MODEL ENGINEER

Vol. 188 No. 4169

17 - 30 May 2002 £2.10

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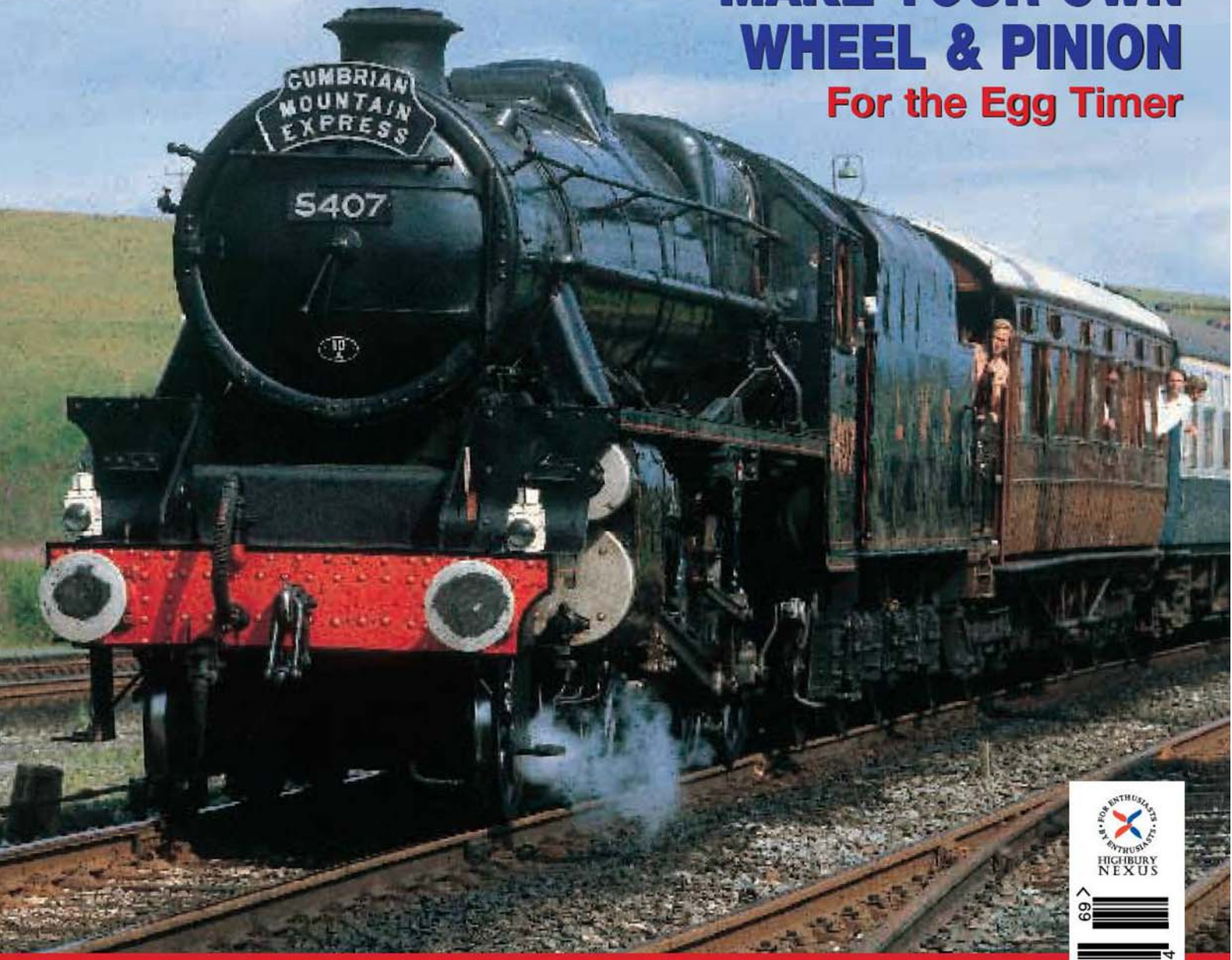

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Model Engineer is published by
Highbury Nexus Special Interests Limited
Nexus House, Azalea Drive, Swanley, Kent BR8 8HU
Tel: 01322 660070 Fax: 01322 616319
www.nexusonline.com
Highbury Nexus Special Interests is a wholly owned subsidiary of Highbury House Communications plc.

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Direct Subscriptions and Back Issues are available from Nexus Subscription Services, Link House, 8 Bartholomew's Walk, Ely, Cambs CB7 4ZD Phone: 01353 654422; Fax: 01353 654400
Email: wss@wyvernet.co.uk
Rates for 26 issues (annual), 13 issues (six months):
UK: £54.60 (annual) £27.30 (six months);
Europe: £69.00 (annual), £34.50 (six months);
RoW Surface: £70.00 (annual), £35.00 (six months);
RoW Airmail: £74.50 (annual), £37.25 (six months);
US Surface: $98.00 (annual), $49.00 (six months);
US Airmail: $113.50 (annual), $56.75 (six months).
Cheques payable to Nexus Special Interests Ltd.
Second class postage paid at Rahway NJ USA.
Postmaster, please send address corrections to Model Engineer c/o Mercury Airfreight International Inc, 2323 Randolph Avenue, Avenue 1, NJ 07001. Usps 0011099.
US Subscription Agent: Wise Owl Worldwide Services, 1926 S. Pacific Coast Highway, Suite 204, Redondo Beach, CA90277-6145, USA.
Phone: (310) 944-5093; Fax: (310) 944-9963.
Email: wiseowl@sprintmail.com
Website: www.wiseowlmagazines.com
Visa/MC/Discover accepted.
Canadian Distribution by Gordon & Gotch Periodicals (Toll free 1-800-438-5005).
Model Engineer is published fortnightly.

ISSN 0026-7325

IN THIS ISSUE

● Vol. 188 No. 4169 17 May 2002 ●

On the cover ...

At one time preserved at Carnforth, LMS Standard Class 5MT 4-6-0 No. 5407 is seen here departing Hellifield Station in North Yorkshire.
Probably better known as a 'Black Five', No. 5407 was one of a batch of 226 locomotives built by Armstrong Whitworth between 1936-7 to a design by Sir William A. Stanier.
The 'Black Fives' earned an enviable reputation for reliability and were popular with both footplate crews and shed staff. Several of these locomotives have been preserved to delight a new generation with their stylish appearance, distinctive exhaust note and deep-noted whistle.

(Photograph by James Guilliam)

INDEX to ADVERTISERS

Classified Advertisements on pages 372-374

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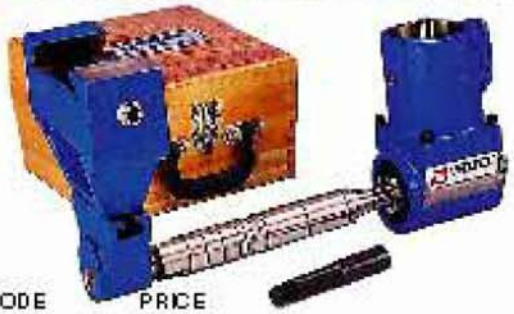

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SMOKE RINGS
With the Editors

Early Sunday morning activity in the steaming bays at the Leeds SMEE track in the superb grounds of Eggborough Power Station just off junction 34 of the M62, venue for IMLEC 2002 to be held 6/7 July.

Norman Lowe

John Chamberlain, Hon. Secretary of Wigan DMES, writes:

"It is with great sadness that I write to inform you of the death of Norman L,owe, a member of the Wigan & District Model Engineering Society for over fifty years, a past President of the Society, and Honorary Life Vice President at the time of his death. Norman had been taking medication for angina for some time but his death from heart attack on 2 April, aged 71, came as a dreadful shock to everybody.

"He served his apprenticeship as a pattern maker, then obtained employment at the locomotive works at Horwich, where he progressed to the top of his profession and ended his career as Chief Instructor in the Pattern Shop. He was involved at Horwich with the full size replica of Sans Pareil *built for the Rocket 150 celebrations at Rainhill, producing patterns for the driving wheels and particularly complex cylinders, the castings of which were done under his guidance. He had previously made the replica wooden chimney for the L&YR radial tank 1008, now in York Museum. He was a personal friend and admirer of the late Don Young, and made the patterns for Don's designs.*

"Norman's first model was built when he was seventeen, a 3½in. gauge Black 5. Coming from a rural community with no electricity available, he marked and cut out the frames for this by candlelight and did the turning on a treadle-operated lathe. His equipment and skills improved and he continued building locomotives, winning a Silver Medal at the 1981 Model Engineer Exhibition with his 5in. gauge L&Y Radial Tank. This was denied the highest honour because the coupling rods were judged to be 'fish bellied', a feature which Norman, with his extensive knowledge of the prototype, had gone to considerable pains to reproduce. The judges' comments caused him much irritation, and he vowed never again to enter his models in competition, a sad omission because his skills continued to improve, and his models were worthy of any scrutiny. These were usually built with the aid of works drawings, which he rescued by the hundred when steam traction was abandoned at Horwich.

"Norman completed eight locomotives in all, the final one being a 5in. gauge L&Y 'A' Class 0-6-0 goods engine, showing extraordinary workmanship. In between locomotive building he produced several clocks which, as could be expected, were exquisite examples of the clockmaker's art. At the time of his death he was involved in the re-building of his original Black 5.

"Norman was a true gentleman of 'the old school' and was unstinting in the help given to members of the Society, and in his efforts to improve the standard of their workmanship. His encyclopedic knowledge of all things railway will be a great loss, not just to our Society, but nationally and is knowledge that once gone is lost forever. Our loss is nothing to that of his wife Joyce, to whom he was completely devoted, and our thoughts must be with her at this sad time."

Stolen models

Following publication of information concerning the theft of Martin Rant's 5in. gauge locomotive and rolling stock, we have heard from Didcot Police (01235-512929) regarding the reference quoted (*Smoke Rings, M.E.* 4167, 19 April 2002).

We have been asked to draw readers' attention to the fact that the number quoted was incomplete and should have been as follows: URN 1248 15/03/02. Anyone able to assist in the recovery of these stolen items should contact Didcot Police quoting the number given here. We regret any inconvenience caused by publication of inaccurate data.

Stolen locomotive

We learn from Norman Smith, Chairman of Lucas SME, that the society workshop was broken into on Friday 22 March and the club locomotive was stolen. An 0-4-0T to the *Ajax* design, it is in all-black livery, lined out in red and carries the name *Ernie Homer* on the side tanks.

Details of the theft have been posted on the Lost Models Directory **http://www.modeleng.org/lost/thanks.htm** A reward is offered for information leading to the recovery of this locomotive; anyone who can help should please ring Dave Thomas on 01675-465789.

NAME Narrow Gauge IMLEC

Nigel Thompson, Hon. Secretary, NAME reminds us that the next Northern Association ME Narrow Gauge International Locomotive Efficiency Competition is scheduled for the weekend 1/2 June and will take place at the track-site of South Cheshire SME.

At the time of writing, entries are currently still being invited and application should be made to Mr. M. Gee-Pemberton at *Trees*, Middlewich Road, Holmes Chappel, Cheshire CW4 7ET.

ENTRIES ARE NOW WELCOME FOR THE

INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

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THE MARTIN EVANS CHALLENGE CUP

FOR STEAM LOCOMOTIVES OF 3½ AND 5in. GAUGES

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at their track at

EGGBOROUGH POWER STATION
Nr. SELBY, NORTH YORKSHIRE
on 6/7 JULY 2002

For Entry Forms, apply by telephone to **Edwin Hughes** on **01757-707454**
It may be necessary to limit the number of entries, so early application is advisable.
Confirmed entries will receive further information nearer to the event.

POST BAG

Silver-solder alloys

SIRS, - I read with interest the letter from Mr. Sellen in Kent (*Postbag, M.E.* 4163, 22 February 2002) regarding the lack of information about the B6 silver-solder alloy often recommended by the late LBSC. I knew that the alloy C4, which he had also recommended, had been re-coded as Silver-flo 24, but information on B6 was hard to come by. I had made some searches some years ago but drew a blank and abandoned my quest. The letter from Mr. Sellen encouraged me to undertake a new search which this time was more successful.

The answer is to be found in a MAP Technical Publication, *Soldering and Brazing* by A. R. Turpin, first published in 1955; my copy is of the 1973 edition. This book is now out of print but may be found on the secondhand market. The current book of this title was written by *Tubal Cain* (the late Tom Walshaw) and I cannot guarantee that the same information is given in Tom's book.

The following specification is published for both B6 and C4:

Alloy	Melting Range	Tensile Strength
B6	790-830°C	28T/in.^{2}

The highest melting silver-brazing alloy in the JMC range. Use Tenacity 4A flux.

C4	740-780°C	34T/in.^{2}

Suitable for both ferrous and non-ferrous jointing, and use where two-stage brazing calls for a subsequent joint with Easy-flo in close proximity. Use Tenacity 4A flux.

-

Current Johnson Matthey technical brochures list the following two alloys with identical characteristics:

Alloy	Melting Range	Tensile Strength
Silver-flo 16	790-830°C	505N/mm^2

Useful alloy where step-brazing is a consideration.

Silver-flo 24	740-800°C	470N/mm^2

Used in aerospace component manufacture and by model engineers.

-

For step brazing, Johnson Matthey suggest the following:

1st Op.	Silver-flo 18	(784-816°C)
2nd Op.	Silver-flo 33	(700-740°C)
3rd Op.	Silver-flo 55	(630-660°C)
4th Op.	Easy-flo 2	(608-617°C)

Silver-flo alloys 24, 20, and 16 are also suited to step brazing.

For the Silver-flo range of alloys, the use of Tenacity 4A flux is generally recommended; it is a general purpose flux intended for use with brazing alloys which have a liquidus between 700-800deg.C. Easy-flo flux is, of course, to be used with Easy-flo alloys and is ideal for small fittings and fabrications. Soluble in water, it is easily removed but where overheating and prolonged heating is likely to occur, as in the final stages of boiler making, then Tenacity 4A flux should be used. Prolonged heating can lead to the Easy-flo flux becoming exhausted and inactive before the alloy can be applied.

It is general in the model engineering hobby to refer to boiler making or fabricating as 'silver-soldering or hard-soldering'. Although I and very many others have used this terminology for as long as I can remember, it is technically incorrect. Soldering is a thermal process which takes place below 450deg. C, while brazing is a process that takes place above 450deg. C. The only work that can truly called silver-soldering is when a silver bearing soft solder such as Comsol is used. Comsol is a lead-tin alloy which contains 1.5% silver. The recommended flux for Comsol is Johnson Matthey's Soft-Solder Flux No. 2S which is liquid and non-corrosive for use on copper and brass.

Readers should note that the names of the solders and fluxes mentioned here are trade names of Johnson Matthey products; other suppliers have their own trade names. Suppliers may supply products under BS1845 or EN1044 reference numbers.

I have recently been in contact with the Materials Technology Division of Johnson Matthey with regard to the forthcoming SMEE Seminars, one of which will be on silver-brazing; I have found them most helpful. The information contained in the forgoing has been extracted from their latest technical brochures.

Gerry Collins, East Sussex.

Mr. Smith uses three similar blocks to separate the jaws when refurbishing a 3-jaw self-centring chuck.

Logging locomotives

SIRS, - I was pleased to read Keith Wilson's most interesting article and welcome news in *M.E.* 4163, 22 February 2002, with reference to the Canadian 2-8-2. It is a shame that there are not more North American 5in. gauge plans and castings easily available in the UK. A nice Pacific would go down just fine.

As to the 2-8-2, Locomotive No. 11 of the Comox Logging Co. was originally built by Baldwin in 1923, C/N 57409, as Donovan Corkery Logging Co. No. 4. Oil fired, with a boiler pressure of 200psi, 18 x 24in. cylinders and 44in. drivers, it had a tractive effort of 30,000lbf.

Comox aquired it second hand and donated it in 1962 to the Logging Equipment Museum of Crown-Zellerbach in Canada.

The 'scoop' below the 'buffer beam' was common on North American locomotives used for yard switching (shunting) or short trip duties, the brakeman of the crew standing and riding there while carrying out his switching duties. I understand that this is no longer allowed.

I think it unlikely that the boiler and cylinders were never lagged. The cladding, lagging and crinoline were probably removed some years ago as a safety precaution, a practice common in North America for preserved locomotives left outside. The UP *Big Boy* (4017) inside a new building at Green Bay, Wisconsin, USA is not lagged. Corrosion of cladding and release of asbestos can happen in the climate of the Pacific North West, which, in terms of rainfall, is not too far removed from that of the UK.

Sparks were arrested by the mesh type apparatus on top of the chimney, though the fine mesh itself seems to have rusted away.

Two logging railroads remain in North America, one in Washington State and the other, owned by Canfor (Canadian Forest Industries) on Vancouver Island, which possesses a superb 1920 Alco 2-8-2 No. 113 which was used in the 1990s for steam haulage on special occasions. The parlous state of the Canadian logging industry in recent years may mean it will not be steamed or repaired and paid for by the Company in the near future.

The last 'normal' use of steam on Vancouver Island was on MacMillan Bloedel's system in 1973, where their No. 1055, a Baldwin 2-8-2 saddle tank, worked at the Chemainus mill.

There are other preserved locomotives on this beautiful island, including Shays and Climaxes in the Forest museum at Duncan, and another Canfor tank engine at Beaver Cove, with a large tree growing through one of its log trucks.

Eric Ellis, Gloucestershire.

Truing chuck jaws (1)

SIRS, - When truing the jaws of a 3-jaw self-centring chuck it is important to ensure that the jaws are clamped firmly to simulate holding a piece of round material. The following method was recommended to me by an elderly colleague.

First, strip and remove any swarf from inside the chuck. Next prepare three pieces of parallel bar of equal thickness to clamp between the flats at either side of the gripping surface of each jaw as shown in the photograph (above). When the chuck is fully tightened, the jaws will be experiencing a similar resultant force as if they were holding a piece of round bar.

Now mark the jaws with marking out fluid or a permanent marker pen and, with the use of a toolpost grinder or a mini-drill held on a vertical slide, remove material from the jaws little by little. When the colouring has been removed from the length of the gripping surface of all three jaws, the chuck should be true.

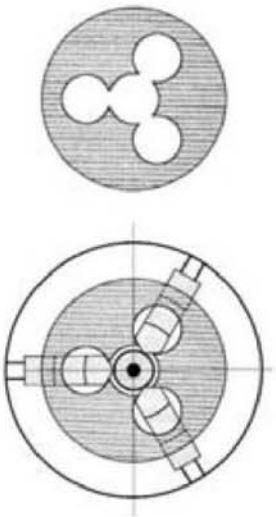
Before returning the chuck to service, it is advisable to strip and clean it thoroughly to remove all traces of abrasive.

Ian H. Smith, Lothian.

Truing chuck jaws (2)

SIRS, - I didn't find it easy to visualise what sort of plate Pat Twist (*M.E.* 4166, 5 April 2002) used to load the jaws of his chuck for grinding, but he seems to have loaded it outwards at the back of the jaws. If so, he may have been lucky to get a good result, and the scroll must be relatively unworn.

The conventional method for this is to load the jaws inwards so as to take account of all the backlash in the right direction. This can be done by using a tri-lobe plate made as shown the accompanying drawing.



Mr. Finn's tri-lobed plate technique for truing the jaws of a 3-jaw self-centring chuck.

Note that it does not require to be made to a high degree of accuracy, as the jaws will even out the load as it is applied. All that is necessary is for the jaws to be loaded and the tips to be available for grinding.

To get the best concentricity, the jaws should always be tightened up from the same key point, usually No. 1. On some chucks this is marked, but if not, make sure that when tightening against the restraining plate, you always use the same point, and mark it for future use after you have ground the jaws back to truth.

Tony Finn,
East Riding of Yorkshire.
tony@finn-aj.freeserve.co.uk

Polycyclic aromatic hydrocarbons

SIRS, - The following letter was published in our local newspaper, the *Otago Daily Times,* here in Dunedin, New Zealand under the heading *Firefighters*. I feel the heading could just as easily have read *Model Steam Engine Operators/Drivers:*

"I am writing in response to a report headed Firefighter, cancer link still a mystery *(ODT, 9.2.02). I wish to refer the Fire Service and the relevant committee group to the toxicological textbook* Casarett and Doull's Toxicology: The Basic Science of Poisons *(ed. C. D. Klaassen). This text describes compounds that toxicologists around the world regard as the causative agent in cancers in populations such as firefighters, namely polycyclic aromatic hydrocarbons (PAHs).*

"It was first identified in 1775 by Percivall Pott that chimney sweeps were at an increased risk of testicular cancer due to the high concentrations of PAHs in soot. PAHs are generated by the incomplete burning of carbon-based materials (wood and coal) and are some of the most highly carcinogenic chemicals known to date. As a doctorate student in the department of pharmacology and toxicology at the University of Otago, I suggest that the effect that has been noticed, within the New Zealand population of firefighters, is a risk that was identified many years ago and does not warrant the further spending of taxpayers' money. It would be far more appropriate to invest in better respiratory protective equipment. Belinda Bray, Dalmore"

Bob Newbury
Dunedin, New Zealand.

Turbine nozzles

SIRS, - A recent contribution and follow-up correspondence tend to infer that high-efficiency (De Laval) nozzles may not be successful in small sizes. Several builders have in fact succeeded in operating these nozzles, including the late Professor D. H. Chaddock and W. H. Elkin.

A relevant article by W.H.E. in *M.E.* 2350, 23 May 1946 was followed by further information in *M.E.s* 2587-2592, 21 December 1950-25 January 1951 by D.H.C., the latter describing a power/steam consumption test of W.H.E.'s turbine at SMEE.

The 1946 article contains confusing contradictory statements, and some mental gymnastics to explain them! With the benefit of hindsight, it is easy to see that a significant error caused W.H.E.'s nozzle test results to be flawed.

W.H.E. recorded an exit velocity of only 900ft./sec for the 0.022in. throat nozzle when passing (supposedly) 1oz./min. at 60psig. The mass flow was far too high. It should have been nearer 0.4oz./min., giving an exit velocity of 2200ft./sec. in the impulse test.

The theoretically attainable velocity of 2450ft./sec. with this heat flux gives a velocity coefficient of 0.9 (over 80% efficient). Checking the turbine design in a very basic manner, using the originally specified wheel/steam ratio (0.128), shows that theory and practice are as one.

Kearton stated that the operating conditions of these nozzles must *"closely approximate"* those used at design.

This is our problem, we need to know:

1: Mass flow (see Prof W. B. Hall, *M.E.* 3984, 6 January 1995)

2: Pressure and temperature at nozzle inlet (see Don Broadley's letter concerning regulator loss, *M.E.* 4103, 24 September 1999)

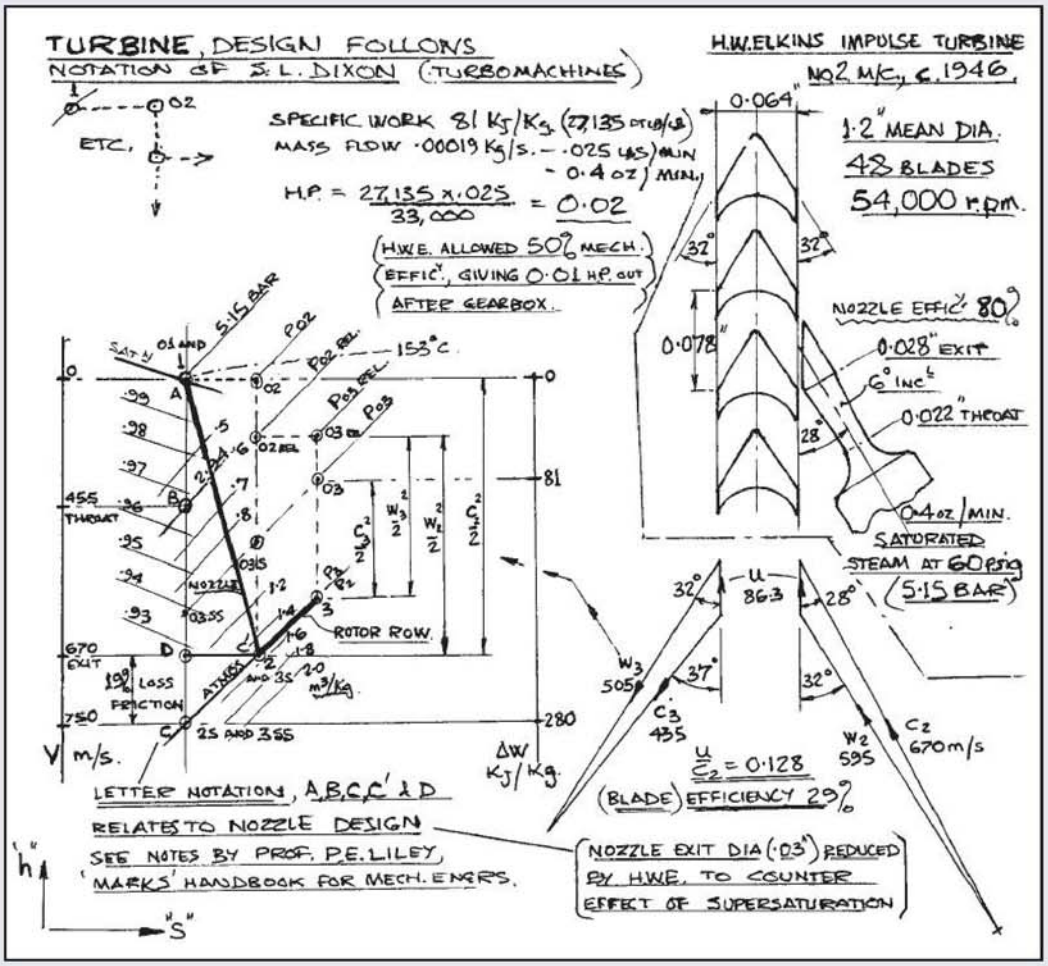
3: Efficiency (80% according to W.H.E.'s results; 80% according to *Tubal Cain's Model Engineer's Handbook*).

An important point regarding the efficiency is that if, at design, it is allocated too low a value, the result is an over-expanding nozzle, i.e. its divergence is too great. Mr. Yates described the pitfalls of this in his letter; sub-sonic velocities result.

Too high a value pushes the design towards parallel throat design, an extreme case of under-expansion, giving low supersonic velocities.

The nozzles are most easily designed using the Mollier Diagram method. A 'designer friendly' chart of isochors (SI units) accompanies K. Raznjevic's *Handbook of Thermodynamic Tables and Charts.* No steam tables are needed with this, all necessary information, including specific volumes, steam velocities and specific work are read directly or from 'attached' scales.

R. Pridmore, South Yorkshire.



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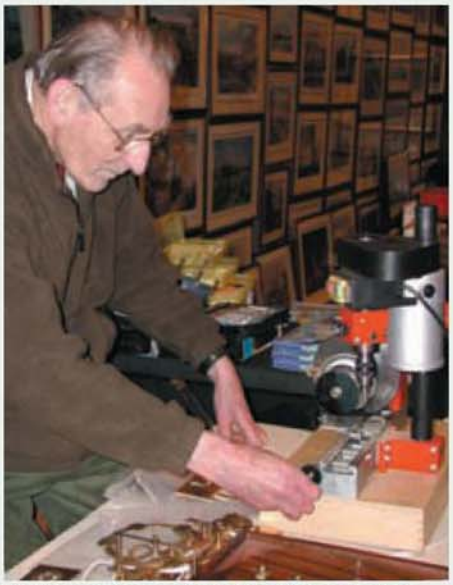
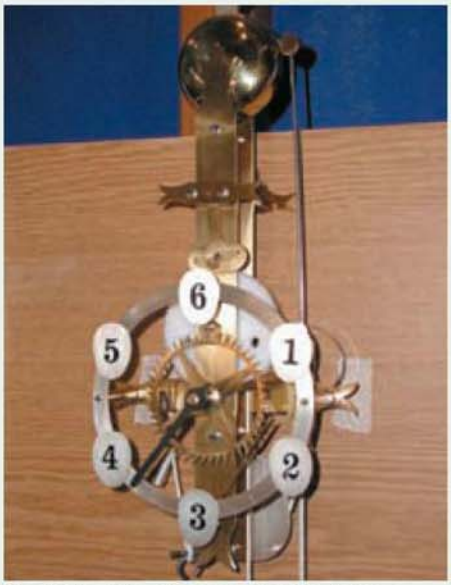


The Author demonstrates wheel-cutting using the Unimat 4 lathe on the RiteTime Publishing stand at MEX 2001 at Sandown Park.



The Author's Eggtimer was displayed on the RiteTime Publishing stand at MEX 2001 at Sandown Park.

John Wilding FBHI

introduces some enhancements suggested by constructors, and describes how to cut the gear and make the pinion.

