from page 587 (M.E. 4299, 11 May 2007)

Anthony Mount completes the saddle key to the flywheel before moving on to the bearing pedestal and wooden base designs.

The next operation is the tricky bit. Clamp the bush by the ends in the milling machine vice (have another piece of material the same length at the other end of the jaws to balance the closing forces). Position it so that the bush overhangs the edge of the vice. With a slitting saw mounted in the machine spindle, cut out a piece from the bush 3mm thick.

It needs to be done 1.5mm either side of the centre line of the bush so that the saddle will sit squarely on the centre line of the crankshaft. Bring the saw down until it touches the top of the flange, zero the index dial and use the dial feed to position the saw.

File the top of the wedge flat so that it sits nicely in the key slot. The wedge needs to be a good fit widthwise in the slot, and the end should be just proud of the flywheel boss when driven home.

With such a slow taper great care is needed when fitting as it is easy to remove too much stock and the wedge will go in too far. But there is enough material for about six wedges in the prepared blank so there is no need to despair if the first one goes wrong.

Bearing pedestal (part 29)

The bearing pedestal is an awkward shaped component. Full size it would have been cast integral with the main frame, but we need it separate so that we can machine it. It starts off as a piece of 40 x 8mm mild steel bar. Cut off enough for two pedestals and square up all round by milling. In **photo 42** you can see the two mounted in the 4-jaw independent chuck for boring out the seating for the bearing support. Discard one unless you are building the engine with a two webbed crankshaft.

Three holes can be drilled and tapped in the base for M3 Allen cap head screws to fix the bearing pedestal to the main frame.

The bearing seating and cap are identical to those used on the other outboard pedestal. Drill and tap for the stepped studs and, as for the other pedestal, check carefully that the bottom of the seating is square to the side of the pedestal, otherwise the crankshaft will not be in the correct plane.

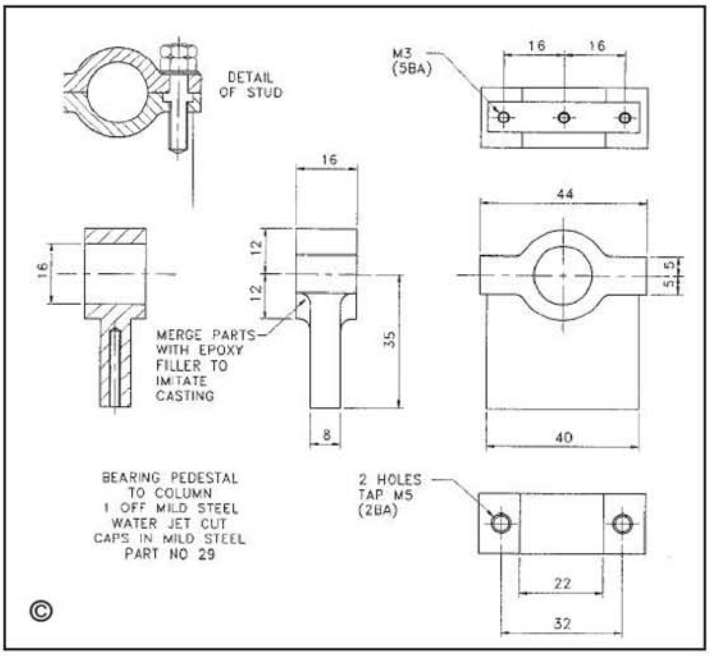
Use the lathe to drill and bore for the bearing bush. The bush should be of the split variety, but as the crankshaft is parallel we can get away with a solid bush. The extended end of the oil cup engaging in a hole in the bearing will stop it from turning. Assemble the seating to the pedestal and the pedestal to the main frame. I used epoxy filler to form a fillet where the pieces fitted together to imitate the curved junctions that would be there on a casting. Once painted no one will know.

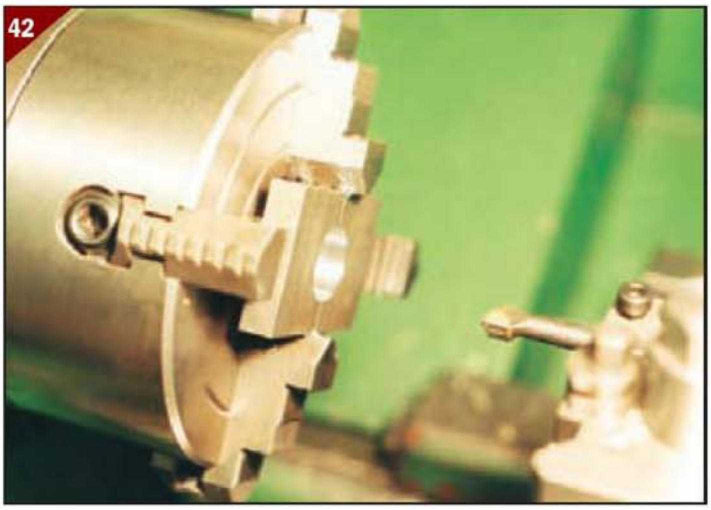
Wooden base (part 30)

Nearly all model stationary engines need a base of some sort for the engine to be mounted on, both for display purposes and stability. This engine is no exception.

I used a round base on the Fairbairn engine as the engine column was circular and it reflected the shape of the engine. But as this engine was a little longer but still had a round frame I decided that for

42. Boring the two bearing pedestals in the 4-jaw chuck.





this engine I would use an elliptical base.

As the engine is quite tall I went for a thick, quite heavy base to give stability, and to give balance to the proportions of the engine.

The type of base and its finish is the option of the builder; I like a polished hardwood finish and generally go for a mahogany or teak colour, as this was the traditional material for such things in Victorian times, the period when most of my prototypes were built.

However, both are tropical hardwoods and we have all seen the terrible damage being done to the rain forests. So use second-hand timber, if you can get it, to avoid using new imported timber or use a home grown timber and stain it to give the colour you want.

The working of wood can strike terror in the hearts of many engineers, but in fact it is a lovely material to use provided you realise it has a thing called grain, which does not occur in metal or at least not in the metals we use. However, it may be that Cotswold Heritage will be supplying ready-made wooden bases.

