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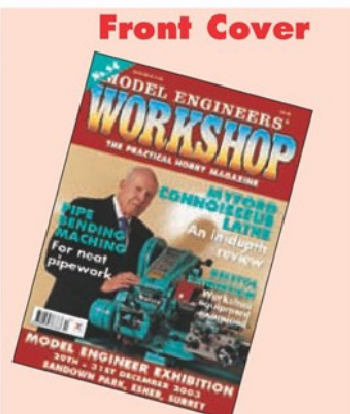
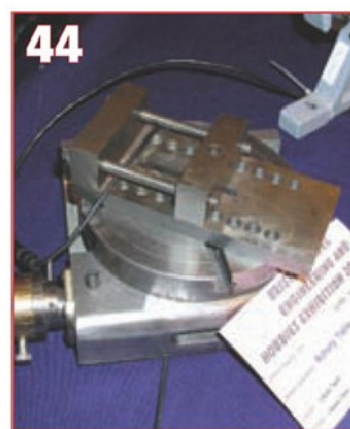
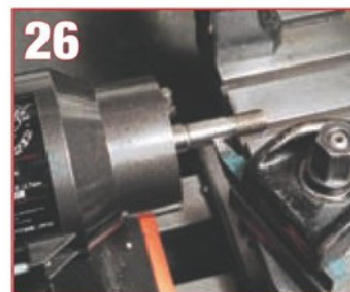
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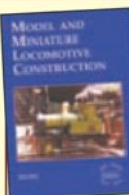
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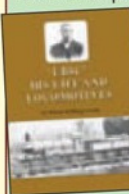
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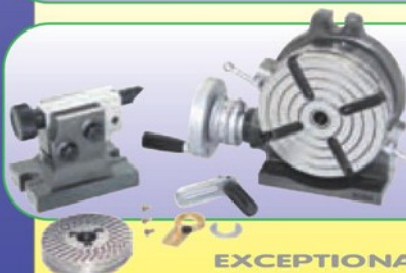
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An easily fitted variable speed control for your lathe or miller

CL Range



Getting the right speed for the job can be a tedious and time consuming job, changing belts and pulleys - and even then, the bottom speed can still be too high for some operations.

Now, with Newton Tesla ready built speed controllers, you get smooth, continuous speed control, with motor speeds from 1150 to 1800rpm.

All CL and ML Controllers are supplied complete with a new, high torque, variable speed motor that fits directly onto Myford and other lathes of up to 1HP. These motors are to the Imperial "56 frame" and have a 0.625" diameter shaft, although metric motors can be supplied, on request, for other machines.

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Designed originally for all Myford ML7, Super 7 and Super 7 Plus lathes, they are suitable for virtually all machines including Tom Senior, Raglan, Colchester and Drummond, and for woodworking lathes too.

PRICES (inclusive of VAT)

CL400 with 0.5HP motor	£390
CL750 with 1.0HP motor	£425

CL range features start, stop and emergency stop buttons and speed control with forward, reverse and jog.

ML370 with 0.5HP motor	£464
ML550 with 0.75HP motor	£499
ML750 with 1.0HP motor	£515

ML range features start, stop and emergency stop buttons, jog button and speed control with forward and reverse.

UK mainland delivery £18.

ML Range



The Newton Tesla system is based on technologically advanced Mitsubishi single-to-three phase inverters. All systems are provided complete with a matched 3-phase motor ready to mount, plug in and go. All are designed to work from single phase 220/240V, 50/60 Hz domestic mains supplies.

In addition to smooth control, giving chatter-free operation, the controller ensures that once you have set the motor speed, it automatically compensates for the cutting load, giving high torque even at low speed. The system also incorporates complete electronic motor protection.

The New CL Range

The CL Controller range has been introduced to give savings in space and cost. They feature the same high torque motors as the ML range but incorporate a new, compact inverter giving a depth of only 88 mm.

The ML Range

With a proven track record of over 500 units sold worldwide, the ML range are perfect companions for Myford type lathes and give the ultimate machining performance. They also exhibit excellent starting characteristics, giving up to 300% full load motor torque at 3Hz, through using flux vector control technology.

About Newton Tesla

Established in 1987 by George Newton, the company is a major supplier of AC and DC variable speed drives to industry, handling power ratings of up to 750KW and 11,000V. Newton Tesla engineers travel throughout Europe, troubleshooting in factory automation and speed control.



NEW CL RANGE!
Lower cost, more compact version available now!



What Our Customers Say

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Brian Nicholls
Myford VMC Miller

I have just unpacked and tested my new motor and drive WOW! So smooth and controllable, with slow spin up and variable speed. And so very quiet.

Alan Patching
Myford Super 7

I was very impressed with the service I received from Newton Tesla It was very good value for money.

Derek Toller
Colchester Student Lathe

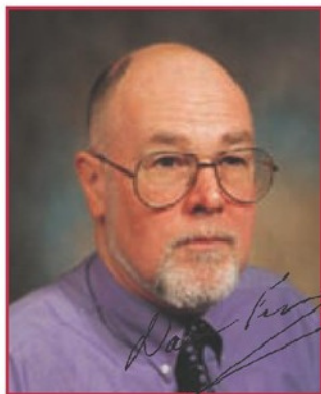
Call us now for more information and friendly advice on 01925 444773 or visit www.newton-tesla.com

NEWTON TESLA

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Newton Tesla (Electric Drives) Ltd, Unit G18, Warrington Business Park, Long Lane, Warrington, Cheshire WA2 8TX, UK
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ON THE EDITOR'S BENCH

Reader Survey

Looking over the results of the reader survey, reminded me of some of the comments offered in my inaugural editorial column (MEW Issue 79), with particular regard to the aspects of balance. Four dimensions of balance were considered, engineering expertise, technology, workshop equipment, and workshop purpose. Out of the survey, there did indeed come some critical comments and suggestions relating to each of these balance considerations, however it was also instructive to read these in conjunction with the information given relating to hobby interests and other magazines purchased. While there are indeed those readers who would wish to see an end to computing and electronics content, some 12% show this as an interest, followed by 9% car, 8% rail, 6% photography, 6% motorcycle, 5% woodwork, 4% planes, 3% boats, and 2.5% shooting. Principal workshop activities run as 37% workshop equipment, 27% engineering models, 9% other models, 8% clocks, 8% vintage transport.

The responses to the questions on principal workshop machinery and most recent purchase, again illustrate the wide variety of facilities, and perhaps a growing acceptance of larger machinery in the amateur setting, (numerous entries of lathes 6-8 in. and mills of Bridgeport size and larger). The occurrence of DRO systems under "Most recent purchase" may be taken as evidence of their increasing popularity.

Harking back to the question "How do you rate Model Engineers' Workshop magazine, it was further subdivided and the percentage response was as follows:

	Very Good	Good	Fair	Poor
Types of article	43	52	5	-
Quality of articles	45	52	3	-
Quality of drawings	44	48	7	-
Balance between complex and simple	27	61	11	1
Overall quality of MEW	55	42	3	-

While, as has been stated before, "You can't please all of the people all of the time", it does indeed appear that the team involved in producing this magazine is managing to please a majority of readers

for most of the time. In this context, we must place at the forefront of the "Team", our many contributors; it is the quality and variety of the articles offered for publication that in turn make MEW possible.

Another machine for the workshop

Of course it's all Tom's fault, as it was he who phoned to enquire as to what I knew about Emco F1 cnc milling machines. The answer, in short, was nothing. He then went on to elaborate that he and fellow club member Alistair would be going to look at two of these machines on the following Saturday, and yes there was a spare seat in the car if I was interested.

The journey took us past Haddington (south of Edinburgh) to visit Doug. Cameron, a machinery dealer who works on the basis of "No fancy premises, promises, or prices". It's a formula which seems to work as his business continues to thrive while many others north of the border have fallen by the wayside. Much of the stock was of course, heavy industrial kit, but amongst the much larger equipment were the two Emco F1's also a small Emco cnc lathe, and three Denford Orac cnc lathes, most powered up for demonstration.

The outcome, following coffee, biscuits, and a bit of horse trading was that Tom acquired an Emco F1 and an Orac, Alistair settled for the second F1 and the small Emco lathe, and my own workshop has now seen the addition of an Orac. For the benefit of those who (as I was) are unfamiliar with these machines, they were all originally marketed mainly to schools and colleges for cnc training purposes, are all very much "bench size", and therefore easily accommodated in the amateur setting. All of the machines acquired, run on single phase power, have the axes powered by stepper motors, and are equipped with ball screws. At some stage in the future, when we have all gained some experience with the new acquisitions, it may be possible to compile a form of review. It may well be that, following the example set by Dick Stephen, the control software could be upgraded, now that quite sophisticated CAD/CAM systems are becoming available at affordable prices. Certainly first impressions are that these machines were all built to a good quality standard, and are now appearing on the market at a fraction of their original price, having done relatively little hard work. Doug Cameron can be contacted on 01620 860 871 or see the website www.cammach.co.uk.

Thunder in the glens

This year marking a century of Harley Davidson motorcycles, it was not surprising that the annual gathering of the Harley Owners Group should be something special. Centred on Perth (unlike previous events at Aviemore), the event played host to many hundreds of these machines, some looking straight from the factory, many having been heavily customised, but all immaculately presented. This is clearly an organisation that knows how to set up enjoyable social occasions, with the week end entertainment including performances by a Freddy Mercury look-alike, Nazareth, and Suzy Quatro.

I have to confess that in my motorcycling youth, I always thought of these machines in almost the same light as a caricature of an elderly American, thirsty, overweight and sluggish. Having chatted to a number of owners, they all emphasise that for long distance effortless touring, the big Harley has few equals, but I haven't been sold one yet. One other point of interest; prior to the gathering, many prophets of doom warned of the expected noise and anti-social behaviour to be expected of bikers. Comments afterwards by police and local politicians have however been extremely complimentary, and the city seems keen to accommodate them next year.

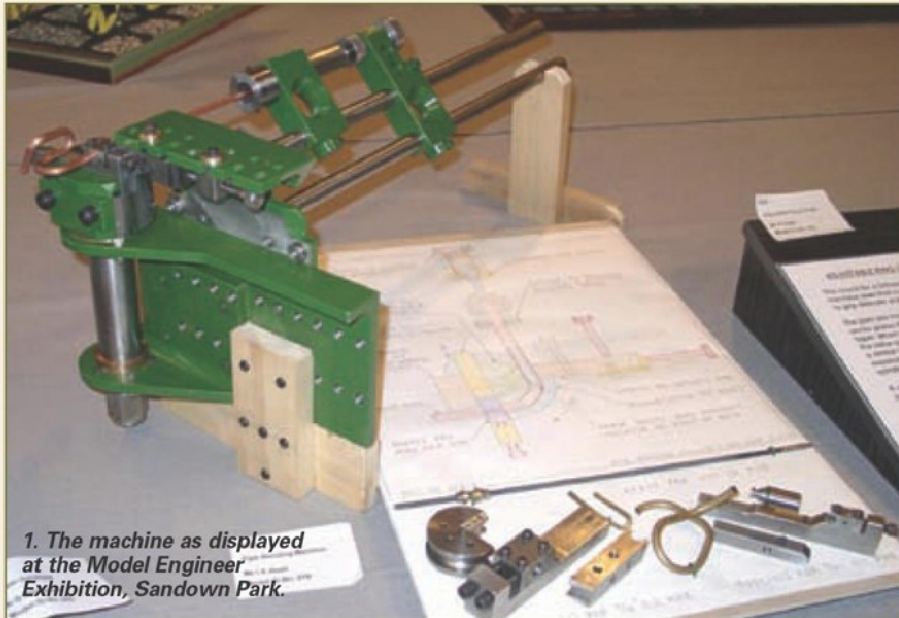
Model Engineer Exhibition

I have, in the past, commented on the low number of competition entries in the workshop equipment category, and the tendency for entries to be in "Exhibition finish". Letters from readers have made various observations, some preferring to avoid the pressure of competition, others indicating that while their items of tooling etc are fully functional, they lack "Exhibition finish", and hence they prefer not to compete.

In conversation, Chief Judge, Ivan Law has commented that workshop equipment should simply have an "appropriate" finish. It is also noted that each year various trophies are simply not awarded, because there are no entries matching the criteria. One such example might relate to workshop equipment produced by an "under twenty-five year old".

Those who don't wish to be involved in competition, might wish to consider exhibiting in the Loan section. There are many good ideas and ingenious devices lurking in workshops, hidden under bushels, which deserve a wider audience.

CONSTRUCTIO BENDING M



1. The machine as displayed at the Model Engineer Exhibition, Sandown Park.

Ian Hunt shares the secrets and describes the construction of this unusual design which was awarded a Silver Medal and the Bowyer-Lowe Challenge Cup at the 72nd Model Engineer Exhibition

All the drawings are third angle projection. The dimensions are shown to three places of decimals, but this does not mean they must be accurate to a thou. Limits on dimensions are not mandatory, but indicate the quality of fit required with the mating part. This can be made to suit and is cross referenced on the drawing. I still have my original 1947 Myford ML 7 and will assume all the turning and boring can be done on a machine of this size. The methods used for milling will depend on whether the machine is vertical or horizontal and the tools you have available.

Construction

Main Fabrication - Detail 1.

You will need a 24in. length of 6 x 3½ inch angle section ⅜in. thick or preferably ½in. thick to make details 1. & 2. Check for squareness and brush off any rust. If it is very rusty consider a visit to your local shotblaster. My last visit cost £5 for a

Most of my working life was spent on the design of tools, machines and plant for the manufacturing areas of Rolls Royce Limited. On occasional visits to the pipe shop, two hydraulically operated pipe bending machines were to be seen producing very nice bends in thin wall stainless pipe, better than anything I could produce in my home workshop. The essential feature was a bullet shaped arbor fixed inside the pipe to prevent it collapsing at the point of bend. There is nothing progressive in this method as the pipe goes from straight to fully bent as it slides over the bullet head at this point. You cannot go back and bend it a bit more.

This idea just went into the memory bank we all have of things you know and after thirty years of locomotive, clock and toolmaking and a few unbent pipes waiting in the workshop, it seemed the long intended provision of a pipe bender using this idea, was about due.

In 1989 I produced a one sheet arrangement drawing for my own use to meet the following specification:-

1. Easy to make in home workshop
2. No castings
3. Bending capacity up to ⅜in.
4. Mounts in bench vice to use
5. All clamping to use socket screws
6. Special tooling to be simple and easy to make.