●*Part XI continued from page 135 (M.E. 4165, 22 March 2001)*

The egg timer has now been featured in four major model engineering exhibitions in the last two months. As a result I have received some interesting feedback from constructors. It seems that despite my attempts to make this a simple beginner's project, many constructors want to make every part of the timer and prefer not to buy ready made gears, so I intend to describe the cutting of the two main gears in the Unimat 4 lathe.

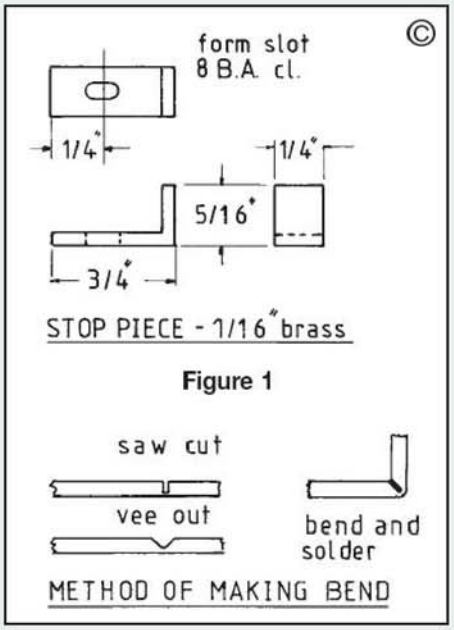


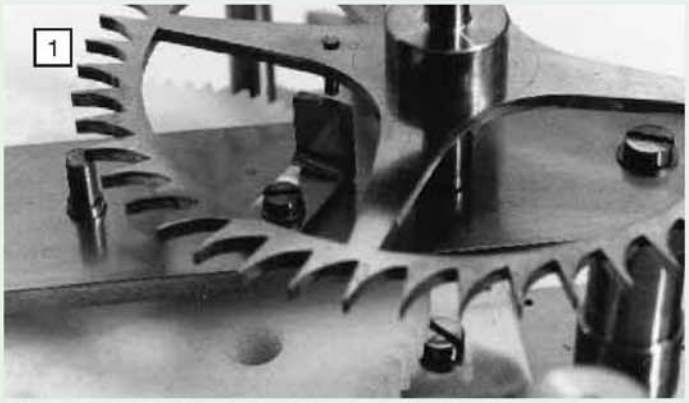
Figure 1

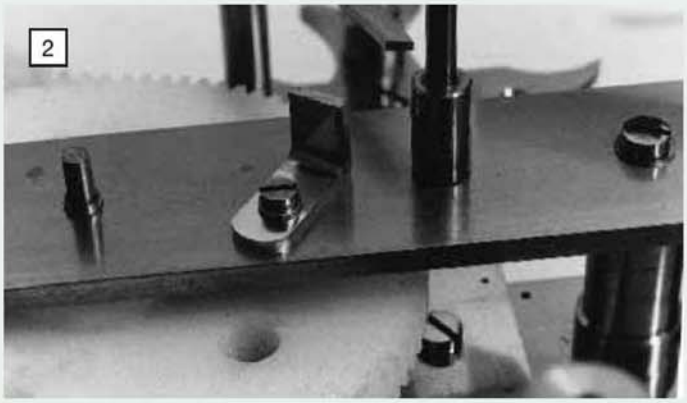
Secondly, some constructors feel that when the bell is sounded at the completion of the timed period the mechanism should also cease operating. At the moment the timer will continue to run until the jockey weight has reached its topmost position. This modification is quite simple and can easily be included.

Thirdly, some have expressed the feeling that there is quite a bit of work involved for what amounts to a six minute clock! *"Would it be possible to convert it into a clock?"* they ask. Yes, I think it would be quite easy and I am working on this at the moment. I am trying to do this as a simple modification so that those who are well advanced with the project or even those who have finished it can convert it to a clock using the existing layout and escapement.

Stop piece

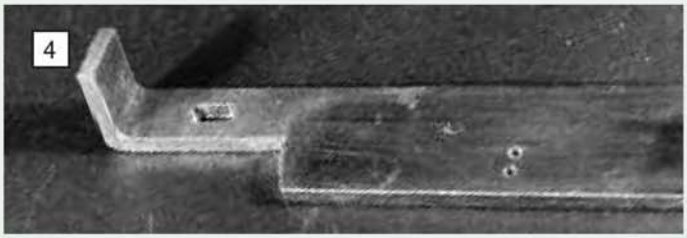
To arrest the mechanism after the bell has been sounded, all that is required is a simple angle bracket bolted to the front plate. I show this on the drawing (**fig 1**) and bolted to the frame in **photos 1** and **2**. The bracket projects sufficiently so that it catches the pin which lifts the bell



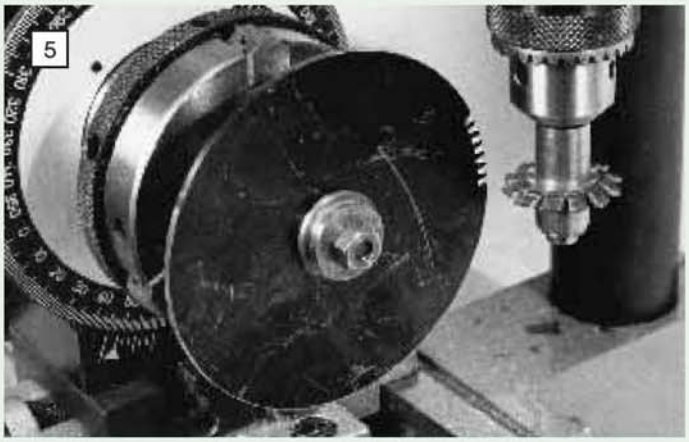


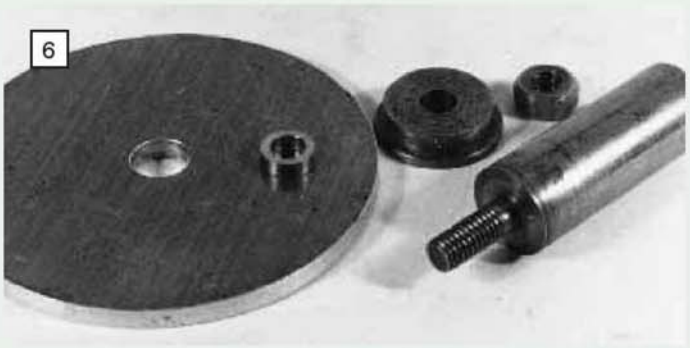
Two views of the stop piece.

Two 8BA clearance holes are drilled close together.



After forming the slot, note that the component is still attached to the parent stock.





Above: the mandrel for mounting the blank and the backing piece.

Left: a general view of a wheel blank being cut in the Unimat 4.

hammer. When the minute wheel is pulled forward to set the time the pin is also released from the bracket. A slotted hole is provided in the long arm of the bracket and by using this adjustment the movement can be stopped within a few seconds of the bell being sounded.

Construction

The bracket can be made from a piece of brass angle of 1/16in. thickness, or bent up from a strip of brass of the same thickness. I chose the latter method. Before bending the brass, make a saw cut across the strip at the bending point, to a little over halfway in depth. This saw cut can be opened out to a 'V' shape with a square needle file and the brass bent up to a right angle. The bend is then fluxed and filled with soft-solder.

The slot is formed by drilling two adjacent 8BA clearance holes, joining these up with the piercing saw and finally filing to shape. Two stages in this work are illustrated in **photos 3** and **4**. You can see that the bracket is still attached to the parent stock at this stage. It is so much easier to hold the work for drilling and filing if there is a 'handle' by which it can be gripped in the vice.

The position of the bracket is determined by trial and error. When the correct location is found, mark through the slot for drilling the No. 50 hole prior to tapping 8BA. The relationship between the length of the pin and the short leg of the bracket is such that the pin is released from the bracket when the minute wheel is pulled forward.

Wheelcutting

In Part IX of this series (*M.E.* 4163, 22 February 2002) I discussed the methods of doing this work on the Unimat 4 and the accessories required. Also shown was an illustration of the radial cuts on the minute wheel being cut using a slitting saw. Cutting wheel teeth is exactly the same except that the slitting saw is replaced by the No. 8 module cutter (**ref 1**). A general view of the set-up is given in **photo 5**. The blank is mounted on a true running mandrel and turned to the correct outside diameter as given in Thornton's leaflet which is supplied with the cutter.

The chuck is then removed from the lathe headstock and transferred to the dividing head as shown here. The cutter is adjusted not to the lathe centre height but to the centre height of the dividing head when mounted on the cross-slide. You can check this with another height gauge similar to the one made for use on the lathe.

When cutting wheels in the correct type of brass the cutter can be run fast, Thornton suggests 3-4000rpm. The blank should be coated on its periphery with layout blue and two adjacent teeth cut, gradually feeding the cutter in until the tip is formed leaving a witness as seen by the blue line. All unused slides are then locked and the 90 teeth cut at full depth in one pass as can be seen in the illustration. Some people stop the cutter after each pass and bring it back through the tooth space stationary, I find it does no harm to keep the cutter rotating.

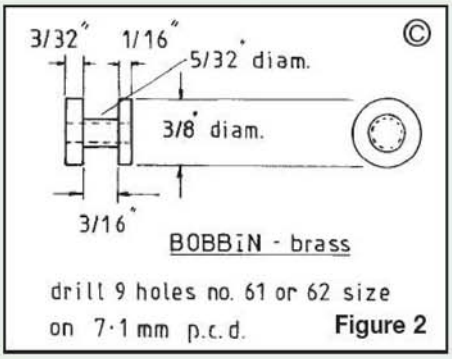


Figure 2

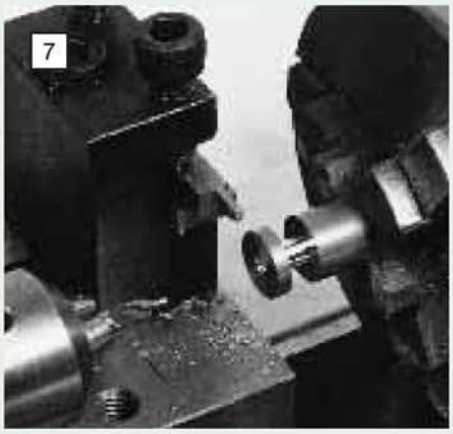
It is normal practice to arrange for a backing piece to be positioned behind the wheel blank to provide more rigidity. The diameter of the backing piece can be little less than the depth of the teeth. I show this item together with the true running mandrel for mounting the wheel in **photo 6**.

Making lantern pinions

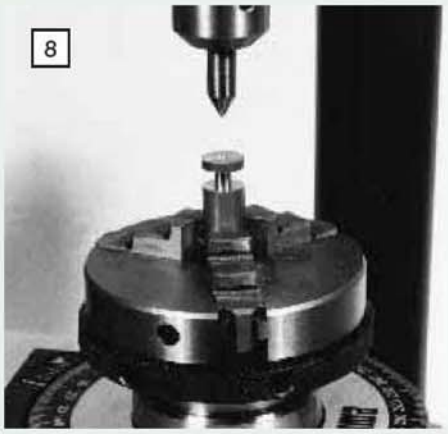
This type of pinion works very well as a follower but I often use them for driving in motion work where the loading is light. One advantage of lantern pinions is that their construction only involves turning and drilling in the lathe whereas a solid pinion would need another cutter as pinions cannot be cut with the same cutter as used for cutting the wheel. I have to confess that in order to save on costs I have used a wheel cutter to form a pinion of 20 leaves and even as low as 16, but this was again only in motion work.

The general procedure for making the 9-pin lantern pinion required in this egg timer is to machine a bobbin from 3/8in. dia. brass rod according to the drawing **fig 2**. The waste material at the centre is most easily removed with a parting tool as demonstrated in **photo 7**. The chuck is then unscrewed from the lathe headstock and mounted on the dividing head which itself is secured to the lathe cross-slide facing upwards as can be seen in **photo 8**. A centre is gripped in the drill chuck and the embryo bobbin is centred under the drill chuck by manipulating the cross-slide and leadscrew feed handles.

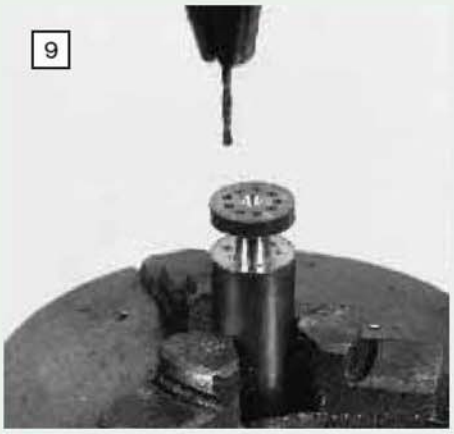
The pitch circle diameter (pcd) for this pinion is 7.1mm (0.281in.) so the bobbin must be moved either sideways or backwards half that amount. This is accomplished by using the divisions on the feedscrew handles. Make sure you take up the backlash first. The diameter of the pins is not critical as long as they are not a tight fit between ▶



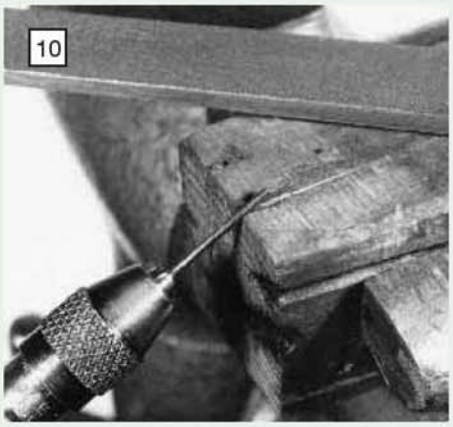
Waisting the bobbin with the parting tool.



Centering the bobbin.

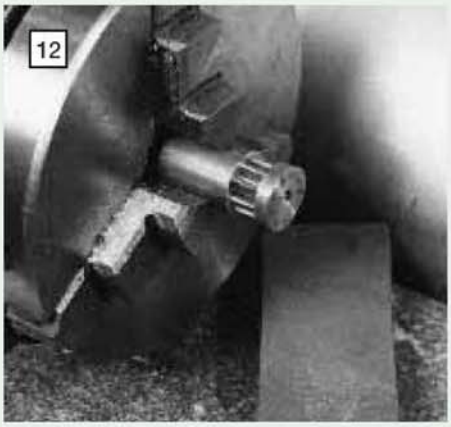


Drilling the bobbins.



Rounding the ends of the pins on the wooden filing block.

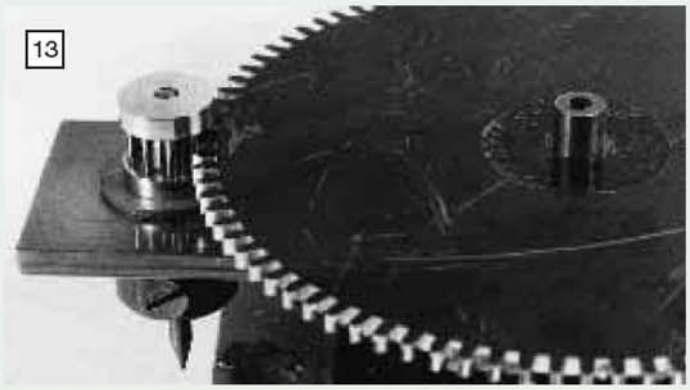
In the process of pinning a bobbin.



Stoning away the surplus part of the pins.

the wheel teeth. Blued pivot steel is an ideal material to use and is obtainable in a range of sizes equal to number drills. Another suitable material could be 1mm silver-steel. If using the latter, a No. 61 or 62 drill can be used for the drilling. The drill should protrude some 1/2in. only from the drill chuck and in this size can be run fairly fast, I used AC 1 on my Unimat which is some 920rpm. The 36 hole circle is used, indexing every fourth hole. The drill passes through the top flange and some 1/32in. into the lower flange. A view of the operation is shown in **photo 9**. It is most advisable to have a trial run on a scrap piece of brass before drilling the bobbins. If the drill makes the hole too large then try the next smaller size down.

The silver-steel or pivot steel is prepared by holding it in a pin vice in a groove on the wooden filing block and filing a rounded end with a clockmaker's pivot file (**photo 10**). If the pin will not enter the holes in the top flange then these should be lightly broached with the tip of a cutting broach. Broaches in this size are cheap and if you haven't one of the right size then break the tip off one that is too small. Apply a smear of Loctite 601 to the pin and feed it into the hole in the flange, finally tapping it into the hole in the lower flange. Remove the surplus with cutters. If you have used blued pivot steel you will have to nick the pin on the corner of the bench grinder and break it off. A view of this work in progress is given in **photo 11**.



Depthing the wheel and pinion.

On completion, the work is returned to the lathe headstock and the ends of the pin are stoned flush with a well oiled carborundum stone (**photo 12**). Finally, the centre hole is drilled to the size of the arbor which should not exceed 1/8in., then parted off. It is advisable to check the engagement with the wheel on my depthing tool (**ref 2**) as demonstrated in **photo 13**. The wheel should, of course, be nicely crossed out.

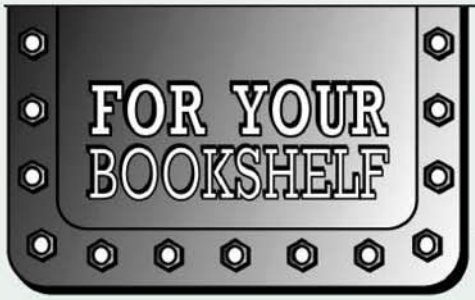
These 'compact' lathes with a drilling and milling spindle are ideal for making lantern pinions and I use the Unimat 4 now for carrying out all of this work.

It has been a pleasure to meet so many constructors of the egg timer at the various exhibitions where it has been on show. Many had almost finished the project and were looking at other clock constructional ventures, the Castle clock being a strong favourite as this was one of the three clocks I made on the Unimat 3 lathe.

References

(1) This cutter is available from P. Thornton, The Old Bakehouse, Upper Tysoe, Warwickshire CV35 0TR.

(2) This homemade depthing tool can be found in my book *Tools for the Clockmaker and Repairer* available from RiteTime Publishing, 18 Woolmer Way, Bordon, Hampshire GU35 9QF, or it can be purchased from J. M. Wild FBHI, 12 Norton Green Close, Sheffield S8 8BP.



Workshop Procedures
by W. R. Smith BSME, FBHI, FNAWCC, CMC, CMW, CMEW
Available from:
RiteTime Publishing Ltd,
18 Woolmer Way, Bordon, Hampshire GU35 9QF
Tel: 01420-487747
Fax: 01420-474647
Price £40 (£2.50 p&p UK)

This is the fourth video produced by Bill Smith covering techniques on the subjects of clockmaking and workshop practice. In this one he deals with a range of lathe procedures for carrying out 'off-beat' operations such as cutting internal wheel teeth on a Strutt epicyclic clock which Bill has just made. A book on the clock is soon to be published and will be available from RiteTime Publishing Ltd.

The tape commences with the various ways of indexing the lathe headstock when cutting clock wheels. These range from the use of the bull wheel, the mounting of lathe change wheels, the use of division plates for direct indexing and the mounting of a dividing head at the rear of the headstock mandrel. The author's principal lathe is the Myford Super 7 and this is featured in the video with his other lathe, a Sherline for which Bill has made many attachments. For those starting from scratch Bill deals with the 'making' of a division plate. Using the Sherline CNC rotary table for indexing and cutting wheel teeth is also ably demonstrated.

Trepanning brass discs in the lathe when making ring wheels is clearly shown. The use of Superglue for the temporary fixing of wheel blanks when wheelcutting etc., is illustrated together with their removal. Numerous off-beat procedures are shown. One, which I had never seen before, is a simple attachment for forming concave or convex radii on work in the lathe such as when it is required to machine a lenticular pendulum bob.

Ways of inserting and removing powerful mainsprings from their barrels in the lathe is clearly illustrated. Also clearly shown are the methods for checking if a spring is the correct length for a barrel. This is carried out with the spring in the barrel.

Numerous little dodges are shown such as 'spotting' in the drilling machine, repairing lantern pinions, a centre finder for repivoting, a holding clamp for the drilling machine and overhead milling gear for driving the milling spindle.

This video is packed with practical information for the engineer and clockmaker. My only critisism is that many of the devices are homemade and to reproduce these, the viewer really needs drawings to go with the video. Perhaps this is something which might be considered in the future. *JHW*

USING SOLID LAMINATE BOARD

Harry Whitelaw
discusses some applications for melamine faced synthetic resin bonded paper board.

For a number of years now I have been using SRBP (synthetic resin bonded paper) for various engineering purposes. Known as 'solid laminate' in the trade, the material is basically a 'super thick' (16mm) Formica with a melamine finish on both faces. Formed of laminated paper, resin bonded under great pressure, it is used in the fitting out of laboratories and other sterile rooms. It is also sometimes used to form the partitions, doors and worktops in public toilets. I have found the material to be very useful in the making of machine and jig parts. It is both strong and rigid.

SRBP can be cut easily using a band saw. It machines well and, when cutting on a milling machine, fairly heavy cuts can be taken without putting any undue strain on the machine. Care must be exercised towards the end of a heavy cut as the last piece may break away. A good finish is easily obtained, however, care must again be taken to avoid chipping the melamine finished surfaces. Climb milling using a spiral end mill which applies a shearing action, gives best results. However, used with care, a slot drill gives perfectly acceptable results. The material is not particularly abrasive and there is no excessive amount of tool wear when using HSS cutters.

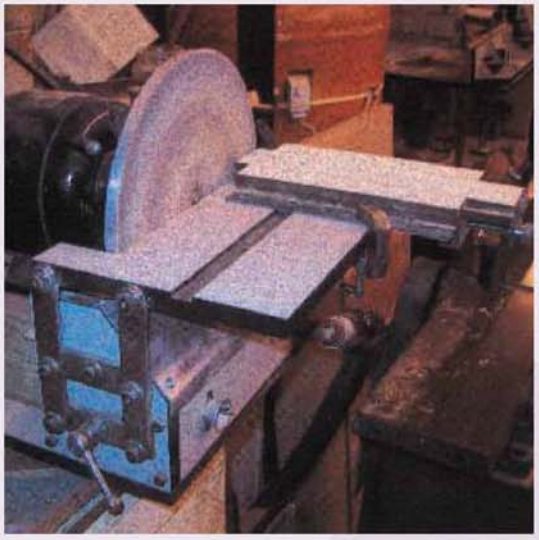
Drilling is somewhat more difficult as the material tends to bind onto the drill bit. This difficulty can be overcome by withdrawing the drill frequently to clear the cuttings, and by using lubricating oil as a cutting fluid. Tapping is not difficult and holes tapped into the face of the material are immensely strong. Tapping holes into the edge of the material can cause delamination or splitting unless the workpiece is well supported in a vice or by clamping between plates while tapping. If screws inserted in the edge of the laminate are over tightened, this also can result in splitting.

When screws or bolts into the edge of the material must be really tight, it is best to use the technique employed in 'flat packed' self-assembly furniture (**fig 1**).

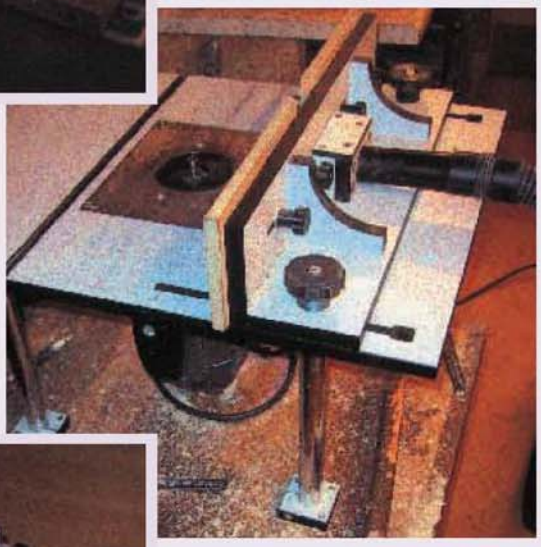
Some items of equipment I have made using solid laminate are shown in the photographs.

How does one obtain supplies of this useful material? It can be purchased in 1200 x 2400mm sheets from trade suppliers but it is expensive at around £250 per sheet, a sum which includes a cutting charge for cutting the sheet into quarters as a full sheet is very heavy and would be rather unwieldy. However, I obtain all of my material from a joiner friend who occasionally uses solid laminate on fitting-out jobs. He collects all the off-cuts that would normally end up in the skip. Even quite small off-cuts can be useful, and the piece cut out of a worktop to accommodate an inset sink yields a very useful sized off-cut.

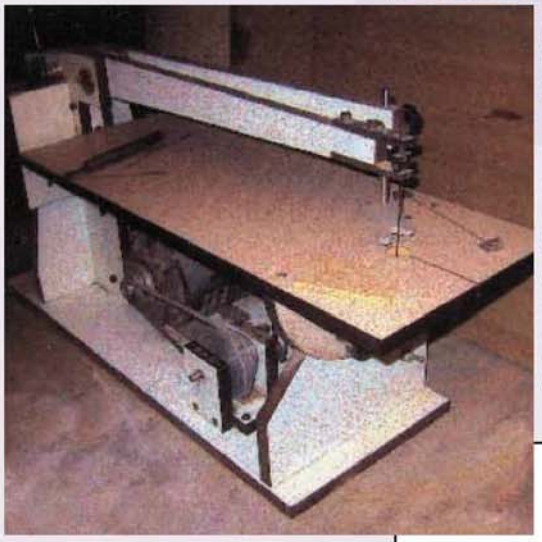
Readers with friends or acquaintances in the joinery or shop fitting business could perhaps benefit by cultivating that friendship and making some enquiries.



Sanding disk and 'circle sanding jig'. The four bar linkage mechanism on the end is mirrored on the opposite side and provides a 'virtual pivot' for the worktable. When the table is set at a downward angle there is no increase in the gap between the sanding disc and the worktable. This is very effective and was copied/adapted from a very old industrial disk sander. The 'circle sanding jig' can produce perfect wooden discs in the range from about 1in. up to 2ft. in diameter provided the job can stand a 1/8in. diameter hole on the underside.



The router table and fence shown here was made mostly from solid laminate, however the router mounting plate was made from two sheets of 1/8in. steel plate riveted together. The bottom of these plates is 1/2in. smaller all round and the plate assembly, which is secured with four countersunk screws, sits into a pocket milled in the router table.



This scroll saw was made with an extra deep throat for a special job. A cam mechanism at the end of the top arm is fitted to permit quick release of the blade tension between jobs. When 'tensioned-up' a very satisfactory 'ping' is heard when the blade is plucked. There is no discernible deflection of the solid laminate arms when the blade is under tension.

Secure edge fixing can be arranged by using a cross-drilled plug threaded to suit the bolt selected for assembly fitted into one of the boards. If appearance or an uninterrupted working surface is important, the plug can be inserted into a blind hole drilled from below. These fixings are probably available as proprietary items.

Solid laminate board is available from Performance Panels Ltd., Carvic House, Black Brook Way, Stainland Road, Greetland, Halifax HX4 8ED.

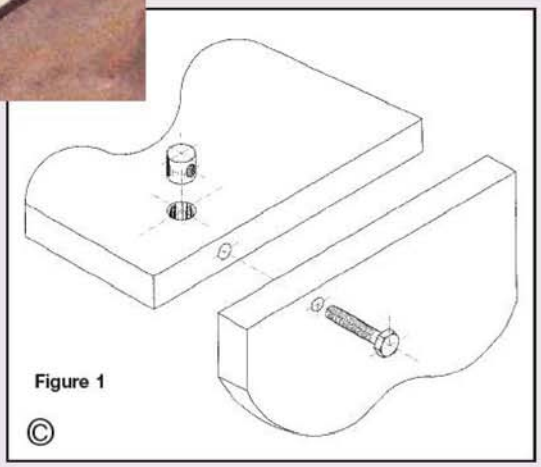


Figure 1

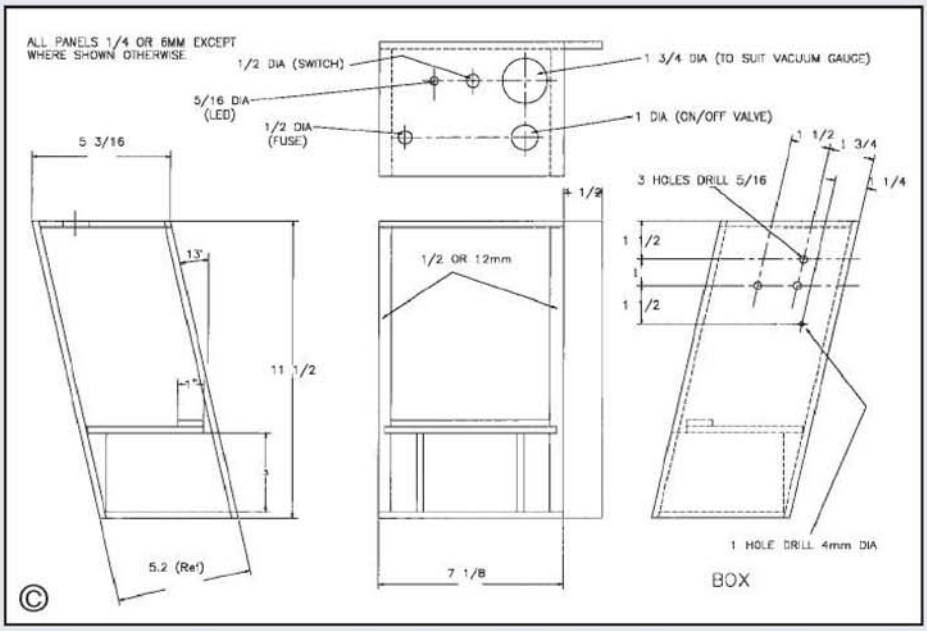
VACUUM BRAKES

THE FRIMLEY LODGE MINIATURE RAILWAY VACUUM GENERATOR

John Jones

advises the purchase of pumps and batteries before making the boxes, and starts work on the valves.