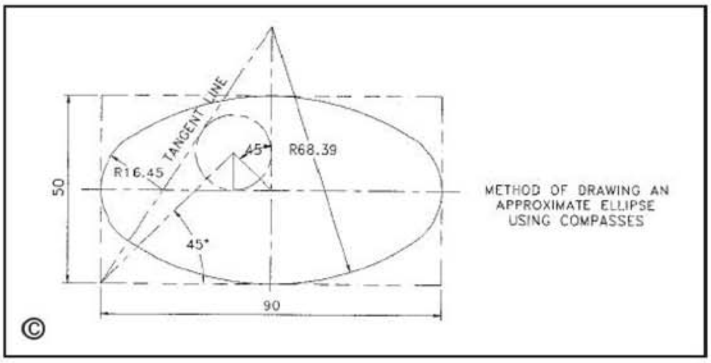
I have given a drawing for the base but you do not have to stick to the size if you do not want to. Out of interest I have given a means of drawing an approximate ellipse using a compass, which only needs two different size arcs, and the junction of the two arcs comes on the line of a true ellipse. It is a most useful device. Should you need to draw a number of parallel ellipses using this method start with the smallest otherwise you will end up with a kink in the ellipses, as they get smaller.

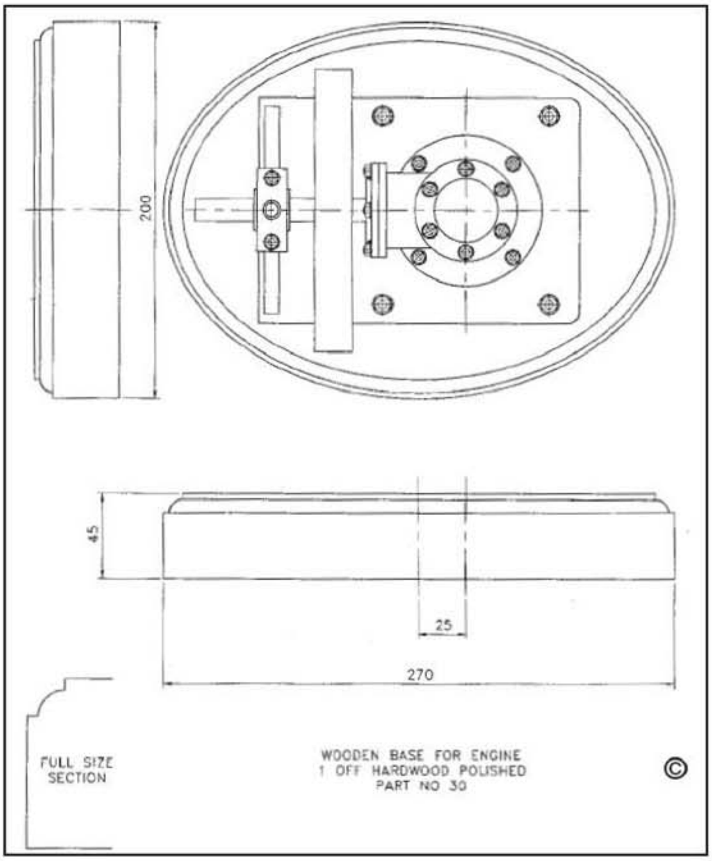
Start by drawing the major and minor axes. Draw a rectangle to the overall dimensions of the ellipse. From (in this case) the bottom left-hand corner draw a 45deg. line upwards. From the centre draw a 45deg. line to cross the first 45deg. line. Drop a line from the junction of the two 45deg. lines to the major axis. Using the junction of the two 45deg. lines as the centre draw a circle touching the major and minor axis. Draw a tangent line from the circle to the bottom left-hand corner. Extend this line to reach the minor axis (in this case outside the perimeter of the ellipse). Where the tangent line crosses the major axis is one centre point and where the tangent line reaches the minor axis is the other centre point. As you can see from the drawing the junction of the two arcs is at the tangent line.

I did draw a true ellipse over the approximate ellipse, but they were so close I doubt if it would show up very well in the magazine so try it for yourself.

Once you have your ellipse cut it out, either by hand using a bow or coping saw, or by machine using a jig, fret or bandsaw or perhaps a router in conjunction with a handmade plywood template. You can work in a moulding around the top edge. A small router cutter for an ogee or ovolo moulding will do the job easily.

Clean up with glasspaper, the

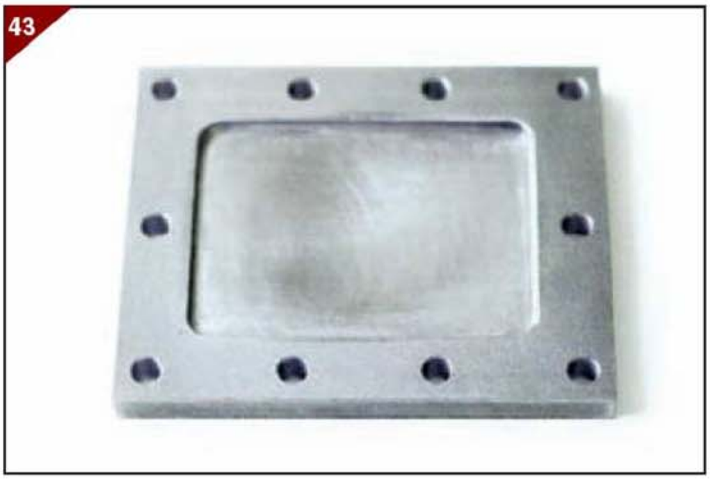




most labour intensive part of the job. Then stain and polish to your taste.