The finished machine can be seen in the photos 1& 2. It weighs 36 lbs and I usually store it separated into its front and rear subassemblies. It has been on our club stand at the Midlands Exhibition several

times but not elsewhere until entered in the Sandown Park Exhibition last year. I needed a sample pipe for the exhibition so using ⅜in. x 22 S.W.G. annealed copper pipe, and the smallest former available, produced 90 & 180 degree bends with the pipe at mid bend only 0.004in. out of round. The diameter of the former was 0.418in. and the pipe opened out by 0.007in. when released. This was achieved without trouble or experimentation and indicates that an even tighter bend could be made using a smaller former.



2. Located as intended in a bench vice

CON OF A PIPE MACHINE (1)

spade and a casting. Put aside a 6.25in. length to make detail 2. and cut to make both pieces of detail 1. Machine the outer faces of both pieces starting with the large face and making the small face square to it. If your material is only $\frac{3}{8}$ in. thick, remove only a minimum amount. I used flycutters to machine all the flat surfaces rather than ruin cutters on all that millscale. They are easy to sharpen, and in my opinion, give a better finish than any cutter with more than one tooth. If you have access to a big lathe with faceplate and angle plate consider this as an alternative method.

Machine part of the inside surface of the larger piece to make a seating for the smaller piece and fix together with the four screws. Check that it is parallel across the 5.500in. dimension before drilling and reaming the dowel holes.

Next, treat the assembly as one piece and mark out on both sides the 1.875in. bores, the surrounding profiles and any remaining unfinished edges, also the 2 BA holes near the large bores. Separate the parts and finish both except for the large bores, these should be drilled, sawn and filed to about 0.100in. undersize.

Reassemble for the last time, fitting the locating dowels and being sure the four screws do not protrude from the back face. Drill and tap the 20 holes. Now to finish the 1.575" bores. Any lathe of 20 inch swing can bore these on its faceplate, clamping on the flat side. On a horizontal mill, 5.5inch cross travel is a bit excessive for a small machine, but it might be within the vertical travel of a small vertical mill.

My preferred method would be to use a tool bit in a bar mounted between centres, clamp the part to the lathe cross slide and use the longitudinal traverse to bore both holes in line. You would need a bar about 1.5in. diameter x 13in. long with the tool bit in the middle. Alternatively, a short bar 8in. long with the tool bit near one end could bore one hole and be turned end for end for the second hole. If the spindle rotation is reversed, you would not have to reset the tool bit to face the other way and should get both holes exactly the same size.

If using a Myford in this way you can clamp through some of the tapped holes as these line up with the pitch of the cross slide tee slots. The part also needs lifting by one sixteenth of an inch but clamping on a piece of 16 S.W.G. sheet would be near enough.

Bushes

Two bushes are needed to fit in detail 1. and their bores should be the same size because the bending spindle must fit from either end. Mark out and drill 4 BA tapping size the 3 holes through the flange, but do

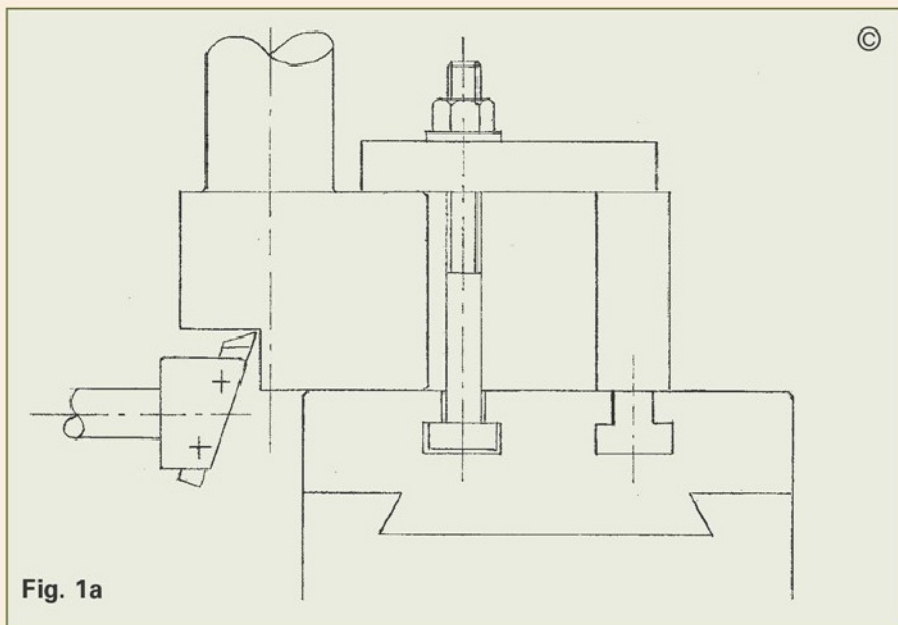


Fig. 1a

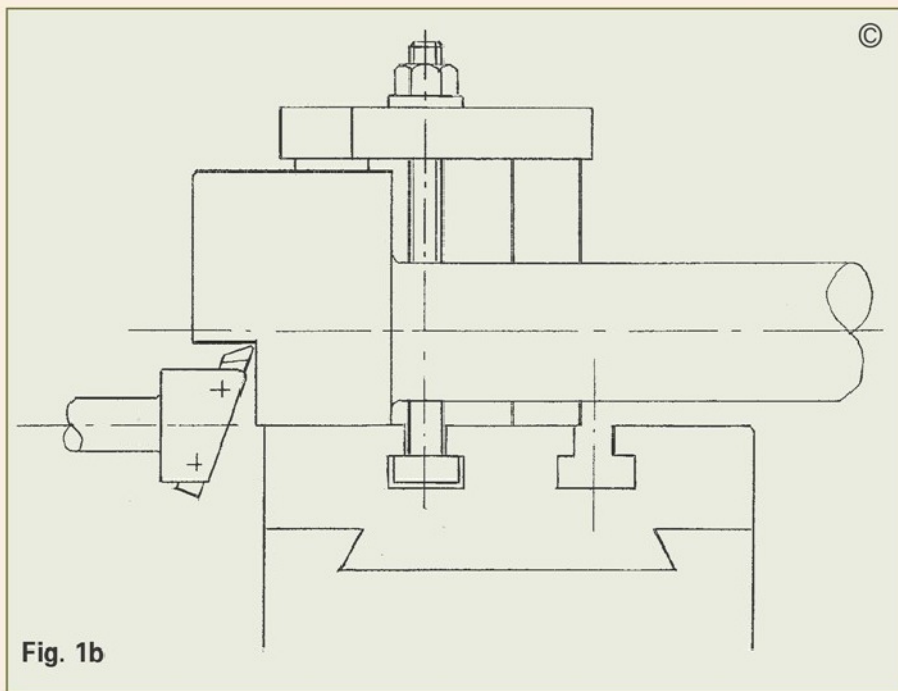


Fig. 1b

not tap until you have used each bush to spot through the position of the clearance holes in detail 1.

Mine are bronze but cast iron, brass or aluminium will do. Make sure the ends of the screws are below the bearing face.

Spindle

The bending spindle (Detail 12) is the most complicated of all the parts and a big lump for a small lathe.

When I moved from production to a small toolroom, aged 16½, I found their machinery included four lathes. Two Southbends, the largest and smallest of their range, a 1920's vintage American geared head lathe made by Sebastian, a company unknown to me then and unheard of since, and a large gap bed lathe with a 4 foot faceplate. This machine was on its way to the scrap dealer from its previous home when it was intercepted by our foreman who was something of an

ALTERNATIVE POSITIONS
OF SPINDLE & ARBOR UNITS

3.090 (USE DET 13 TO ADJUST)

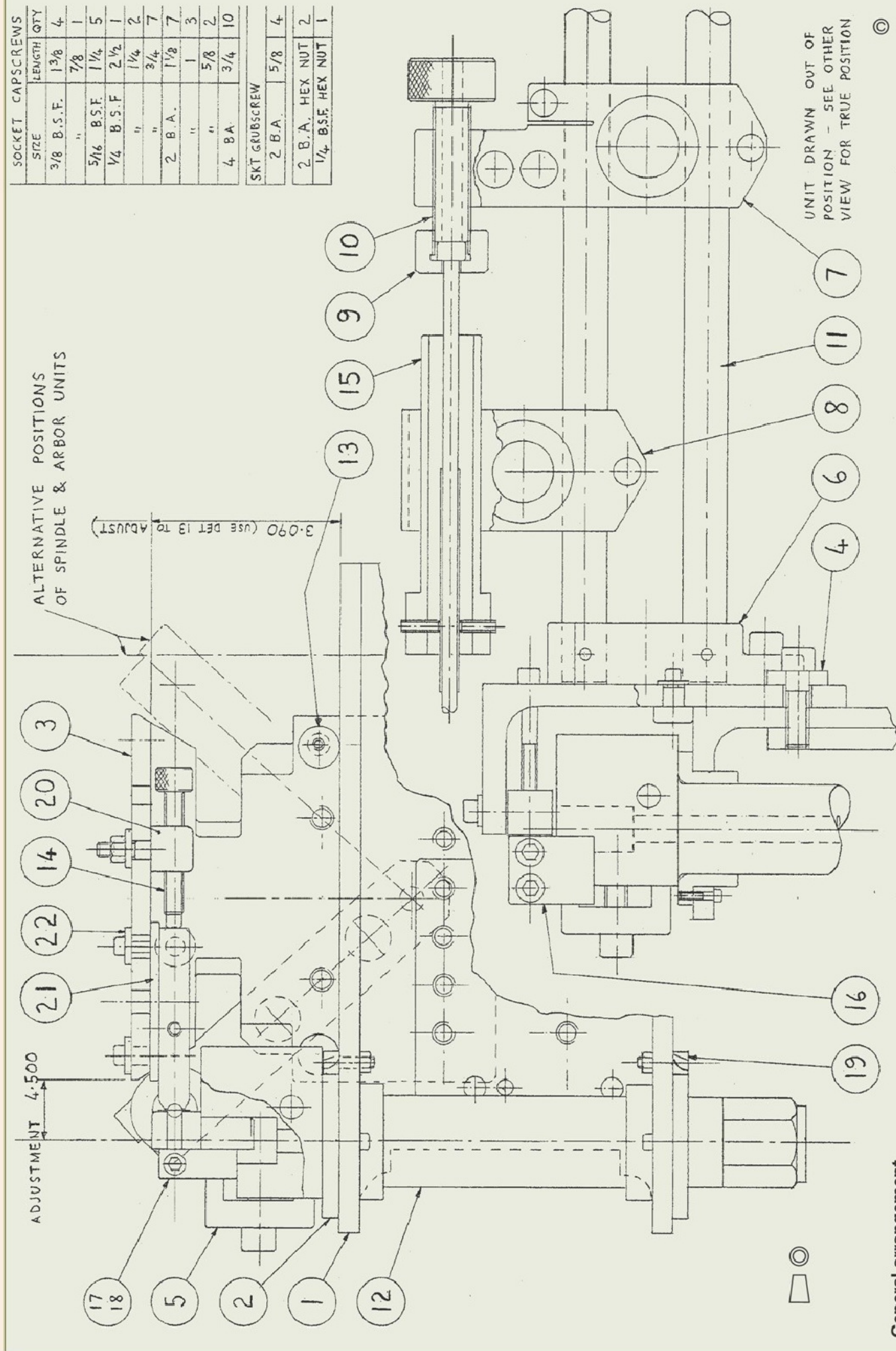
ADJUSTMENT 4.500

SOCKET CAPSCREWS		
SIZE	LENGTH	QTY
3/8 B.S.F.	1 3/8	4
"	7/8	1
5/16 B.S.F.	1 1/4	5
1/4 B.S.F.	2 1/2	1
"	1 1/4	2
"	3/4	7
2 B.A.	1 1/8	7
"	1	3
"	5/8	2
4 B.A.	3/4	10
SKT GRUBSCREW		
2 B.A.	5/8	4
2 B.A. HEX NUT		2
1/4 B.S.F. HEX NUT		1

UNIT DRAWN OUT OF
POSITION - SEE OTHER
VIEW FOR TRUE POSITION

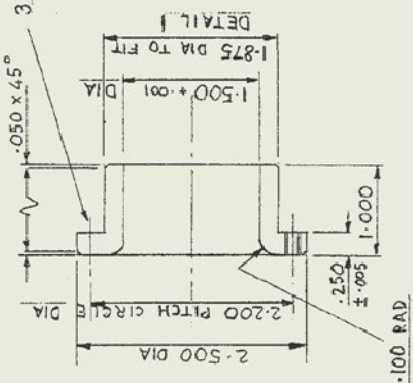
©

General arrangement

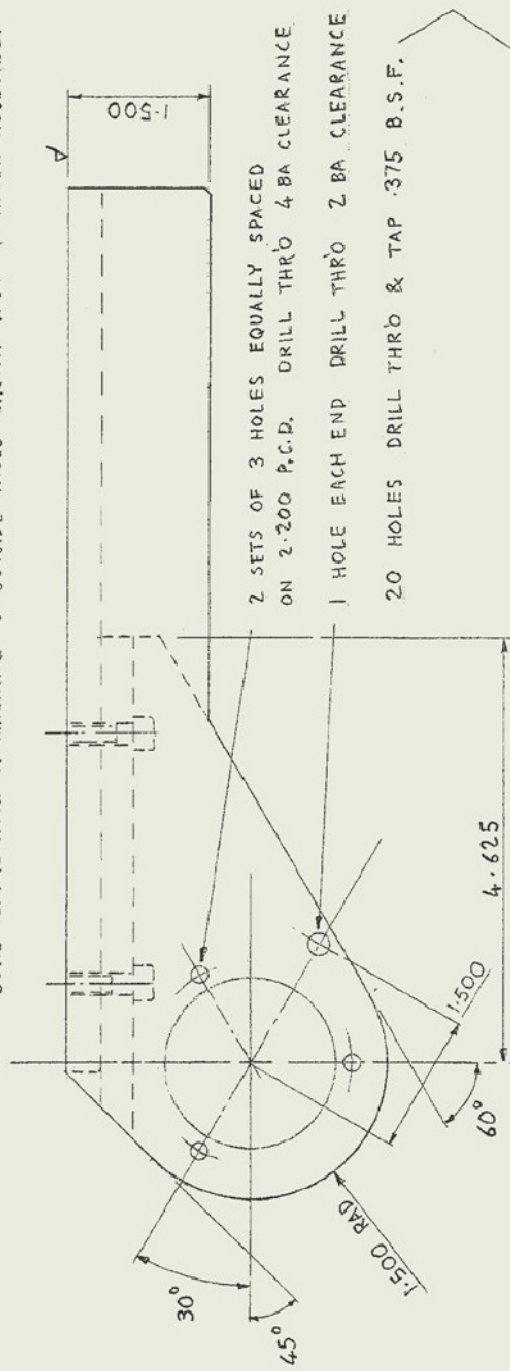


ASSEMBLE FROM 6 x 3 1/2" ANGLE SECTION OR LARGER .375 TO .500 THICK
 MACHINE JOINT FACES & PERMANENTLY FIX TOGETHER WITH SCREWS & PINS
 BORE LARGE HOLE & MACHINE 3 OUTSIDE FACES SHOWN THUS V AFTER ASSEMBLY