●*Part II continued from page 241 (M.E. 4167, 19 April 2002)*



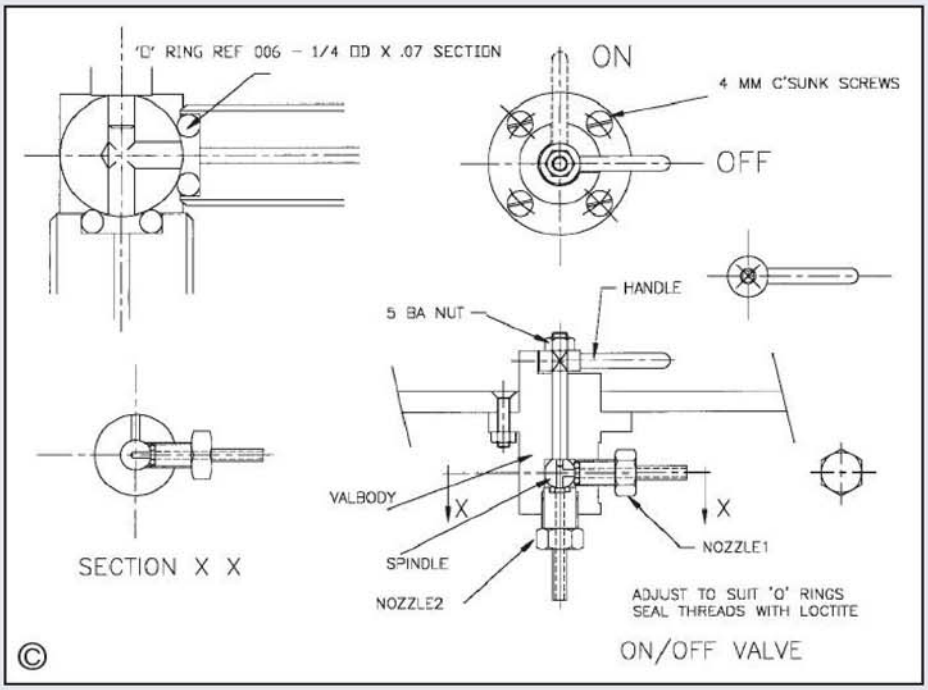
The drawing of the box shows those made for the Guildford carriages. It is about the minimum capacity to take all the components. It highly recommend that you take delivery of your pump and battery before cutting too much plywood because the major components such as the pump or battery may vary in shape and size from those shown. The actual size and shape of your box will have to suit your carriages and the fixing method you decide upon.

In the past we have used vacuum ON/OFF valves that consist simply of two close fitting brass discs designed to either close off vacuum altogether or to allow air into the system. However, after some time these can become worn or the faces become dry to an extent where they will not close completely, resulting in a constant leakage to atmosphere.

We needed something more reliable. The ON/OFF valves recommended by Peter Gardner are as shown in the accompanying drawings. O-ring seals are used to close off the seal faces completely. The valves are made from brass and stainless steel plus a 3/8in. dia. bronze ball. If you are only making one or two valves, just work to the drawings. Even so careful machining is required to ensure that the valve operates smoothly, the ports line up correctly and in such a way that the O-rings do their job of sealing, and that all sharp corners are carefully removed so that the O-rings remain undamaged when rotary movement of the valve spindle takes place.

Constructional details

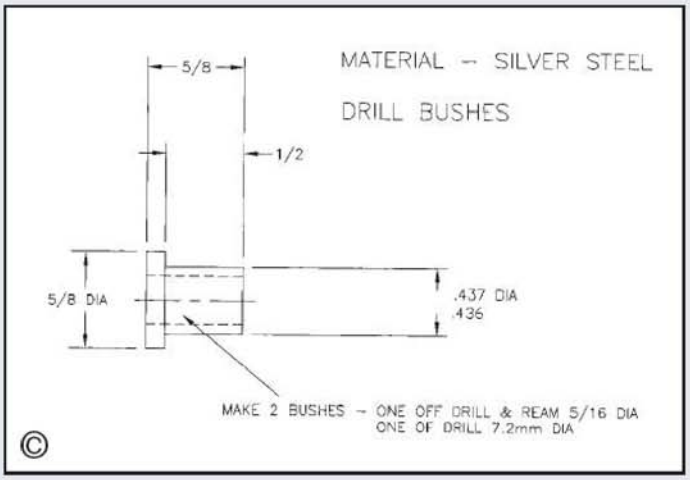
For the Guildford set-up we required twelve valves, two for each of six trains, so I made jigs and fixtures just for the purpose so that each of the parts are interchangeable. Another advantage of producing fixtures is that they they are available for further production in the future if required. I shall now detail the steps to be taken to produce valves in some numbers.



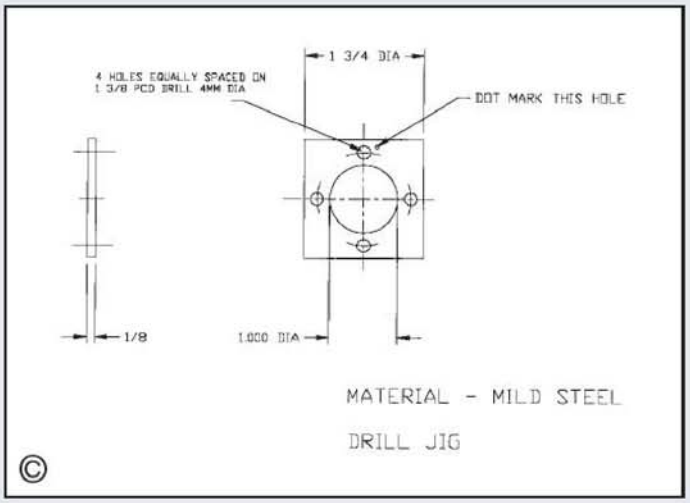
The assembly drawing of the ON/OFF valve clearly shows the components parts. When in the OFF position the ports are connected and therefore vacuum remains in the lines, but when in the ON position, the valve admits atmospheric air into the system and the train vacuum is therefore destroyed. There is nothing too difficult about making the valve parts except that they must be made with precision and care. The most important thing is that, when assembled, the two drillings in the ball line up accurately with the two nozzle ports in the valve body.

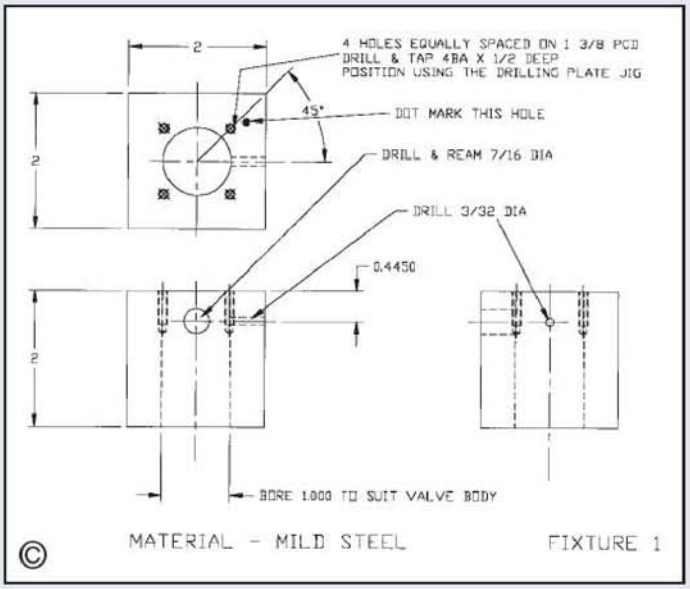
The main body of the valve is made from 1in. dia. brass bar with a separate 1/8in. thick flange. You could of course manufacture the item completely from 1 3/8in. dia. bar but this seems somewhat wasteful — apart from which, I had none of the larger sized bar, but I did have some 1in. material. First hacksaw or part off chunks of brass just over 2in. long, the number corresponding to the number of valves under construction. Face off both ends to bring the piece to 2in. long.

The flanges can either be parted off from 1 3/4in. diameter brass or cut from 1/8in. brass plate. If you are parting them off, then drill and ream or bore 1in. dia. to an appropriate depth before parting off, leaving you with a completed flange. If you are cutting them from plate, mark them out and hacksaw a little larger than 1 3/4in. square but don't drill the 4mm dia. holes yet. I am fortunate in owning a 4-jaw, self-centring chuck so drilling and reaming the 1in. dia. hole was a doddle. The next step is to silver-solder the flange into place on the valve body. You can then grip the body of the valve in the 3-jaw chuck and turn the flange to 1 3/4in. diameter.



Two examples of the ON/OFF valves produced for the Guildford MES vacuum brakes. A fully assembled ON/OFF valve is shown on the left. The valve on the right is shown dismantled into its component parts.





The drill jig is required at this point. A simple item made from a bit of 1/8in. mild steel plate, it is just a case of careful marking out and boring 1in. dia. for a nice sliding fit of the valve bodies. Don't forget to dot mark one of the holes. Now slide the jig plate over the first valve body, hold it in place using a small toolmaker's clamp and drill the 4mm dia. holes in the body flange ready for the 4BA screws. Now dot mark the appropriate hole on the valve body flange.

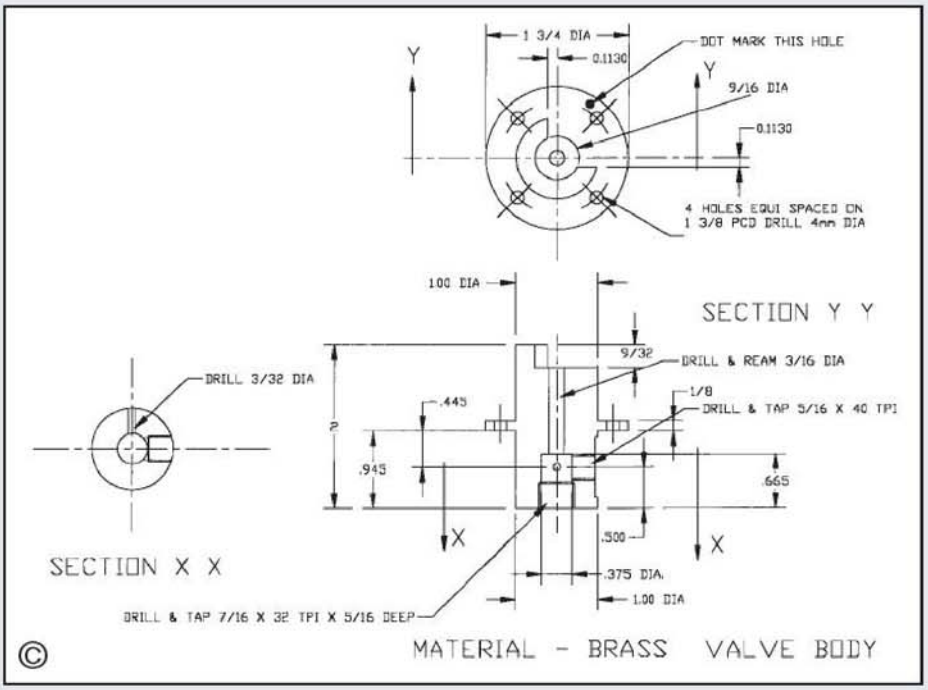
The next step is to grip the top end of the valve body in the 3-jaw chuck, centre drill, drill and ream 3/16in. dia. right through, drill and bore the 0.375in. dia. hole to the correct depth and tap 7/16in. x 3/8in. deep. This hole is important, the 3/8in. diameter must be a snug fit for the bronze ball which will eventually be fitted as part of the valve spindle. Since the hole must be flat bottomed, it is best produced using a flat ended boring tool rather than a reamer. You will not get a truly flat bottom with a reamer. Apart from that, the last 1/4in. or so of the hole will be a few thousands of an inch less than the required size and the ball will jam itself in.

Now, to finish off for the time being, slide your drill jig over the top of the valve and drill the four fixing holes, not forgetting once again to dot mark one hole, making it the same one as on the jig plate. Having completed these operations on each of the bodies, they can be set aside for the moment. Don't machine the side ports or the 9/32in. deep quadrant recess in the top just yet.

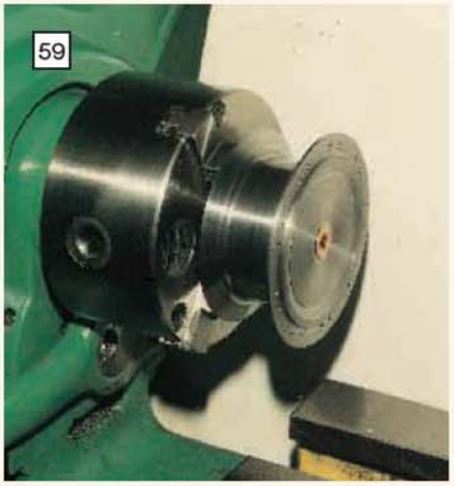
We now require fixture 1 (see drawing). It is made from a 2in. square block of mild steel machined to size with the sides nice and square to each other. Grip the block in the chuck and either drill and ream the 1in. dia. bore, or drill and bore so that the valve bodies are again a good slide fit in the fixture. Mark off, drill and ream the 7/16in. dia. side hole and the 3/32in. dia. drilled hole. Use a bit of 1in. diameter scrap down the bore to align the drill jig with the bore, and drill and tap the four 4BA holes. Dot punch the appropriate hole once more.

We also need the two drill bushes. One can be drilled and reamed 5/16in. dia., the other can be drilled 7.2mm dia. which is the tapping size for 5/16in. x 32tpi.

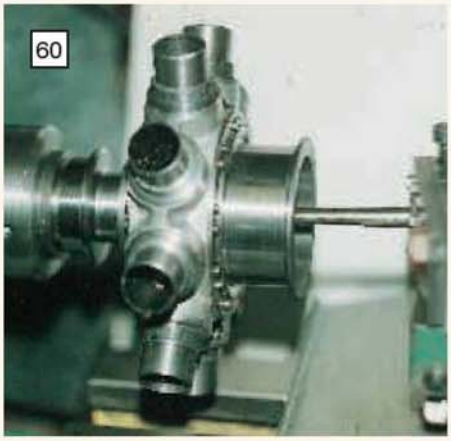
●*To be continued.*



The first stage in machining the tappet rod housing. The blank has been faced both sides and the front recess is being bored out with a stout boring bar.



The second stage in machining the tappet rod housing. The part is gripped from the recess by the inside jaws of the 3-jaw chuck.



The final stage in machining the tappet rod housing. To ensure true running the item is mounted on the crankcase and finish turned off the rear bearing housing mandrel. Use only light cuts because of the overhang.

BUILDING A 1:5 SCALE GNOME ROTARY ENGINE

Rowland Lowe

deals with the front tappet housing, gear housing, prop boss, valve cages and rocker brackets.

●*Part V continued from page 245 (M.E. 4167, 19 April 2002)*

The first stage in making the front tappet housing is shown in **photo 58**. A blank is faced both sides and the front recess bored out undersize. An over thickness bronze blank for the bush is also pressed in, with the central hole left until later or not drilled more than 1/4in. diameter.

The workpiece is then reversed in the chuck and gripped from the recess by the inside jaws as in **photo 59**, and the rear face finished to size except for the bore of the bush. As much as possible of the outside is also turned, except for a small amount oversize for finishing. The mounting holes are drilled by the same method as for the rear bearing housing, remembering also the top dead centre marking.

The method adopted for the next stage harks back to the fact that everything revolves around the crankshaft and the technique described is used to ensure true running. **Photograph 60** shows the engine assembled and mounted on the rear bearing housing mandrel. The amount of overhang is noted, but only finishing cuts are required. The cylinders (note number order!) can be removed to reduce weight. With a sharp tool and light cuts, I had no problems in finishing the part to run true. The central bush is now also bored to fit the front of the crankshaft. The front flange mounting holes are drilled later from those on the front gear housing.

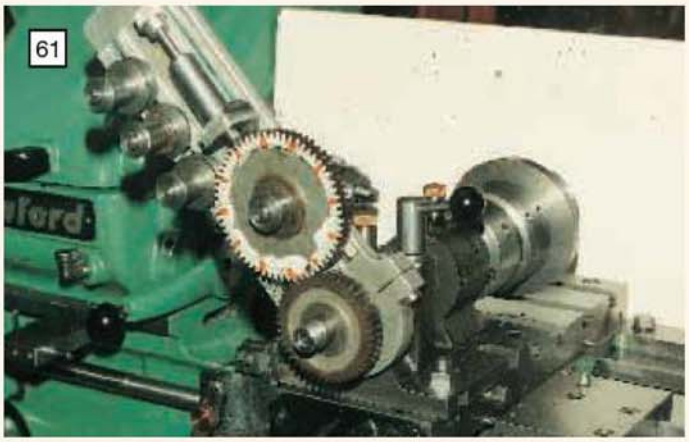
To improve rigidity and ease of mounting for the next operation, I made a small slave faceplate. This is seen in **photo 62**, the face being turned and drilled to fit the tappet rod housing face. Finally drill and counterbore for the tappet guides using the set up shown in **photo 61** where a 60 tooth idler gear is used to allow better contact with the indexing plunger. Top dead centre is identified with No. 1 hole which is used as a starting point. The completed job is shown in photo 62. Note the home-made counterboring tools. When making the counterbore for the inside, the pin is also the drill shank, so remember to cut the teeth for operation in the opposite direction to normal.

Front gear housing and prop boss

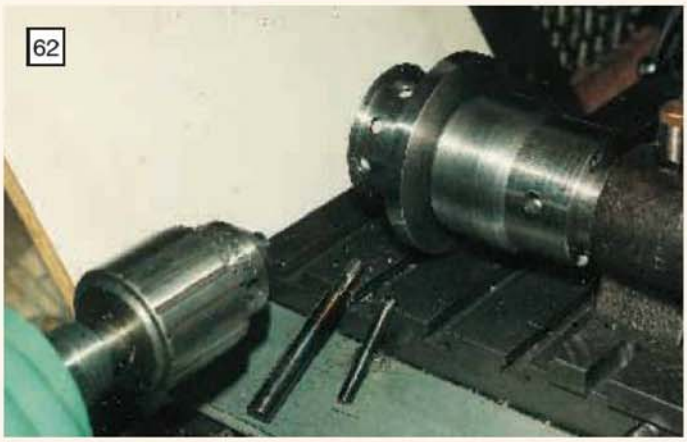
Moving forward along the crankshaft, these are the next items. The first stage is to mount a blank in the 3-jaw chuck as shown in **photo 63.** Drill through 6mm or 1/4in. dia. only, turn the rear surfaces to finished dimensions and bore out the recess for the central gear.

Next, mark top dead centre, mount on the dividing head and drill the fourteen mounting holes, using a 70 tooth change wheel indexed every 5 teeth as in **photo 64**. Note the error in this photograph, which shows the holes drilled for the gear mounting studs. This is incorrect, as they are done later, being located by a gear depthing tool using the finished central bush and the gears themselves to give exact location. The six mounting holes for the propeller boss (item 53) are spotted through from this part later.

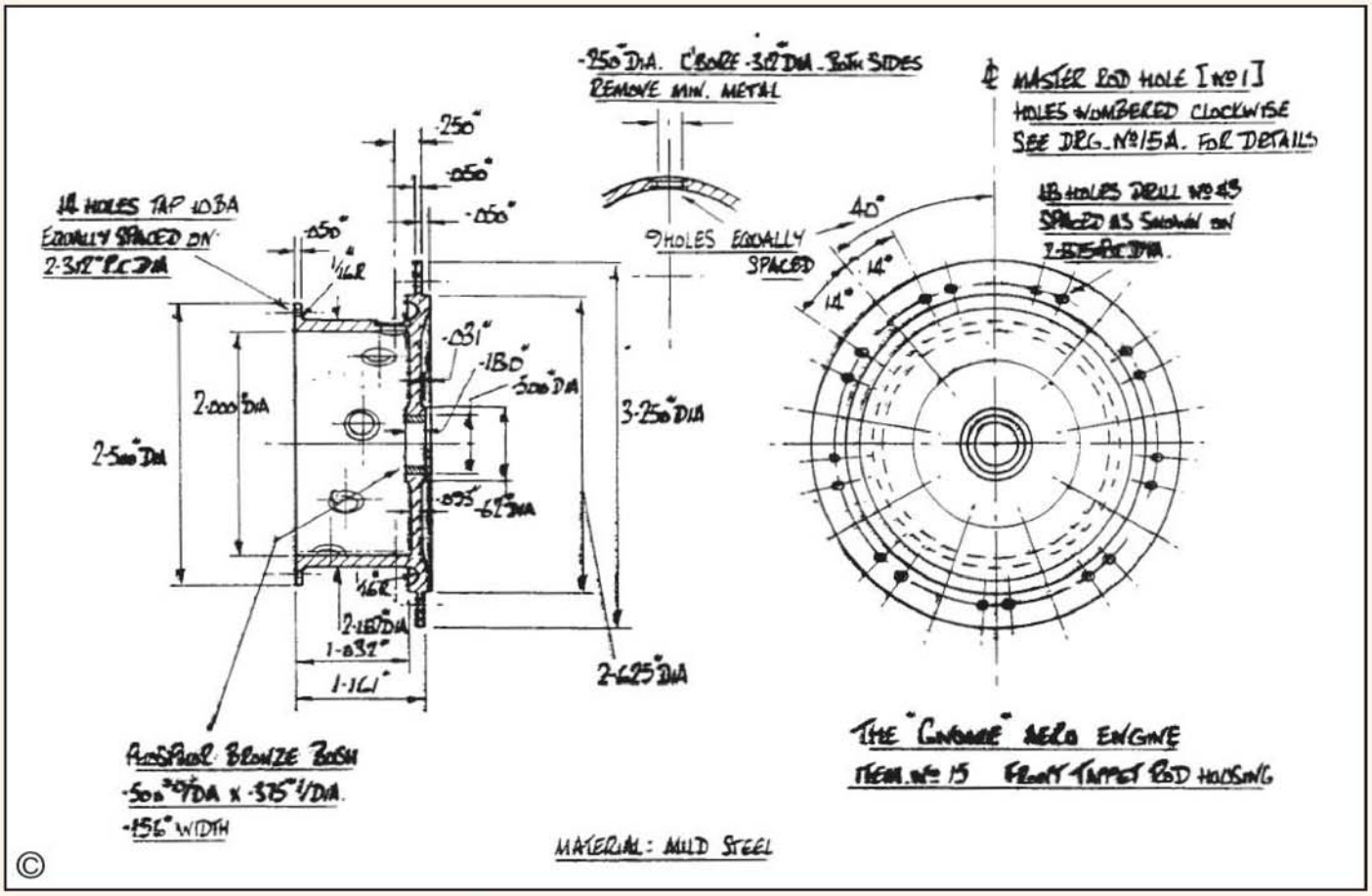
In order to finish the front of the gear housing, modify your slave faceplate with a recess to fit the gear housing and a central tapped hole. If you



The dividing head set up used for drilling and counterboring the tappet rod housing for the tappet guides. A 60 tooth idler gear has been fitted to permit a more convenient position of the detent.



Drilling and counterboring the tappet rod housing tappet guide holes; the home made counterboring tools can be seen resting on the boring table of the lathe.



use a plate in the 3-jaw chuck, do not move it until the turning is complete. **Photograph 65** shows this stage. The front is turned to final dimensions, the portion under the bolt head being finished off by holding the workpiece in the 3-jaw chuck by the outer edges of the flange and bedded against the chuck jaws to ensure square running. Fit the bush. The bush bore can be finished now, but I prefer the method shown in photo 60 to retain true running, assuming the lathe to be not so badly worn as to be unable to cope with the overhang.

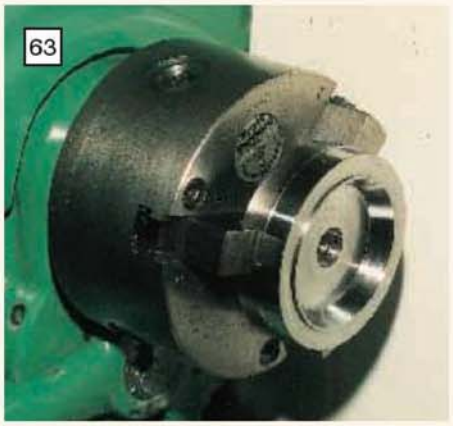
The last main item to run on the crankshaft axis is the propeller boss. First face both ends of the blank and rough down the front portion to a little more than the final major diameter of the taper and a little shorter in length. Reverse in the chuck as in **photo 66** and finish turn the mounting surface and interior. Drill the six mounting holes as previously described.

Assemble the engine on the rear bearing housing mandrel and drill a centre hole to give support while turning the outside profile, as in **photo 67**. The top-slide taper setting device can just be seen. Now cut the front thread. The boss is bored through by the same method as the crankshaft, finishing with a 1/4in. dia. D-bit as in **photo 68**.

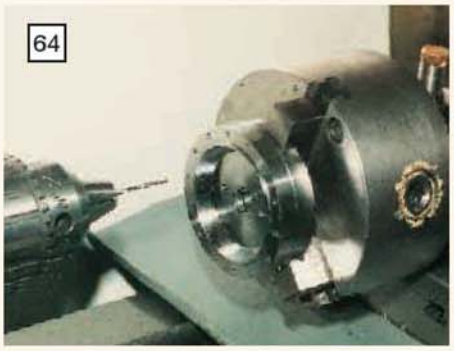
Small parts: valve cages and rocker brackets

The main shape of the engine is now emerging and work can be started on the smaller parts. These were made as materials came to hand, and do not indicate a necessary order of construction.

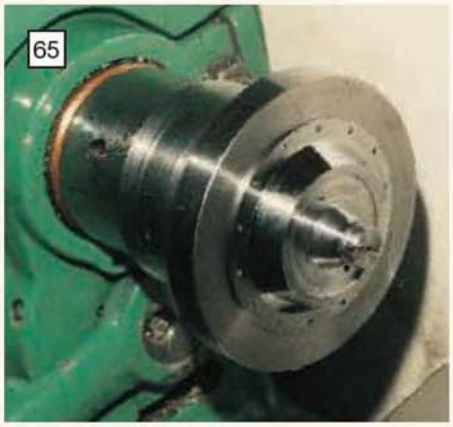
The set up shown in **photo 69** was developed for production of identical parts from bar stock. It also saves material that would otherwise be used for chucking and evens out lathe bed wear as the whole length of the bed may be used. An unexpected bonus was easier parting off, a bar



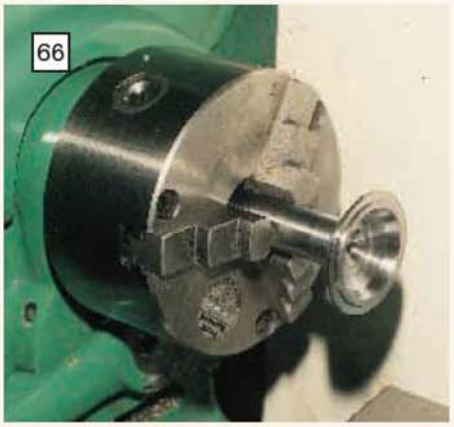
The first stage in machining the front gear housing using the 3-jaw chuck with outside jaws fitted.