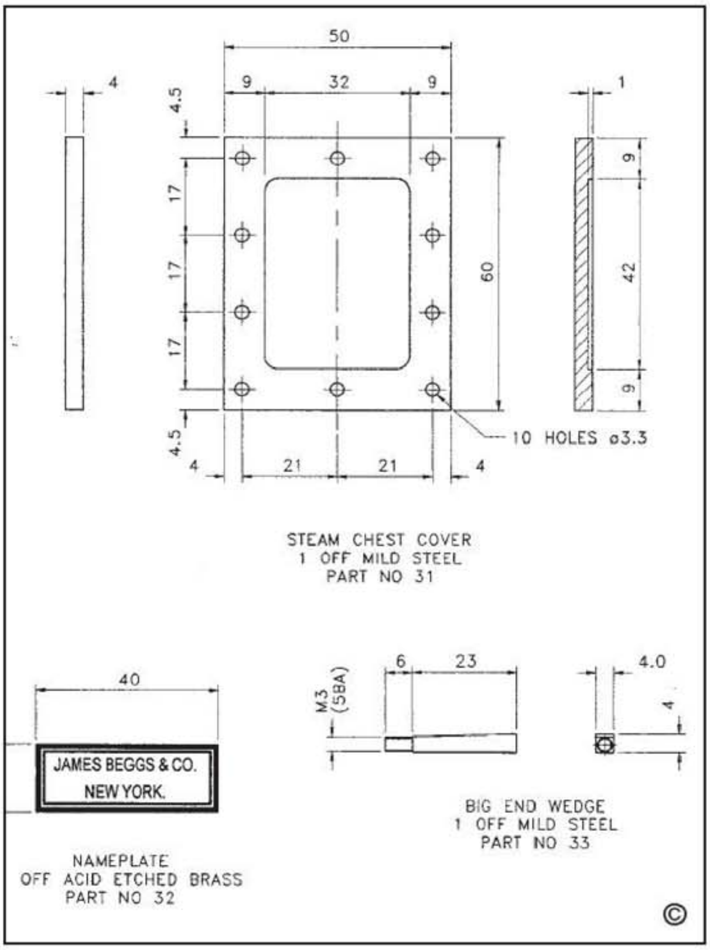
While you are working on the base cut in a small nameplate to let future owners of your model know what it is and who made it. It might appear on the *Antiques Road Show* in 2106.

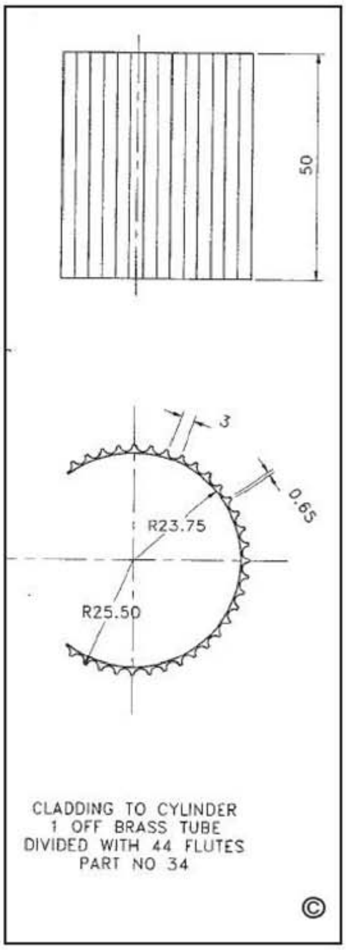
If you build the engine without the pedestal bearing then it would be in proportion to make up a circular wooden base. This would be an easy turning job in the lathe - provided you do not mind wood shavings all over the workshop. It might be to your advantage to go to a nearby shop selling woodworking tools to see if they can put you in contact with a local, amateur >>



43. The finished steam chest cover.

44. The wooden press tool used in the bench vice to make the nameplate.





wood turner. He might be looking for somebody to turn up something in metal for him and you could do a swap.

Steam chest cover (part 31)

The steam chest cover can be left off until the engine is assembled and the valve set. It is a rectangle of 4mm thick mild steel plate drilled for the stud holes, which can be taken from the steam chest itself, using it as a template, or set out using co-ordinates.

I have shown a 1mm deep recess in the centre of the cover, sometimes this recess was ribbed or the initials of the builder or the name was cast in. You cannot see from the engraving what James Beggs did. I set mine up in the machine vice of the vertical milling machine and milled the recess in a series of steps using a 6mm slot drill. I went around the outside of the recess first leaving the land a bit over size then bringing it to size having previously measured with the Vernier calliper how much to remove. The stops were set then it was an easy matter to machine away the remaining material. **Photograph 43** shows the completed cover.

Nameplate (part 32)

The engraving I have of the original engine shows a cast nameplate fixed to the base casting of the engine, set at approximately 45deg., on the cone or drum (see the elevation drawing) so I suppose this is where we should put ours. However, it is unsymmetrical and I wonder if it could be artistic license to get the name into the drawing 'face on' as the engraving is a three quarter view. I put mine on parallel to the crankshaft.

I had an acid etched plate made that looks just the part, and hopefully there will be a nameplate in the kit. I expect the plate was fixed to the base with a couple of screws, though no fixings are shown on the engraving.

The base cone is of course curved and the nameplate needs to be bent to suit. **Photograph 44** shows a wooden press tool in the bench vice with the nameplate in position ready for bending. However, to make things a little complicated the curve needs to be a tighter radius than the cone to allow for the spring back in the brass nameplate.

You can use a couple of tiny screws into tapped holes in the base cone. I tried double sided sticky tape and found it performed well. The material I used is sold in car accessory shops for fixing trim. It is a very thin foam material with adhesive both sides.

It is important that the nameplate is fixed straight and on the centre line of the engine. I used a couple of square cards about the size of a business card propped against the cone in line with the fixing nuts to centralise the plate.

Big-end wedge (part 33)

The big-end wedge or key is a piece of 4mm square mild steel tapered along one long edge to hold the big-end bearing in place. It is also threaded on the small end for a nut to pull the wedge into place and to hold it there. A washer will also be needed to bridge over the square hole the wedge is passing through.

Cylinder cladding (part 34)

I have used both wooden lagging and metal on my engines, as can be seen in the photographs shown earlier in the series. It is traditional to use a couple of thin brass bands to hold the wooden lagging in place around the cylinder. However, they are not shown on the prototype engraving so it could be that they were screwed to wooden rings fixed to the cylinder under the lagging. We cannot do that but we can attempt to do something similar.

First a word on wooden lagging strips. To be as most prototypes there should theoretically be a small bead between each strip but this is not really practical in our scale so use square edges.

To make the lagging easy to handle I first cut up sufficient strips about 5mm wide and 3mm thick and about 10mm longer than required. These are glued to a piece of cloth using a PVA adhesive. Apply the glue to the cloth and lay the strips in place avoiding getting any glue on the edges of the strips.