3 HOLES EQUALLY SPACED - TAP 4 BA

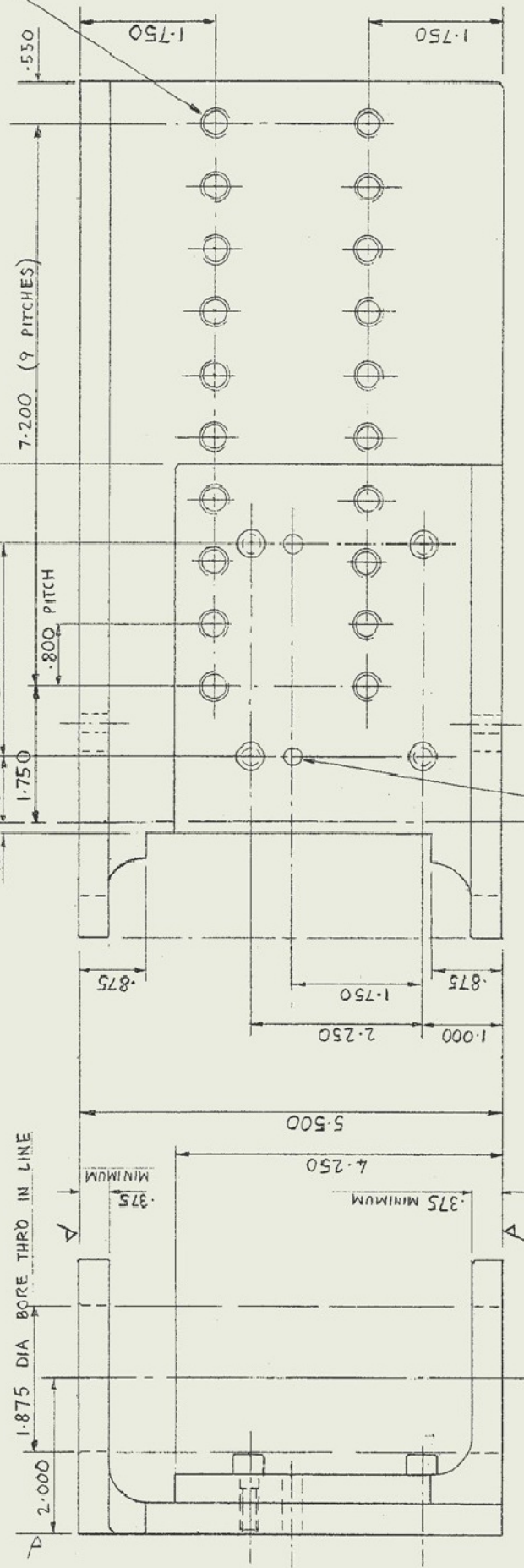


DETAIL 2 - 2 OFF
 MATL: BRONZE OR CAST IRON



2 SETS OF 3 HOLES EQUALLY SPACED
 ON 2.200 P.C.D. DRILL THRU 4 BA CLEARANCE
 1 HOLE EACH END DRILL THRU 2 BA CLEARANCE
 20 HOLES DRILL THRU & TAP .375 B.S.F.

1.875 DIA BORE THRU IN LINE



Details 1,2
 Material - steel
 angle section

DETAIL 1 - 1 OFF
 MATL - STEEL ANGLE SECTION



3. The main fabrications, bushes and spindle

empire builder. My previous ideas on cutting angles and tool life did not apply in the toolroom and roughing out on these inadequate machines was done with tools having 30 to 40 degrees of top rake with frequent regrinding.

I assume we start with a sawn length of $3\frac{1}{4}$ in. or 80mm dia. drawn bar. Check the sawn ends for squareness, select a length datum on the best end and hold this end in a 4 jaw chuck. 80mm is a bit tight to make 3.125in. but get the best out of it as the next material size is 90mm. If necessary, we can go undersize to 3.100in. or 3.075in. Support the outer end with a centre, rough and finish turn and make sure both bearing diameters fit both bushes. The reduced diameter between should be suitable to run on a fixed steady for the second operation. Turn the large diameter as far as the chuck jaws leaving it plus 0.010inches. All the excess length is at the tailstock end and you can remove it or have a longer hexagon. If the amount to be removed is excessive, progressively redrill the centre hole so that you still have a centre in the finished end and the option of support from what should be a half centre while facing.

The $\frac{1}{8}$ in. hole through the spindle drilled from each end, is not expected to meet perfectly in the middle. If it will pass a $\frac{1}{8}$ in. rod (to be used to knock out any former stuck in its location), it will do. A long series drill is preferable here, as the jobbers drill has only 4.25in. of flute when new and you need 5.25in. of hole. To finish the large end, reverse in the chuck and use a fixed steady for support. There should not be much metal to remove.

All the remaining features are relative to each other so we should start with the one most likely to go wrong and use that as a datum for the others. This is the $\frac{1}{8}$ in. hole starting offset on the outside diameter intended to take a tommy bar for bending smaller pipes. Start with a short pilot hole, sight to an offset line marked across the end face. If satisfactory, drill deeper and open out to size, but if it is going wrong use a slot drill in the miller as deep as possible and follow through with the drill.

Sight from this hole to mark out the flat and step. Careful sawing could remove most of the surplus material before finishing on the miller. On a vertical miller a vice or vee blocks could mount the part horizontally either along the table or across it. A flycutter or endmill will machine the horizontal surfaces, but only the side of an endmill will produce the vertical face. I did mine on a horizontal mill with the end face clamped to the table and overhanging, so that the step face was accessible to the top arc of a flycutter. The other face was cut at the same setting and

then clamped to the table when the part was reset horizontally for the final face. Set ups for these operations are illustrated in **Sk1a/Sk1b**. Please note the limits on some dimensions. The main fabrication parts with bushes and spindle are shown in **photo 3**.

If you refer to **photo 4** the machine is set up for bending in the other mode. This is why the spindle must fit from either end and why there are two rows of tapped holes in detail 1. Also shown is a 15 inch ring spanner and I suggest you obtain this item before cutting the exact size of hexagon on the tail of the spindle.

When you have produced the tapped holes in the end and side, only the engraving remains and I suggest we leave this until the other engraved part Detail 15 is made.

Pipe Vice Clamp (Detail 5)

Two views are shown on the arrangement drawings, one looking at the front and one from the right hand end. I have invoked draughtsman's licence to rotate the spindle 90deg between these views so that we have two similar side views of the top of the spindle. One view shows the large pipe vice clamped in position and the other view, one of the two small vices. It also explains why the tapped holes in the side of the spindle are deeper than one would normally expect. The detail drawing shows how the corners of the clamp should be removed to delay fouling conditions when the spindle rotates.

Bracket (Detail 3)

The piece of angle section left over from detail 1, can now be retrieved and the short leg sawn off to finish at 2.100in. inside (not outside). The outside faces of the angle should be machined flat all over and be square to each other, removing the minimum amount if your material was only $\frac{1}{8}$ in. thick to start with. Both inside faces should be machined parallel to the outer ones but this need only be as far as shown on the drawing. Most of the dimensions are taken from these inside faces and are therefore unaffected by the "thick as possible" recommendation.

The end shapes and the pattern of holes

and slots are symmetrical about a vertical section through the centre of this part. Before these features can be accurately marked out, both end faces should be finished to make the 6in. dimension. To produce the slots I would normally drill a hole at each end, file one hole until a sawblade can be inserted and then saw to the other hole down both sides. Finish the slots with a file or end mill. If milling on a vertical machine you can use the two parallel slugs just made to lift the part clear of the table. This will allow the cutter through the slots without risk of touching the table. These slots are 0.3in. longer than the pitch of the holes in detail 1. so that perfect judgement is not necessary when selecting which screw holes to use for a particular machine setting.

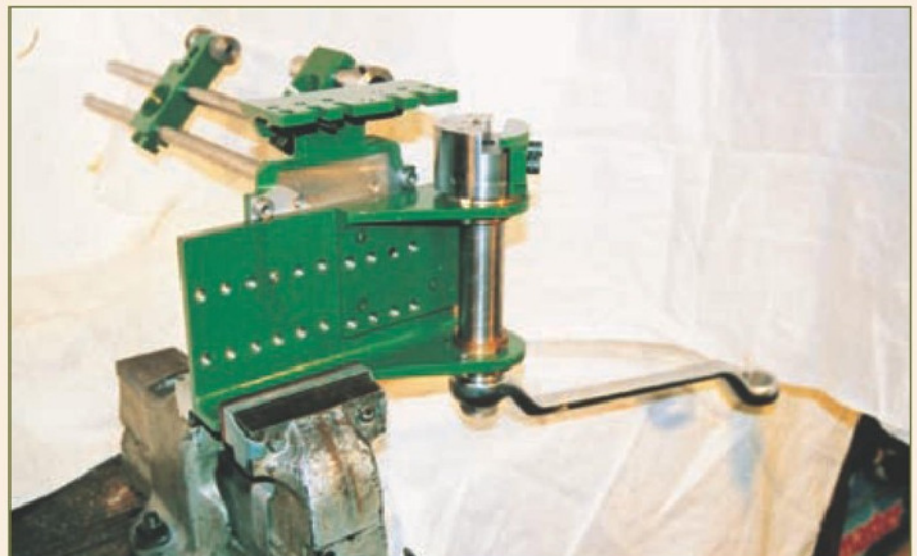
When bending pipes through large angles the tail of the pipe vice and its clamp may foul on the ends of this part, so each end should be cut away as shown on the drawing. This shape is for clearance and need not be particularly accurate. The position of all the remaining holes and slots is however important, as these line up with adjacent parts and tooling and you should try to locate these to within 0.010in. of their true positions. When you have made detail 4, from a piece of bright steel strip and the eccentric pins, detail 13, we can have a trial assembly with detail 1. The vertical relationship between the two parts depends on the heads of the eccentric pins resting on the top of detail 1. Using these, small adjustments are possible to obtain the 3.090in. dimension, then they are permanently locked. Both the $\frac{1}{8}$ in. clamping screws should be free in their $\frac{1}{8}$ in. slots.

In the next issue, the manufacture of the remaining components will be considered, and comments offered on operation.



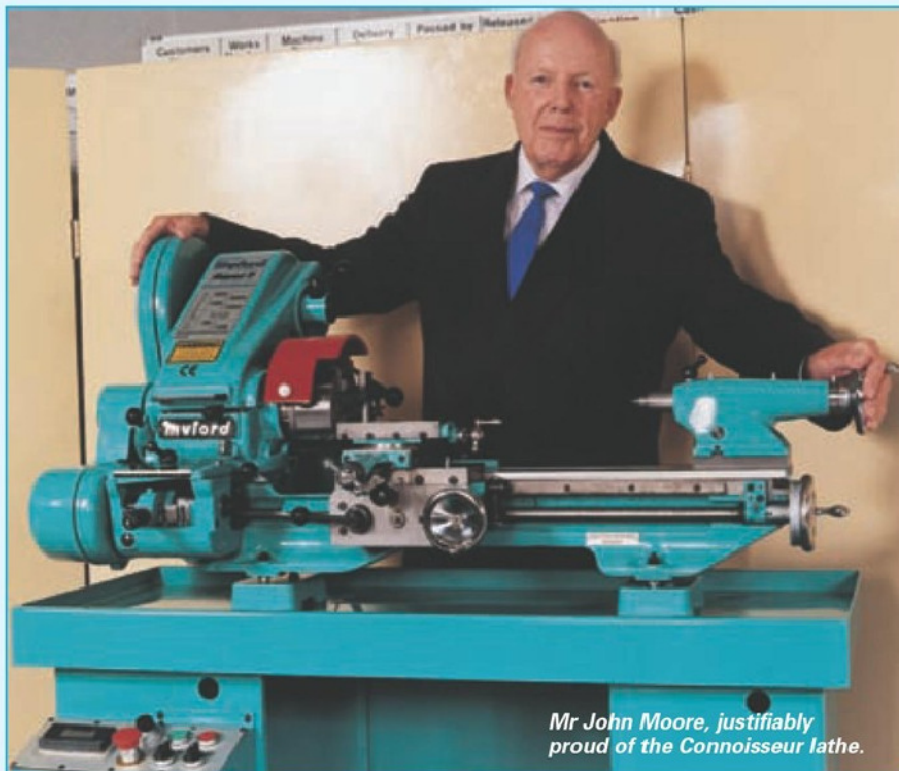
Supplier

Materials for the Pipe Bending Machine may be obtained from:
Blackgates Engineering, 207/209
Wakefield Road, Drighlington,
Bradford, West Yorkshire, BD11 1EB.
Tel. 0113 285 3652, email
sales@blackgates.co.uk



4. Ring spanner located on spindle hexagon

THE SEVEN DYNASTY



Leading edge to cutting edge

"John Moore entered the family business to join the design and development office in 1945, after completing an engineering apprenticeship with Rolls Royce at Derby and subsequent detail design experience on Gas Turbine development. At this time, the ML7 lathe was being tooled-up for production. Earlier, the ML7 concept had been worked-up by a week-end committee, during the last weeks of World War II, with low cost and high production in mind. The late Malcolm Mather was working on this project as design draughtsman at that time.

The following years saw ML7 sales take-off, to reach outputs of more than 500 machines per month at the height of the post-war boom. During this time, the quick-change gearbox was introduced, re-worked after early gear failure problems, and is largely unchanged today. A countershaft clutch was added to the optional equipment, and this became acknowledged to be one of the desirable features of the Series 7 lathes."