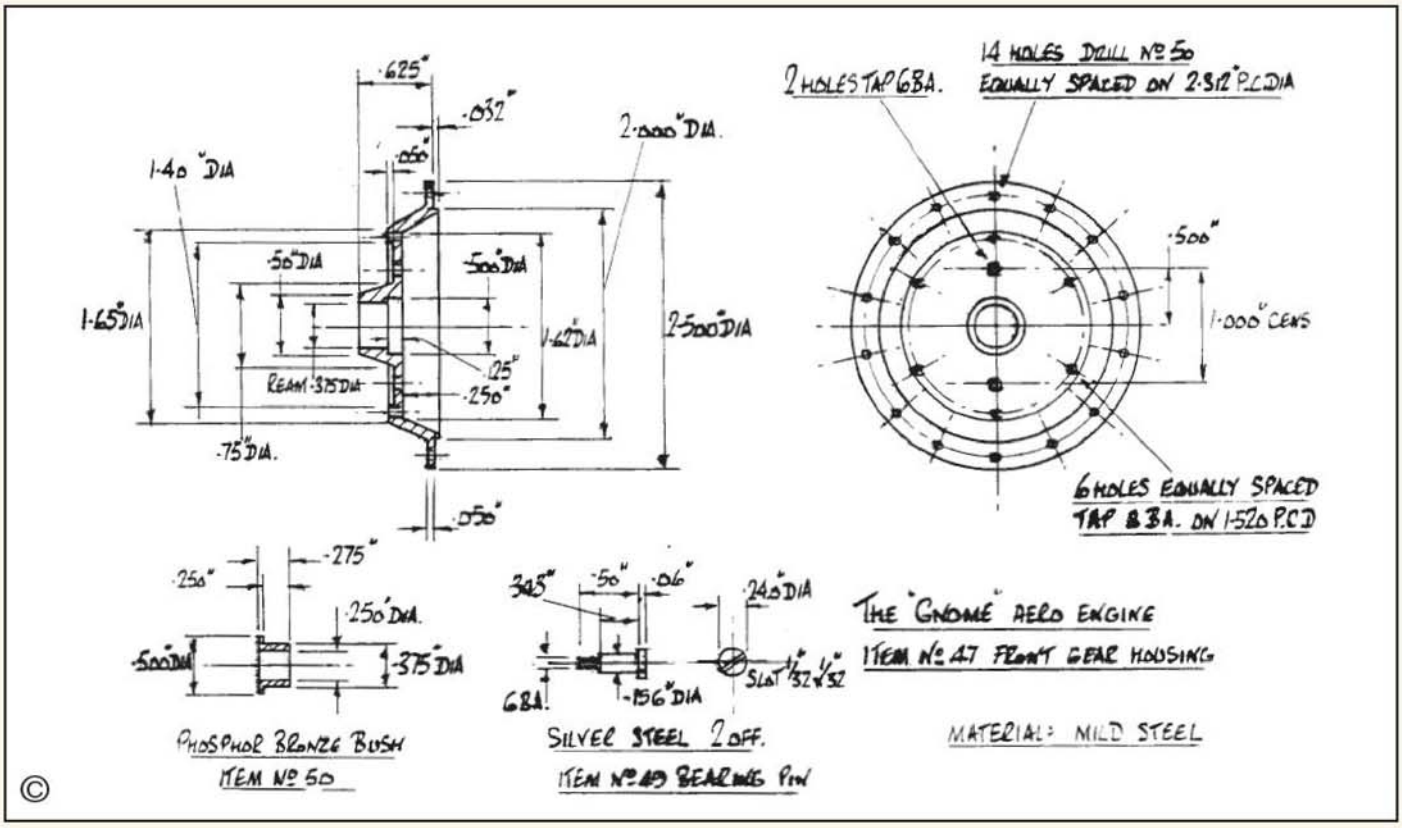
Drilling the mounting holes in the front gear housing. Note that an error has occurred on this part and the gear mounting studs have been drilled. The position of these should be fixed by using a gear depthing tool and the finished central bush as a datum.

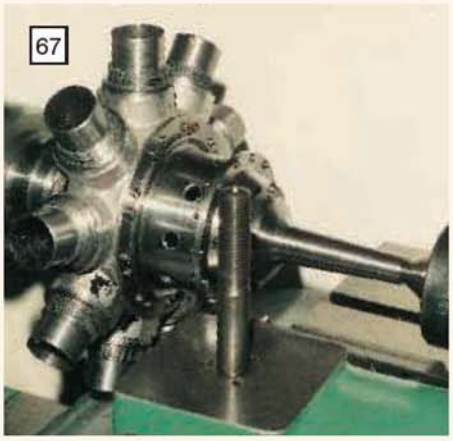


Turning the front of the gear housing using a recessed slave faceplate fitted to the master chuck. The part is clamped with a central screw.

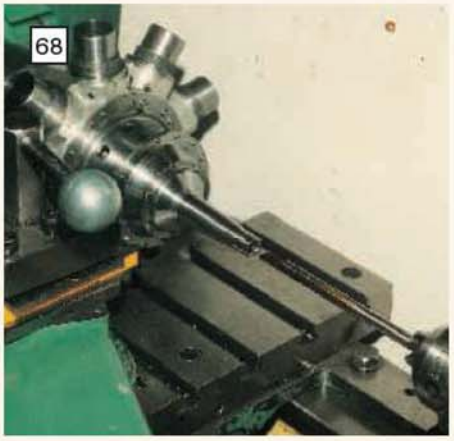


Turning the propeller boss. The blank has been roughed down and reversed in the chuck for finishing the mounting and interior surfaces.





Turning and screwcutting the outside of the propeller boss which has been mounted on the front tappet rod housing which in turn is mounted on the crankcase to guarantee concentricity.



After boring, the central bore was finished to size using the homemade D-bit shown here. By this stage all the work on the outer diameter of the propeller boss had been completed.

Turning the valve cages from bar stock. The home made fixed steady is in use to enable all the parts to be made from one length of bar with minimum wastage of material.

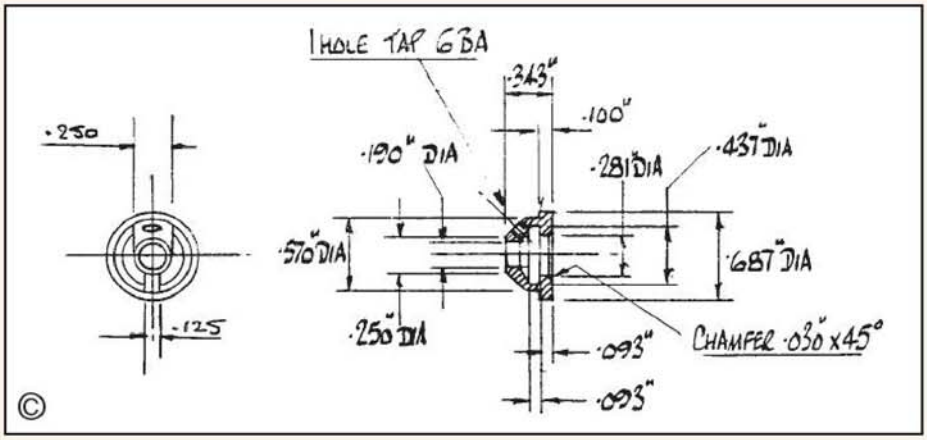
supported at two points being more rigid than in the chuck jaws alone.

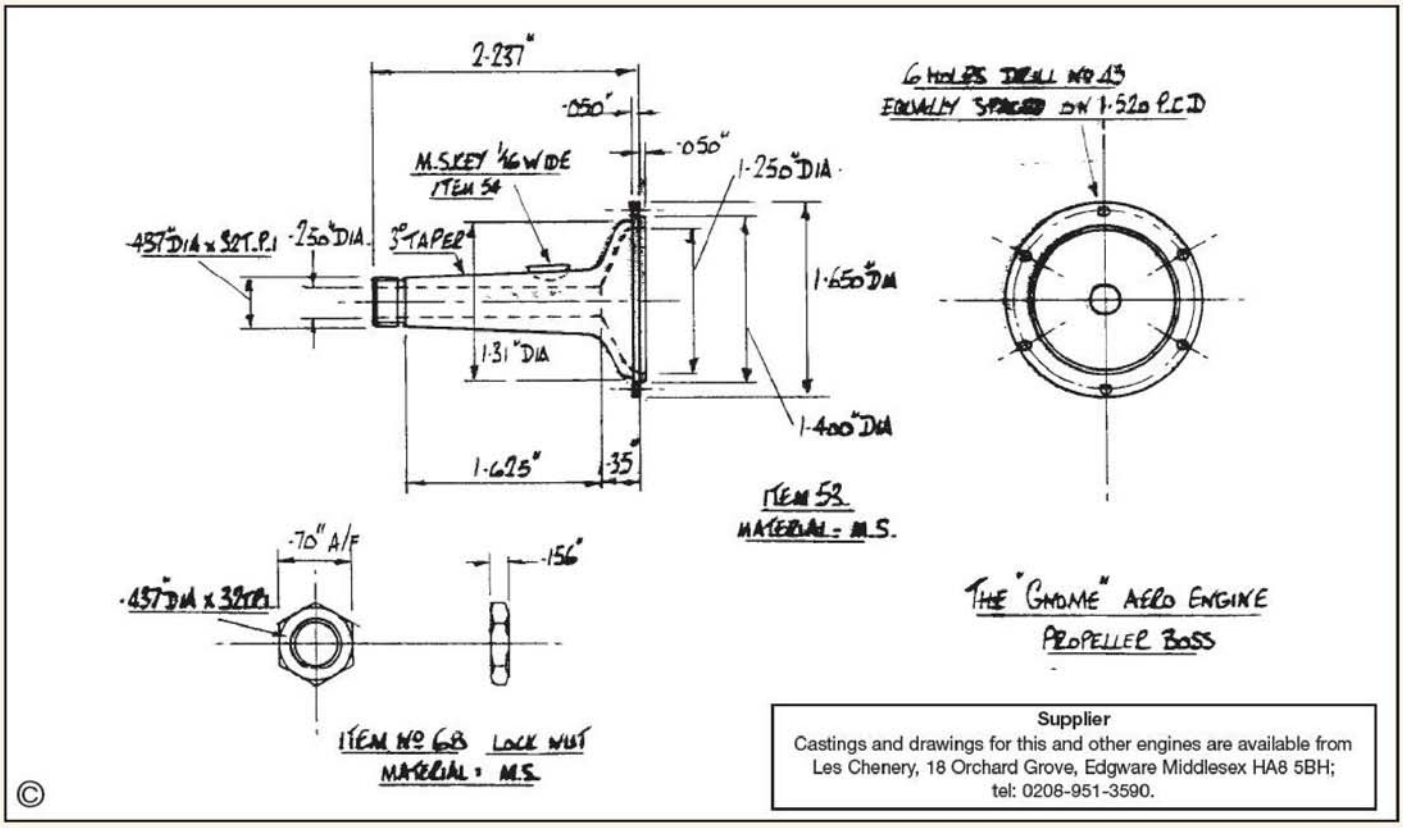
Refer back to the steady drawn in fig 3 and illustrated in photos 16 and 17 (*M.E.* 4163, 22 February 2002). The method is as follows:

1: prepare a bush to suit your bar stock,
2: face and turn the external profile,
3: drill the hole through and
4: part off the blank.

When the blanks (plus a few spares!) are made, prepare a split bush to hold the blank in the 3-jaw chuck. The bush is shown in use for a later step in **photo 70**, but first mount the blank base outwards, open out with a 9/32in. dia. drill and chamfer the valve seating.

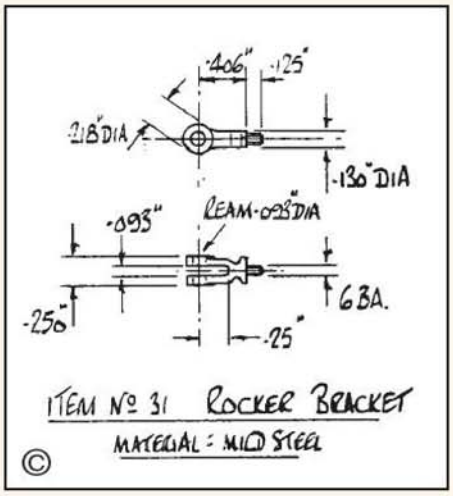
Now study **photo 71**. On the left is a first stage blank. In the centre is a block on which the blank is screwed down for end milling on the vertical slide. On the right is a milled cage, and in front a form tool made from 1/8in. gauge plate which is used to finish the inside of the cage. First the left hand end is used to cut a groove, and then the right hand end to finish the internal taper. Note when making the tool that it must be adequately backed off to give cutting clearance in the small diameter available. Before hardening, check in a 9/32in. dia. hole. Harden and temper to straw. The size of the internal recess can be seen through the milled portions. When finished size is reached on the first workpiece, note the index readings and finish all the cages to this size.

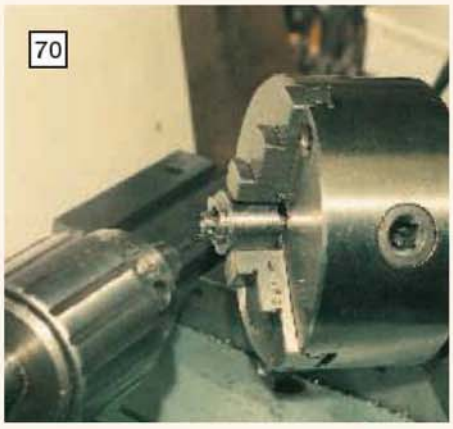




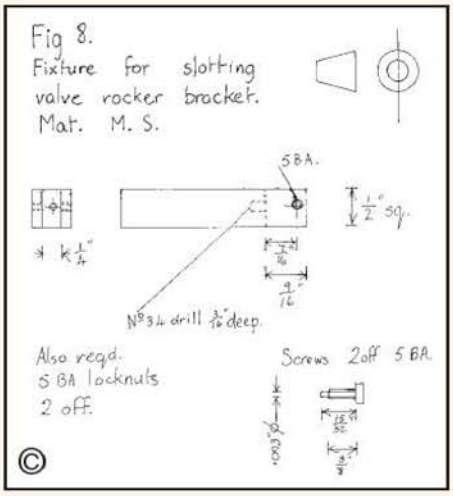
Supplier

Castings and drawings for this and other engines are available from Les Chenery, 18 Orchard Grove, Edgware Middlesex HA8 5BH; tel: 0208-951-3590.





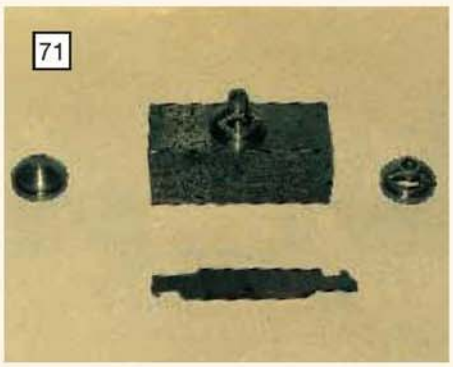
The valve cages are held in a split bush gripped in the 3-jaw chuck for the finish turning, drilling and milling operations. Here the 6BA tapping hole is being drilled.



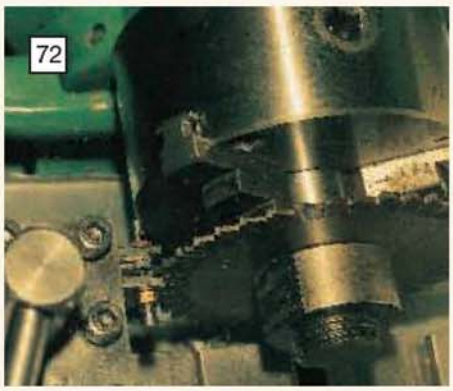
Returning to photo 70, this shows the tapped hole for the valve rocker bracket being drilled. The valve rocker brackets are turned from square stock using the 4-jaw chuck. They are a little difficult to hold securely for slotting, and **fig 8** and **photo 72** show a fixture for securely holding them and its use.

Photograph 73 shows a 3/32in. mandrel on which the rocker is mounted to machine the small circular face on each side of the rocker fork. A small peg provides the drive and the threaded securing collar also acts as a diameter gauge.

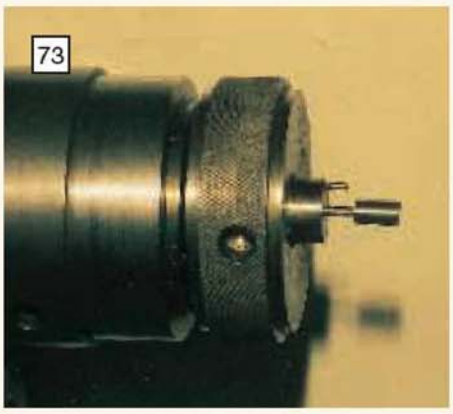
●*To be continued*



A valve cage blank (left), the milling fixture (centre), a milled valve cage (right) and the form tool necessary to complete the turning of the valve cages.



Slotting the valve rocker brackets using a slitting saw mounted in an arbor in the 3-jaw chuck and the fixture shown in fig 8.



The slave mandrel used for machining the circular face on the rocker bracket fork sides.

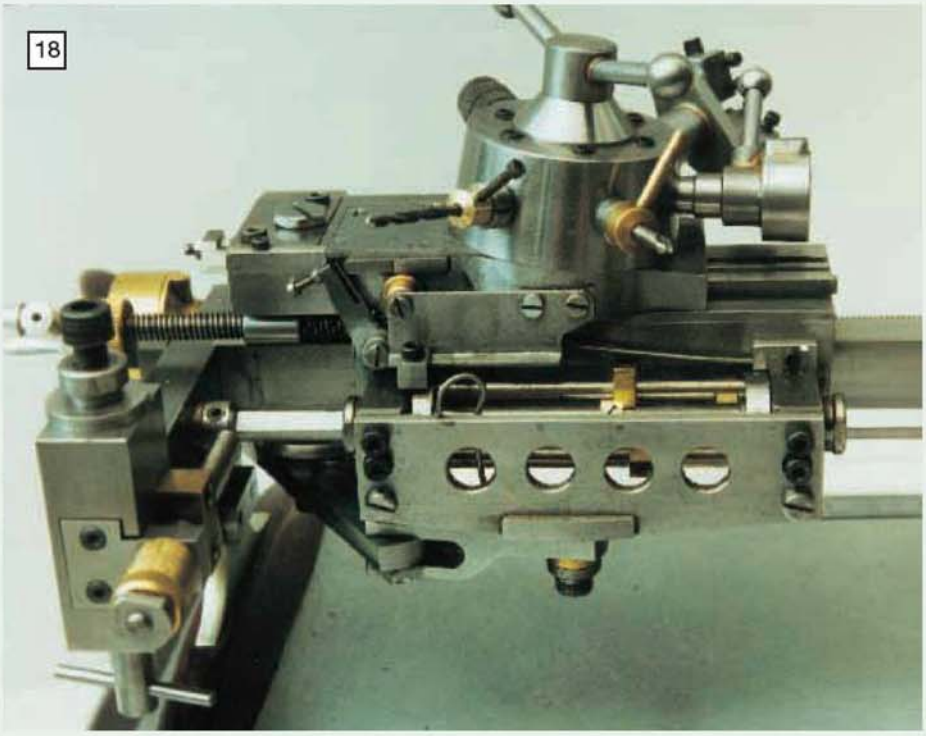
BUILDING A MINIATURE UNIVERSAL LATHE

Colin Barter

discusses the design and construction of the capstan turret and introduces the dividing head.

Photographs by Gerry Collins.

●*Part VI continued from page 247 (M.E. 4167, 19 April 2002)*



Turret travel stop system. The turret has moved back and the tappet has emerged from the side of the slide to engage the cranked lever which rotates the stop bars. On the angled edge of the thin plate at its left-hand end is the adjustable stop which comes against the adjustable stops on the stop bars to limit forward travel of the turret slide. Also visible under the slide is the anchor point and the linkage of the hand operating lever.

With the indexing/locking of the capstan turret completed, the next problem that faced me was scheming out the system of stops to limit the travel of the capstan slide for each tool position. For example, in position one a tool travel of 1 1/2in. might be required, in position two a travel of 3/4in., and so on. The stop system had both to provide this and not get out of sequence. In small capstans such a system can be achieved by a number of long screws mounted in a rotating collar geared to the capstan head, each screw being set as required for its particular tool position. In my capstan head there was no space for such a simple system. The only locations were alongside the base slide either on the leadscrew (front) side, or at the rear. There was insufficient room at the front for what I proposed, which was to have an assembly of six stop bars which somehow I had to rotate in sequence with the capstan head.

The assembly rotates around but clear of the cross-slide drive shaft which runs along the rear of the lathe. This stop bar assembly comprises a tubular centre with steel collars silver-soldered to its ends. It is supported in brackets bolted to the side of the base slide. The brackets each contain a hardened steel bearing with a conical nose which fits matching coned holes in the collars. These can be adjusted so that the stop bar assembly rotates freely but with negligible end float thereby minimising any lateral errors when machining work is in progress. Equispaced around these two collars are the six stop bars each with an adjustable stop, (see photo 14, *M.E.* 4167, 19 April 2002) and **photo 18** here.

The problem now was how to index this rotating assembly in sequence with the capstan head. After some thought and a few trials, the problem was resolved by providing a cranked lever mounted on the base slide at the rear end. As the capstan slide moves back to its rearward position, a tappet on the slide pushes the lever back and lifts an indexing bolt fitted with a spring-loaded detent. The detent catches a stop bar and rotates the stop bar assembly one sixth of a turn on full slide rear movement. When the slide moves forward the bolt with its detent and the cranked lever fall back to its starting position under spring load, the detent slips past the following stop bar and in that position prevents further rotation of the stop bar assembly.

A second small spring presses on the stop bars to prevent inadvertent movement as the indexing bolt falls. The tappet on the slide that moves the cranked lever is also hinged and is pushed out into its working position by the capstan head indexing finger. When the slide moves forward, and after indexing the capstan head, the indexing finger moves back to its starting position and allows the spring-loaded tappet to slip back out of sight in the side of the slide. If no indexing takes place the tappet does not emerge and the indexing of the stop bar does not occur so that the indexing of the capstan head and the stop bar do not get out of sequence.

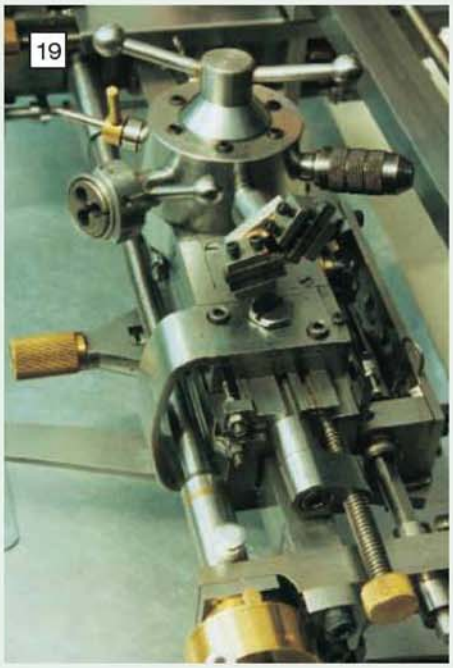
The final item in the mechanism was to provide an adjustable stop on the capstan slide that would come against the stops on the stop bars. This is carried on a little plate mounted on the side of the slide. It so happened that the lever system operating the rotating stop bars did not always fall to its starting position. By making the support plate longer, the end mounting screw came in the right position to allow a little brass roller to be fitted. When the slide moved forward from its rear position, the roller nudged the raised horizontal end of the cranked lever to the fully dropped position. Another small addition was a little spring finger at the vertical end of the cranked lever that allows for a slight overrun without straining the lever system.

Boring the tool holes in the capstan head

When fully assembled, the holes for the tools had to be bored in the capstan head. This was done on the little lathe with the capstan assembly fitted. The first operation was to centre drill each tool position using a centre drill held in a collet. With the hole centres marked, the capstan head was removed and the positions of the tool clamps marked on the top surface. These were then drilled through 2BA tapping size. The six holes were then opened out and reamed 1/4in. dia. to approximately 3/4in. deep, drilling from the bottom surface and using a machine reamer. Six clamp cotters were turned from 1/4in. dia. rod with a 4BA extension sufficiently long to stand above the top face. With nuts fitted and tightened, the cotter blanks were held securely in the head.

The head was refitted to the capstan slide and each of the six holes was drilled out to 9/32in. diameter. The six holes were then opened out using a short spear pointed silver-steel drill of a diameter reduced to a few thou under 5/16 inch. With a 5/16in. dia. machine reamer fitted in the headstock mandrel bore, the holes were reamed to 0.3125in. diameter. Final finishing of the holes was by hand with the head removed. Each clamp cotter was removed and number stamped, its temporary 4BA tail cut off, and turned to its finished length. The final operation was to tap the six holes for the clamp screws and to fit these.

Finishing the tool holes by hand necessitated the holes running into the central pivot hole. As there was a likelihood of dirt or swarf finding its way into this area I bored out the turret pivot hole to a sufficient diameter and length to permit a thin brass bush to be inserted to blank off the inner ends of the tool holes. In order to ensure the concentricity of the bores, this operation was carried out on a mandrel turned in the lathe.



View of the capstan slide looking towards the headstock with tools mounted in the turret. The screw with the knurled knob at the rear of the slide can be raised to bear on the rear of the turret slide and prevents slide movement when using the turret as a tailstock. Note that the curved bracket is the connection between the hand lever and the turret slide.

Capstan head operating lever

At the same time that I was sorting out the rotating stop bar system, I was looking for an anchor point for the capstan slide operating lever. I had considered an anchor pivot clamped to the auxiliary bed but this was not very practical. With two bearing brackets fitted to the rear side of the capstan slide base to support the stop bar system, all I had to do was to fit a plate or bar between the two brackets and fit a permanent anchor pivot to the bar. The plate would stiffen the bracket assembly and would accept the relatively light loads from the hand lever.

The hand lever and linkage was made up and fitted but although it operated the slide satisfactorily the linkage fouled the tools mounted in the capstan head when this was rotated. The solution was to mount the lever system below the slide base and connect it to the capstan slide by way of a rather fancy shaped bracket. This was made in spring steel, this material being stiffer than mild steel and less liable to permanent distortion under load. I would have preferred it to be 0.015-0.020in. thicker but I have to admit that it was difficult enough to bend the present one to its finished shape (**photo 19**).

Subsequent additions and modifications

The turret indexing system as first conceived and constructed worked, but it had no positive means of ensuring that the indexing finger was always returned to its starting position. A small spring loaded plunger or button located in the indexing slot in the intermediate plate provided sufficient force to retard the indexing finger as the capstan slide moved forward.

In milling the recesses in the capstan slide for the various indexing components, too much metal was cut away. The easiest way to restore the missing metal was to fit a little disc or button and file a flat on it as necessary. As it formed part of the guide surfaces for the locking plate it was made in silver-steel, hardened and tempered.

Capstan tools

The capstan required some special small tools. These included two small cutter boxes using 1/8in. square silver-steel for tools. They are too small to incorporate roller steadies and use hardened steel steadies instead. A die holder for 5/8in. dia. button dies and several sleeves for holding centre drills, etc. have also been made. The small cutter boxes and the die holder could have been machined from the solid but as the workloads are comparatively light they were fabricated from separate items and silver-soldered.

I found that standard drill chucks, even the small Jacobs 0-5/32in. chuck, were a little large for convenient use. More compact fittings were obtained by making up sleeves with a grub screw to hold drills. These are usually tapping drills for nuts and so not many are required. I made a new tail for an Eclipse Pin Chuck (No. 160 with three little collets), which fits the turret and is shorter. Some of these small tools are shown in photo 19.

A point to note is that the fit of the tool shanks in the turret must be very close as any slackness causes the tool to tilt out of alignment when the tool clamp is tightened. Although it will involve a lot of reworking of these small tools, I have decided to make a taper reamer and ream the turret holes to take taper shank tools.

Worm shaft assembly of worm wheel mounted on lathe headstock.

Dividing head

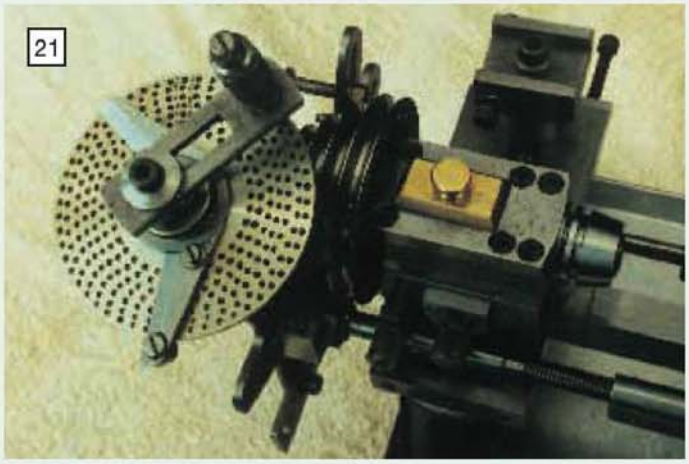
The need for a dividing head (**photos 20, 21** and **22**) occurred when I was making a new escapement wheel for a clock. As I schemed it out I decided that it should be suitable for use both on my 3in. lathe and on the little lathe. The dividing mechanism should be suitable for mounting on the little lathe headstock and the dividing head mandrel should also be able to be used as a light milling/drilling spindle.