When dry cut off the surplus both sides with a tenon saw bringing the strips to finished width that will fit between the cylinder flanges. The edges can be planed, if required, using a block plane and a shooting board. Lay the sheet on a piece of plywood with the ends of the strips against a thin stop previously glued to the ply, and plane the thickness down to 2.5mm and clean up with glasspaper. Stain and polish the strips. A little bit of fitting will be required around the exhaust boss. More on the subject of the cylinder cladding next time.

To be continued.

FLUXITE
SOLDERING

KEITH'S COLUMN

ECHILLS WOOD Railway update

Keith Wilson introduces this article with a comment on the perils of moving house before bringing us up-to-date with events at the Echills Wood Railway.

As you may well imagine, to move house at my age (74) with workshop as well presents certain difficulties; the proverbial blue-'tailed' fly hasn't got much to learn if you get my meaning.

The 'trouble-and-strife' (wife) is rather reminiscent of a hen that has just hatched ducklings; but such is life. Clearly, work in workshop is non-existent for a time; the more so for the fact the move is temporary until the bungalow we want is ready. It follows that practical work on *Lillian/GWRillian* is perforce suspended for the time being.

Therefore:

The Echills Wood Railway

I have worked the 'not dead but sleepeth' gambit before, but now I can say 'wide awake and climbing steadily' at their new site in Kingsbury Water Park, Bodymoor Heath Road, Kingsbury, Warwickshire. I was able to visit on Good Friday for its Easter opening.

Although not yet able to perambulate peripatetically as well as I used to, I managed to get some nice photographs, it was interesting to see so many 'standard gauge' locomotives were working for their living. Some of the pictures show GWR locomotives doing their stuff. I am always prepared to admit that there were other railways with their own style of locomotives, preferably steam powered, and I regret that the only Britannia picture was unable to be cleared in the computer. All of the engines at one time or another came to a stop just within the shadow of the station awning; this was not always curable. All the locomotives performed well, but one could have done with some valve re-setting!

I am not completely familiar with the engines of the ''ell-of-a-mess' railway. But it always seemed to me that some of them had rather small diameter chimneys - Royal Scots and Princesses come to mind. Incidentally it is not easy to find any great important dimensional differences betwixt Kings and Princesses. It is said that when Bill Stanier moved from Swindon to Crewe, a cabin trunk or two of drawings went with him; the design of the Princesses certainly bears this out!

Also to be seen were a BR Prairie working well, and later on there was some fun double heading with the Hall and a GWR Prairie, with the Hall correctly in front. The rule is 'bogies lead ponies'; in turn 'ponies lead drivers'. Readers should also note that an LNER locomotive was present and working.

A thing I found rather interesting was the first carriage on one of the 'scale' trains was a very good GWR 'Auto-carriage'; the shape of the ends gives the game away. Although not a carriage person, I believe that these were the longest on the line, and had to run round rather sharp curves on branch lines - hence the shape of the carriage ends. Some had main line experience too, some push-and-pull trains ran from Ealing Broadway to Greenford; this meant running through West Ealing and round the branch line to rejoin the Northern main line via High Wycombe to Birmingham and Wolverhampton.

Trains used to run from Paddington via this northern

1. The river/ lake bridge.

2. Thirlestaine Hall preparing for work.

line to Greenford and must have run on at least to Ruislip where the Great Central (Gone Completely) joined the joint line through Gerrards Cross, and Beaconsfield to High Wycombe where it and the Maidenhead to Oxford line joined forces.

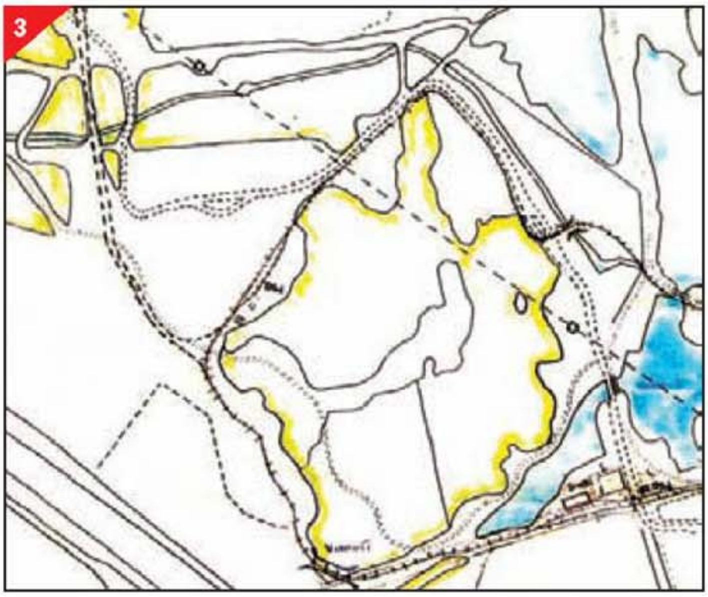
This Northern branch left the main line at Old Oak Common West, going via Park Royal, Alperton, and Perivale. An interesting bit of railway system occurred near O.O.C. West in that there was a high-speed double crossover from main to relief (fast to slow!) just before the branch, with a normal double cross-over just afterwards. This system occasionally led to two express trains behind Kings and/or Castles running side by side into platforms 8 and 9, this/these was/were an island platform. Having experienced this many times in my train-spotting days, I can vouch for its impressiveness.

Technically theft

Although technically illegal, it was by no means rare to walk down the slope in order to place a coin on the rails; usually a halfpenny. When the train came in, of course the coin was rather flattened. Normally, the coin stayed on the rail being thumped by the two bogie wheels; occasionally it was also thumped by the first driving wheel. On one occasion several of us placed coins and were powerless to do or say anything when a platelayer came along and pocketed the whole lot! Can't blame him, but was it technically theft?