Birth of the Super Seven

"Towards the end of 1950, the post-war boom began to lose its momentum, and

sales began to fall. This, with the need for higher cutting speeds, and appeals from prominent model engineers, brought about the decision to develop a machine with higher speeds, and work commenced exploring possible bearing arrangements. The result of this development activity was the new SUPER 7 'HIGHSPEED' lathe, offering higher speeds and a much improved cutting performance, which is unsurpassed today by most lathes, of similar proportions but fitted with anti-friction bearings. The current arrangement produces excellent geometry and finish in workpieces, and has become a favoured set-up in other MYFORD products. The first machines were delivered in 1953 and, from the outset, the SUPER 7 was a success.

In the following years, largely under the control of Malcolm Mather, a power cross-feed motion was added to the Super 7. Models 280 and 254 lathes followed, but failed to replace the Super 7 in the esteem of model engineers."

Super Seven Plus and Connoisseur

"The recent decline in demand volume has compelled the company to rationalise the line of small lathes in manufacture, and it was decided to continue with Super 7 products only. John Moore returned from retirement and a big-bore spindle and bearings was developed, offering 1inch /

In any discussion of model engineering topics, it is never long before Myford lathes are mentioned. As it was intended to feature in this issue, the review by Harry Paviour, of the Myford Connoisseur Lathe, I felt that it would be of interest to many readers, if Mr John Moore, presently Chairman of Myford Ltd. and one of the principal driving forces within the company during the last half century, might be persuaded to offer a brief historical perspective. Although he prefers to remain "behind the scenes" Mr Moore did, uncharacteristically, step into the limelight to share centre stage with the flagship model, and gives the following insight.

25mm clearance through the bore, a new spindle nose with safe-reversing feature and mounting a 5in. self-centring chuck - this to be known as a SUPER 7 PLUS.

Work on bearing lubrication, to accommodate higher bearing surface speeds, together with great experience with the application of variable-speed electrics on cylindrical grinder workheads and on woodlathe headstock drives has facilitated the development of the latest Super 7 variant - 'THE CONNOISSEUR', which has a very refined drive, with revolution counter and a 50% increase in top speed.

The 'CONNOISSEUR' is offered as an all-singing/all dancing, 3000 rpm machine with variable speed drive, spindle indexing and anti-friction thrust arrangement on the cross-feed motion. Adaptors are offered to convert all spindle mounted accessories, with old No.2 Morse nose detail, so that the user's existing equipment still applies.

This machine represents the ultimate, so far, in operating speed-range, cutting performance and versatility for the dedicated model engineer. It's compact proportions help, in terms of installation space, yet the capabilities offered compare with much larger, bulkier machines.

The Super 7 evolutionary process continues, and the future holds great promise of even better capacity and facilities.

Now officially retired, John Moore has vested the running of Myford Limited with his son, Christopher (Managing Director). Nevertheless, John still still devotes a lot of his time to the Myford Design Department, improving and upgrading all machines in the Myford range, in consultation with Christopher, as well as introducing new concepts for the company's products."



THE CONNOISSEUR LATHE



1. The Connoisseur installed in the workshop.

There cannot be many model engineers anywhere in the world who have not heard of, owned or used a Myford series 7 lathe during their time in the hobby. Those not owning one of these lathes at home, the chance of using one at evening class has no doubt provided many an individual with the satisfaction and opportunity to tackle some of the larger capacity components for their model.

Decision time

The decision to buy a new lathe nearly two years ago was not taken lightly. I had at the time a 1970's Myford ML7 lathe with an added gearbox and a counter shaft clutch unit. This lathe had carried out sterling service in the building of a large 2in. scale traction engine.

There was always a plan to purchase an all singing, all dancing lathe, having retired in late 1992, after a career spanning more than 30 years working in an Emergency Service profession. This purchase is intended to see me through until such time as the undertaker reminds me that I cannot take it with me on my new journey, either to that big workshop in the sky, or down to act as boiler man to the fiery furnace!

Attending the Model Engineering Exhibition at Sandown Park in December 2001 provided me with a selection of new lathes to look at for inspiration. Many would feel that they would be spoilt for choice as to which one to go for. Since I

had become a follower of the "Model Engineering" hobby way back in the middle 1960's, I have, like a lot of model engineers, gone through the usual evolution of purchasing used, and in some cases, very old lathes. Starting with a small plain round bed bought in 1966 for £3 at an auction, then a Faircut Junior, followed by a Drummond round bed in 1975. Moving house, and an unexpected little windfall, allowed me to buy a brand new Myford ML10 lathe from "Thorcraft" down in Hastings, Sussex for £112 in December 1976. Oh, how we thought we had arrived on the scene of model engineering. This lathe was to stay with me for the next 18 years, enabling me to build such locomotives as a 5in. gauge 0-4-0 chain driven vertical boiler Sentinel type loco. The 5in. Reeve's "Gert" and a 3½ in. gauge Bulleid's 1942 Q1 class 0-6-0, plus a few odds and bits of tooling, etc. It was only to leave me when I traded it in for a gearbox and clutch unit for my ML7, which I had bought from a club member (sadly no longer with us) in 1996.

We all recognise that part of the decision making process as to which new lathe one purchases and what, if anything, does one trade in, other than the very first lathe one buys, will also be based on:-

- Past experience of using a lathe from the same manufacturers, complete with any limitation, etc.
- What is one going to use it for?
- What standard of workmanship is one hoping to turn out.
- What is already provided as standard,

Harry Paviour reports on his experience with the range topping Myford machine.

or, is available as an extra for the lathes basic operation? e.g. gearbox, a powered cross-feed or a clutch, etc.
e) "Oh yes", what I have forgotten? What's the budget? It is this last question that usually gets rephrased into "For X pounds, what will I get for my money?"

If one has been into model engineering for many years and using a Myford lathe, then I would be very surprised if under the bench there was not a fair range of attachments, collets, faceplates and home made or commercially bought quickchange toolholders, etc.

This range of ancillary tooling suitable for use on the older Myford lathe could now be used on a new Myford lathe and this was very much the case with me. Persons moving across to a new Myford lathe for the first time may only have a limited amount of existing tooling, which could be usable with the new lathe.

Going back to my new lathe, I have to say that after agreeing to the purchase of a new Super 7 Plus Connoisseur lathe from Myford at the M.E. Show, the completion time was to be a fairly open-ended arrangement with the company regarding the actual delivery date, as the lathe was still to be finalised and enter production. Almost a year to the day of ordering, it arrived to my home address, and away went my ML7 and an old Boxford as part exchange. Moments of sadness at seeing two faithful friends go, but feelings of pleasure at taking on this new lathe, the first one off the production run. My wife said the expression on my face was a picture. Move over Cheshire Cat!

Now that I have got it, it needs to be used and enjoyed. But, before I make my comments on its ability to produce precision turned components, with the larger holding and turning capacity, let us examine what actually went into the design and development that convinced me that this was going to be the last lathe I was to purchase in my lifetime. It may be noted that I am an untrained, self-taught model engineer whose only un-recognised engineering qualification or achievement in the school's metal workshop (just prior to going into the Merchant Navy) was to be, at that time, the only pupil able to lift to chest height and hold it there for five minutes, a full size blacksmiths anvil. Hardly a really credible qualification, but in those days it certainly impressed the girls!

So why did I choose to purchase a Myford Super 7B Plus Connoisseur Vari



2. Chuckguard removed and large face plate fitted.

Speed? (Photo 1). Standing back and comparing an original Super 7 with the new "Connoisseur" standing side by side. What's the difference? Ignoring the new paint job and the identical cabinet stands they may be standing on, the overall first glances will not necessarily pick up the difference. Yes, one machine may have a drum type switch gear, as against the new electronic controller of the new lathe, etc. etc.

The major differences between the two lathes start with the size of the headstock casting, and the spindle, bored to clear one inch stock, with a correspondingly larger spindle nose incorporating a safe reversing feature. It will not be until one opens the drive guards that the new single speed Poly-V belt drive to the countershaft, the new two speed Poly-V drive from countershaft to headstock spindle, and that the headstock spindle indexing plunger to the bull wheel all become obvious. Poly-V belts are much less tolerant of oil than conventional Vee Belts. Myford have therefore incorporated some oil seals, and an oil thrower to minimise belt contamination. Roller thrust races have been fitted to the cross slide feedscrew to improve sensitivity, and finally a more powerful motor which, in conjunction with an inverter drive, provides an overall speed range, from 25 - 3000 r.p.m, the new top speed being a near 50% increase on previous Super 7 models.

The Connoisseur, as with previous Super 7 lathes, may be ordered either with standard or long bed (hardened bedways are standard on Connoisseur models) and either imperial or metric cross slide and topslide feedscrews. My Connoisseur is an imperial with standard length bed. For readers who may wish to be updated, or not be too familiar with the Super 7 lathes, the following technical data will be of interest:

1. The standard bed length has some 18 $\frac{1}{2}$ in. (475mm) between centres. For those going for the long bed model, the distance between centres is 30 $\frac{1}{2}$ in. (780mm).
2. The centre height over the bed is 3 $\frac{1}{2}$ in.

(89mm) giving a swing of 7in. (178mm) with a 3 $\frac{1}{2}$ in. (85mm) wide gap between the headstock and the bed. Within the gap, the 9 $\frac{1}{2}$ in. (247mm) diameter faceplate can enable one to take on large diameter wheels. The overall clearance in the gap bed is 10in. (254mm).

3. (Using the large diameter faceplate (9 $\frac{1}{2}$ in. 247mm) will require the removal of the chuck guard). (See Photo 2)
4. The distance between the jaws of a standard 5in. 3-jaw G.S. Chuck to the standard length lathe bed tailstock is 17in. (431mm).
5. The distance between the front face of the faceplate, and the edge of the gap is 1 $\frac{1}{4}$ in. (47.5mm).
6. The swing over the standard cross slide is 2.062in. (52.4mm)
7. The centre height clearance over the top slide is 0.625in. (15.9mm)
8. The Connoisseur lead screw is $\frac{1}{2}$ in. dia. x 8 threads per inch.
9. The hand wheel on the lead screw is graduated 125 divisions, giving a 0.001in. per division.
10. With the gearbox set for fine feed, the standard finest cross feed per revolution of the spindle is 0.002in. (0.05mm).
11. On the standard length bed lathe with a gearbox, the finest feed per revolution of the spindle is 0.002in. (0.05mm). With a good sharp tool set at the correct height the finish leaves nothing to be desired.

Colour

Being a traditionalist, I accepted that lathes should always be painted "Grey". This traditional thinking was shattered when in the early 80's green painted lathes appeared on the market, supported with explanations that it was preferred by the Europeans, green being a visually soothing colour for working in industry.

When Myford came out with this BS 4800 Aquamarine 16E53 colour for my new lathe the first comment was "all the lathe wants now is a palm tree decal painted on the side"! Now 9 months on from taking delivery I have become



3. Spindle nose adapter enables use of older pattern chucks etc.

accustomed to the colour and find it acceptable within the workshop. Some of the 'matching accessories' from the previous grey ML7 lathe have now received a 'make over' with a coat of Aquamarine colour paint.

Whilst the customer does have the choice of his new lathe being painted an original or traditional colour, the cost of this extra paint job (nearly £500) could go towards additional optional equipment.

Spindle nose adaptor

I think I need to voice at this point, one of my original reservations I had before I committed myself to buying this new lathe. It may also be a very valid point, that owners of existing Myford lathes should also consider when deciding on the purchase of a new "Connoisseur" lathe. Remember, what I said above about the value and use of your existing tooling, attachments, collets, etc. that would normally fit onto the standard Myford 1.125in. 12 TPI 2MT Head stock spindle nose. The Connoisseur's head stock spindle nose is bored 4MT with a 42.5mm x 2mm pitch thread. The spindle is bored to clear 25.4mm. It is therefore important that when you buy this model lathe, you



4. Workshop layout.



5. Inverter housing mounted at front of lathe.

purchase with it, an "old standard Super 7 spindle nose adapter". This piece of equipment incorporates the nose detail of the original series 7 and 10 lathes, so as to facilitate the mounting of chucks, faceplates and collet chucks, etc. on the new machine's larger bore spindle nose. It also incorporates a No. 2 Morse Taper to allow the use of the Myford patent 2 Morse taper collets.

Had this adapter not been available, I think I would have considered just trading in my old ML7 lathe for one of the last small bore Super 7's.

The adaptor's reduced spindle nose is threaded 1.125 in. - 12 TPI Whitworth form and is bored 2MT. The adapter is also supplied with a tommy bar to facilitate removal from the Connoisseur's spindle nose and includes the safe reversing feature as provided on the Connoisseur chucks and faceplate, etc. More on this "safe reversing feature", when reversing the spindle rotation under power later. (Photo 3)

Cabinet

A new model of the Connoisseur lathe can be supplied either for bench mounting or fitted to an industrial stand. As a complete package it looked impressive when I saw it at the Myford's Open Week in October 2002. Tape measure in hand I took all the dimensions to see how it would fit into the workshop at home.

Now my workshop measures 15ft. x 7ft.6in. (call it 5metres x 2.3metres). To take on the supplied industrial stand as well, would, according to my tape measure, require me to completely re-think the layout of my workshop. We all know that a workshop has to feel right to work in, regardless of whether you are right or left-handed. A workshop has to flow according to the way we all work. In my case the new design of industrial stand was larger overall than the earlier steel, non-Myford, industrial stand that I had for



6. Control panel, note E-stop and tachometer.

the ML7 lathe. It would also have meant re-locating the milling machine to a central position on one side and positioning the new lathe and larger cabinet stand across the end wall. (See Photo 4)

Why then, have Myford made a larger cabinet stand? It is to accommodate the main machine controls and variable speed inverter unit in an external housing, which could easily be removed at a later date, should maintenance work be required. The housing measures 12in. (30cm) wide x 5½in. (14cm) deep x 20in. (50cm) height. (See Photo 5) At the time of preparing this report (July 2003), Myford have subsequently managed to reduce the overall length of the industrial stand by 5in. (125mm).

The overall depth away from the wall or window as some model engineers prefer to position their lathe, means the lathe and control housing space should require not less than 25in. (63cm) depth of floor space. Another valid reason for choosing the "Connoisseur" was so that I could retain my own, non-Myford stand with the original raising blocks.

Electronic variable speed inverter housing

The only challenge I had was mounting the vari-speed control housing. I was conscious of the required depth compared to that of the original "Dewhurst" type "drum" forward/reversing switchgear I had for the series 7 lathe. Time was spent after the lathe was delivered and set up on the cabinet stand as to where I wanted the vari-speed control unit. At one time I considered fitting it on the end of the cabinet, underneath the leadscrew drive and tumbler reverse lever. At first a good idea, as it reduced the overall depth of cabinet and motor assembly, thereby providing space between the bench opposite and the lathe.