Dissatisfied with its split plain bearings that always needed oiling, I had been considering a new headstock for the little lathe. Making the dividing head afforded an opportunity to check out manufacturing methods as well as ideas which could be incorporated in the headstock.

I intended to make the division plates using what I believe to be a very old method. The dividing mechanism would use a worm and wheel that I already possessed. It was a bit on the light side and the worm slightly damaged. A check with a screw thread gauge showed the worm to have a pitch of 18tpi so there would be no problem in making a new one.

I proposed to use the collet system from the little lathe for work holding so this not only fixed the dimensions of the dividing head mandrel but also put a limit on the size of work which could be handled.

●*To be continued.*



View on division plate showing sector fingers and index arm.

The wormshaft assembly with a division plate in place and the components of the dividing head mandrel, the worm wheel and the pulley when using the mandrel assembly as a milling spindle, also the second division plate.

THE 'CROFT' MILL ENGINE

John Bertinat

describes the base and flywheel to complete this simple engine which would make an ideal introduction to the hobby.

●*Part III continued from page 252 (M.E. 4167, 19 April 2002)*

Base or bedplate
(Part 20, Detail Sheet 7)

Dealing first with the cast baseplate, as this was the form employed on the prototype, I have added bosses for the holding down bolts and have hollowed out the underside of the original school-made casting. Pads are provided on the face of the casting to receive the main engine components, thus eliminating the necessity for machining a large flat area. With the additional clearance provided by these pads, separate wells for crank and eccentric clearance may not be necessary, but in any case they provide a receptacle for excess oil.

The pad surfaces where alignment is extremely important are those for the cylinder block and guide bars and, in the absence of machining facilities, these could be dealt with by file, surface plate and patience! I skimmed the prototype on my M1 milling machine. The holes for the cylinder attachment are marked out and drilled, to be spotted through the cylinder block at a later stage. The eight M4 tapped holes for the guide bars and bearings are spotted through at the appropriate stage of assembly.

The first assembly task to be undertaken is the positioning of the cylinder unit and this, complete with piston rod and crosshead, is set on the bedplate such that the crosshead is centrally located between the pads on the casting at both ends of the stroke. With the cylinder clamped firmly in the correct position, the fixing holes in the latter are spotted through from the underside of the bedplate, drilled and tapped, and the cylinder firmly bolted in position.

Now the crosshead is assembled, complete with guide blocks and, using inside calipers, the crosshead is set so that the distances of these guide blocks from the machined pads on the base are the same on both sides of the crosshead; this distance, minus the thickness of the guide bars, gives the true length of the distance pieces (25) which length should approximate to 24mm. The crankshaft and connecting rod may now be added to the assembly and the holes for the bearing pedestals spotted through, drilled and tapped M4.

If, instead of the casting, a fabricated bedplate is used, this may be cut from sheet steel or alloy about 6mm thick. Owing to the absence of mounting pads, clearances are reduced slightly and an aperture is required to clear the crank and connecting rod, but the eccentric should clear unless a casting of larger overall dimensions is used. Appropriate information is given on Detail Sheet 8 (see *M.E.* 4167, 19 April 2002). The flat plate image is made slightly less prominent if washers are soldered or secured to the base by Araldite at the holding down points, to simulate raised bosses at these positions.

Flywheel (Part 36)

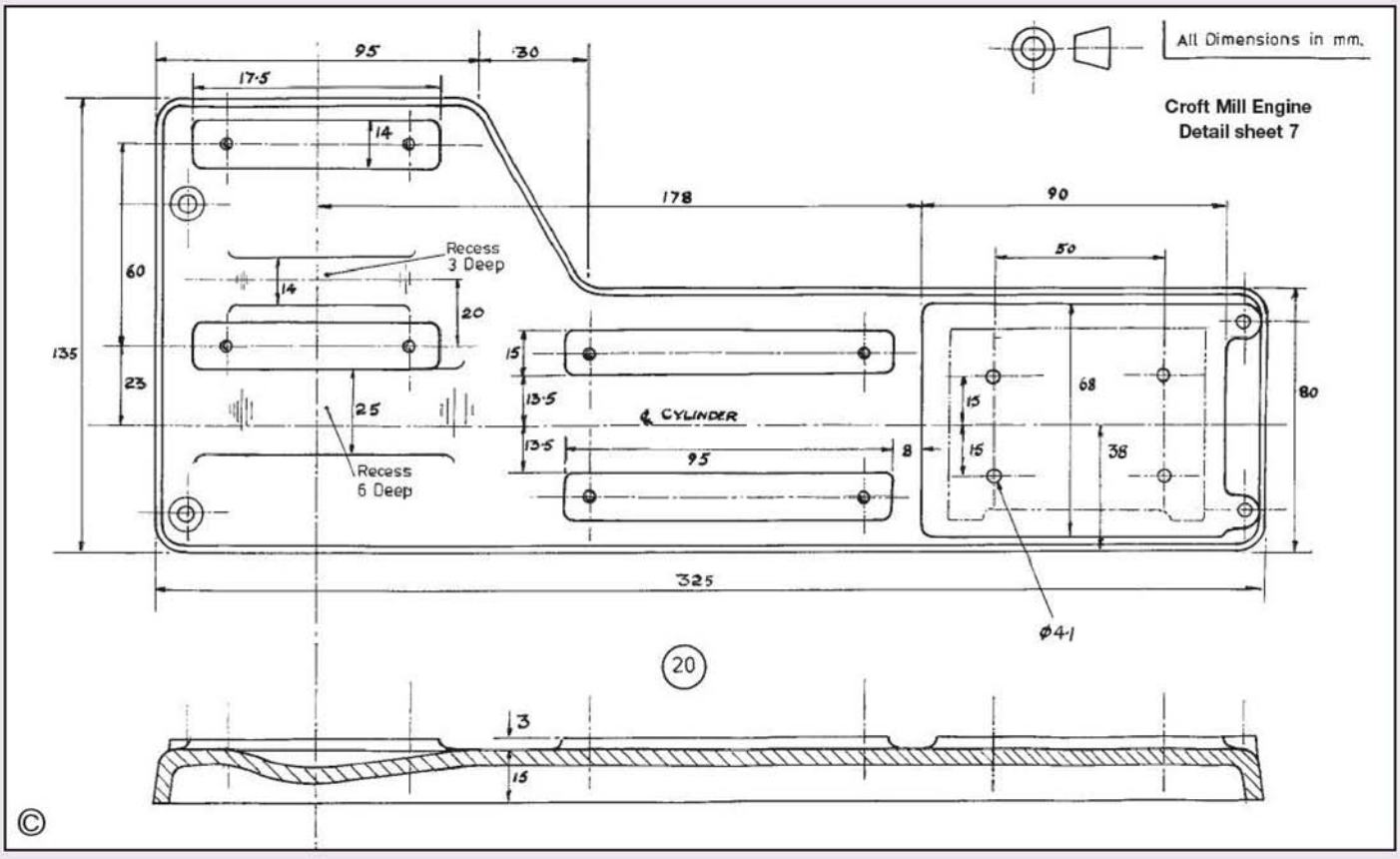
This item is not detailed as there are possible variations according to the casting employed. The wheel used here was 7 1/4in. (185mm) dia. with a rim face width of 3/4in. (19mm), but apart from fitting the crankshaft, dimensions are not critical. The prototype wheel was cast by the school in aluminium alloy and an example is shown in **photo 5**, being machined on my own rather ancient Myford Super 7.

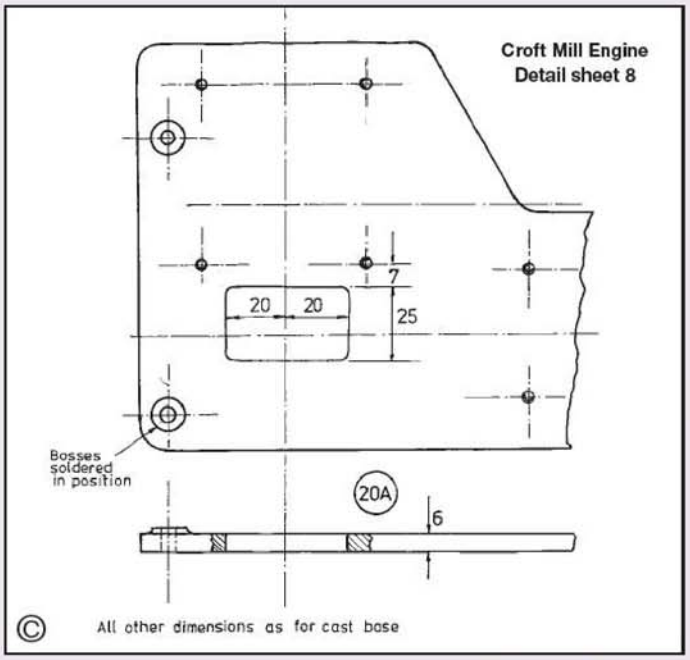
The photograph shows the lathe motor apparently exposed to swarf ingress, but I can assure readers that the lathe is never operated without a 'temporary' cover over the motor; this cover is not particularly photogenic, hence its absence in the photograph.

For machining, the wheel casting is clamped to the lathe faceplate using three clamps locating on the wheel spokes and placed as close to the wheel rim as possible to avoid the risk of distorting or even breaking the spokes during the clamping operation. Packing pieces of equal thickness are placed between the rim and the faceplate surface, adjacent to the clamps and clear of the outer edge of the rim. This setting enables the whole periphery of the rim, as well as one of its sides, together with the boss, to be machined at one setting.

It is desirable to drill the boss to only 11 or 11.5mm. dia. and then to use a small boring tool, as seen in the rear tool post in photo 5, to bring the hole to reaming size. Without this precaution, any lack of uniformity in the material of the boss will cause the drill to run out, resulting in a 'wobbly' flywheel.

For readers who might be interested, the boring tool holder shown formed part of a comprehensive rear tool post system described many years ago in these pages by 'Duplex; to the best of my knowledge, castings and drawings for this useful accessory are still available from Woking Precision Models.





The flywheel casting is carefully clamped to the faceplate using plate clamps and suitable packing behind the spokes. The bore may be finished by reaming but should first be bored to ensure concentricity.

To return to our flywheel, for finishing, the casting is reversed on the faceplate, no packing being needed this time unless the wheel boss gets in the way, and the remaining face and boss machined. The wheel is located on the engine crankshaft by an M4 or M5 socket grub screw, as a simple alternative to cutting a keyway in both shaft and wheel.

Conclusion

The foregoing just about completes the constructional details of the engine. On final erection of the cylinder and valve chest, oiled paper jointings are cut out to fit the various covers. Standard M4 nuts and screws are used and the various studs required can, if desired, be made from standard M4 studding, although I prefer to use correctly made studs having only the ends threaded.

Valve setting

This topic has been discussed frequently in the model engineering press, but for completeness the relevant sections are discussed here.

With the valve chest cover removed, the valve is adjusted on its spindle so that when the eccentric is given a complete turn, the steam ports open by an equal amount at each end of the cylinder.

With the crank on outer (top) dead centre, the eccentric is set to lead the crank such that the steam port is open by about 0.01in. (LBSC used to refer to 'tram ticket lead', i.e. the port should be open by the thickness of an old tram or bus ticket!) If all is correct, turning the crankshaft through 180deg. should produce the same conditions at the other end of the cylinder. Incidentally, the normal direction of rotation of these engines is 'up and over' i.e. for the engine as drawn, clockwise from the flywheel end.

For the initial running test, compressed air is possibly more convenient than steam and I find that if the engine is not too stiff, the humble bicycle pump provides a convenient source of air supply.

Further development

With the Editor's approval, I shall next provide further details and drawings of the more elaborate Mk.II version of the basic engine described here; this was shown in photo 3 in Part 1 of this series (*M.E.* 4165, 22 March 2002, p136).

●*To be continued.*

INJECTION MOULDED PLASTIC **MULTI-GAUGE SLEEPER SYSTEM** for 5in. and 5/3 1/2in. gauge railways from **PNP RAILWAYS.**

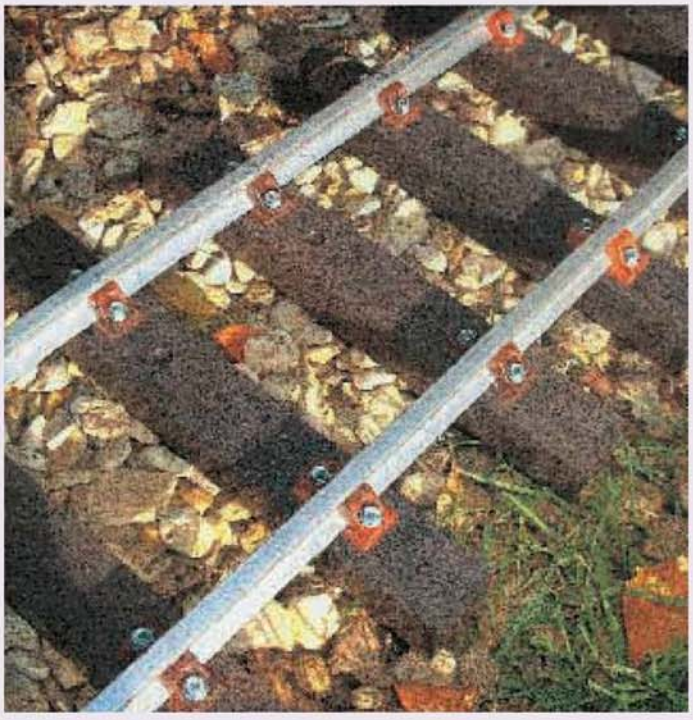
PNP Railways are delighted to introduce a new product to the range: their plastic injection moulded 5in. gauge and 5+3 1/2in. multi-gauge sleeper system. Manufactured from a high-grade engineering polymer, the system is rot, frost and UV resistant.

Slightly larger than scale, the system has many prototypical features which enhance its overall look. The system includes automatic gauging which means that no jigs or fixtures are required: the chairs are simply located into recesses in the sleeper.

Gauge widening for curves simply involves rotating one of the chairs through 180deg. to achieve 1/32in. widening, or both chairs to provide 1/16in. widening.

The system has been designed to suit standard flat bottom aluminium alloy rail 5/8in. high x 5/8in. wide at the base. The chairs can also be used on wooden sleepers.

For a sample pack and brochure please send a cheque for £2 to **PNP Railways, Paul Norman Plastics Ltd, Unit S5, Inchbrook Trading Estate, Bath Road, Woodchester, Stroud, Gloucestershire GL5 5EY; tel: 01453-833388; fax: 01453-834055; website: www.pnp-railways.com**



A good firm squeeze in a substantial vice is necessary to unseat the split screwed ring from its taper. Note the sleeves either side of the chuck.

The component parts of a Jacobs type key operated drill chuck are laid out here. It is important that none of the pieces are lost during disassembly.

DISMANTLING DRILL CHUCKS

Sam Rhodes
details procedures which he has found successful when servicing these sometimes neglected tools.

Over the years, a number of articles have been published in *Model Engineer* concerning the care and maintenance of chucks, but I do not recall having seen any information about dismantling them for general cleaning and renovation, drill chucks in particular.

After a long period of service these pieces of equipment can become stiff and gritty, especially if they have been used in grinding operations or on electric drills used for masonry work. Under these circumstances they could contain abrasive material and would benefit from a good clean-up.

With prior knowledge as to the technique, dismantling a Jacobs type key chuck is fairly easy. Many Jacobs drill chucks are fitted with a taper shank; the job of dismantling is much simplified if this can be removed.

Two mild steel sleeves or bushes are required for the dismantling operation, with a third one of brass or aluminium alloy which is used in the reassembly process. This last needs to be about 1/4in. thick, like a big washer, and is needed to avoid damage to the teeth on the rotating part of the chuck when it is pressed back onto the split screwed ring during reassembly. The bore of the washer needs to clear the part of the chuck body where the three key holes are situated.

The two mild steel sleeves should be about 1 1/2in. long, but must have different bores. The smaller one can be an old disused socket of suitable size that will clear the chuck jaws and just press against the body. The bore of the larger of the mild steel sleeves must clear the top part of the chuck body but must press on the part of the chuck which rotates, that is the part with the teeth on the other end.

Photograph 1 shows the chuck with the sleeves assembled in the vice ready to be pressed apart; a good firm squeeze is required to unseat the split screwed ring from its taper, allowing the chuck to come apart, and a good strong vice also helps. At this stage one must be careful not to lose any of the parts. The component parts of the Jacobs type chuck are shown in **photo 2**.

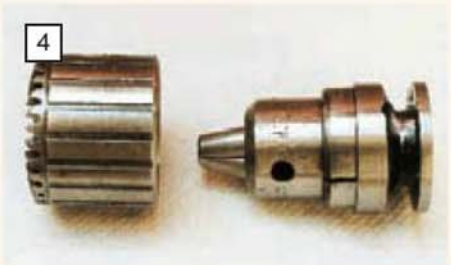
If the taper shank cannot be removed, the set up shown in **photo 3** can be used with the chuck, jaws uppermost, being placed on something solid laid across the vice jaws, and struck with a 2lb hammer. The 'something solid' shown in my photo is, in fact, an old disused face plate. Once again, be careful not to lose any of the bits and pieces when it comes apart.

The main thing to remember when dismantling this type of chuck is that before the toothed sleeve can be unseated from its taper on the split screwed ring, the jaws must be protruding fully at the bottom of the chuck body as shown in **photo 4**. If this is not done, the teeth on the jaws could be damaged as the toothed sleeve will not pass over them when it is freed from its taper, unless they are at their smallest diameter, that is fully retracted within the chuck body.

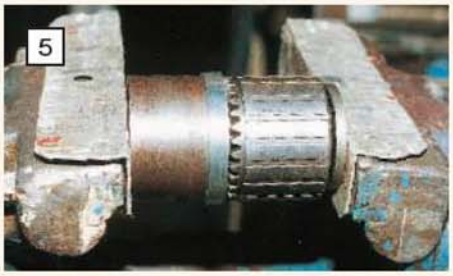
On some of the older chucks the jaws may be stamped, making it easy to replace them in their correct position, but I have found no noticeable difference to true running as long as the jaws are replaced in their correct sequence.

After cleaning the teeth on the jaws and smoothing any burrs or sharp edges, the chuck can

If its mounting shank cannot be removed to facilitate dismantling, the job can proceed by the use of a sturdy support as shown here.



After cleaning and oiling as necessary, the chuck is ready for reassembly with the jaws closed.



The chuck is reassembled by pressing the parts together in a vice. Note the aluminium alloy ring to protect the key teeth from possible damage.

Reassembly can also be completed by the use of a hammer with the key teeth in contact with the soft alloy ring supported on a mild steel sleeve.

Some drill chucks have to be cut open to get them apart; the sleeve is thin walled at this point.

The remaining ring has to be split to spring open and release the components.

Component parts of the non-Jacobs key-type drill chuck; a new outer sleeve and ring are required.

be reassembled, which is roughly the reverse of the dismantling operation, except that care must be taken to see that the three jaws are in the correct order, and are lined up level with each other.

Photograph 4 shows the parts ready for reassembly, with the jaws in position, lightly oiled, and held in their correct position by the screwed split ring.

The toothed part can now be pressed on by means of the vice as shown in **photo 5**, or by the use of a hammer as shown in **photo 6**. In this set up, the chuck is placed the right way up on the solid piece across the vice jaws with the teeth resting on the aluminium washer and the mild steel sleeve underneath.

A piece of tube is placed over the taper shank to rest on the chuck body, and given a good firm blow with the hammer to seat it on its taper, and the job is done.

In photo 6, the piece of tube used — a section of an old box spanner — was a bit on the short side, so I put two washers beneath it to avoid any damage to the end of the taper shank.

For anyone with a fly press, all these operations would be much simplified, but the vice and hammer methods do work.

The other type of key operated chuck, usually of European or Far Eastern manufacture and fitted to portable electric tools must be dealt with in a more drastic way. This type cannot be pressed apart like the Jacobs chuck because the key teeth and the split screwed ring which operates the jaws, are one and the same item. To get the chuck apart, after unscrewing it from its spindle, a piece of mild steel bar is gripped tightly in the jaws, and this bar is held firmly in the vice, while the chuck body is carefully sawn right around, just above the key tooth with a fine tooth hacksaw.

This part of the chuck body is very thin walled and when it is cut through, it can be removed, leaving a thin band holding the two halves of the toothed ring together. This band can now be cut through carefully when it will spring open, releasing the two halves and the chuck jaws. If the jaws are still gripping the mild steel bar, and will not come loose, a tap on the end of the bar with the hammer will release them.

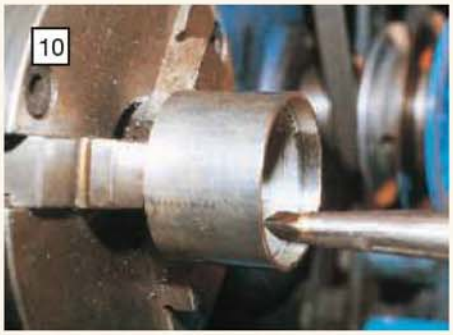
Photographs 7 and **8** show these operations; the pieces that have been cut away are now scrap, and new parts must be made to replace them. **Photograph 9** shows the component parts of this type of chuck. The replacement parts are two in number and consist of a piece of thin walled tubing of suitable bore and a turned ring which will form the bearing on the end of the chuck body. After the tube has been cut to length and faced at each end, it is bored out to fit the step on the split toothed ring at one end and the turned ring at the other; in both cases a good tight press fit is needed.

This operation is shown in **photo 10**, the tube shown in this view came from my scrap box and is stainless steel which is quite suitable for the job, but does not lend itself to being knurled easily, which would improve the appearance of the finished chuck. The turned ring can now be made from a large mild steel washer and is shown in **photo 11**. The bore is a nice running fit on the end of the chuck body, and a narrow shallow groove is put in the centre of the outside diameter to retain the locking compound, which is used on both ends of the tube on assembly.

The step on the toothed ring is already grooved and will retain enough locking compound to ensure a secure joint when pressed into the tube end. **Photograph 12** shows these two parts separately. On assembly the turned ring is pressed into the tube first, by means of the vice and as shown in **photo 13**, and left for the compound to set before the two mated parts are pressed onto the split toothed ring. This latter item is already in position on the rest of the chuck assembly, using the vice method again, as shown in **photo 14**.

Finally, **photo 15** shows the finished chuck with its new stainless steel outer sleeve. It would look much better knurled, but it is quite serviceable and works very smoothly.

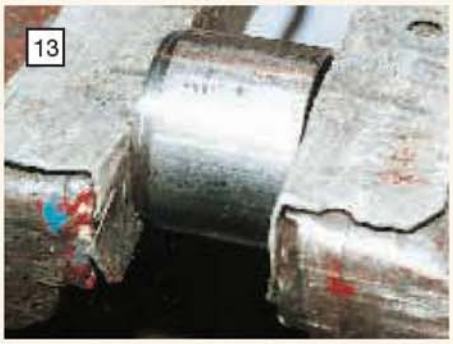
No dimensions can be given for any of these operations, which can only be measured from the size of the chuck being worked on.



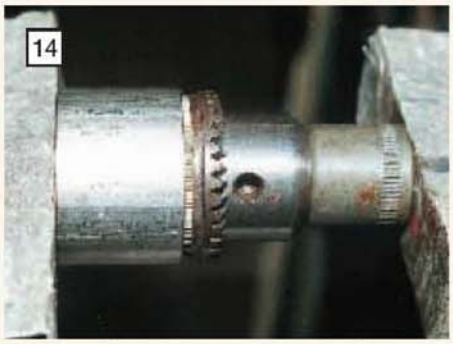
A replacement sleeve is made from a piece of thin walled tube, faced and bored to fit (see text).

The replacement turned ring can be machined from a large steel washer (see text).

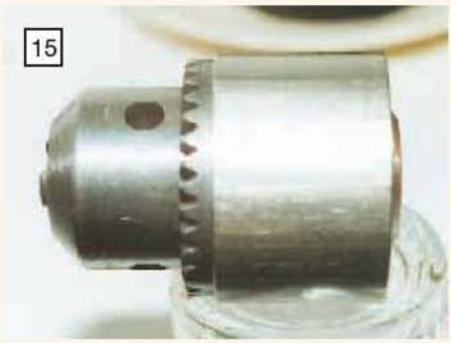
The replacement sleeve and ring ready for reassembly of the non-Jacobs type drill chuck.



The new ring is pressed into the new sleeve. The ring is grooved to hold the retaining compound.

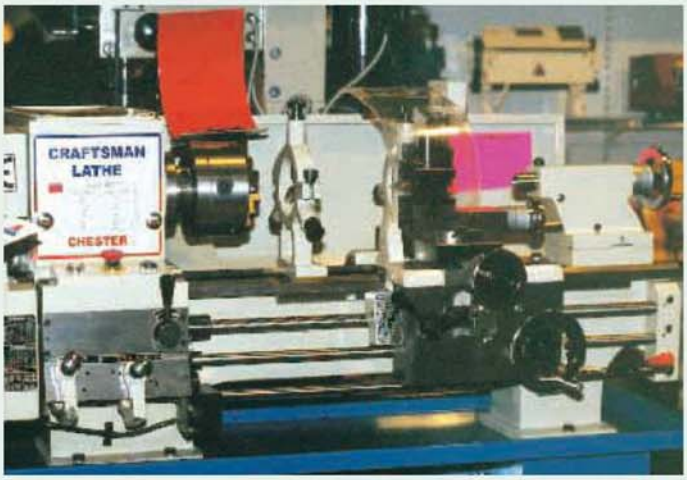


After the adhesive has cured, the new sleeve and ring are pressed onto the split toothed ring.



The refurbished chuck is now ready for further service. A knurled sleeve may be preferred.

The stock in trade of Barry Miller's Compass House Tools in East Sussex includes a range of tooling and ready-made battery electric locomotives.



Always very supportive of the Model Engineer Exhibition, Chester UK had a large range of machines and smaller tools and equipment on offer.

TRADE STANDS

AT THE 71st MODEL ENGINEER EXHIBITION

Gerry Collins
spent some of his time at MEX 2001 checking out what was available from the suppliers attending the event at Sandown Park.

Many model engineers attend exhibitions, not only to see models, but to stock up on tools and materials and to pick up the latest bargains. There were certainly a number of these latter to be had at Sandown Park, even if you had to search for them. Several of the stands had tools and accessories that had come from factory and workshop clearances. If you were prepared to look you could find just the item you required at a fraction of the new price, very useful if your workshop contains larger machine tools than the normal home workshop.

One of the improvements that have taken place in engineering is the sharpening and honing of cutting tools. With diamond impregnated sharpeners even the hardest cutting tool can be honed to a razor sharp edge for a fine finish. Diamond Machinery Technology inc. of Marlborough, Massachusetts, USA (perhaps better known as DMT Diamond Sharpeners) had a full range on show, not only for metal working tools, but for plane irons and other woodworking tools. I did suggest to my wife that she might like some diamonds for her birthday but a diamond lap was not quite what she had in mind!

Nearby was the stand of Chester UK Ltd., the well-known supplier of machine tools. They had a wide and varied selection of lathes and milling machines on display. The lathes aimed at the model engineer range from the DB8 with 4in. centre height to the Cub 620 with a centre height of 6in. and distance between centres of just over 19 inches. If you have the space, the Chieftain lathe might be on your shopping list but, with a weight of around $2^1/2$ tonnes, you will need deep foundations as well as a deep pocket.

Just down the hall was another regular *M.E.* advertiser: Chronos Engineering Supplies. Owner Mark Smith and his staff were kept busy throughout the show. Mark specialises in supplying high quality small tools including the well known 'Vertex' brand. Chronos has a large mail order business encouraged by supplying a free catalogue, something that could be followed by other companies that seek our custom.

It was good to see John Wilding in attendance on the RiteTime Publishing stand with examples of his clocks, including the Weight Driven Egg Timer as recently described in these pages. John was wheel cutting on the Unimat 4 lathe, a demonstration which attracted considerable interest. For those who wished to make a clock, a good selection of books was available on this stand.

Tipped tools are the modern way of cutting metal, (for the model engineer at least). J. B. Cutting Tools and Engineering Supplies had a very wide selection on show. With shapes and sizes to suit all applications, the very knowledgeable staff behind the stand were able to provide a tip for every application.