VE Day

On the evening before the first anniversary of the famous VE day, the up Cornish Riviera ran in five consecutive portions, Castle-hauled, all very full. In those days, railways were still the main people-carriers and the Great Western had a fabulous *esprit-de-corps*; somehow rolling stock and locomotives were found, plus of course crews to operate them. I recall another day when troops were being de-mobbed by the thousand. I was having a joy ride (properly paid for) down the line to Slough or Reading, it seemed that every home signal on the Up Main had a Hall or a Castle patiently waiting beside it, of course complete with train. Some problem for Control! I had some experience as Controller at Echills Wood Track one very busy day with 13 locomotives in steam at the same time; I only had to do this for just on four hours, eldest son then took over for three and a half hours; both of us were just about 'knackered out' that evening although little or no physical effort was involved. No collisions or near misses were recorded, but it was certainly work needing mental concentration! The interlocking system helped lots too. For humans are likely to err, but to really make a mess is the prerogative of the computer! Not fair really, because a computer only does what it's told to do. Trouble is, it cannot



necessarily know that an incorrect entry has occurred.

Back to Echills Wood

There were trains leaving and arriving on the running line (single track) turntable, some sidings, coal and water supplies, working just out of the station (Harvesters) and the line to and from the main yard where locomotives steamed up or were blown down and cleaned, sometimes re-lit for some more running. Some passengers were carried; fortunately they were mostly railwaymen or relatives thereof.

Not long after the war the Central line on the London tube was extended to West Ruislip, whereupon the Great Western service was withdrawn. The Tube line had been started before the war, the track bed was completed but no rails laid. In a similar way, the Eastward extension from Liverpool Street to Ongar had made some progress in the form of tunnels; these were used as workshops and storage places for most of the war.

But I digress.

It will be seen that the main station is named Harvesters, same as the main station at Stoneleigh. This station was right beside a pub at Stoneleigh, hence the name; although the pub was demolished well before the railway was moved to Kingsbury Water Park.

One of the pix, taken from Harvesters station, shews a train crossing the lake bridge. >>

3. A map of the track site.

4. BR Prairie in steam.

5. Auto-carriage.

It says a lot for digital cameras, for it is a good 100 yards away. In fact it was so far away that I snapped the wrong train, for it did not show up very clearly until I saw the picture in the computer. I had meant to get a shot of the King on the bridge, instead got *Thirlestaine Hall* double heading with one of my 8 GWR Prairies. Equally welcome of course, not entirely because it was Great Western, but for me steam is the tops.

I managed to get a shot of the railway map, reproduced herewith. The run is just about level all the way, which makes driving a hefty train somewhat easier. At present much building is still taking place, eventually it is hoped that a full signaling system will be 'up and running'. There is a nice signal gantry at Harvesters, (semaphore, GWR style, lower quadrant - is there any other?) and eventually there will be automatic barriers at road crossing points, flashing lights, bells etc. It is surprising just how foolish people can be when crossing a railway, and I would rejoice at motorists who deliberately and almost unbelievably dodge crossing gates being 'severely dealt with'. Innocent lives have been lost, often horribly. I recall a case when in spite of flashing lights and a queue of waiting cars a motorist just raced past and wrecked a train. As far as I know, the driver of that train was trapped against the boiler. We've all got to pass on some time, but there are ways - and ways. There is much research being done in methods of prolonging life - no quarrel with that - but one terrible idea comes to mind. Should anyone succeed too well and make it permanent, there is the horrible thought that some nit-wits might succeed in making it compulsory. Ugh! And once again, Ugh!

As I recall, the continuous track is about one 'kill-o-meter' (correct pronunciation) long ($^{5}/_{8}$ of a mile), wandering through beautiful woods, two water crossings and back into Harvesters. I am not sure of the first locomotive to steam a train all the way round, but a very nice 'Shay' did its stuff on 21 Jan 2007 and I had my first trip. It was quite interesting, for a Shay does not puff.

In the locomotive yards were amongst other puffers a GWR small Prairie (Firefly class, 45xx) and a couple of narrow-gauge engines, one of which did some good work during the afternoon.

Owl's owling!

I don't know if it was co-incidence, but Thursday night, 12th April, we were quietly relaxing after a somewhat hectic day - packing for a house-move is not one of the lighter matters. For from a few days previously we had heard strange noises coming from our semi-blocked house chimney; blocked just by a sheet of hardboard cut to fit the fireplace. Wind whistlings, dropping bits of brick and tile, cement etc. The wind noises sounded exactly like an owl (a

Wilsons Words of Wisdom

There is no error that some people at some time will not consider as their truth.

Raymond Burnard

nowl?) for (eventually) obvious reasons. Several times did I remove the hardboard and have a good look, but apart from the aforementioned house-debris nowt was clearly visible. However, about 9pm there was a bigger than usual bang, and a brown owl appeared clambering out and flying round the room!

Shrieks fit to wake the dead from the 'trouble-and-strife', (and I must admit that the sight caused me some shock too) and she disappeared through the door. I think she opened it first! I opened windows, but Owly just wanted to keep out of reach - don't blame him/it/her but eventually 'h-i-h' flew straight at the window and stunned itself; so I could grip it gently and carefully and then gently toss through the window, when (as expected) flight was resumed out into the garden. I regret not taking a photograph, but it is not always easy to think clearly in such circumstances. Although knowing that owl's flight is virtually noiseless, the problem of locating 'Owly hourly' (sorry, couldn't resist the temptation) was made rather difficult if t'was not visible. It really was noiseless until an obstacle was met. I can just imagine *"I was sucked into a huge hole, kept for days in blackness, butted my way out and was promptly attacked by a terrible three-eyed multi-handed vertical monster which couldn't eat me and I fought my way out, utterly exhausted, and found my way back home"*.

I added two ground-hitting falls to my total since spinal re-bore operation. (Maundy Thursday 2006) making the total about 32, including a couple of cracked ribs and a graze on the head. However, if I fall down, it can hardly be blamed on anyone else, but if it happens in a shop of some sort one gets super treatment by the staff, but I always apologise. I only count falls when I hit the floor.

After the owl incident, discovered wife had fled upstairs and was sobbing on the bed (it was quite a shock on top of the moving kerfuffle); and she took just over the hour to recover and return to the living room.