So I tried it on the side of the cabinet stand and did not like it, Why? The sloping top of the vari-speed housing displays the electronic tachometer and digital display.

The top of the housing also has fitted the large red mushroom head emergency stop button, as well as the other controls we will refer to later. (See Photo 6) So it was unbolted from the side position, and re-bolted to the position we see in the photograph. It may be worth making the comment, and I can only refer to this as "hear say evidence", if I have interpreted his remarks correctly, that one model engineer placed his vari-speed control housing at right angles to the lathe on another adjacent cabinet, due to lack of working space.

As my cabinet swarf tray is not as wide as Myford's commercially built ones, I did experience, even with the swarf guards in place, that swarf and cutting oil were falling onto the top of the sloping speed control cabinet. A simple but effective remedy to stop this, was to use a piece of



7. Power connector and isolator.



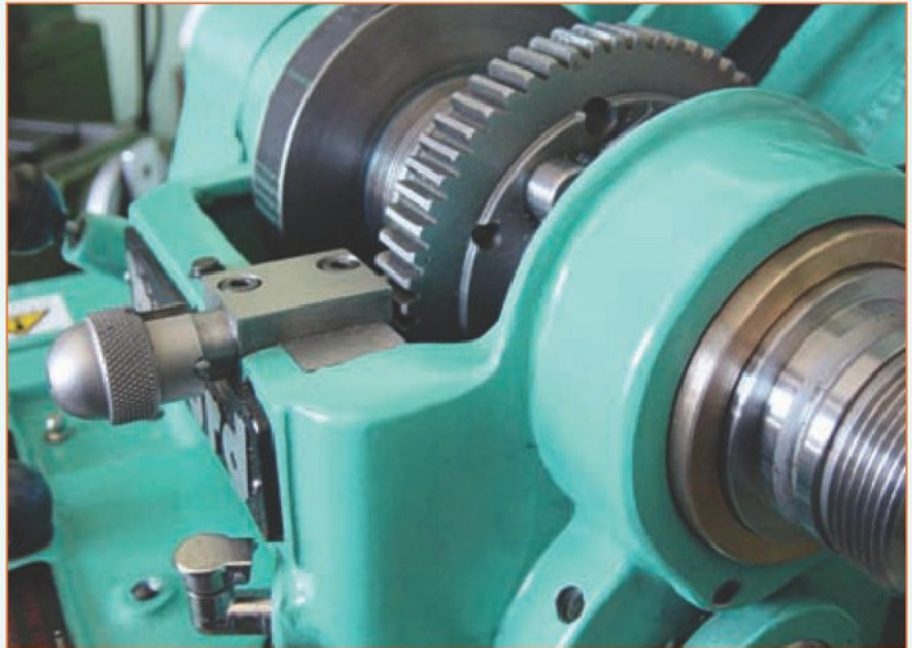
8. Showing the size difference between the old (left), and new (right) headstock spindles.

"Butyl" garden pond liner material as a flap over to cover the top of the control housing, which is then clipped on to the lip of the swarf tray by three clips. All I have to do is then roll the flap over the lathe controls when they are set and running, but still providing quick access to the emergency stop button.

The power inlet to the control housing is via a CEE 17 plug with 3 metres of HO7 insulated cable, suitable for a 230 volt, single 50/60 Hz AC supply. (See **Photo 7**) With fuse protection of 10amps from the normal house/workshop supply, the first time the power supply was switched on after installation, the whole house, including the workshop, went into darkness. Comments by "Senior Management", are not to be repeated in print! Subsequently traced to a faulty power supply CEE17 plug on the control unit.

Larger capacity headstock

The idea of providing a larger capacity headstock to the series 7 lathe is not a recent consideration. If readers talk to model engineers of some standing, and to Myford's management, they will be told that the idea of the series 7 being "beefed up" to have a larger capacity internal bore on the headstock spindle was first suggested many years ago. A window of opportunity finally presented itself, in a busy development programme, when



9. Two features are visible here, the "V" groove for safe reversing, and the bull wheel indexing plunger arrangement.

Myford decided to rationalise the range of lathes they manufactured.

I am sure that most of us when taking on a 3½ in. or 5in. gauge loco or a 2in. scale steam driven road vehicle, have wished for the capacity to place a larger diameter length of material up into the hollow headstock spindle. Not a problem if you own a larger make of lathe. So what usually happens is that you end up having to work between centres using the fixed or travelling steady. Not any more, with this larger headstock assembly that now provides an internal spindle bore of 25.4mm (1in.), as against the former series 7 that is bored ⅝in. but only clears ⅜in. For readers who own or use a Myford 254 lathe, the spindle capacity is identical. (See **photo 8**).

I think it is worth noting at this point, that owners of existing Super 7 lathes should not contemplate carrying out a modification by thinking they could purchase the larger diameter headstock spindle and a set of bearings for the Connoisseur, under the impression that they can upgrade their lathe by boring out an existing headstock and fitting the same. Forget it, the level of re-engineering is

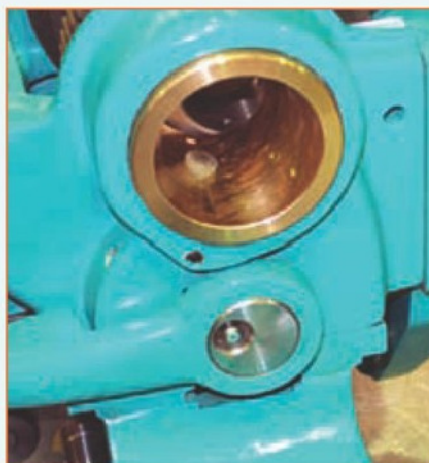
much more involved, and even if you succeed, one heavy cut and the resultant thin wall headstock casting will break up with possible dangerous results. Chuck guard fitted or not!

The photograph of the two spindles (**photo 8**) provides an indication of the difference, and general increase in mass, between the larger "Plus lathes" and the previous Super 7 headstock spindle that was standard for so many years.

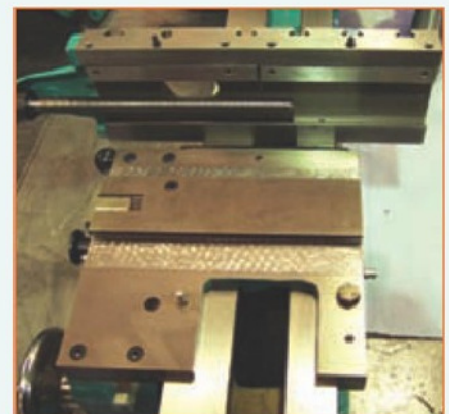
The other features on this headstock are that with the increased through bore, you also acquire a 4MT taper within the M42.5 x 2mm pitch on the spindle nose. Hence, the need to obtain a spindle nose adapter, so as to be able to use your existing chucks, etc. A very valuable safe reversing feature facility is provided on the spindle nose. This facility is in the form of a 'V' groove machined behind the thread. On the chuck backplate is a "grubscrew". At first appearance, one might quite understandably think that the grubscrew makes contact with the 'V' groove in the spindle nose. Well it doesn't. To do so would create displacement between the backplate and spindle nose resulting in loss of accuracy. Instead the shouldered grubscrew is tightened until the shoulder firmly locates. At this point, the cone on



10. A headstock spindle undergoing inspection.



11. Each front headstock bearing is precision scraped and bedded to its individual spindle.



12. Precision scraping the saddle and cross slide.



13. Tailstock attachment to accept older style chucks etc.

the grub screw enters, but does not quite touch the vee groove. (See **Photo 9**) Should there be the slightest tendency for the backplate or whatever to unscrew, the cone on the grub screw runs into the right hand flank of the vee groove preventing any further rotation.

Whatever lathe we have used where one can open up the headstock guard, we have sought ways of using the bullwheel as a simple form of indexing device. Many designs ranging from the simple to the elaborate, have been published in the M.E. publications to achieve this aim. The Connoisseur now has such a device built in to the headstock, attached to the side of the headstock casting. It is a tapered plunger machined to the DP of the 60-tooth bullwheel held back by a spring that on a twist will release it into the bullwheel. The plunger has a notch machined in it, so that it will locate both in the root of the gear teeth and by turning the plunger

through 90° on the crown of the teeth giving a possible 120 divisions. (See **Photo 9**) There is a minor question concerning the possibility of operator error. If when using the lathe's indexing facility, one forgets to retract the plunger before switching on the lathe and releasing the clutch, - nothing happens, - other than the slipping belts and mutterings under the lathe users breath, not to be repeated in print! Yes, the voice of experience.

To further develop this indexing facility when using the bullwheel, my approach was to lightly mark the bullwheel at the base of every tenth tooth with a centre punch. A high percentage of my marking out work is by the division of six. Those of you that may wish to use other permutations of sixty may consider adopting other removable marking system or using a range of colours to identify the divisions.



14. Drill pad attachment fitted to tailstock.

What you cannot see

The Myford series 7 lathe spindles are made from EN32M casehardened steel. The final machining operation on these spindles is to precision grind all the internal and external bearing and location diameters, with emphasis on both concentricity and roundness. Each spindle is inspected at the Myford factory using both Taylor-Hobson Tally-rod and Tally-surf inspection machines to verify the concentricity, roundness and surface finish. (See **Photo 10**)

Each Myford headstock for the series 7 lathe is precision bored, making sure that both the bronze bearing bore and the angular contact bearing bore are both parallel and geometrically true. (See **Photo 11**) Assembling the bronze tapered front bearing into the headstock as achieved by freezing the bearings. This type of assembly minimises misalignment and distortion in either the bush or the bore of the headstock.

Finally, each front bearing will then be precision scraped and bedded to its individual spindle, by fitters who have years of experience carrying out this work. This procedure enables the larger front bearing journal to run at a high speed, at a minimal clearance setting and, ensures that all the previous precision work culminates in the remarkable turning performance that the Super 7 provides. This larger head stock provides an improved unsupported turning performance which, in turn, makes it easier to part off using the Myford back tool post attachment, and also offers more than adequate support for the added overhang of the new/old spindle adapter.

Drive, motor and controls

Gone now are the Vee belt drives. We have moved onto the use of Poly-V pulleys and belts, both for the primary (motor to countershaft) and secondary (countershaft to the headstock) drives, giving negligible "running noise" compared with the older Vee belts. The speed ranges achieved from the belt drive down from the countershaft to the headstock, and the use of the back rear reduction, provides the user with a range of variable speeds from 26 - 3000 rpm. However, by fitting the electronically controlled variable speed inverter the exact speed for cutting the material can now be set, using the 10 turn potentiometer, providing a sensitive speed control, the actual speed being clearly visible on the electronic digital tachometer.

You can now appreciate the importance of positioning the vari-speed control panel, where it can be clearly seen during the lathe operation. There is now no more "near enough" reliance on the set speeds determined by the Vee belts and pulleys. We can now conscientiously refer to the charts with the recommended cutting speeds, and dial up precisely.

The motor fitted to my Connoisseur lathe is a 0.75 kW (1hp), 230-volt, three phase, 50/60Hz, resilient mounted industrial rated motor. As previously

described, a separate enclosure houses the electrical installation, which includes a lockable isolator.

On the top of the inverter housing are the controls, the stop, start, buttons, forward and reverse and the run/jog selector switches (using this control is the nearest you will see a model engineer jogging). In the middle of the panel is the big red mushroom head emergency stop button with "turn to release". (See **Photo 6**).

This "jog" facility I have found very interesting to use. It took me a bit of time to get used to it and now really appreciate its value, especially if I was screw cutting small diameter fine pitch threads, using a tailstock die holder, or using a thread chaser to clean a thread. The jog facility now saves me having to use the hand turning handle that one previously fitted into the back of the headstock spindle. I also appreciated the reverse arrangement using the jog operation, by holding down the button one could reverse back through the cut thread in a very controlled manner. I remember the temptations of the fruit machines with the "nudge" facility, which enabled the player to crank the display round to get the three oranges, and then win, if you were very lucky. This reminds me of this facility. Oh dear, another sign of a mis-spent youth!

Long cross slide

Before moving on to the general points of the lathes cross slide; we should include a few words on the construction, preparation and assembly. All the castings for the cross slide assembly are made from grade 14 machine tool cast iron. Each slide is precision ground, both top and bottom. The dual gibs will be ground to the correct angle, and each slide is fitted to the saddle by hand scraping. The saddle is then hand scraped and bedded to the cross slide. The advantages of precision fitting and scraping of the saddle and cross slide, are accurate alignments and a smooth operating slide. (See **Photo 12**).

Even with my original ML10 lathe, and then the later ML7, I always preferred to have the long cross slide in place. A longer cross slide has always been a standard fitment on any Super 7 lathe, and I find having that extra length gives you extra flexibility, especially when using a rear tool post parting off attachment, or when you are using the power cross feed on large diameter wheels.

The long cross slide measures 3 $\frac{1}{4}$ in. wide x 10 $\frac{1}{2}$ in. long, with five 'T' slots. The maximum travel before you risk disengaging the feedscrew is 8 $\frac{1}{2}$ in..

The threads to the cross slide screw, are

10 threads per inch. The micrometer dial divisions are marked out 0 – 100, giving feed per division of 0.001in. (0.025mm).

The topslide provides 1 $\frac{1}{2}$ in. travel with a feed per division of 0.002in. (0.05mm). The topslide feedscrew is also 10 threads per inch.

Some years ago, I had the good fortune to be given the salient parts of a "Multi Stop" used in conjunction with the saddle turret for rapid repetition machining. I have now fitted this to the back of the lathe bed; it now forms a useful saddle stop. But I hasten to add, not when the power longitudinal traverse is in operation.

Tailstock

Moving on to the tailstock, which retains the standard 2MT bore, with a travel distance of 3 $\frac{1}{2}$ in. (92mm). I found this to be one of those parts of the lathe, which have probably had more variations and attachments made or bought for it, than the rest of the lathe put together. Again, I can emphasise the point that those who trade in their older series 7 lathe, should, if they wish, retain some of these attachments.

If there is one piece of equipment I would like to see for the tailstock, (or I could make one), it is the lever operated tailstock attachment. There was at one time on the market the Cowell's rack feed tailstock, provided with a depth index. (I believe that a similar attachment is imminently due from Myford Ltd.)