A stand that is always busy is Shesto, suppliers of small tools for the general model engineer and clock maker. They are the distributors for the Sievert range of propane torches and help and advice was available to visitors with queries.

In the little village of Rotherfield, East Sussex is the shop of Compass House Tools. Owned by Barry Miller, an active member of Uckfield Model Railway Club, everyone one on the stand can 'talk' model engineering and offer tips and advice. On show was range of good quality small tools and a selection of ready-to-run battery electric locomotives manufactured by the company and to be seen on many club tracks around the country.

A cutting tool for every application: visitors were spoiled for choice with the stock on the JB stand.

Chronos UK is noted for their good quality small tools and useful range of books and materials.

Warco UK is well known for their excellent imported machine tools and accessories.

No show would be complete without Bruce Engineering in attendance. With Bruce and Gerry Davey being assisted by Paul Gammon and Anthony Mount, the stand was bursting with supplies for the model engineer. Nuts, bolts, fittings, castings for a range of models — it all seemed to be there and there was rarely a moment when customers were not seeking to purchase.

Up from the West Country was the well-known nut and bolt manufacturer and supplier EKP Supplies. Based in Bratton Fleming on the edge of Exmoor, the company has supplied the bar ends from the screw making machines for some time which, sold in bundles of mixed sizes, made a good source of material for the stock cupboard. They have now branched out and provide a large range of shapes and sizes in brass and mild steel, half-round beading in various sizes, and a range of gasket materials including a new product from the Hermetite range, namely Hermetite Green, a gasket material that model engineers will find useful.

At the far end of the hall, against the window was the Myford stand with the new and improved range of machine tools. Most model engineers will be aware that Myford have introduced an improved version of that old favourite, the Super 7 with an enlarged mandrel and headstock and other upgrades. On show was the top of the range Super 7 Plus Connoisseur. Its electronic variable speed drive means you have stepless speed variation over the full range from 26rpm in back gear to 3,000rpm in top speed. The control system also features a 'jog' mode which runs the mandrel at a pre-set low speed in each range (15, 100 and 248rpm) which is very useful when truing up a work piece or clocking with a DTI.

The new headstock arrangement means that a 1in. dia. bar can be passed through the mandrel. The cross-slide has also received attention with needle and roller thrust races replacing the plain bearings fitted to the earlier models. For simple dividing, a detent plunger arrangement is fitted to the 60 tooth bull wheel. The cost? Just over £7,000 but you get a lot of lathe for your money and it will last a lifetime. Most existing Myford fixtures and fittings can be used on the new machine so if you are upgrading from an earlier machine you do not have to buy a new set of accessories. I did hover around the stand in the hope that there may be a free sample or two on offer, but no such luck! Also on display were examples of Myford's vertical milling machines the VM-B and the VM-E both fitted with the Vari-speed drive.

Normally much busier than here, Anthony Mount was on duty on the Bruce Engineering stand.

The LA Services Ltd., (also known as The Engineer's Emporium) stand had plenty for the model engineer. Not only were there second-hand tools, but engineering books, models, and many other goodies to tempt money from out of visitors' pockets.

Unfortunately, for varous reasons, the local foundries that were a feature of many towns are now a thing of the past. College Engineering Supplies are suppliers of castings to the model engineer. Not only do they provide casting for tools such as vices, angleplates, etc., but sticks of cast iron in various sizes which are ideal for making bearings, pistons and many other applications.

Another well-known importer of machine tools is Warco, presided over by Roger Warren. Roger had on display a number of new items, so new in fact that they were not even in the brochure. The new all-geared head lathe, the GH1322 is proving very popular. The new brochure should now be to hand and a 'phone call to Warco (call 01428-682929) will soon see one on your doormat. While you are in contact, ask for the small tooling brochure which has recently been extended.

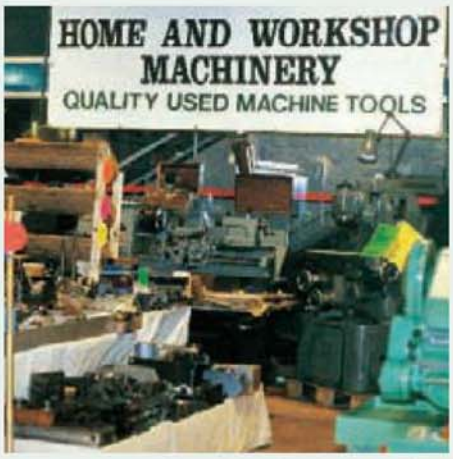
An item which caught my eye was a granite surface plate, dimensionally more stable than a cast plate, Roger does not bring many to shows as they are so heavy, but the very reasonable price includes delivery; a very strong carrier bag would have been required to get one of these home from Sandown Park! Another item that is proving very popular is the multi-tipped live centre. Gone are the days of needing male and female centres of various sizes, this is all you will require, housed in a smart wooden case it is easy to see why they are creating a great deal of interest among model engineers.

It is a sad reflection on the state of technical education and industry in this country, that many second-hand machines are coming onto the market at prices little more than those charged for imported new machines. The development of phase converters has helped so it is no longer necessary to change the motor to suit the single-phase domestic supply, or to get your local electricity company to lay in a three-phase supply to your workshop. One company at Sandown Park which regularly advertises in these pages is Home & Workshop Machinery, based in Sidcup, Kent. With a mouth watering display of 'pre-owned' lathes and milling machines, the choice was much extended by copies of their list giving details of the large stock still back in Kent.

Finally for this brief review, a company that can be guaranteed to be in attendance, all the way from Dartmouth in South Devon, is Tracy Tools. Well-known for their very extensive range of taps, dies, reamers and drills, the stand is a first port of call for many model engineers wishing to replace the odd breakage or blunt tool.

There were plenty more trade stands than I have been able to mention and, I regret the omission of any in which you were particularly interested. Many of the stands served the more general modelling public with electric motors, gears, wheels, electronics, special wood sections — the list is endless.

It was unfortunate that the organisers did not produce a guide or catalogue to enable visitors to contact companies after the show was over. I understand that a hall plan sheet was given to visitors on the first day or two but I never saw one. It is a great pity that some of the well-known suppliers were absent. On numerous occasions I was asked: *"Where's XYZ's stand?"* or *"Is ABC here?"* Those not present missed a great deal of business; perhaps the organisers will offer such a good deal next year that everyone will come, it would do the hobby a world of good!



The fascia says it all: visitors enjoyed rummaging through all sorts of tooling on this stand.

EKP have established themselves as suppliers to the trade as well as to personal shoppers.

The latest in a long line of highly regarded and much respected centre lathes from Myford Ltd.

CANVEY RMEC HOLIDAY WEEK

Don Cottle from the south coast aboard his 7¼in. gauge Schools class locomotive. Members and visitors spent a lot of time watching it or enjoying a ride behind it. (Photo: Francis Rogers)

Brian Baker
describes recent work at the Canvey RMEC track site and invites us to visit or participate in this year's Holiday Week 1-8 June.

A Modellers' Week was put on by the Canvey Railway and Model Engineering Club last year in order to allow modellers and club members time to appreciate the fruits of their labours. It seemed to us that we spent so much time painting, weeding and working on the maintenance of the existing railways in addition to concrete mixing, welding and track laying of new facilities that we seemed to miss out on the simple pleasure of using our models. Therefore, the Canvey Modellers Week was born.

Initially, the club was unsure how many visitors were likely to appear and we decided as a club that if all our members enjoyed themselves and no visitors came, then that would be counted as a success. In the event, we need not have worried. I think our hospitality and ever-growing list of facilities are well known in the area and every day we had visitors to share our enjoyment in playing trains. Some of the visitors stayed on site or in local hostelries, but many came just for a day to see what was going on and then came back for the next day, and the next, etc. The weather was very kind — which always helps, and the water on our temporary model boat pond was regularly disturbed by the passing flotilla of small craft, to delight the onlookers.

Bill Linsell from the home club, who usually drives his model roller at the site, was delighted to get the chance to drive Bruce Allen's 3in. gauge Case traction engine. (Photo: Francis Rogers)

As the club has a Sunday public running obligation, the public were hauled by different locomotives from those usually on duty, and that added to the fun and interest. Plenty of tea and cakes meant that the inner men were well

All four unloading sections on the 7¼in. railway were in use when this photo was taken and it looks as if the two new sidings installed on this turntable during the winter will be fully utilised for Canvey RMEC Holiday Week 2002. (Photo: Brian Baker)

A number of Chingford Club members visited us during the week; here a Canvey Island member is obviously explaining the virtues of standard gauge preservation to Ron Manning before the latter reverses his locomotive onto the main circuit. (Photo: Brian Baker)

Peggy White, Gary Garrett and Brian Anker look on as the steam launch **Lady Sarah** *glides across the portable model boating pond. (Photo: Brian Baker)*

Ian Mortimer's 5in. gauge Duchess was just ambling for our photographer. This track has now been upgraded with steel rail and plastic sleepers. (Photo: Francis Rogers)

looked after and on Tuesday evening everyone adjourned, well scrubbed and pleasantly sunburnt, to attend an evening's entertainment and a lavish meal at a nearby restaurant. This was a chance to enjoy each other's company without worrying about the boiler pressure.

So, with the first year having been such a success, the club has decided to stage the event again this year from 1-8 June 2002, when the facilities of the club will once more be in use, but with some of the improvements in use on which we have been working during the winter. The 3½in. and 5in. elevated track has been completely refurbished and upgraded using steel rail mounted on plastic sleepers placed on top of the existing structure. Although the old track was always very rigid, being of an all welded construction, it tended to be noisy. Preliminary running has shown that the new rail has less rolling resistance and the plastic sleepers have deadened the noise of the rolling stock. We would value your opinion of our refurbished track, so please come and give it a try.

Owners of 5in. gauge locomotives will also be able to try for the first time the choice of the 46ft. long bridge, previously reserved for 7¼in. gauge locomotives only, since we have also managed this winter to install an extra rail on the outer of our two ground level circuits. Finally, the signal box has now been completed and much of the ground level circuits are under the control of semaphore signals and pneumatically operated points making for more realistic running.

A new carriage shed means that we will have more storage on site, both for locomotives and passenger vehicles. An increasing number of club members have become interested in 'garden' railways and our agenda includes a plan to build such a railway at our Canvey Island location. We will, however, have a test track in use as last year as this facility was well used, mainly by club members. We have concrete roads, some asphalt paths and a large field for traction engines and rollers.

A dyed-in-the-wool steam man, Ron Manning had to be given special instructions by owner Reg Smith before he could cope with the intricacies of the class 170 Turbostar. A new carriage shed has been built in the shade of the trees in the background. (Photo: Brian Baker)

The model boat pond will be on site once more and it would appear that lots of locomotive owners have a model boat tucked away somewhere, so this could be an opportunity to see if it still floats. We have arranged for the same restaurant to provide our 'special' evening meal but it will be on Wednesday this year. As an addition to last year we have decided on at least one occasion to have an evening running, possibly including a fish and chip supper or a barbecue depending on preference.

With all this on offer, we hope you will pay us a visit and enjoy the chance to use your models in a different location. As before, plenty of tea, biscuits and cakes will be available. By previous arrangement, we can organise camping, caravanning or motor caravanning on site, and if you would like details of this or anything else you can ring Adrian Smith (01268-559560) or Brian Baker (01702-512752).

Finally, the accompanying photographs from last year's Canvey Modellers' Holiday Week should serve to whet your appetite!

In the shadow of the new signal box, a Hunslet quarry locomotive from Chingford switches from the outer to the inner circuit, a 170 Turbostar runs through on the outer circuit and a **Romulus** *awaits passengers in the platform oblivious to the two photographers discussing film speeds!*

This is the life! This picture sums up the week; Author Brian Baker is about to top up his fluid level on a warm, sunny afternoon while model yachts sail on the pond in the background. Call Adrian Smith (01268-559560) or Brian Baker (01702-512752) to learn more about this year's CRMEC Holiday Week.

LETTERS TO A GRANDSON

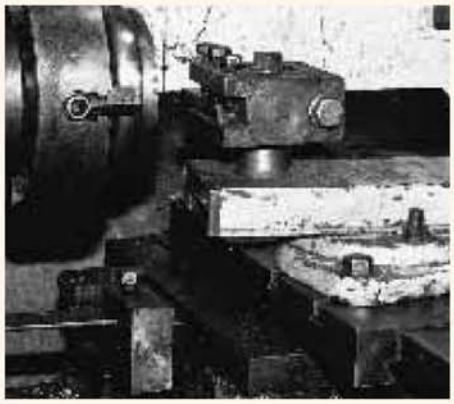
M. J. H. Ellis

describes how he resolved the problem of engraving a handwheel with 167 equal divisions.

●*Part XXXVIII continued from page 252 (M.E. 4167, 19 April 2002)*

Dear Adrian, I have already mentioned my 5in. IXL treadle lathe as being one of the treasures found in a scrapyard. It had a worn place in the leadscrew and although this did not affect the usefulness of the machine for milling, it was rather an eyesore and if you recall, I made a replacement for it. I made the new leadscrew a couple of inches longer than the original so that I could fit it with a graduated hand-wheel like that on Myford lathes. However, I encountered a problem: the IXL leadscrew had a 6tpi thread. One turn of the leadscrew hand-wheel therefore moved the saddle 1/6 = 0.1667in. or 166 2/3 thous. Graduation of the handwheel in thous. was therefore not likely to be easy! I think you'll be interested to hear how I resolved it, particularly when I explain that the method is applicable to practically any requirement in angular division.

Had I chosen, I could have made one of the divisions the odd 2/3rd of a thou. although in fact I decided that in the circumstances 167 equal divisions would be both easier and more appropriate. The technique is capable of producing any number of equal divisions up to 360, which I take to be the most anyone is likely to need. The method is also sufficiently versatile that it can be extended to produce non-linear scales such as, for example, a logarithmic scale. The only restriction is that it must be possible to calculate or otherwise determine to a suitable scale the relative distances between the divisions. You will appreciate how this can be done when I describe the method in detail.



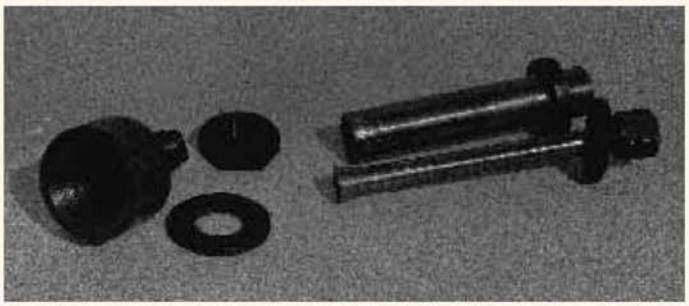
The divisions were engraved using a screwcutting tool laid on its side. Note the stop clamped to the front shear.

The handwheel for the Author's 5in. IXL lathe which is fitted with a 6tpi leadscrew required 167 divisions.

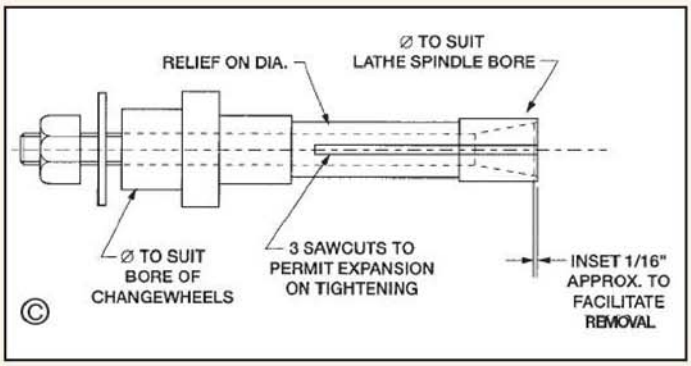
I first sheared a piece 18in. long x 7/8in. wide from a sheet of 16swg (0.0625in.) brass using the bench lever shear. This was a mistake as the strip took on a sideways set of some 3/16in. which I then had to correct by milling the edges. It would have been much better had I used a hacksaw with a fine-toothed blade. When this material had been squared up I set up the vertical slide square across the lathe bed, with a piece of wood some 3 x 1in. bolted horizontally across it, and milled a rebate along the top of it into which the brass strip would fit. A couple of dogs held it by its upper edge (see photo below).

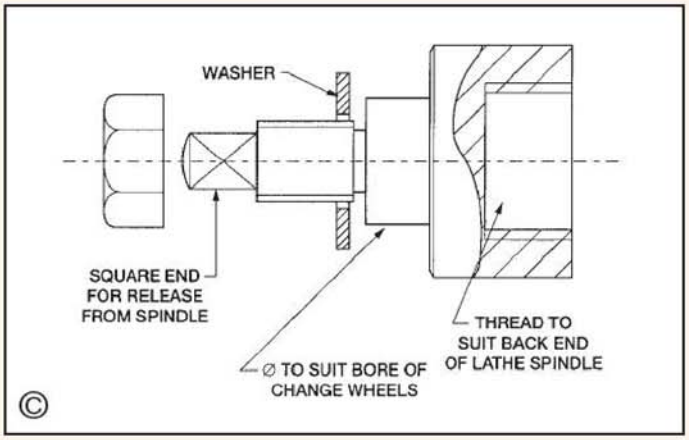
My idea was now to use a 3/16in. centre-drill in the 3-jaw chuck to drill a row of 1/16in. dia. holes all along the strip a little below the centre-line. It was convenient to drill them at 1/10in. intervals, advancing the table after drilling each hole by one complete turn of the cross-slide feed screw. Had the graduations been unequal, each advance would have been by the required distance, to the nearest thou.

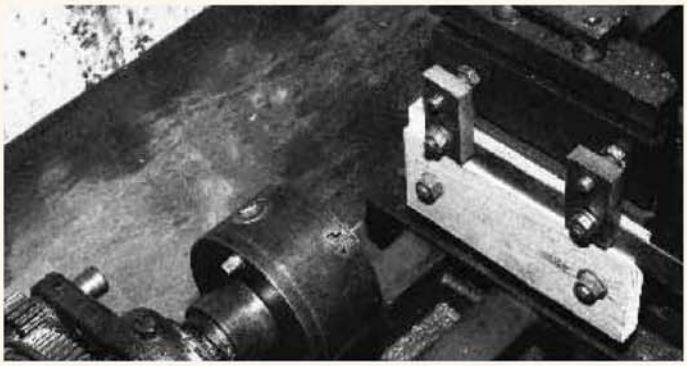
To ensure that the centre-drill did not cut too deep and produce an unwanted countersink, the saddle was brought against the stop held on the front shear of the lathe-bed by the clamp visible in the first photograph. Anyone who made such a clamp purposely would find many uses for it thereafter, beginning, indeed, with the scribing of the graduations as described later.



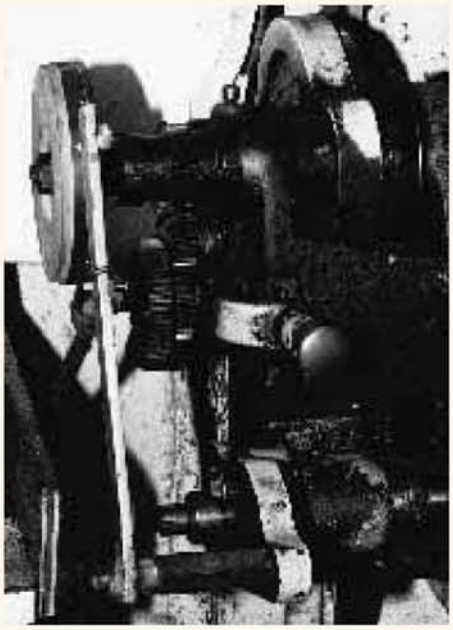
Adaptors for attaching index wheels to the lathe spindle. The external adaptor which screws onto the threaded spindle is shown on the left while the internal expanding adaptor is on the right.







Clamped to a piece of rebated timber, the brass strip is drilled from the lathe spindle and indexed hole-to-hole with reference to the cross-slide index to allow linear or non-linear increments to be created (see text).



The brass index strip is fitted snugly onto a wooden disk secured to the back of the lathe spindle and a makeshift detent arranged to locate each successive hole.

The 167 holes required in the strip took up nearly 17in., it was therefore necessary for me to proceed in stages. The regular sequence of holes was easily ensured when the strip had to be moved on, by using the centre-drill to locate the last hole which had been drilled before the dogs were screwed down again. Towards the end, the brass strip projected so far behind the lathe that it would have come up against the wall. This was overcome by reversing the strip end-for-end, and drilling the rest of the holes from what had been the back.

When this stage had been completed I annealed the brass strip by heating it to dull red, and plunging it into water. The ends were trimmed to leave 167 holes (no, not 168) with 1/4in. or so left over which would later be used to form a dovetail joint. An easy way to count the holes was by setting a pair of dividers to bridge holes number 1 and 11 and just walking them along. In its softened state the strip could easily be bent into a circle giving 167 equidistant holes, prior to carefully filing the joint. A little silver-solder soon completed the joint, after which all burrs were removed.

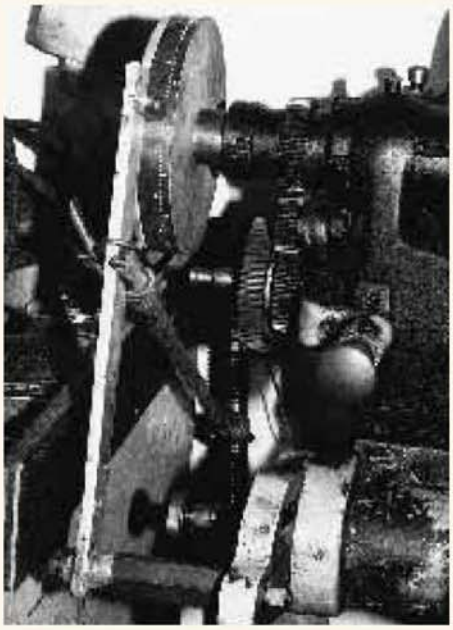
This ring now had to be mounted to form the rim of a wheel. I dare say that I could have turned a brass disk to make the wheel, but I think the plan which I followed was better. I used a piece of hardwood about 1in. thick, drilled a hole in the centre of the blank and screwed it onto a wood-screw of suitable size (2 1/2in. No. 12, if I recall correctly) held in the 3-jaw chuck. The head of the screw was inside the jaws of course preventing the screw from being pulled out.

It was important for the brass ring to be a good fit on the turned wooden disk, and to this end I filed a little chamfer round one inside edge and as the disk approached the correct size, I maintained a gentle chamfer on its right-hand edge. By removing a little at a time, I found it easy to achieve a light press fit. I should mention that I have found that the best tools for this kind of turning are simply the regular metal-cutting lathe tools. When a satisfactory fit had been achieved the disk was unscrewed and the ring tapped gently into place, one edge flush with the edge of the disk. Finally, to be on the safe side, I secured it with three small screws. To finish the wheel off, I mounted it to run true in the 4-jaw chuck and bored it to the same diameter as the change-wheels.

To use it for indexing, I would have to mount it on the left-hand end of the mandrel. Depending on the lathe, there are two ways of doing this:

1: Many lathes have a thread on the tail-end of the mandrel to take a collar or collars by means of which spindle end float is taken up. If a few spare threads project beyond the collar(s) these can be used to hold an adapter, the tail of which fits the bore of the change-wheels and so enables them to be used for indexing.

2: If the mandrel is hollow, an adapter can be made to fit inside it. The barrel of this adapter should be a snug fit in the bore with three or four lengthwise slits to allow it to be expanded to grip the mandrel by means of a pull-bolt. The method is similar to that for securing the handlebars of a bicycle. The female taper must be deep enough for the end of the draw-bolt to be countersunk by at least 1/16in. or so to facilitate driving the



The detent is held in place by the action of a tension spring and every tenth hole in the brass index strip is identified by a dab of typist's white correction fluid.

adapter out of the bore. A washer under the nut of the draw-bolt also serves to hold the change-wheel or in this case, the wooden index wheel. Adapters of both types are shown.

All that remained to be done was to improvise a detent in the form of a beak, just small enough to enter the 1/16in. holes by a little under 1/16 inch. The detent fitted on a change-wheel spindle on the quadrant.

I engraved the graduations on the lead-screw wheel with a screwcutting tool laid on its side.

If I haven't mentioned it before, a dab of white correction fluid (Tippex or similar) is ideal for marking every tenth hole so that these graduations may be made longer than the others. In fact, it can be used for all kinds of temporary marking. It dries immediately, and although it will not rub off, it can easily be scratched off after it has served its purpose.

I have that self-satisfied feeling that this letter was worth writing.

Your affectionate Grandpa.

● *To be continued.*

IMLEC 2002 AT EGGBOROUGH

Arthur Bellamy explains:

Years ago the then Editor of *M.E.* had a problem, the New Year had come and gone and he had nowhere to hold the International Model Locomotive Efficiency Competition. Pondering as to where there was a good track with ample car parking facilities, he remembered that the Leeds Club had run a Southern Federation Rally only a little while before and he reckoned that their track could fit the bill.

A Saturday meeting was arranged for the Editor to meet the committee and sell them the idea over tea and sandwiches. Yes, it was tea in those days. To cut a long story short, with only about three months notice the Leeds Club polished the track, painted anything that didn`t move and *Hey Presto!* IMLEC 1988 was at Eggborough and everyone had a good time.

This was the year a big engine came up from the South, ran on Saturday and won the competition with an 'impossible' 4.392% efficiency, a figure that has not yet been equalled. On the Saturday evening the two available dynamometer cars were coupled together nose-to-nose and a load applied. A locomotive pulled this unusual combination for several laps of the track and the readings were recorded. Each car provided similar figures and the results were considered fair.

The driver of this winning engine reckoned that his high value was because the track is uphill all the way round! He explained this by revealing that by careful driving he was able to keep the regulator open or partly open all the time and that even going down the bank he didn't let the passenger cars push the locomotive.

The following year, on the Leyland track, this same locomotive achieved over 3% efficiency. This engine has now had several good runs in similar events and we understand that a sibling from the same stable is being prepared for entry (hopefully) in this year's competition.

Other attractions will include the village of trade stands, a visit by the Vincent Motorcycle Club, a number of MG cars, an Aveling & Porter traction engine, and a Stanley steam car with a genuine 1909 engine — and 'Boy, does it go!'

Watch this space … and make a note for IMLEC 2002 at Eggborough on 6/7 July. Don't forget the date, bring your caravan or tent, there's plenty of room. See you there.

KEITH'S COLUMN

LOGGER

AN AMERICAN TYPE 2-8-2 LOCOMOTIVE

for 5in. and 7¼in. gauges

Keith Wilson

acknowledges the assistance he is now receiving and details the crossheads for both locomotives.

●*Part IV continued from page 259 M.E. 4167, 19 April 2002.*

I have mentioned Flexo Steels several times as makers of vast varieties of springs — coil only, alas. However, I have never provided any further details such as address, 'phone number etc., so: Flexo Springs Ltd. are at Hill Street, Kingswood, Bristol BS15 4HB, tel: 0117-967-3313; e-mail: **sales@flexosprings.com** Website: **http://www.flexosprings.com**

Understandably, they have a minimum order charge of £15; I have always found them most helpful and pleasant to deal with.

Shake well before taking the mixture

Due to the similarity of their names, it occurs to me that builders may get mixed-up betwixt *Logger* and *Slogger*. This is of course possible, and could occur whatever names were chosen. So as an additional aid I am titling *Logger* drawings in red, *Slogger* in blue. This should help, just so long as long as I remember to do it!

Picking up from where we left off last time, that is with keys and keyways in wheels, axles and crankpins, it was suggested to me by a good engineer several years ago that it would have been better to cut the keyway first and to use this to line up the crankpin hole. However, a little further thought revealed two points of interest.

The stresses caused by the drill (rotational) are rather higher than those caused by the broach (linear and steady). Also, the crankpin being further away from the main bore means that there is much more leverage for the same potential backlash. So, my advice is to drill and ream first, following with the broach.

Imagine my surprise when I found that by using a ¼in. drill as a pilot and following this with a 31/64in. drill ready for reaming, there was no real need for the reaming-size bush. Admittedly, there is no reason why the second drill should wander off-course in any particular direction, so it will therefore almost certainly run true.

Full-size, at Swindon they had a big fat machine for jig-boring the crankpin holes after the wheels were on the axles; this is all very well, but such a machine, although vital for this process, is unlikely to be overmuch used elsewhere.

Proportions

As you already know, I am preparing this design for 7¼in. and 5in. gauges. In general, of course, I could design the 5in. bits, then click on the AutoCAD 'proportion' icon, enter the scale factor 1.45 and *Hey Presto!* 7¼in. dimensions would pop up all over the computer screen. Well, of course it does, but there is an annoying wasp in the proverbial woodpile, for measurements seldom work out to convenient round figures. This doesn't matter overmuch in some places, but if, say a stock size doesn't work out, then I would be even less popular than usual. So I need to spend some additional time on getting 'even' with sizes for silver-steel, bearings, and suchlike. I shall apologise in advance for any bits that slip through and ask you to please let me know if (when) you find any.