We have now been together for 47 years - seems longer! - but blow off steam at each other on occasions, which helps. Safety valves are not always on boilers! **ME**

6. Thirlestaine Hall *at work.*

7. Royal Scot.

NEWS

From Malcolm Stride

Notices

The Model Steam Road Vehicle Society Annual Rally takes place on 23/24 June. The rally will be held at the Tewkesbury Rugby Club and further details can be found on the MRSVS web site at www.mrsvs.org

I have received information about the **Charles Burrell Museum** in Thetford, Norfolk. This museum tells the story of Charles Burrell and is run by Thetford Town Council using volunteers. For further information including opening times telephone 01842-765840 or email at burrel@thetfordtowncouncil.gov.uk

The annual **Chiltern Steam Rally** at Prestwood, Great Missenden, Buckinghamshire is to be held on the 7/8 July this year. Gates will open at 10am and there will be demonstrations of timber sawing, threshing and stone crushing together with stationary engines, tractors and models on display. The event is organised by the Chiltern Traction Engine Club. Contact John Turner (t: 01494-526807) for further information.

The date of the planned open day at the **City of Sunderland MES** has been brought forward to the 2 September 2007 because the society is taking a stand to the Model Engineer Exhibition at Ascot on the original date.

Lost and Found

John Britton of **Grimsby and Cleethorpes MES** found an item on the club stand at the Harrogate show that was left by a visitor. The same can be reclaimed by telephoning John on 01472-276910 and telling him what it is.

A Warning

A delegate at the **Northern Association AGM** told the meeting that a member of their club had bought a B1 with a new boiler on Ebay with a current Northern Association hydraulic test certificate. When presented to the club boiler tester it was found that firebox stays were not fitted. A check with the issuing club revealed that they had not issued the certificate and the club had informed the seller they would not test any more of his boilers. The moral again is if you are contemplating buying a loco on Ebay make sure it has a boiler certificate and check that it is valid. This was reported in the **Saffron Walden DSME** newsletter.

If any readers hear of other such incidents, we will report them here.

Gauge 1 Model Railway Association

The following press release has been received from G1MRA.

"The Gauge One Model Railway Association is proud to announce that it is celebrating its Diamond Jubilee year in 2007. The Association was formed in 1947 and caters principally for the modelling of standard gauge prototypes using both live steam and electrically powered motive power.

Often referred to as 'The Premier Gauge', Gauge 1 enjoys a unique reputation as a particularly sociable and co-operative bank of enthusiasts and the Gauge 1 hobby has enjoyed a considerable surge in popularity in recent years as the garden railway hobby has burgeoned. Membership currently stands at nearly 2500 members worldwide, and several impressive G1MRA layouts are an increasingly familiar sight at major model railway exhibitions where they draw large crowds of spectators.

Commercial support has grown to keep pace with this growing interest and there are an increasing number of ready to run models becoming available in addition to the more traditional pursuits of kit and scratch building of both locomotives and rolling stock.

To celebrate the Diamond Jubilee Year, a number of activities are planned throughout the year with two weeks of special events occurring in June. This program will kick off with a two day extravaganza event at the Warwickshire Exhibition Centre, followed by an extensive program of get-togethers at member's garden railways. The first week culminates with a special commemorative dining train experience on the Severn Valley Railway.

These events are for members and their guests only, with special invitations being extended to other specialist model groups."

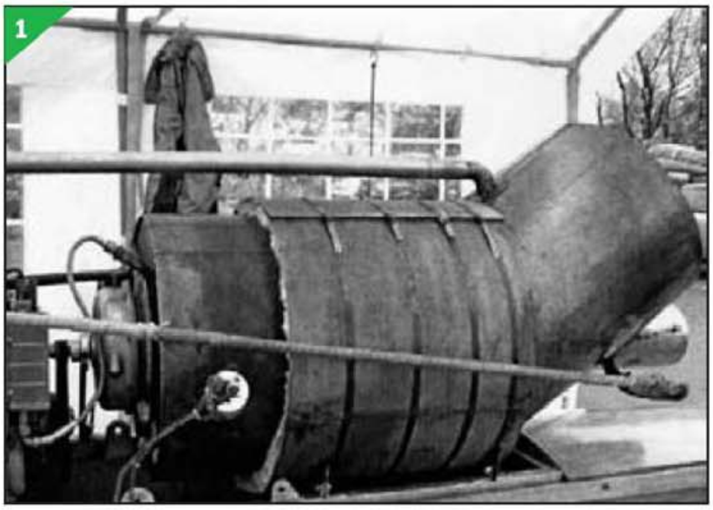
Full details of the celebrations and a host of other essential information about G1MRA are featured on the Association website www.gaugeone.org where joining details may also be found.

UK Club News

Arrangements for the centenary celebrations at **Bradford MES** next year are progressing. The society is to hold a special exhibition at the Industrial Museum and the society archivist, Michael Gray, is apparently scouring every copy of this journal since 1899 for references to the society. I hope he does not get sidetracked by interesting articles along the way as I sometimes do when looking at newsletters! Amendments to the boating pond scheme planned for Northcliffe are being discussed with the consultants prior to submission to the council for approval before seeking funding.

Members from **Colchester Model Engineers** recently travelled to the **North London Society at Colney Heath** to take part in a themed meeting, running locomotives based on London & North Eastern railway designs. The Colchester members ran six locomotives during the day, which were of three different gauges. Details of the summer events can be found on the web site at www.csmee.co.uk or by phone on 01206-822735. New members are always welcome.

Edinburgh SME is making plans for an orderly vacation of >>



1. The steam generator from the full size high speed boat being trialled on Coniston Water.

2. The Isle of Man railway Beyer Peacock locomotive which was one of the lots at the Drewatt Neat auction.

its club room by December and is looking at several alternative sites in the area. A major tidying up exercise has resulted in several trips to the local scrap metal merchant raising a total of £300 for club funds. The society has received offers of help and storage facilities from the Esk Valley club and the Scottish Model Engineering Trust. Eight members visited the Dalzell Rolling Mill in Motherwell and all agreed that "it was an absolutely terrific evening". The mill is the second largest plate rolling mill in Europe.

The Model Steam Road Vehicle Society appears to be branching out slightly because the latest newsletter features a small piece on a full size steam speed boat on trial at Coniston Water. The boat is driven by a horizontally opposed engine powered by a one million BTHU liquid fuelled boiler which generates 1000psi of steam pressure. From the picture, the unit looks suspiciously like a flash steam boiler (**photo 1**) and driving the boat must be an interesting experience.