Two pieces of kit I find very valuable to have are the tailstock adapters, the first with the M42.5 x 2mm pitch thread, i.e. identical to the headstock, and the second is the hollow centre, with plain and 'V' drill pads. Both are with 2MT's (see **Photos 13, 14**) I have also found it very convenient to retain the original tailstock adapter with the original series 7 spindle nose detail and threaded 1 $\frac{1}{2}$ in. x 12 TPI Whitworth form. As I referred to earlier, the value of keeping back any chucks, small faceplates, etc. is that these can now be used with the new machine.

Standard equipment supplied with the lathe

The standard equipment that is supplied with a new Connoisseur lathe is:

1. A 5" (125mm) 3-jaw chuck fitted with its backplate.
2. A chuck guard assembly.
3. The headstock reducing sleeve 4MT - 2MT. I have already used and found this very useful.

4. A pair of 2MT hard and soft centres for their use in the head and tailstock. There is nothing to stop you obtaining a 4MT soft centre to fit direct into the headstock.
5. A catchplate with the associated driving peg.
6. Two pairs of DE spanners $\frac{3}{8}$ " x $\frac{1}{2}$ in. BSF and $\frac{5}{16}$ in. x $\frac{1}{2}$ in. BSF.
7. Six Allen keys to fit all the associated screws.
8. A cross slide plug and the "Oil gun".

The oil gun! (See Photo 18)

At last, Myford have managed to find an oil gun that doesn't leak and therefore doesn't have to live in a "baked beans" can or a jam jar under the lathe bench. These new oil guns are made by "Wanner" in Switzerland. They are specifically designed as oil guns, - these are not grease guns being used to pump oil. Trust me, they are the business and they don't leak.

Use and impression

Some people may say that only having use of a new model lathe for nine months is hardly enough time to really get to know its full potential. In the short time of ownership I have put it to a fair amount of work, not turning large numbers of loco wheels or a set of 5in. G cylinders, etc., but using it on most days for a variety of large and small jobs. As the saying goes it's "the best thing since sliced bread".

It is the "variable speed" facility that enables one to accurately turn at the recommended rpm for the type of metal to be machined. That now moves the amateur/model engineer towards the ability and finish expected of the professional engineer. During large diameter facing cuts, it becomes very easy to progressively increase the rpm in order to maintain surface speed.

The jog switch for screw cutting and chasing threads is still a novelty to me, compared with having to use the "hand winding" attachment fitted up the back of the headstock spindle, and, of course, the new Poly-V belt drive, in conjunction with a smoother better balanced (electrically) three phase motor, makes the lathe run and sound like a well-oiled sewing machine.

Yes, I'm pleased with it, but have just that tinge of sadness as I feel that I will not have an excuse to experience the pleasure of buying another new lathe in my lifetime. But who knows, the next time around!



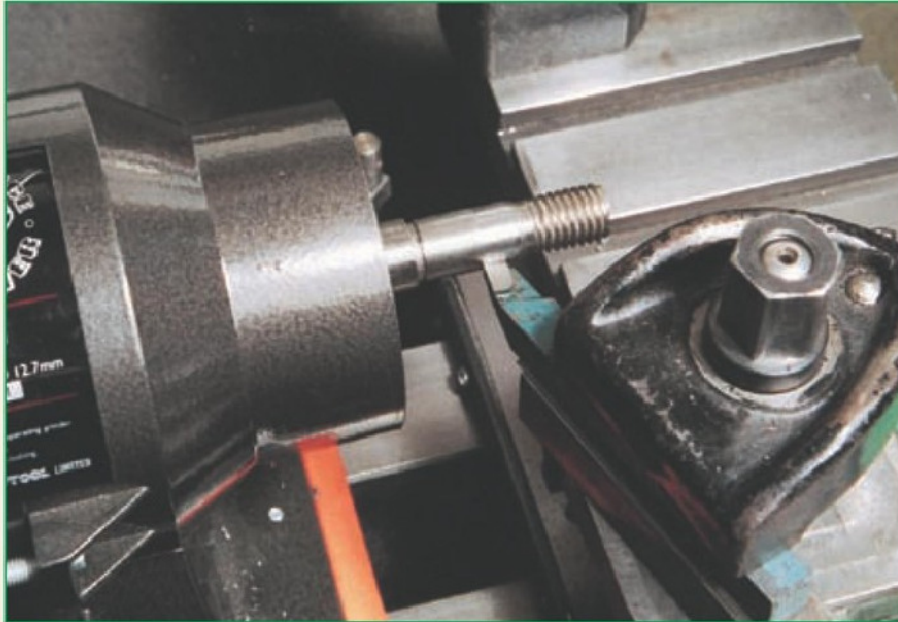
Acknowledgements

1. Myford Limited, Nottingham - For providing the technical information on inspection, testing, assembly and checking procedures during the assembly of the lathe.
2. John Evans, Moreton-in-Marsh, Glos. - For the photographs using his Digital Sony Cyber Shot. 3.2 Mega Pixels Camera, both with and without the flash facility.



15. The new oil gun – leaks are not an optional extra.

TOOL AND CUTTER GRINDING HEAD



1. Machining the grinder's spindle whilst powered by its own motor.

Rationale

Having put to use the grinding rest and its accessories described at the end of the milling projects series I was more than delighted with the results achieved. However, using a standard off hand grinder, I soon became aware that having both cup and saucer wheels available would improve things still further. This is not surprising as such wheels are standard practice for serious tool and cutter grinding. Several of the standard wheel forms are given in the accompanying sketch, (Sk 1).

Making a spindle and motorising this with some form of belt drive I considered to be too much effort for what would be of limited benefit. I had though, purchased previously, a small (125mm) off hand grinder to use as a drive motor, having stripped it of its wheels, and thought that I could convert this to take the cup and saucer wheels.

As it had cost only around £18-00, I was concerned that at this price the bearings may not be up to scratch, but checking for shake and end float found them to be perfectly adequate. I originally purchased this from the local DIY superstore but they no longer seem to be available from this source. However, at the time of writing this article, Machine Mart do still list a grinder of this size, but failing this similar quality grinders with 150mm diameter wheels are available at only a few pounds more.

Design considerations

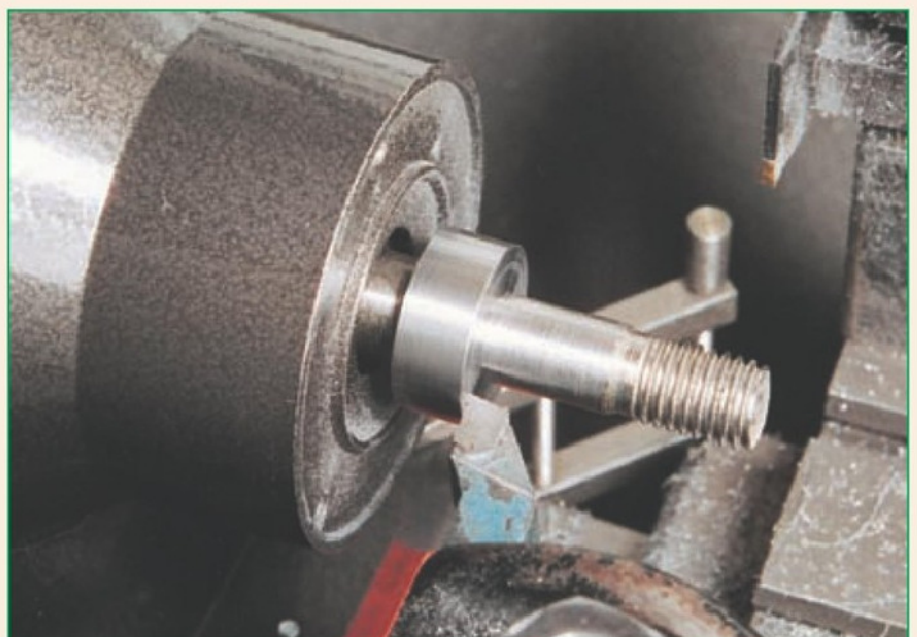
Common practice when using these types

of wheels, which usually have larger centre holes than the wheels originally fitted to budget grinders, is to fit them with permanent adapters (although cheap commercial, non permanent items are frequently plastic mouldings). These enable wheels of differing styles to be interchanged very quickly and with only minimal need of truing up at each change. The published assembly drawings GA 1 and GA 2 should make the situation clear. I have also included dimensioned detail part

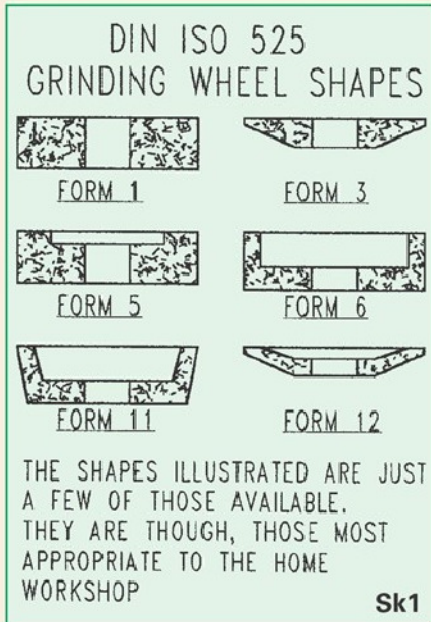
As an addendum to the Milling projects series, Harold Hall describes the modification of a cheap bench grinder for accurate T & C grinding.

drawings though these will need to be checked carefully against your own situation. Spindle diameter and length, hole diameter in the wheels and their thickness are areas that must be considered.

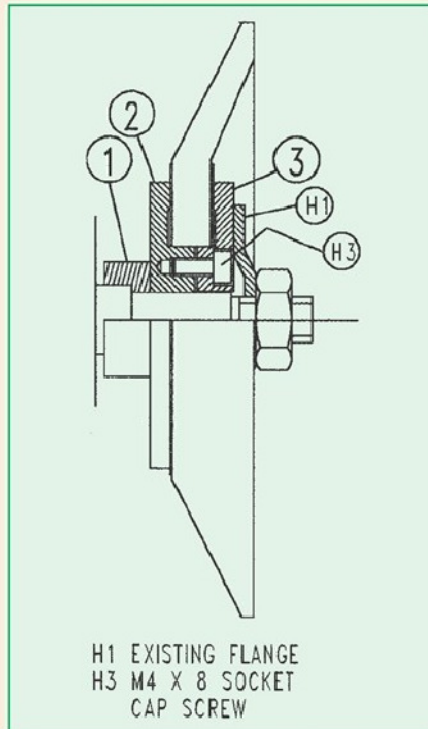
The dimensions given suit a 12mm spindle and a nominal wheel bore size of 31.75mm. In order to work with complete wheel and flange assemblies, I have indicated an arrangement using a combined bush/flange (parts 2 and 3) on each side of the wheel, clamped lightly together by three capscrews (H2 & H3). This does not give much scope for positioning the screws H2 and H3 and this would become more difficult if the grinder has a larger spindle. My 150mm grinder does though have a 12mm spindle so perhaps the problem may not arise. Since the screws do not carry any great load, it is likely that their diameter could be reduced to M3. It would also be quite feasible to produce an arrangement having one bush/flange as part 2, working in conjunction with a flange/washer combining the functions of parts 3 and H1. In this case, the individual components would naturally separate on removal of the spindle nut, losing much of the advantage of the pre-assembled quick change.



2. Machining the face of the added bush again powered by its own motor.



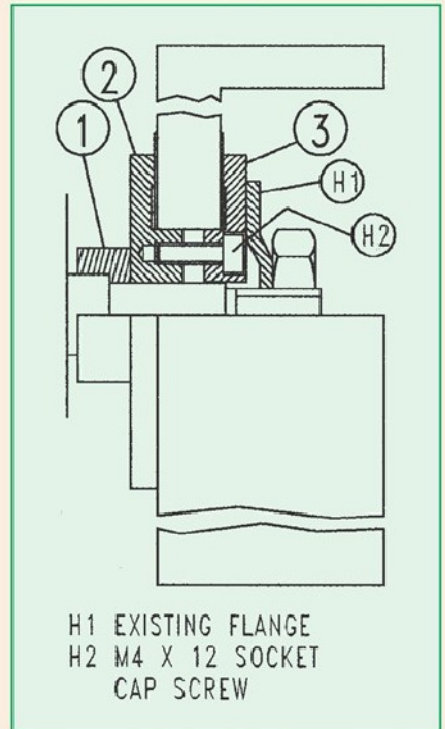
The step in the spindle against which the wheel flange adjoins was not well made and more importantly only 1mm high. This was improved by the addition of the Spindle Bush (Fig 1) which was fixed to the grinder spindle using a two part resin adhesive. I did not though consider this alone was sufficiently accurate, and machined the bush's face, whilst in situ, using the grinder's own motor for power. I mentioned above a spindle diameter of 12mm, however, as purchased, the spindle was $\frac{1}{8}$ in. diameter and machining took place as follows. Leaving the spindle at $\frac{1}{8}$ in. and making the bush to suit should be satisfactory but I would still recommend machining the face against which the wheel clamps whilst on the spindle, doing this whilst powered by the grinder's own motor. I would also check that the $\frac{1}{8}$ in. spindle runs true before leaving it at that diameter. The following is the sequence of events as I undertook them.