I am receiving a very great deal of help from some good friends living not far away from the prototype on Vancouver Island. Clive Ellis, Maurice Foord and Paul Ellis have all taken photographs using both film and digital images, and have made measurements which come by telephone and e-mail, some in due course by snailmail and all brilliantly useful. I suspect that this series will be one of the best-illustrated ever. Regrettably, Baldwin, the maker of the original locomotive, no longer exists, so the chances of a general arrangement drawing are a bit remote; however, several good folk are searching. Meanwhile I am doing my best (worst?) to get a reasonably authentic miniature.

Axleboxes and axles

Machining the main axleboxes is substantially identical to the method for dealing with the smaller ones used on the pony trucks.

The axles will need some minor machining at the ends to get better bonding (Loctite 601) in the wheels before cutting the keyways, I refer to this as 'cotton-reeling'. If about ⅛in. is left full-size at each end of the seat to locate the wheel, and some 0.002in. turned off between these points, a much stronger bond will result. This applies no matter what size the wheel seat.

For keyways, get a piece of bright mild steel, 1 1/2in. square — exact measurements not vital — and bore it through with a hole to match the axle diameter. In this hole, cut a keyway parallel to one of the sides. This will then build into a jig on the milling machine table and ensure that all four axles match precisely. Remember that right-hand side leads, so if the axle be held with the left-hand keyway uppermost, then the right-hand keyway will point away from you. As always, cut the keyways with a slot-drill, gentle cuts being recommended — about 0.030in. at a time should be fine. For best accuracy, it also helps to do each successive cut in the same direction.

If at all possible, finish-machine all wheels assembled on their own axles. It won't matter that the cannon box and bearings are in place.

The final operation is to use Loctite 601 to bond in the crankpins, which should also feature cotton-reeled seats, using a spacer to get the right amount protruding from the wheel face. Wash the bonding surfaces with acetone which is readily available from Shakewell's (local chemist) and is lots cheaper than tetrachloromethane (which used to be called carbon tetrachloride).

Key-steel should be used for the keys (says Patrick). Plain silver-steel is not ideal. Key steel is slightly over-thick on nominal (my lot is plated, which seems to be the reason) so it is a good force-fit in the keyways. Cut the keys to about 1/64-1/32in. over length and round off one end. When the wheel seat and bore are cleaned up, anointed and assembled, give the wheel a bit of a turn to make quite sure that the bonding agent is spread throughout the joint, line it up roughly and drive in the key which will line up the wheel precisely. Any surplus key can be machined off later, trimming the axle to size. It looks rather dumb if for some reason the axle doesn't quite reach the end of the bore; flush is ideal, but a fraction protruding doesn't look so bad.

It is a very good idea to drill a hole into each end of the axle, sufficiently deep to get about half-way into the bearing, then cross-drilling just before the end of this hole to permit oil to be injected into the axle end for ease of lubrication. Just before the end? Take it gently, for if the drill snags and breaks off there will be the dickens to pay to get the bits out.

Flimsy?

The frameworks of these pony trucks appear to be rather flimsy, however it should be remembered that all they have to do is to shove the wheelset along the rails; the main loading is vertical. Over this side of the pond we put guard irons on the bogies or ponies when these are used, on t'other side cowcatchers are generally fitted on leading buffer beams, so shock loads on trucks are considerably less. In the case of *Logger/Slogger*, there is a low-mounted step on the pilot beam for the benefit of shunters and the like.

Experiments have been tried, over here at least, of adding brake gear to bogies; however, it proved not to serve any great purpose and was discontinued. It was perforce somewhat complicated and added little or nothing to the stopping distance. Harry Holcroft mentions something of this in his *Outline of GWR Locomotive Development*.

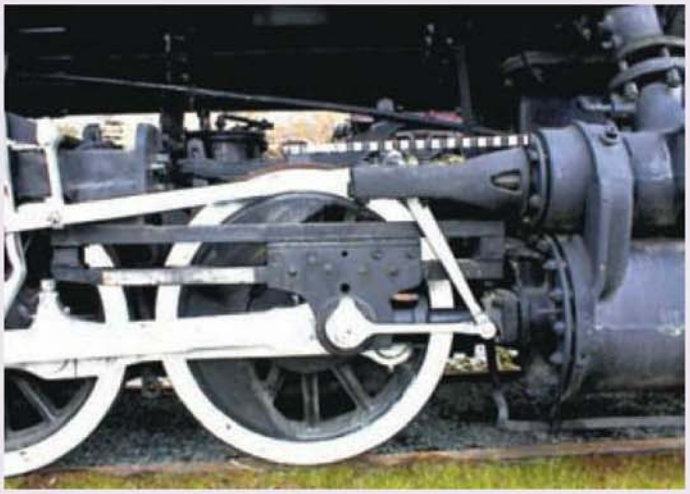
I am sorry not to be able to give much in the way of actual parts to make yet, for (at the time of writing) a general arrangement drawing has not materialised. It goes without saying that if one doesn't turn up, I will have to do the best I can from photographs. The design of this locomotive is at present proving rather tougher than I had hoped, because of the virtual impossibility of accurate scaling from the (admittedly splendid) range of photos provided by friends listed above.

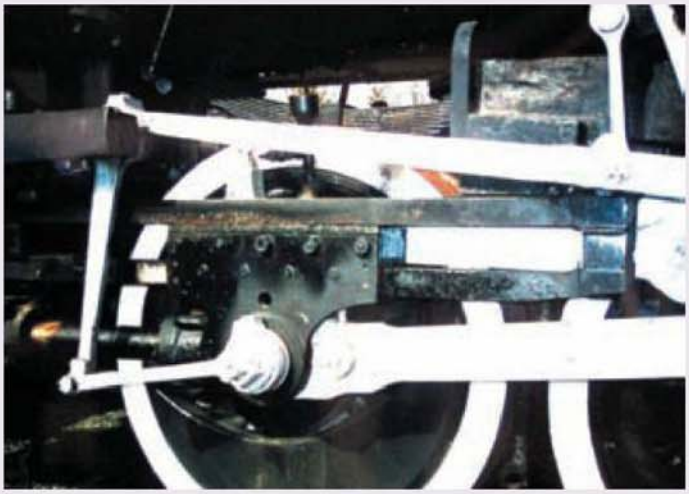
The reason is quite simple: no way can you get an accurate scale measurement unless it is in the same plane as the reference measurement. Thus I had been a long while trying to get a good valve gear layout, but due to the above parallax problems I have laid it out many times only to find that in dead centre position the combination lever is anything but vertical. Now I am perfectly capable of doing the design work on Walschaerts valve gear, but it would not necessarily be an accurate version of the engine, and until I can get things dead right by use of the G.A, it would not be right for me to make inspired guesses. But recently the full set of measurements arrived via e-mail — phew! — so herewith a few pictures.

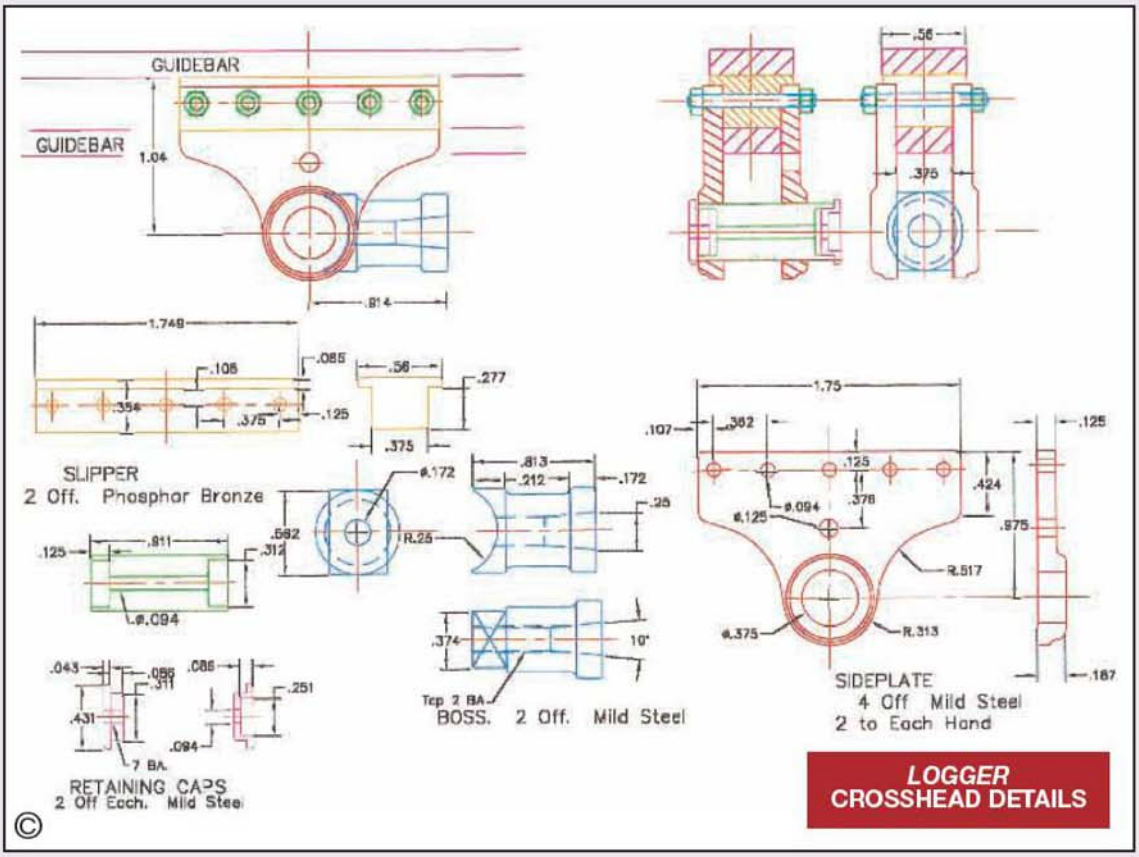
Many items can be dealt with without any scaling problems; these include the wheels, axles and axleboxes. There is also enough information on the crosshead, so herewith the complete drawing of this item in both gauges.

A word of warning. I do not know precisely what size these drawings will appear in 'ours' but I have deliberately used some different colours to make things a bit clearer.

I cannot state definitely that the slipper was in fact made of phosphor bronze — preferably of the drawn variety — but in our sizes at least I know of no better metal. Note that the boss is silver- ▶







brazed into the two sides; make sure that the holes for the little-end pin are dead in line. Since these need to be a good fit to size, drill them a bit smaller — say ream 7/16in. for the *Slogger* version, using a piece of stock to keep the sides in line. The smaller holes for the fixing studs may be done to size, use a couple of studs and a distance-piece to get correct spacing. Use all five studs if you want to, but no less than two.

The close-up photograph of this crosshead shews another line of nuts/studs/what-have-you below the five that I shew; I don't know what they were for. It is feasible that something was bolted to the crosshead at this point, but I am only guessing. I have another crosshead picture of a different Baldwin 2-8-2, without the lower row. It is possible that they were for a side-control slipper; they are certainly not likely to go through the lower guidebar!

After silver-brazing, clean up and then open out the pin holes reaming to 1/2in. dia. for the big one, 3/8in. for the small. Use good-fitting studs for the top holes, reaming through the bronze slipper and then (preferably) using silver-steel studs, merely threading the ends.

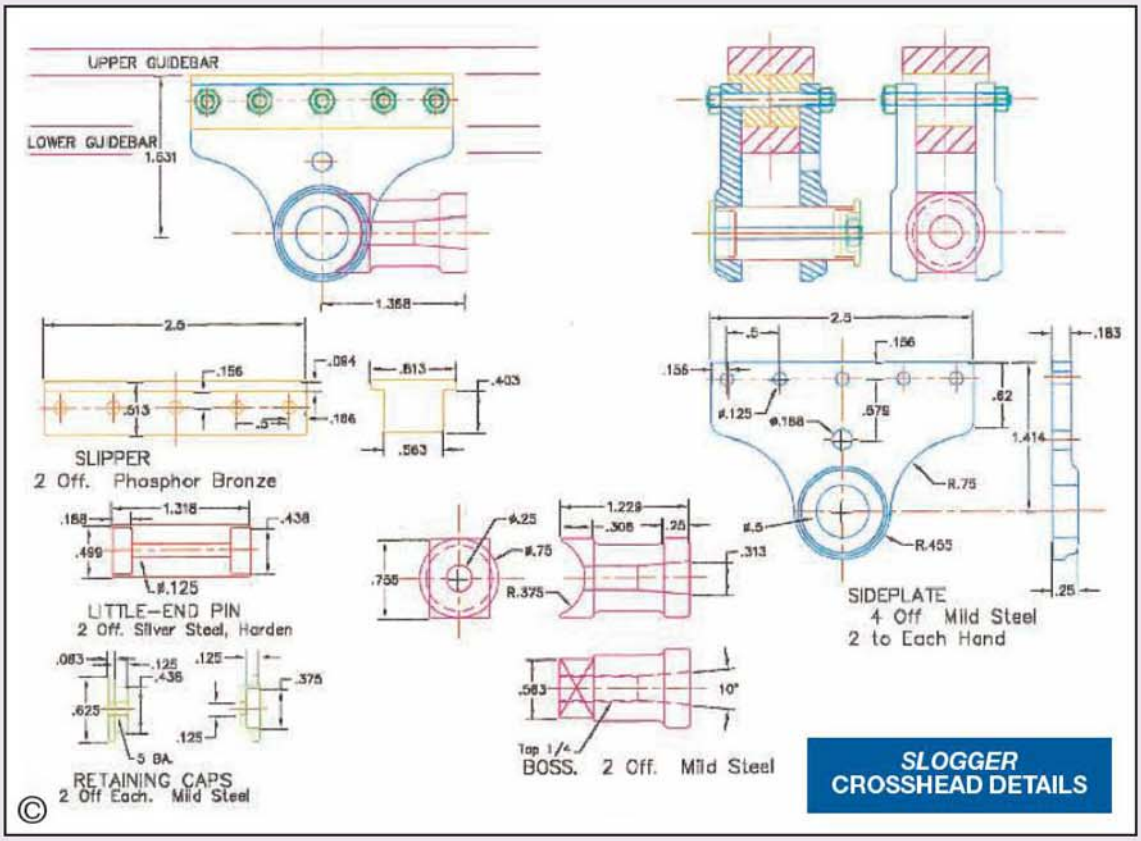
To get the taper hole in the boss, make a simple taper reamer. This is easily done with a piece of silver-steel, turning a 10deg. taper (set top-slide of lathe to 5deg.) and then file or mill to half the diameter. Harden right out, then temper to pale straw. This will probably cut as it is, but it's best to stone it up a little with a small whetstone. Remember, however, that it should not be used as fast as a high-speed tool, take it in gently with some 'suds' and you'll be okay. No need to take to full-size at this stage, but have a 'dummy' piston rod handy, this can then be driven into the hole and used to line-up the boss during silver-brazing.

The pin is made from silver-steel, hardened or not at your choice. Many years ago, I examined one of my own locomotives (1366) after several hundred miles of running, the bronze bushes (that I had expected to replace) were still virtually perfect, whereas the crankpins and little-end pins were quite distinctly oval.

It is very easy to make new crosshead pins, note that the design is such that the high-precision outer surface of the pin is 'untouched by human hand'(?) and therefore should always be a good fit. Note that the pin is much longer than it apparently needs to be, but of course, the anchor link has to be mounted on it as well.

This locomotive is a good example of the American layout of valve gear, I believe it is called the 'all-square' system. The lower end of the expansion link lies just about on the motion centre-line instead of well above it like most of the English engines, and the anchor link on the crosshead pin rather than using a drop-arm as is common 'this side of the pond'.

●*To be continued.*



CLUB CHAT
With Stan Bray

The spirit of OMLEC 2001: Kevan Ayling takes up the challenge with his 5in. gauge SR Leader and Ian Scott riding as guard at the tail end of a massive train. Despite the ornate and air-smoothed headgear, Kevan did not manage to carry off the brand new OMLEC trophy (inset). Guildford MES will be running OMLEC 2002 during the weekend 10/11 August this year.

UK News

Due to his heavy involvement in and commitments to the North York Moors Railway, Alan Worden has had to stand down as Hon. Secretary of **Ryedale SME**. Anyone wishing to contact this society should now write to the new Secretary, Michael Burch at 4 Mill Way, Ampleforth, York YO62 4DR (01439-788033).

Following a year of being unable to run for the public due to track alterations and the rebuilding of their pavilion in Vivary Park, members of **Taunton ME** will at last be able to go ahead this summer, and everyone is looking forward to the opportunity to run the railway again. They were able to return to the park just before Christmas and so have had ample opportunity to prepare for the coming season. During the interim period, meetings have been held at Stoke St. Mary, just outside Taunton, and a varied programme was organised to maintain members' interest. Her Majesty the Queen was scheduled to visit Vivary Park on 2 May but we suspect it wasn't to ride on a train on the newly refurbished track. The raised track caters for 3½ and 5in. gauge locomotives and it has been suggested that a new ground level track with 7¼in. gauge may be built at Creech St. Michael Playing Field for which members are awaiting approval from Somerset County Council.

As usual, **Guildford MES** has organised many events for the running season. Their long established and very popular annual rally will take place over the weekend 20/21 July and, as a result of the overwhelming popularity of OMLEC, the Open Miniature Locomotive Efficiency Competition, the first of which was run last year, the event will be repeated this year during the weekend of 10/11 August. A disability challenge has also been arranged for 7 July. A great deal of work has had to be completed in preparation for all this, so that the club can maintain its customary high standards. A new connection between the 7¼in. gauge track and the traverser should be ready in time for the rally, and the tunnel now sports a brand new lining. We should perhaps emphasise that although OMLEC 2002 will be held at Guildford in August, IMLEC, unfortunately cancelled last year, will be taking place at the Eggborough track of **Leeds SME** on 6/7 July as planned.

The **Melton Mowbray DMES** Easter Steam Up found a good number of members taking advantage of the fine weather to give their locomotives an airing and to enjoy a pleasantly sociable occasion. The AGM was attended by 28 members who, among other things, approved a small increase in subscriptions for next year after learning of the shortfall in passenger revenue for 2001 as a direct result of last year's foot and mouth epidemic. Preparations, including the installation of a new safety fence, are well in hand for the annual rally, Whissendine 2002, to be held over the weekend 8/9 June.

Resulting from an attempt by vandals to set fire to their headquarters, members of **Crawley ME** have replaced their original wooden doors with steel ones. It had been hoped that their premises could be extended this year to include a clean seating area and a toilet block, arrangements for financing this were therefore being investigated. However, continued arson attacks in the area are causing members to have second thoughts and plans may have to be shelved for the time being until the problem of vandalism shows signs of abating.

In order to make the best use of longer daylight hours during the summer, members of **Harrow & Wembley SME** have arranged additional meetings for Wednesday evenings every month commencing 8 May and continuing through to September. Here too, vandals have caused probems, apparently damaging the roof of a garage used by the club for storage, with the result that it now leaks and its repair has had to be added to the long list of tasks to be dealt with in the near future. The local authority has donated a load of scalpings, small stones resulting from the resurfacing of local roadways, which will be used to improve surface areas used by pedestrians and vehicles. New electric motors are being tested for suitability for powering the club locomotive; it is planned to fit two per axle and run them in series via a 36V controller.

A society which embraces various interests and numerous activities, **North London SME** is currently re-considering the structure of the management group for its track site at Colney Heath in Hertfordshire. Traditionally, and for obvious reasons, this has been administered by members whose main interest concerns live steam passenger hauling locomotives. Recent years have witnessed the formation of other groups within the society, notably of members with interests embracing boats, garden railways and traction engines, extending the use of the track site to the mutual benefit of all concerned. However harmonious this arrangement may be, decisions relating to the operation and financing of the track site should logically account for all the interests involved. The election of a committee has therefore been proposed to ensure that the full potential of the track site is realised. The club's application for charity status has been refused by the Charity Commissioners on the grounds that the club exists for the benefit of its own members, a reason given in several cases where application has been turned down. It seems that any club seeking charitable status must be able to demonstrate by the wording of its constitution that the main object of its activities is to operate almost exclusively for charitable purposes; with the need to use much of its revenue for continuing improvements to club facilities, this is unlikely to be particularly easy.

Keith Wilson asks us to remind readers that **Wolverhampton DMES**, of which he is Honorary President, meets at 7.30pm on the first Friday of every month at the Fordhouses Community Centre. The society has a 7¼in. gauge track in a nearby public park at Baggeridge, about five miles south of the city. The track is at present being extended; potential new members are invited to go along to Fordhouses where they are assured of a warm welcome. Alternatively, Keith may be contacted by e-mail at **keithgwrloco@fsbdial.co.uk** for further information.

Members of **Reading SME** were highly satisfied with the performance of their new non-steam club locomotive which had its first outing at the beginning of the season. It is proposed to use it mainly as a standby engine and when steam locomotives are being prepared for their run, although it will no doubt be used for passenger hauling on public running days. It is pleasing to note from the club newsletter how much interest the several junior members take in club activities; also noteworthy is the fact that they are not backward in coming forward when it comes to writing to the editor with their points of view, all of which indicates both maturity and a great deal of common sense.

The season started well for **Wortley Top Forge ME** when a large contingent of members arrived armed with spades, rakes, hoes and forks ready to get cracking on track maintenance. In no time at all they had lifted a long length of the track, cleaned out the weeds and accumulated rubbish, put in clean ballast and relaid the track. Such an effort in itself was splendid, but when account is taken of the fact that it was absolutely pouring with rain throughout this activity, the result was little short of marvellous. It is now hoped that all this enthusiasm will be directed towards other ▶

events organised by the club, in particular those for which a portable track is used. It has been noted that in the past some of these have not been as well organised as they might have been, so the creation of a new committee post has been proposed, for an organiser with responsibility to find enough members to man the track when it is taken out.

Two new members have been welcomed into an apprentice scheme organised by **Plymouth MS**; they intend to make a battery powered locomotive based on the design by Rex Nicholls published in *Model Engineer* in 1989. Vandals, or perhaps they were thieves, attempted to break into the club premises last January but failed to do so, although they did manage to cause considerable damage to the main door. A steel door is being fitted to guard against further such attacks. They also smashed a number of slates on the roof thereby creating a lot of work for members. Minor problems of vandalism continue to cause annoyance and frustration, and take up the valuable time of those who would prefer to be doing other things. It appears that such mindless anti-social behaviour is something with which this and many other clubs and societies, not only in the UK but around the world, are having to contend.

Major construction work was necessary during the building of an extension to the **Docklands & East London MES** track at Belhus Woods. This involved crossing a dyke and, now this obstacle has been overcome, efforts are being directed towards clearing the track bed and laying the track which, when finished, will give a 200% increase in the length of the layout. With an average of about 30 members, the society is not very large, despite which great strides have been made since the site was obtained at Belhus Woods Country Park. Regrettably, Norman Phelps, who has been the club's President ever since it was formed, and who played a major part in obtaining the track site, has had to relinquish his post and will be sorely missed. The society is currently without a President and expects to remain in this situation for a time.

We learn from the **Northern Association of Model Engineers** that their Narrow Gauge IMLEC will be held 1/2 June this year at the **South Cheshire SME** track. Entries for this event are welcome and should be sent to Mr. M. Gee-Pemberton at 'Trees', Middlewich Road, Holmes Chappel, Cheshire CW4 7ET.

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.

Dr John Farrington	*Rugby MES*
Arthur George Smith	*Northampton SME*
Jack Gregory	*Durban SME*
Alan Mould	*Society of Ornamental Turners*
Jack Vizard	*Harrow & Wembley SME*

A cold, wet and windy evening did not prevent 30 members of **West Wilts SME**, and their wives, from attending a social evening at the Warminster Conservative Club. Here everyone was able to relax and enjoy one another's company and an excellent meal, rounding off the evening with a game of skittles. All present were particularly pleased to welcome founder member Bob Savory to the party who, now generally unable to attend club functions, was transported there and back by club Chairman, Mike Harmsworth. The annual club photographic competition failed to attract more than six entries despite the offer of a prize of a year's subscription to one of the model engineering magazines. Tom Buckland won this year's competition with a picture of a crank and crankshaft for a *Cirrus* Engine.

As usual, the *Bulletin,* newsletter of **The Society of Ornamental Turners,** arrived in the form of a 46 page magazine, printed on heavyweight semi-matt paper and containing enough reading material and information to last any member for several weeks. A great deal of advice and wisdom is to be found in its pages, and it was perhaps inevitable that sooner or later someone would adapt a computer for ornamental work; a photograph of just such a prototype device appears in the current issue. The annual awards were announced during the society's AGM, as follows: *Howe Cup:* George White; *Cattell Cup:* Mike Bain and Tony Brooks; *Haythornthwaite Cup:* Tony Cliffe; *Jowett Medal:* Geoff Brandon; *Geoff Brandon Cup:* Derek Pearce; *President's Cup:* George White.

During the spring bank holiday, **Talyllyn RPS** will be holding a barbecue at Dolgoch for members, this being just one of several events to take place over that weekend. These include a ladies' day when a train called *The Elizabethan* will be in operation. It will not travel as far or as fast as its illustrious standard gauge predecessor, but there will be some real one-upmanship. The footplate crew will consist of Elizabeth Green and Elizabeth Mann, and the guard will be Elizabeth Garvey. We wonder what George and Robert Stephenson would have made of that!

World News

New Zealand

The Micrometer, newsletter of **Auckland SME**, has recently contained a series of articles on lathes of various makes. Very interesting reading, the series has featured a diverse range of models. Although most are now obsolete, there is every chance they may be found on the second-hand market. The information is gleaned from **www.lathes.co.uk** which some readers with access to the internet may wish to visit for themselves. The club reports a steady increase in membership with five new entrants in March alone, indicating that the hobby is certainly healthy in New Zealand. Having committed themselves to exhibiting at the Glenbrook Jubilee Show it was found necessary to exhort members to bring as many items as possible for the club's own show which was held at Easter.

With repairs to the pond completed and, when we last heard, waiting to be re-filled, the April meeting of **Southland SME** was set aside especially for marine matters and to reform the boating section, including the election of a Commodore. It is a long while since there were sailing facilities which resulted in ebbing interest, now a good number of members are eagerly looking forward to being able to get back to their favourite pastime. In March, the club meeting took the form of a visit to the headquarters of the **Invercargill New Zealand Railway Interest Group** where, among other things, they were able to see in operation a special model railway layout with models of typical New Zealand trains travelling through a model of typical New Zealand scenery.

South Africa

A full-sized Lawley narrow gauge locomotive which has stood for many years on a plinth at Len Rutter Park, headquarters of **Rand SME**, has now been removed and taken to Sandstone Estates for complete restoration to working order in time for an event at the estate. Two club members are already employed by the estate and will be heavily involved in the restoration work. As well as model engineering, the society is much involved with full-size preservation and has a very fine collection of preserved stationary internal combustion engines. Information about the society's involvement in this type of work has spread far and wide, to the extent that Arthur Prescott, one of their leading lights, was recently appointed to the Stationary Hall of Fame by the UK based magazine *Stationary Engine*. *Arena Travel*, a British travel company, has arranged for a party of enthusiasts from Britain, Canada and the United States to visit the Rand society in April. The group will also include Peter Love, editor of *Tractor and Machinery* magazine, and while there they will attend the event at Sandstone Estate where they should see the Lawley locomotive in action.

Australia

A new workshop being built by **Hornsby MEC** is rapidly taking shape and machinery is being installed. When it is completed, the old workshop will be used to house track maintenance equipment. An ever-increasing number of books has meant the need to build a new library, and after major renovation work has been completed, a building that once housed a Ronaldson & Tippet internal combustion engine is to be used. The work involves raising the concrete floor to avoid problems from possible flooding, cladding the outer walls with steel sheeting and lining them internally with plasterboard. Late last year, a particularly heavy storm caused considerable damage to the track, and another in February severed both electricity and telephone connections for a day or two. *Galston Valley News,* the club newsletter, is a fair sized magazine and traditionally has been sent to members and the *Model Engineer* office folded, with a label showing the addressee. In the way which typifies some officialdom, the Australian Post Office now refuses to accept it for posting unless at least five strips of adhesive tape are put round the outside. This extra work will increase the time spent on the magazine by John Knights who has taken on the task of preparing the newsletters for posting. It has therefore been decided that future mailings of the newsletter will be in envelopes. All very well, but it involves the club in considerable additional expense; since the old system had worked well enough for years, it seems that these days regulations are made by petty officialdom just for the sake of it.