In common with many clubs this year, **North London SME** has had to deal with some storm damage to trees at the Tyttenhanger track site. One poplar tree situated near the tunnel had to be felled after being uprooted. The March meeting was a forum Painting Our Models and produced many useful tips for those present.

The Editor of the Prospectus from **Reading SME** has visited the Nottingham Industrial Museum at Wollaton Hall and thoroughly recommends a visit to the site. The main exhibits are railway and mining artefacts, lace making machines, Raleigh cycles, Brough motorcycles, Ericsson telephones and the Basford pumping engine. The engine is a Woolf compound beam engine, built by R & W Hawthorn in 1858. Steaming days for the museum are on the last Sunday of the month. The museum can be contacted on 0115-915-3900 or via the Nottingham City web site at www.nottinghamcity.gov.uk

The good news from the club is that the last of the concrete beams on the raised track has now been replaced, bringing an end to the four year project started in 2003. The sleepers are now going to be replaced with a plain design with no slots for the rails. Progress also continues on the new Scottish themed 0 gauge layout with the baseboards now finished.

The following was published in the newsletter of the Saffron Walden DSME:

"At a steam rally last week, I spotted a father with his son of nine or ten examining a nicely restored traction engine. The lad asked his dad what the sack of black rocks on the ground was for. The father admitted he hadn't a clue but asked the traction engine owner. Who patiently explained what coal was and how it was used to create steam.

What do they teach in schools these days? Surely it isn't too much for our younger generation to have a grasp of history within living memory."

I think it speaks volumes!

World Club News

Canada

Training courses at the **British Columbia SME** are starting again now running has commenced. The courses sound very extensive and cover conductors, diesel/electric engineer and Steam engineer. The steam engineer course consists of three days of mixed theory and practical work followed by a written examination. This is just to get the "Learners permit" which allows the trainee to move to the actual driving training.

New Zealand

Maidstone MES is being involved in the planned improvements to the park in which it operates and has been asked to provide details of future plans and how the city council could assist if needed. This sounds like a very positive approach.

Trade News

A Successful Auction

Bristol Auctioneers, **Dreweatt Neate**, carried out a private house call in Bristol where a gentleman had recently passed away. They were called in to look at a collection of 0 gauge model railway items, but also stored under a bed were three Great Western Locomotive nameplates. They had been purchased in the early 1960s for just £11 direct from British Rail by the late vendor who was a railway worker. At the auction held recently the three name plates were purchased by private collectors for a figure just over £53,000. The collection of 0 gauge railway items also sold for many thousands of pounds.

Also on offer in the auction was the Late Ronald Phipps collection which had been consigned from Kent to this specialist auction and realized over £50,000 with a top price of £18,500 including auctioneers premium being paid for a 4in. scale model of a Burrell Showman's engine, this was followed by a specialist dealer purchasing a 4inch Burrell Agricultural engine for £12,000 including premium. The auction had a very large attendance attracting bids from as far as America and numerous parts of Europe.

Other prices included £7,000 for a 5in. gauge model of an Isle of Man,, Beyer Peacock, narrow gauge, locomotive (**photo 2**) built by a Taunton model engineering club member which has gone to a private buyer in Brighton who hopes to use it on a weekly basis.

A 5in. gauge Liberation 2-8-0 Locomotive sold at £5,600 and a 5in. gauge GWR Armstrong Class 4-4-0 locomotive and Tender found a buyer at £4,800.

It is not always the largest item that makes the most money with a very small model of a horse-less steam carriage selling at £3,700 to an American collector. The carriage was brought into one of the auctioneer's valuation days at their office in Godalming, Surrey with the vendor thinking it was of very little value.

Collectors of 0 gauge were also in for a treat with two interesting collections being offered for sale, one from Bristol and one from East Sussex and these attracted buyers from all over Great Britain. A top price of £1,620 was paid by a French buyer for a Bassett Lowke 0 gauge electric LMS 4-6-2 tender locomotive Duchess of Montrose with many other similar tender locomotives realizing figures from £400 to £600. It was not just 0 gauge locomotives that where in demand and there were some amazing prices in the rolling stock and accessories sections. A top price of £1850 was paid for five Exley coaches in Southern livery followed by £750 for five Exley coaches in LMS crimson livery despite having very rusty wheels. A boxed Hornby No 1 Passenger set found a very special buyer at £1,680 which we believe to be a record price, despite the box having a damaged lid.

The sale had something for everyone interested in model railways, model engineering, railwayana and transport related items. A Bristol tram head light found a new home at £110 and a 1925 Triumph 500cc motorcycle went to a vintage cycle restorer in Wiltshire for £2,700. The variety of items on offer ranged from model engineering lathes, part built stationary engines through to a Victorian model steam ship which was knocked down for £5,000 following intense telephone bidding.

The auction which also included a special clock section realized close to £250,000 in total and is the largest regular auction of its type in the whole of Great Britain including London. Dreweatt Neate can be contacted at St. John's Place, Apsley Road, Clifton, Bristol BS82ST (t: 01404-47593) or via several local offices.

In Memoriam

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

Magnus Fowler	*Centurion SME (South Africa)*
Neil Kingston	*Burton-upon-Trent MES*

DIARY

JUNE

9 Fylde SME. *Gala Day.* Contact Alan Reid: 01253 882872.

9-10 Guildford MES. *OMLEC - Open Model Locomotive Efficiency Competition.* Contact Dave Longhurst: 01428 605424.

9-10 Harrow & Wembley SME. *Open Weekend.* Contact Roy Goddard at RSGwatford@aol.com

9-11 MELSA. *Queens Birthday Run - Rockhampton.* Contact Graham Chadbone: 07 4121 4341.