GA1 - Saucer wheel flange assembly

Grinder spindle

First I checked to see if the spindle ran true using a dial test indicator. It was OK but I still decided to reduce to 12mm as there was a small difference in diameter between the two ends, also they were poorly machined. The preparatory work involved making both Spindle bushes (1), and cutting a piece of tube to length and truing up the ends on the lathe. The grinder was then set up on the lathe bed (see later comments re this requirement) and the first end machined to 12mm diameter as illustrated in Photo 1. Whilst

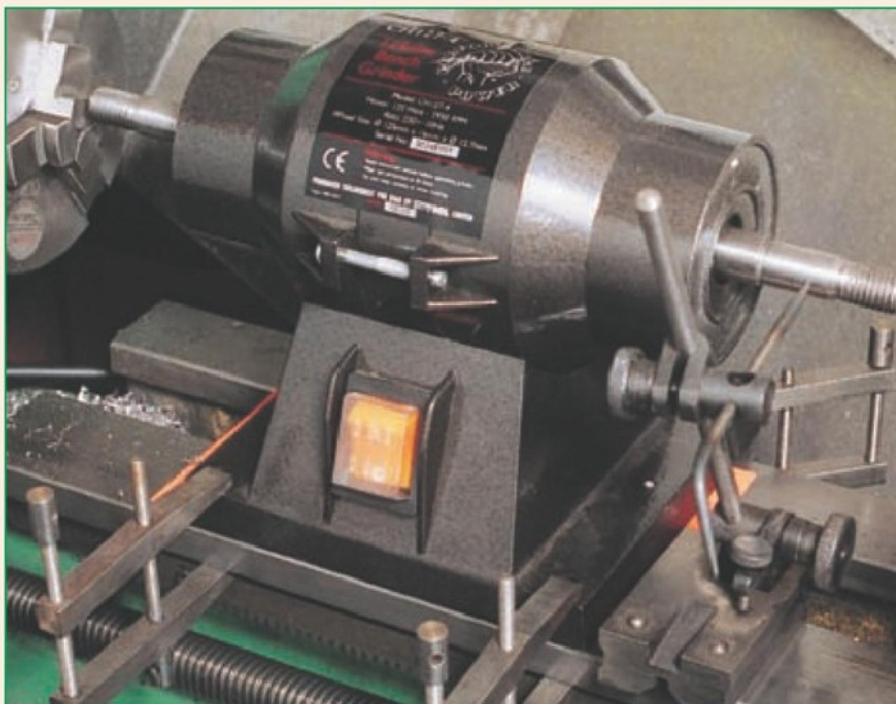


GA2 - Cup wheel flange assembly

the grinder was still on the lathe, the first bush was fitted using two part resin adhesive, the part being held in place using the piece of tube and the spindle nut. This was then left for a few hours for the adhesive to set, after which the nut and tube were removed, and a very light cut taken across the bush's face, Photo 2. The grinder's speed of 2950 rpm was on the high side but for the limited machining taking place and with a carbide tip, there was no problem. The grinder was then removed from the lathe, turned round, refitted and the sequence repeated on the second end.

Mounting the Grinder

Mounting the grinder on the lathe bed will depend both on the type of lathe bed and the form the grinder base takes, as a result precise details cannot be given. On the plus side, only very light cuts will be taken so the security of the mounting will not be severely tested. Because of this, no matter what form the bed takes, adequately mounting the grinder should not present a problem. If the bed ways are rectangular then four small toolmaker's clamps (Photo



3. Setting up the grinder on the lathe bed for machining the spindle and added bush.

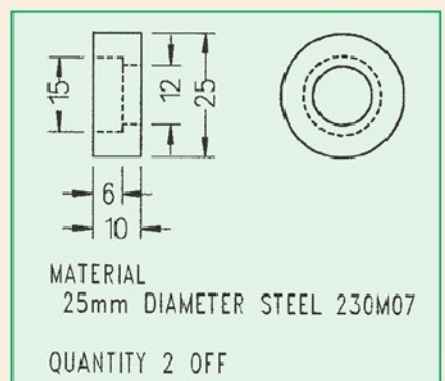
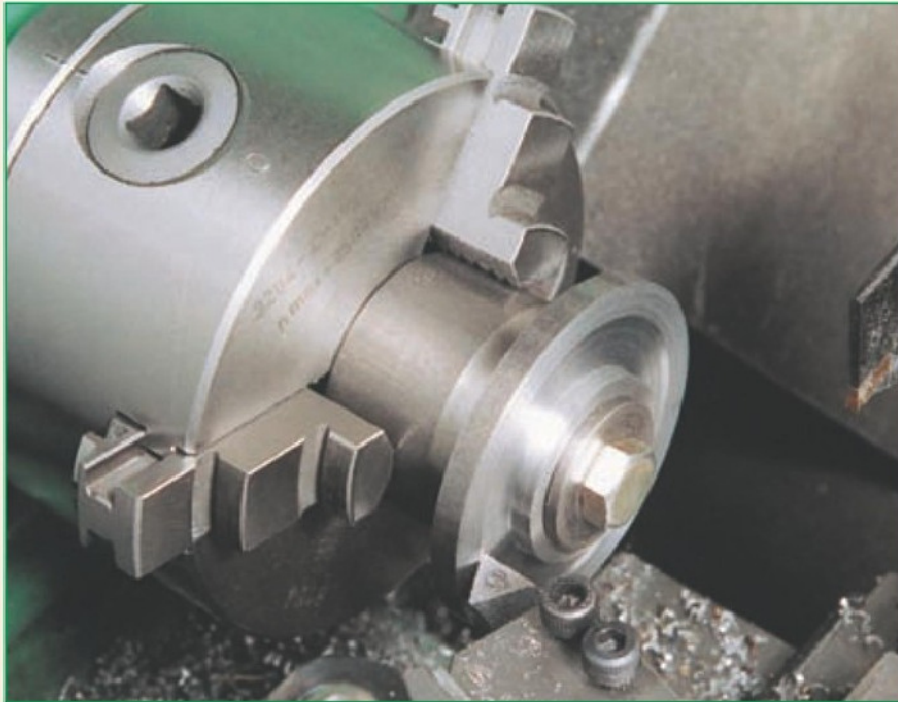
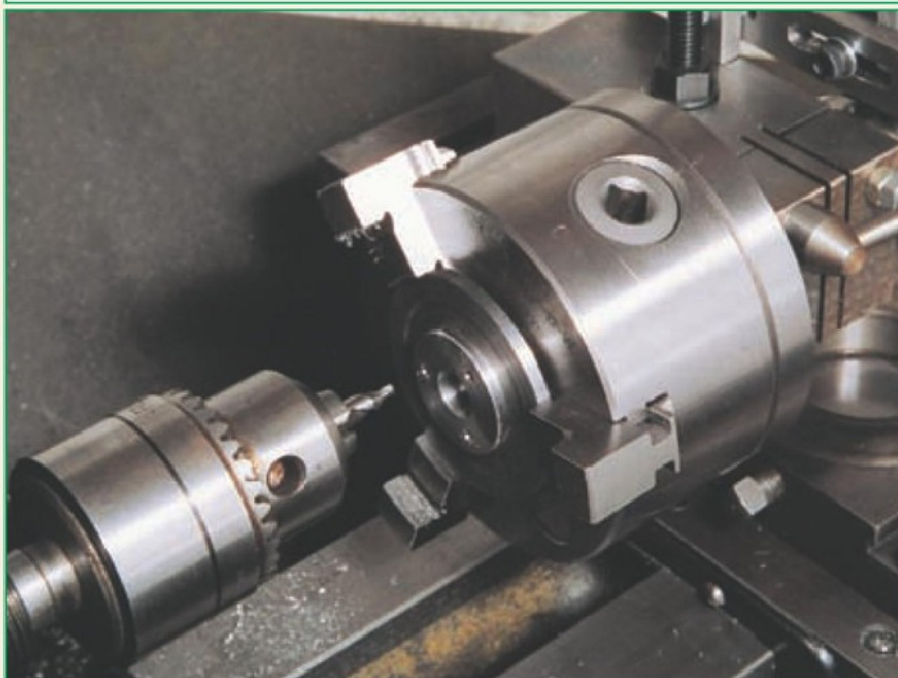
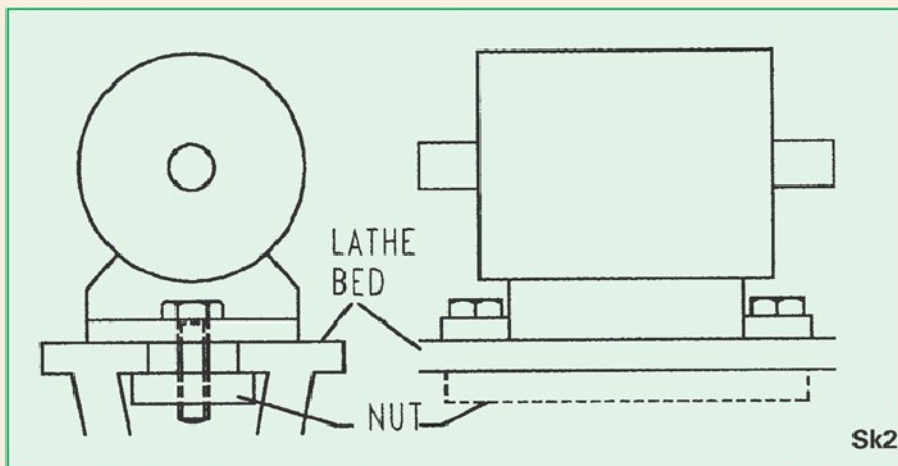


Fig 1 - Spindle bush



4. A stub mandrel is used for holding the flanges for machining.



5. The dividing head, described in a recent article, mounted on the lathe's cross slide for marking out the three holes in the flanges.

3) make an ideal method. Alternatively, if the grinder has a two screw mounting, then a length of steel of suitable width could be tapped to take two fixing screws as illustrated in **Sk 2** or, if four hole fixing, with clamp bars as in **Sk 3**. If the lathe has a Vee bed format then probably these methods could be adopted using some additional packing. If concerned regarding possible damage to the slide ways some thin card packing will eliminate the possibility. Having said that the mounting will not be called upon to withstand heavy loads, do not be complacent. Do give the spindle of the grinder a good tug to check adequacy of mounting prior to machining.

When mounting the grinder the spindle should run parallel to the lathe's axis. Using a surface gauge, with the two pins lowered and against the lathe's bed, check the position of the spindle at both ends using its scriber as seen in **photo 3**. If you have always wondered what the two pins in the surface gauge are for, now you know. For greater accuracy, a dial test indicator could be used in place of the scriber, with care though the scriber should give adequate results. When setting up for machining the second end, allowance must be made for the different spindle diameters. If the diameter of the first end has been reduced to 12mm, then if using the surface gauge with its scriber, the use of a 0.35mm (0.014in.) feeler gauge at the first end will compensate for the difference in the two diameters.

Inner and outer flanges

(Figs 2 and 3)

The essential requirement for these is for their bore, the face which contacts the wheel and that which locates against the spindle bush to be true and parallel and the 32mm diameter concentric with the bore. A detail section of the flanges is given, illustrating the profile which ensures clamping towards the outer diameter, and avoids the possibility of interference with the ends of the wheel bore.

Cut two pieces of 60mm diameter 11mm long and two pieces 9mm long. Place in the three jaw using the reverse jaws and face one side of each. Then reverse, making sure that the already machined face sits cleanly on the chuck jaws, and face the second side to 10 and 8 thick, respectively. At the same time bore each one to a little under 12mm, say 11.6mm. It is essential that the holes in all four flanges finish up the same size. To achieve this, continue opening up the fourth flange to 12mm diameter and leave the boring tool set at this diameter. Replace each flange in turn and using the boring tool at this setting open up to 12mm at one pass. Again ensure that each flange sits cleanly on the jaw steps for this operation. Note that the outer flange is opened up to 12.5mm. at a later stage.

Make a 12mm Stub Mandrel using a piece of material in the three jaw and at least 25mm diameter. First, face and tap the end M8 then turn a 12mm stub 7.5mm long. The 12mm diameter must be a close fit, almost a light push fit, in the bored holes in the flanges. Once made do not remove the mandrel from the chuck until

all four flanges have been machined.

Fit the first flange using an M8 screw and large washer and machine to the 32mm and 5mm dimensions, make also the 0.5mm deep recess, **Photo 4**. Ensure that the 32mm dia. are an easy fit in the grind wheels. Any form of interference fit here would risk cracking the wheel. Repeat for the remaining three flanges. Return the two outer flanges (3) to the chuck and open up bore to 12.5mm as per the drawing. Drill, tap and counter bore as required. Using a centre drill and the dividing head described in the milling projects series mounted on the lathes cross slide, position the holes as shown in **Photo 5**. For this arrangement I added an additional hole in the body of the dividing head for easy fixing, - see the single stud fixing visible in the photograph. It would be a good idea to make a tubular spacer, say at least 30mm diameter and of the correct height to bring the dividing head's spindle exactly up to lathe spindle height, retaining this for future applications.

The wheels

Whilst perhaps not readily available from normal suppliers to the home workshop, the wheels required are widely used in industry and should therefore be available from your local (or maybe not so local in remote areas) abrasives or engineering equipment supplier. Reference to your local Yellow pages should provide an address. The following items are those that I used, though your local supplier may offer something different, albeit only slightly:-

Taper cup wheel, Type 11, 125mm outer diameter, 40mm outer depth with a stated hole size of 31.75mm, grade WA60 KV1

Saucer wheel, Type 12, 125mm outer diameter, 13mm outer depth with a stated hole size of 31.75mm, grade WA60 KV1

(Both stated a hole size of 31.75mm but both measured 32mm)

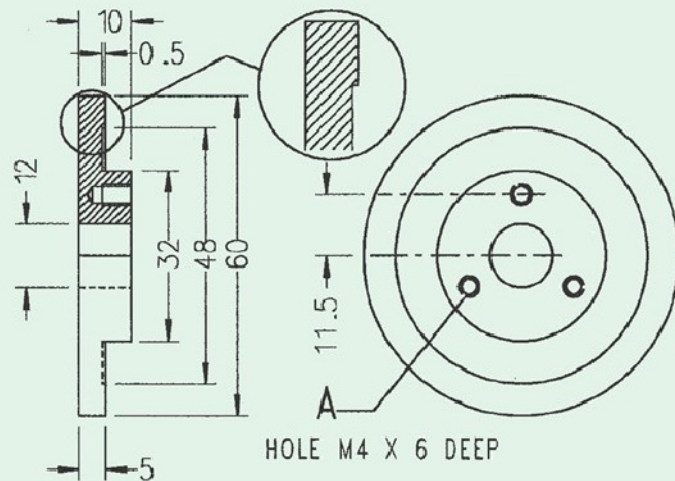
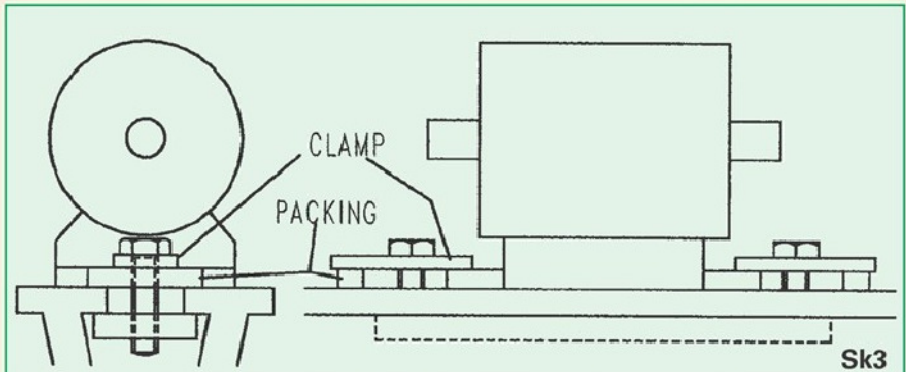
As an alternative to the taper cup (type 11) a straight sided cup could be considered, this would be a type 6. The outlines given in Sk 1 show the more appropriate DIN ISO 525 shapes that are available.