CLUB DIARY

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

MAY

To 26 **Talyllyn Railway.** *First Class for Sunday Lunch.* Enquiries: 01654-710472.
17 **Rochdale SMEE.** *Auction.* Contact Mike Foster: 01706-360849.
17 **Romford MEC.** *Ron Shipton: Essex Airfields.* Contact Colin Hunt: 01708-709302.
17 **Wigan DMES.** *Annual Dinner.* Contact John Chamberlain: 01744-882255.
18 **Gas Turbine Builders' Ass'n.** *Fly In* at Brooklands Museum, Weybridge, Surrey. Contact: Tom Wilkinson: 01508-570977.
18 **Romford MEC.** *Hospice Fete.* Contact Colin Hunt: 01708-709302.
18 **STEAM: The Museum of the Great Western Railway.** *Meet the Railway Workers.* Information: 01793-466646.
18 **York City & DSME.** *Summer Meeting.* Contact Ken Bateman: 01904-421445.
18/19 **Bedford MES.** *Exhibition Weekend.* Contact Ted Jolliffe: 01234-327791.
18/19 **Birmingham SME.** *Southern Federation Spring Rally.* Contact John Walker: 01789-266065.
18/19 **Chesterfield MES.** *Open Weekend.* Contact Mike Rhodes: 01623-648676.
18/19 **Erewash Valley MES.** *Steaming Weekend.* Contact Jim Matthews: 01332-705259.
18/19 **Merstham Model Steam Show** at St Nicholas School, Taynton Drive, Merstham, Redhill, Surrey. 10am-5pm. Adults: £4, Concessions: £2.50, Family (2+2): £8.50. Enquiries 01737-760400.
18/19 **Talyllyn Railway.** *Modellers' Weekend.* Enquiries: 01654-710472.
18/19 **Tyneside SMEE.** *Spring Rally.* Contact Malcolm Halliday: 0191-262-4141.
18-20 **British Columbia SME.** *Spring Meet.* Contact Sean Laurence: (604) 931-1547.
19 **Amberley Museum.** *Stationary Engine Day.* Contact Derek Kilburn: 01798-831370.
19 **Erewash Valley MES.** *Invitation to Valley Road, Lambley.* Contact Jim Matthews: 01332-705259.
19 **Frimley & Ascot LC.** *Club Run.* Contact Bob Dowman: 01252-835042.
19 **Kew Bridge Steam Museum.** *Historic Fire Engine Rally.* Information: 020-8568-4757.
19 **Leyland SME.** *Invitation Day.* Contact Alan Wilson: 01942-715072.
19 **N. W. Leicester SME.** *Running Sunday.* Contact John Elliott: 01455-847040.
19 **Saffron Walden DSME.** *Running Day.* Contact Ken Archer: 01763-852911.
19 **York City & DSME.** *Running Day.* Contact Ken Bateman: 01904-421445.
20 **STEAM: The Museum of the Great Western Railway.** *John Nutty: 'Steam on Cine Film.'* Information: 01793-466646.
21 **Chesterfield MES.** *D.A.G. Brown: Injectors - A Practical Demonstration.* Contact Mike Rhodes: 01623-648676.
21 **Nottingham SMEE.** *David Aitkin: More Hints & Tips for Rivet Counters.* Contact Graham Davenport: 0115-8496703.
21 **Romney Marsh MES.** *Electric Track Meeting.* Contact John Wimble: 01797-362295.
21 **Surrey SME.** *Bits & Pieces.* Contact John Cook: 020-8397-3932.
21 **Taunton ME.** *Traction Engine Night.* Contact Don Martin: 01460-63162.
22 **West Riding SLS.** *Barbecue.* Contact Margery Bradley: 01977-685782.
23 **High Wycombe MEC.** *Track Evening.* Contact David Savage: 01494-527402.
23 **Leyland SME.** *Mark James: Safety First.* Contact Alan Wilson: 01942-715072.
23 **Sutton MEC.** *Evening Steam-Up.* Contact Mike Dean: 0208-657-5401.
25 **Ascot LS.** *Visiting Clubs Day.* Contact Tony Alderman: 01932-854393.
25 **Basingstoke DMES.** *Open Day.* Contact Ian Shanks: 01420-561741.
25 **Chesterfield MES.** *Running Day.* Contact Mike Rhodes: 01623-648676.
25 **Historical MRS (Bristol Area).** *Chris Youett: And You Thought They Were All Clean (Part 7).* Contact Gerry Nichols: 0117-973-1862.
25 **Hornsby ME.** *Family Day.* Contact Ted Gray: 9484-7583.
25 **Old Locomotive Committee.** *AGM.* Contact Peter Gardner: 01252-541999.
25 **Reading SME.** *Childrens' Festival.* Contact Graham Bustin: 01189-615450.
25/26 **Amberley Museum.** *The All Electric Show.* Contact Derek Kilburn: 01798-831370.
25/26 **Ottawa Valley Live Steamers.** *Heritage Weekend Meet.* Contact John Bryant: 761-1109.
25/26 **Guild of Model Wheelwrights** *at Wolverhampton Steam & Vintage Show,* Wolverhampton. Contact Biddy Hepper: 01492-623274.
26 **Aldergrove Model Engineers.** *Spring Meet.* Contact Alex & Bram DeRuiter (604) 856-9420.
26 **Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243-542266.
26 **Elmdon MES.** *Running* at Museum of Transport, Wythall. Contact Chris Giles: 0121-458-1291.
26 **Harlington LS.** *Charity Open Day.* Contact Peter Tarrant: 01895-851168.
26 **High Wycombe MEC.** *Open Day.* Contact David Savage: 01494-527402.
26 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.
26 **National 2½in. Gauge Ass'n.** *Midlands Area Rally* at York City DSME. Contact Clive Young: 01233-626455.
26 **Northampton SME.** *Sunday Steam-Up.* Contact Pete Jarman: 01234-708501.
26 **Reading SME.** *Running.* Contact Graham Bustin: 01189-615450.
27 **Canterbury DMES.** *Meeting.* Contact Granville Askham: 01227-463295.
27 **Hornsby ME.** *Meeting.* Contact Ted Gray: 9484-7583.
28 **Basingstoke DMES.** *Meeting.* Contact Ian Shanks: 01420-561741.
28 **Chelmsford SME.** *Gordon Wells: Talk.* Contact D. Blake: 01376-324205.
28 **Historical MRS (East Lancashire/North Manchester Group).** *Owen Russell: Aspects of LNER Locomotive Design and Working.* Contact John Sykes: 01706-823989.
28 **Sutton Coldfield MES.** *Meeting.* Contact Roger Timings: 0121-308-5875.
29 **Historical MRS (Bristol Area).** *Modelling Practice and Techniques.* Contact Gerry Nichols: 0117-973-1862.
29 **Hull DSME.** *Auction.* Contact Brian Rylance: 01482-647032.
30 **Sutton MEC.** *Pressure Gauges Testing.* Contact Mike Dean: 0208-657-5401.
31 **Vale of Aylesbury MES.** *Track Night & Open Weekend.* Contact Clive Ellam: 01296-623433.
31 **Historical MRS (Essex Area).** *Meeting.* Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.

JUNE

1 **Dockland & E. London MES.** *Track Meet.* Contact P. M. Jonas: 01708-228510.
1 **Kew Bridge Steam Museum.** *Tower Open Day.* Information: 020-8568-4757.
1 **SM&EE.** *Competition Day and Working Model Display.* Contact David Boote: 01202-745862.
1 **STEAM: The Museum of the Great Western Railway.** *Meet the Railway Workers.* Information: 01793-466646.
1 **York City & DSME.** *Summer Meeting.* Contact Ken Bateman: 01904-421445.
1/2 **Vale of Aylesbury MES.** *Miniature Traction Engine Rally.* Contact Clive Ellam: 01296-623433.
1/2 **South Cheshire MES.** *Narrow Gauge IMLEC.* Contact Dennis Mountford: 01270-67439.
1-4 **Leighton Buzzard NG Rly.** *Locomotive Birthdays Gala.* Enquiries: 01525-373888.
2 **Ascot LS.** *Members' Steam-Up.* Contact Tony Alderman: 01932-854393.
2 **Bedford MES.** *Club Running Day.* Contact Ted Jolliffe: 01234-327791.
2 **Bromsgrove SME.** *Opening of Extended Track at Avoncroft Museum.* Contact Janet Lamb: 01905-775797.
2 **Harlington LS.** *Queen's Golden Jubilee Day Running.* Contact Peter Tarrant: 01895-851168.
2 **Leyland SME.** *Derian House Charity Day.* Contact Alan Wilson: 01942-715072.
2 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.
2 **South Durham SME.** *Steaming Day.* Contact B. Owens: 01325-721503.
2 **Talyllyn Railway.** *Tom Rolt Vehicle Rally.* Enquiries: 01654-710472.
2/3 **Chesterfield MES.** *Steaming at Papplewick.* Contact Mike Rhodes: 01623-648676.
2/3 **Talyllyn Railway.** *Fifties Weekend.* Enquiries: 01654-710472.
2/3 **Guild of Model Wheelwrights** *at Newstead Abbey,* Ravenshead, Nottingham. Contact Biddy Hepper: 01492-623274.
2-4 **Vale of Aylesbury MES.** *Golden Jubilee Weekend.* Contact Clive Ellam: 01296-623433.
2-4 *Strumpshaw Traction Engine Rally* Strumpshaw Park, Strumpshaw, Norwich, Norfolk.
3 **Historical MRS (London Area).** *Meeting.* Contact John Millbank: 0208-948-0556.
3 **Stockholes Farm MR.** *Queen's Golden Jubilee Running.* Contact Ivan Smith: 01427-872723.
3-5 **Elmdon MES.** *Running* at Museum of Transport, Wythall. Contact Chris Giles: 0121-458-1291.
4 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
4 **South Durham SME.** *Meeting.* Contact B. Owens: 01325-721503.
4 **Taunton ME.** *Meeting.* Contact Don Martin: 01460-63162.
4 **West Wiltshire SME.** *Steam-Up at the Great Bulkington Railway.* Contact R Nev. Boulton: 01380-828101.
5 **Bristol SMEE.** *Peter Bashford: Aircraft Development.* Contact Trevor Chambers: 01454-415085.
5 **Hutt Valley MES.** *David Grant-Taylor: Geothermal Technology.* Contact Gavin McCabe: 567-4487.
5 **West Wiltshire SME.** *Steam-Up.* Contact R Nev. Boulton: 01380-828101.
6 **Leyland SME.** *Diesel or Electric Outline Traction Topics.* Contact Alan Wilson: 01942-715072.
6 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
6 **Sutton MEC.** *Bits & Pieces.* Contact Mike Dean: 0208-657-5401.
6 **Talyllyn Railway.** *Chris Awdry's Duncan's Day.* Enquiries: 01654-710472.
7 **Vale of Aylesbury MES.** *Track Night.* Contact Clive Ellam: 01296-623433.
7 **Maidstone MES.** *Evening Run & Jacket Potatoes.* Contact Martin Parham: 01622-630298.
7 **North Norfolk MEC.** *Michael Haynes: Risk Assessment for Model Engineers.* Contact Gordon Ford: 01263-512350.
7 **Portsmouth MES.** *Bring & Buy.* Contact Bob Aldred: 023-92-523366.
7 **Rochdale SMEE.** *Meeting.* Contact Mike Foster: 01706-360849.
7 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
8/9 **Amberley Museum.** *Collectors' Weekend.* Contact Derek Kilburn: 01798-831370.
8/9 **Cardiff MES.** *12th Welsh Miniature Locomotive Rally.* Contact Trevor Jenkins: 029-20755568.
8/9 **Harrow & Wembley SME.** *Open Weekend.* Contact Dr. Roger Greenwood: 020-8427-2755.
8/9 **Melton Mowbray DMES.** *Whissendine 2002.* Contact Phil Tansley: 0116-2673646.
8/9 **West Riding SLS.** *Club Rally.* Contact Margery Bradley: 01977-685782.
9 **Birmingham SME.** *Summer Gala.* Contact John Walker: 01789 266065.
9 **Guildford MES.** *Running Day.* Contact Dave Longhurst: 01428-605424.
9 **Leeds SMEE.** *Steaming Day.* Contact Edwin Hughes: 01757-707454.
9 **Plymouth MSLS.** *Running Day at Plym Valley Railway.* Contact John Brooker: 01752-671722.
9 **Sutton MEC.** *Track Day.* Contact Mike Dean: 0208-657-5401.
9 **Guild of Model Wheelwrights** *at Worcester County Museum,* Hartlebury Castle, Kidderminster. Contact Biddy Hepper: 01492-623274.
9- 14 July **Talyllyn Railway.** *Talyllyn Vintage Train.* Enquiries: 01654-710472.

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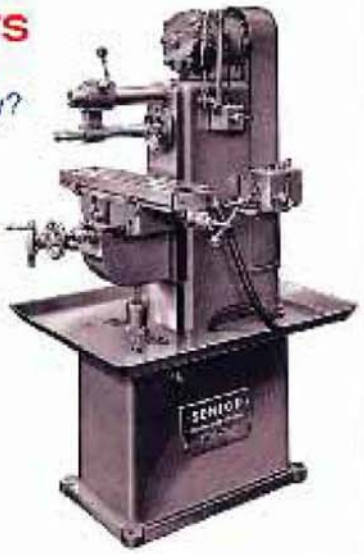

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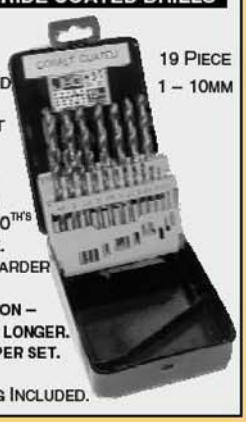

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BRITAIN 15" rep-alternative, 6 station turret, clutch brake, approx 60 collets ..... Appointed £1,250
GOLDCHESTER CHIPMASTER 5" c 20", gearbox, variable speed, 3 jaw chuck, face plate, 4 way tool post ..... Just £950
GOLDCHESTER RANTAN 1800 centre, 5" c 20", gearhead, power f+o/b, gearbox £1,600
GOLDCHESTER RANTAN 2000, 6½" centre height c 20", bed between centres, 11½" bore, 16 speeds, D1-6 camlock drilling & 1¼ jaw chucks in very nice condition £2,250
GOLDCHESTER STUDENT, 6" c 24" gearhead, variable partial gearbox, metric cut ch, coolant £1,150
GOLDCHESTER STUDENT Square Head, 1500 Range 12 speed Motor Model, Gearhead, Gearbox, Imperial, Power Cross Feed & Gap Bed, Dual Dial + 2 Jaw Chucks, Taper Turning, Coolant, etc £2,950
GOLDCHESTER STUDENT 1220 6" c 40" + gap bed, 19" swing, 2 + 4 jaw chucks, distance tooling, taper turning, dial indicator, coolant, splash back, very nice, extra data £2,450
GOLDCHESTER MASTER 618" c 20", 3 gears gearhead, power f+o/b, gap bed ..... Nice Order £1,625
GOLDCHESTER TRIUMPH 2000 7½" c 50" Full 6 screwcutting Gearbox and Power Feeds, Gap Bed, 2/4 Jaw Chucks, distance Tooling, Faceplate etc + ... In very nice order £5,950
GOMEZ LS 90 Lathe ..... Mint + Original Unit £775
DENFORD 280 5" c 20", 3 jaw chuck, 6 way tool post, dual dials £950
HARDINGE capstan lathe ..... As New £695
HARRISON L5 40" c 20", fully tooled + complete with clutch £950
HARRISON L5 6" c 24", gearhead, gearbox, excellent colour machine ..... From £950
HARRISON M40, 5" c 24", 3 jaw chuck, gap bed + power f+o/b, clutch £1,400
HARRISON M40, 5" c 24", swarf guard + c, gap bed, 2 and 4 jaw chucks, tooling ..... 200 + dis low new £2,250
HARRISON M40, 5" c 24", gearhead, clutch c, gap bed, power f+o/b, tooling + coolant ..... Very Nice Order £1,725
HARRISON M40, 5" c 24", gearbox, gap bed 3/4 jaw chucks, tooling ..... 200 + dis low new £2,450
MYFORD ML10 24" c 12", change wheels, 3 jaw chuck, headstock collet ch £750
MYFORD ML7 24" c 15", change wheels, 3 jaw chuck, new + large selection of lits popular cabs ..... From £750
MYFORD ML7R 22" c 15", gearbox, 3 jaw chuck etc £1,250
MYFORD ML7 24" c 21", change wheels, 3 jaw chuck £1,125
MYFORD SUPER 7 24" c 15", change wheels, 3 jaw chuck ..... Choice £950 – £1,150
MYFORD SUPER 7B 22" c 15", gearbox, 3 jaw chuck £1,250
MYFORD SUPER 7 24" c 21", change wheels, 3 jaw chuck ..... Choice £1,600
MYFORD SUPER 7, 24" c 15", 3 jaw chuck, power cross feed, tailstock ..... Choice +
MYFORD SUPER 7B, 24" c 15", gearbox, Power Cross Feed, cabinet stand, tooling £2,750
MYFORD SUPER 7B, 24" c 21", (long bed) power cross feed, Industrial hardened bed, Industrial stand and doors, green machine £2,950
RAGLAN CAPSTAN 10" c 24" 6 station Turret, Quick Slide, Collet Chuck (per set) & collets, Bar Feed, Variable 6 speed, Coolant £975
TAYLOR SPINNING Lathe 7" c 20", 6 speed motor ..... Nice Order £750
WIGHOW TDS 1 GB 5" c 20", gearbox, power slides, 2 screwcutting tailstocks £1,250

TOO MANY LATHES TO LIST!!

MILLING MACHINES ..... V – Vertical, H – Horizontal

AGERA R2 Universal Toolmakers precision mill, Table 24" c 6" + screwcut leadscrew + collets ..... Just In £650
ADCOCK AND SHIPLEY 825 Horizontal/Vertical Head, 20" c 6" power feed table + hand feed gears, coolant £1,625
BOXFORD VMB5 variable speed 2200MT head, table 30" c 6" + Starrett leadscrew, collet chuck £1,950
BRIDGEPORT Series 1 - 2HP Variable speed Richard power quill head, table, 42" c 9" £2,950
BRIDGEPORT Belt head 2 speed (short end or) head R/C powered head, variable speed 42" c 9" table ..... Very nice + £1,250
GENTEG S2 Horizontal, 1" arbor, belt + powered, 2 phase c/w, single phase motor £725
GENTEG S2 Vertical/Horizontal, quill + 4 SMT head, 25" c 5" table, pedestal model £1,400
ELLIOTT Turret mill RN40 speed 70-4000 rpm, table 45" c 10" power feeds £1,500
EMCO FB2 Vertical 6 speed quill head 2 MT, power feed 21" c 6" table, full coolant tray and cabinet stand and new 2 MT collet chuck ..... Very nice + £2,250
HARRISON horizontal, 24" c 6" power table ..... New £2,250
HARRISON M4 20 tri swivel head R/C clutch, 20" c 6" table powered ..... 240 + dis low new £2,650
HARRISON VERTICAL 20 tri swivel head R/C clutch 20" c 6" table powered ..... 240 + dis low new £2,495
RAGLAN VERTICAL MILL 2 Morse taper, 2 speed motor, matching colour 9" x 5" 2200 RPM, cabinet stand £1,150
SIP PF20, drilling/milling machine ..... New £799
TOM SENIOR MH horizontal, 25" c 6" power table, 1" arbor £775
TOM SENIOR MH VH, 25" c 6", 2 screwcut taper, 1" arbor ..... As New + £1,200 – £1,450
TOM SENIOR TYPE 2 screwcut taper quill feed vertical head 22" c 6" table + end fed, coolant ..... Excellent £2,250
TOM SENIOR ELT MAJOR, 2 screwcut taper quill + end feed, powered 22" c 6" table in extremely nice condition £2,250
TOS FOSAV vertical turret mill, 40 MT, 54" c 10" table, power slide ops £1,950
WIGHOW AEW vertical mill, 20 tri swivel head, powered table 24" c 6" ..... Very Clean £1,625

DRILLS

ASQUITH 14-54 001 MK2 (Smt) Radial Drill ..... Immaculate + tooling inc £2,950
POZGO 4" Bench Drilling Table £225
POZGO 4" Pedestal drilling table £245
WIZDOM GS 4" pedestal drill £245
WIZDOM GS 2 Morse taper pedestal drills ..... Choice £275
WIZDOM GS MF 210 6 speed SMT Bench 210 roller drill £350
POLLARD GOTCHA Pedestal Drill ..... From £300
SIP HDP 600E 16" Bench Drill ..... New £175
STARTRITE MB 5 GUARY 5" c 4 speed bench drill £225
STARTRITE Mercury 2" pedestal drill, 240 volts ..... As New £2,000

GRINDING / BUFFING

BRIEN LEVER 12" x 6" Drill Point Grinder £245
BRIEN LEVER 12" x 6" Drill Point Grinder £625
CLARKSON MK1 Tool and cutter grinder ..... Choice £750
EAGLE MODEL 4W MK II 24" c 6" table with 14" c 6" magnetic chuck + dial indicator £1,150
JONES AND SHIPMAN 540 Surface Grinder & Magnetic Chuck ..... Ex College/New no + o/d £1,650
MILFORD 12" Pedestal Grinder £225
P.L.H. Drilling Machine, pedestal + o/d £225
SUPERIOR Surface Grinder ..... As New £750
WIGHOW Grinder, pedestal + o/d £145
WIGHOW Buffer, pedestal + o/d ..... Each £250

MISCELLANEOUS/FABRICATION MCH.

SMART AND BROWN Lever Operated Saddle Rotary Table £275
GYRATTE 12" c 12" Surface Table £70
TAYLOR HOBSON Model A Engraver £245
UDAT Bench Tapping Machine £225
VERTICAL SHEAR Folder ..... Just In £125
TRIUMPH Collet Chuck plus 15 suitable + Collets ..... As New £225
TRIUMPH BURNERD 4 Jaw Chuck £245
ANGLO GO drilling head + tripod £250
GHA Die Grinder plus Collets and New grinding Wheels £275
VAN GO Lathe ..... Very Nice £215
ESSEX Hardness Tester Type R £125
GBO Micro Mag 04 ..... Reduced
EDWARDS Lightning Rolls, 24" Bench model £215
MARSO Knocking Press + stand 2 speed £625
JONES AND SHIPMAN Knocking Press + stand £275
GLARKSON Drill Point & Tap Lead Grinder ATT ..... As New £625
GLARKSON Mini Radius Grinder ATT ..... As New £625
GLARKSON Air Bearing Rail + Grinding ATT ..... As New £975
TAYLOR HOBSON MODEL K Engraver ..... Stands £1,000
ADE Inverter A.C. hp and or, wire up £250
FLAMERAST moulding bench £100
SIP 7" bandsaw, horizontal + coolant ..... New £250
WELLSAW HACKSAW ..... Child + £245 – £265
RED DEPORT CHERRY Right speed drilling head £625
MYFORD drilling head £225
STARTRITE SG 250 oil-sil saw £250
DUPLEX D29 tool post grinder £245
EDWARDS cast iron set rails £225
ROCKFORD (imperial only) thread dial indicator £65
TOOL (draw type) cabinet ..... make use £150, £245 – £325
HOFFMAN HOBBY TABLES ..... Selection
ARMOD 6" universal machine vice ..... each £45
BURNERD, D1-6 3 jaw grip/su chuck £245
WAHGO, 1" lift hydraulic jack + extractor £495
BURNERD, D1-4 lever collet chuck + collets £400
BURNERD, lever collet chuck + collets £400
GINGHATT, drilling head ..... as is £200
TOM SENIOR Mill / major (round column only) £250
VERTEX Drilling head ..... New £215
VERTEX 6" - 8" - 10" rotary table ..... New From £125
BOXFORD Turret attachment 4 1/2" + quantity of drill chucks £625
MYFORD ML7 / Super 7 rear tool post £40
MYFORD 254 Rear tool post £40
MYFORD Vertical slide tilt + clapp £250
OLIVER - ADRIAN FILER ..... As new £475
LOCKWOOD QUAD HEADED 3/4 D bit Holder ..... New £40
LOCKWOOD QUAD HEADED 3/4 D bit Holder ..... New £40
LOCKWOOD Tool Bar / 3/4 Boxed New £25
LOCKWOOD Tool Bar / 3/4 Boxed New £25
HOLDWIN 6" machine vice ..... Very clean £215
MAGNETIC chuck - 10" c 6" line pole ..... Never used £225
TOM SENIOR Model E pedestal Stand £150
UNION tool and cutter grinder stand £125
HARDINGE Capstan type tool post (Bath type) £175
HARDINGE Collet set, bed stand, stand and motor £150
POINT Tooling, 6 sided ..... Just In
STARTRITE 252 Woodworking Band Saw £975
STARTRITE M-55 Woodworking Band Saw £775
ALGOSA GF 60M Rapid Melting Furnace £200
FLAMERAST CRM 6000 Rapid Melting Furnace £125
GARRO RF 150-3 24" Box and Pan Gamut Use Folder £225
MYFORD Burned Gap to 2 Jaw Chuck ..... Boxed £250
GOLCHESTER HARRISON D12 Burned 4 Jaw 4" Light Body Independent chuck ..... Boxed £175
RUN 4" Lathe / Vertical (Built in Extraction) £225
KASSNIT sewn (garlined) ..... Small £100
KASSNIT sewn (garlined) model 2502 ..... £225
KILNS various ..... £200 Mid £25
TAPPING HEADS 1-12 Morse + Taper ..... 6 selection Just Arrived
MI GROMASTER 5 and accessories + securing kits ..... All packaged as new
POTTERY WHEELS, Mins and accessories + equipment ..... Just In Cheap
SPRAG Powder type press £225
ELLIOTT Horizontal and Vertical drilling head R. 2 jaw chuck £225
HARRISON L6 Taper turning attachment £225
HARRISON L6 Metric Gear Box ..... As is £250
HARRISON L6 Tailstock £245
NEW FRONTIER IDEAL ANC - Machine vice, 55 mm. Jaws precision miniature type Machine vice tailstocks and smaller milling machines £65
STARTRITE MB 250 Horizontal bandsaw, 1997 machine ..... As new £2,250
SIP 1 TON MOBILE CRANE Manufactured 2000 ..... As new £275
MYFORD SAW TABLE for ML7 – Super 7 ..... £140
METROVO Grade A set of slips £245
MARUGO KNURLERS (deep type) £75
F.J. EDWARDS 24" tool cutter £625
RECORD NO 51 quick release bench vice £90
LINK 1.5 tonne mobile crane + top hat £625
METROVO 100/312 Grade A slip gauges £275
GOLCHESTER HIGHMASTER RANTAN turret capstan attachment £975
NORTON EDWARDS Arbor press ..... £225 LEAVES
AJAX 6" Hacksaw £625
SURFAG Spirales low 12" c 12" to 36" c 36" ..... Very Nice low £20
KEESTONE 48 blade holder 16g £250
WEEKEND 2.5 ton mobile garage crane, blue colour £495
UNION 4 1/2" c 20" bench centres £175
HARRISON L5 Vertical slide ..... New or use £245
ELLIOTT 1250 STUDIO MILL vertical head ..... One off (new) £625
FUJI Finisher 6" slide bed, pedestal £245
STEEL STOCK Just arrived – to callers only
ELLIOTT VH/AE 6 drilling head £975
SWAGER BLOCKS ..... £125 LEAVES
JBS Universal Grinding Vice ..... Choice £225 LEAVES
BOX TABLES Grade A and B, examples ..... £10 – £250
SLIPS/GAUGES Metric/Imperial, New Grade; 87 Kit pieces ..... £225 LEAVES
HORIZONTAL METAL BAND SAW 6" c 6" capacity ..... New £750
KASHET Mini Furnace ..... Each £75
GOLCHESTER STUDENT MASTER Round head, face plate, scale gauge ..... £595 LEAVES
GAUGERS AND SMITHS Hacksaw £245
BORING HEADS 32 Morse, R8 Taper, Max. Cap 4" ..... New, each £90
ANVIL, 1 on 1 on stand £125
ODDIE Machine Bed Clamps (pair) ..... Appointed £4.50
HEIGHT GAUGES by Chesterman, Starrett, Moore and Wright ..... Price £85
ELLIOTT VMH Graphic 10" Index £225
DIE BOXES ..... Price £85
TRANSWAVE SHP Converter ..... New £225
TRANSWAVE SSHP Converter ..... New £325
TRANSWAVE TSK - FIT rotary converter ..... From £525
CROMPTON PARKINSON 25 HP, multi belt mount, Rockwell type 7 Type motor ..... New £140
BARLOW CRANK MODEL MK1 SB ..... Middle £275

COMING IN; SMART and BROWN 1024 Lathe, FLOTT 12 Speed bench Drill.
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