9 Nottingham SMEE. *Diesel Day.* Contact Pete Towle: 0115 987 9865.

10 Bedford MES. *Members' Fun Day.* Contact Ted Jolliffe: 01234 327791.

10 Bradford MES. *Rae Gala.* Contact John Mills: 01943 467844.

10 Bristol SMEE. *Public Running.* Contact Trevor Chambers: 0145 441 5085.

10 Canterbury DMES (UK). *Public Running.* Contact Mrs P. Barker: 01227 273357.

10 Carlisle DMES. *Open Day.* Contact Geoff Routledge: 01228 530767.

10 Edinburgh SME. *Club Track Running.* Contact Robert McLucke: 01506 655270.

10 Harlington LS. *Public Running.* Contact Peter Tarrant: 01895 851168.

10 High Wycombe MEC. *Club Running.* Contact Eric Stevens: 01494 438761.

10 Leeds SMEE. *Running Day.* Contact Colin Abrey: 01132-649630.

10 Norwich DSME. *Public Running.* Contact Shirley Berry: 01379 740578.

10 Nottingham SMEE. *Diesel Day & Public Running.* Contact Pete Towle: 0115 987 9865.

10 Portsmouth MES. *Running Day & Barbecue.* Contact John Warren: 023 9259 5354.

10 Saffron Walden DSME. *Public Running.* Contact Jack Setterfield: 01843 596822.

10 Sutton MEC. *Track Day.* Contact Bob Wood: 0208 641 6258.

10 Taunton ME. *Public Running & Fun Day.* Contact Don Martin: 01460 63162.

10 Worthing DSME. *Public Running.* Contact Bob Phillips: 01903 243018.

10 York City & DSME. *Running Day.* Contact Pat Martindale: 01262 676291.

11 Bedford MES. *'Leccy night' we ask owners of electric locos to allow others a drive. All tracks.* Contact Ted Jolliffe: 01234 327791.

11 Erewash Valley MES. *Steaming Evening.* Contact Jim Matthews: 01332 705259.

11 Saffron Walden DSME. *Club Night.* Contact Jack Setterfield: 01843 596822.

12 Romney Marsh MES. *Track Meeting.* Contact John Wimble: 01797 362295.

12 Taunton ME. *Working Party.* Contact Don Martin: 01460 63162.

13 Brighton & Hove SMLE. *Wrinklies Running.* Contact Mick Funnell: 01323 892042.

13 Cardiff MES. *Kids Day Out.* Contact Don Norman: 01656 784530.

13 High Wycombe MEC. *Evening at Track.* Contact Eric Stevens: 01494 438761.

13 Hull DSME. *Tony Finn: Quiz.* Contact Tony Finn: 01482 898434.

13 Leicester SME. *Meeting.* Contact Keith Baum: 0116 220 9556.

13 Romney Marsh MES. *RMMES Dinner.* Contact John Wimble: 01797 362295.

13 St. Albans DMES. *Roy Verden: Boating Topics.* Contact Roy Verden: 01923 220590.

13 Hull DSME. *Tony Finn: Quiz.* Contact Tony Finn: 01482 898434.

14 Sutton MEC. *New Driver's Run.* Contact Bob Wood: 0208 641 6258.

14 Worthing DSME. *First Summer Barbecue.* Contact Bob Phillips: 01903-243018.

15 Canvey R&MEC. *Meeting.* Contact Brian Baker: 01702-512752.

15 Rochdale SMEE. *Annual Models Running Night.* Contact Bob Denyer: 0161-959-1818.

15 Romford MEC. *Track Maintenance.* Contact Colin Hunt: 01708-709302.

16-17 Bournemouth DSME. *Open Weekend.* Contact Dave Fynn: 01202-474599.

16 Brighton & Hove SMLE. *Club Outing to Blatchington Mill.* Contact Mick Funnell: 01323-892042.

16 Canvey R&MEC. *Members' Only Running Day.* Contact Brian Baker: 01702-512752.

16 Chesterfield MES. *Efficiency Trials.* Contact Mike Rhodes: 01623-648676.

16-17 Dockland & E. London MES. *Public Running.* Contact P. M. Jonas: 01708-228510.

16-17 Harrow & Wembley SME. *Visit by South African Live Steamers.* Contact Roy Goddard: RSGwatford@aol.com

16 Oxford (City of) SME. *Family Day.* Contact Chris Kelland: 01235-770836.

16 Romford MEC. *Trackside Afternoon.* Contact Colin Hunt: 01708-709302.

16 Romney Marsh MES. *Track Meeting.* Contact John Wimble: 01797-362295.

16 SM&EE. *Rummage Sale.* Contact Maurice Fagg: 020-8669-1480.

17 Basingstoke DMES. *Efficiency Competition.* Contact Guy Harding: 01256-844861.

17 Canterbury DMES (UK). *Open Day.* Contact Mrs P. Barker: 01227-273357.

17 Cardiff MES. *Steam-Up & Family Day.* Contact Don Norman: 01656-784530.

17 Frimley & Ascot LC. *Club Running.* Contact Bob Dowman: 01252 835042.

17 Guildford MES. *Public Running.* Contact Dave Longhurst: 01428 605424.

17 Hereford SME. *Charity Event.* Contact Nigel Linwood: 01432 270867.

17 High Wycombe MEC. *Engine Efficiency Day.* Contact Eric Stevens: 01494 438761.

17 Leighton Buzzard NG Rly. *Fathers' Day.* Enquiries: 01525 373888.

17 North Cornwall MES. *Sunday Steam-Up.* Contact Geoff Wright: 01566 86032.

17 Norwich DSME. *Public Running.* Contact Shirley Berry: 01379 740578.

17 Nottingham SMEE. *Public Running.* Contact Pete Towle: 0115 987 9865.

17 Oxford (City of) SME. *Public Running.* Contact Chris Kelland: 01235 770836.

17 Plymouth MSLS. *Public Running.* Contact Malcom Preen: 01752 778083.

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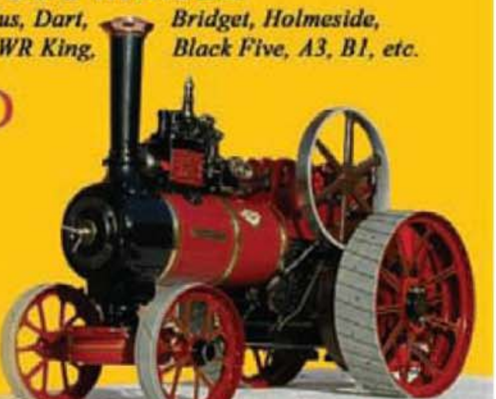

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