A brief explanation of the wheel material code may be of interest to readers from non engineering backgrounds. WA indicates that the abrasive material is high purity white aluminium oxide. The number 60 identifies the grain size, which may vary from very coarse (circa 12) to very fine (up to 600). K denotes the hardness grade on a scale from A - soft to Z - hard, and V indicates a vitrified bond or process. Other process symbols which may be encountered include S - silicate, RF - rubber reinforced, and O - oxychloride.

If you use a 150mm grinder there is no need to increase the wheel diameters to 150mm as 125mm and 150mm grinders will both run at the same speed, around 2950rpm. The larger wheels are also likely to be significantly more expensive, and maybe more difficult to obtain. Expect to pay around £40 total for the two wheels, whilst opting for a type 6 wheel could make the total cost a few pounds cheaper.

Mounting the wheels

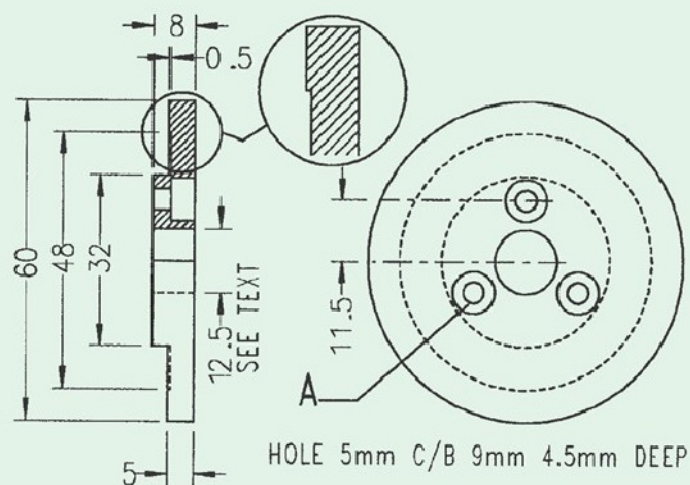
Fix the flanges to the wheels ensuring that the supplied paper disks, known as



MATERIAL
60mm DIAMETER STEEL 230M07.

QUANTITY 2 OFF

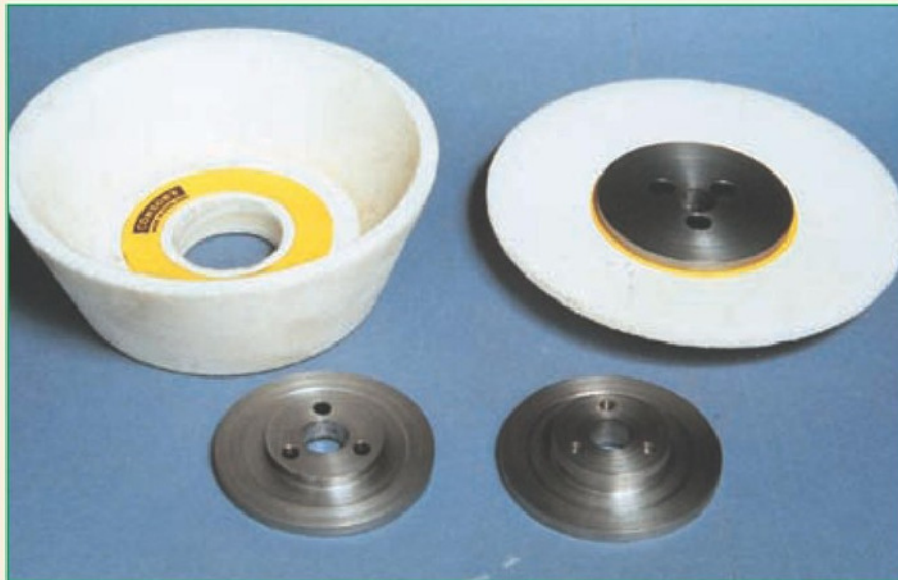
Fig. 2 Inner flange



MATERIAL
60mm DIAMETER STEEL 230M07.

QUANTITY 2 OFF

Fig. 3 Outer flange



6. The two grinding wheels and the flanges for adapting the large hole in the wheels onto a smaller spindle diameter.

blotters, are used. Very lightly tighten each screw in turn then gradually increase the tightness of each screw, again in turn. They should be tightened just sufficiently to securely hold the assembly together without movement, but certainly not as tight as would be done with a metal to metal assembly. Over tightening must be avoided! Then, using one of the flanges supplied with the grinder mount the assembly onto the spindle as shown in the assembly drawings. Again do not over tighten, just apply sufficient pressure to ensure reliable rotation of the wheel. **Photo 6** shows the two wheels, one already fitted with its flanges.

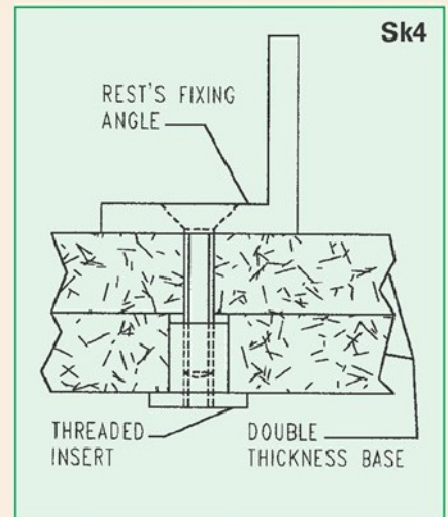
Mounting the grinder

Both grinder and rest need to be mounted on the same rigid base, any flexibility will

cause problems with finish and accuracy, and maybe even safe working. For this I used white melamine faced chipboard using two boards laminated for extra rigidity. These were held together using wood screws from below at the four corners, and with the grinder's and rest's fixing screws also helping. To cope with the fixing screws and nuts that would project on the underside, the edges were finished with strips of soft wood. These were wider than the thickness of the two boards thereby raising the assembly off the work surface.

Direction of rotation

I have read articles, though where at this time I am not sure, so cannot recap, which mention the need for cutter grinder spindles to be reversing. This caused discussion on the advisability of this when using a single central nut for fixing the



wheel as it may tend to come loose. In this arrangement there will be no problem as the apparent direction of rotation differs from end to end, the right hand end being anti clockwise and the left hand, clockwise. As a result the spindle has left and right hand threads to cope safely with this situation.

Mounting the Rest

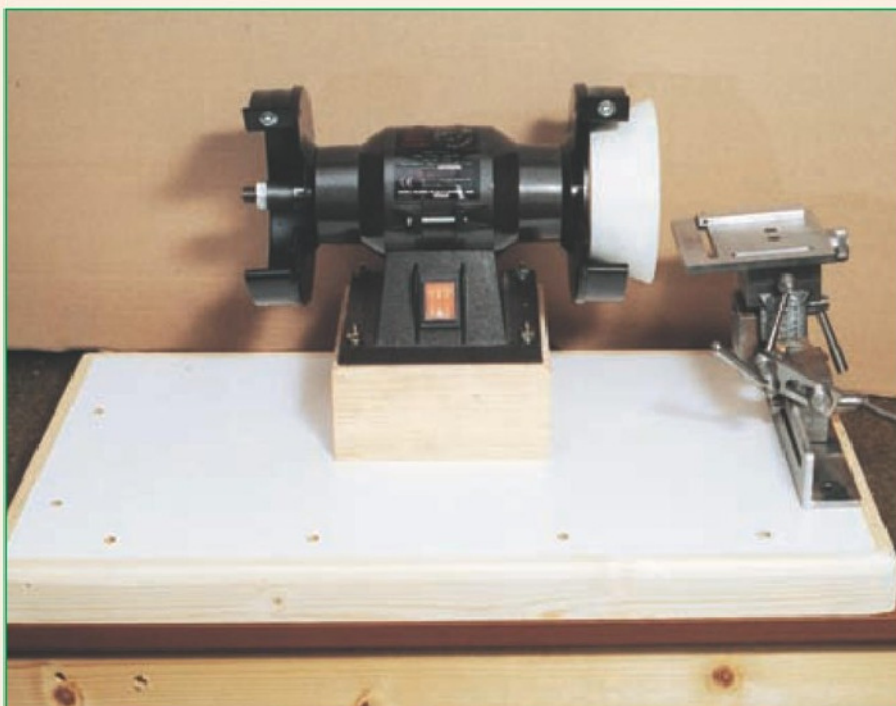
Mounting the rest with the grinder follows the same basic set up as was illustrated in the earlier articles. However, a second position for mounting the rest should be provided at the grinder's side as approaching the cup wheel from this angle will be beneficial in some instances. The mountings should also be repeated at the left hand end. **Photo 7** shows the set up, note the three additional pairs of holes for mounting the rest in the alternative positions. For ease of use, consider fitting inserts in the lower board as shown in **Sk4** as this will avoid the need to gain access to nuts on the underside when changing the rest's position. Make the inserts a push fit, and retain if necessary with two part resin adhesive.

If you are able to obtain a 125mm grinder it is likely that the rest may be a little on the high side for this, possibly more so for a 150mm grinder. The height may be readily adjusted by using a suitably thick piece of wood as a packer.

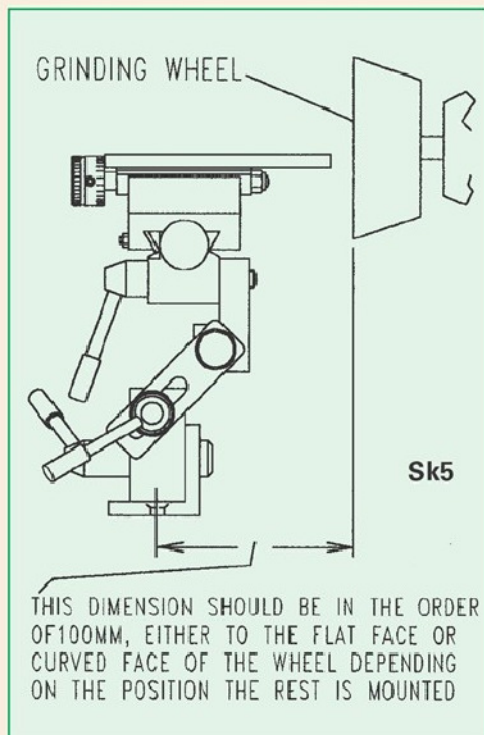
I have not given any dimensions for the overall assembly as these will depend on the dimensions of the grinder being used. However, there is one point that needs expanding on. The method of moving the rest's table closer to, or farther from, the wheel is to pivot the side arms. The design of the rest does though only provides for these to advance the table in front of the base angle as can be seen in **Photo 8**. The reason for this is that upright of the base angle limits the ability for the side arms to swing to the rear. This situation must therefore be taken into account when positioning the base angle relative to the grinding wheel ensuring that it is not too close as this will result in adjustments being difficult to make, see **Sk 5**.

Guarding

I have, as can be seen in the photographs, for the moment, chosen to retain the guards that were part of the original



7. The rest and grinder mounted on a purpose made base.



grinder. As can be seen in photo 7, these are unsatisfactory in terms of coverage now that the wheel projects further forwards, but I feel that only through experience of use will I better understand the level of access required to the wheels, and will then construct a guard offering both protection and convenience. I would though suggest that as removal and fitting of the wheels is very easy, that only the wheel being used should be fitted. This leaves the second spindle without a grinding wheel thus preventing the possibility of accidental contact.

Using the set up

Methods for using the rest will differ little from those described in the earlier article (MEW issue 92 page 12) so have not

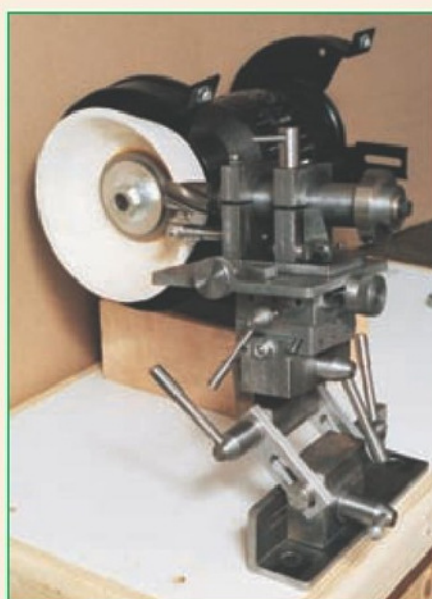


9. Sharpening the end teeth of an end mill with the rest mounted at the side of the wheel and at the right hand end.



8. The side arms permit the table to be moved forward of the base angle, but the vertical web of the base angle prevents adjustment in the other direction.

included any further instructions, I have though included two photographs to show it in action. **Photo 9** shows the end teeth of an end mill being sharpened (sorry for the sharp shadows my slave



10. With the wheel moved to the left hand end and the rest in the front position the cutting edges are being ground.

flash must have been out of position) whilst **Photo 10** shows its cutting edges being ground. These two photographs ably illustrate my comments above regarding adjustments to the rest's side arms. One final comment regarding photo 9, which shows the base angle mounted close to the board's edge enabling the lower clamping arm to rotate a full 360 degrees. This makes it possible to remove the bulk of the rest from the base angle, making it easier to move the base angle between the four mounting positions. 

Other reading

There have been numerous articles in the Model Engineers' Workshop regarding tool and cutter grinding, some of which illustrated the use of both cup and saucer wheels and in various forms of grinder. The following are a few of the more relevant ones that may prove beneficial reading:

Using the tool and cutter grinder (2)
issue 17 page 22

Sharpening end mills and slot drills
issue 25 page 30

Sharpening end milling cutters issue 44 page 42. This is continued in issues 45 to 48

Quorn Variations issue 79 page 16
The Raymac cutter grinder issue 80 page 42

MODIFICATION TO THE MILL/DRILL

Malcolm Sykes of Hallam, Victoria, Australia offers a simple alteration to avoid clamp quill jamming.

Problem

After using the Mill/Drill and clamping the vertical quill to mill a flat horizontal surface, it was found that after completing the operation and releasing the quill clamp, the cross sleeves remained

jammed in place, and still held the quill rigidly in position.

Remedy

The cause was considered to be the angle of the tapered surfaces of the cross sleeves

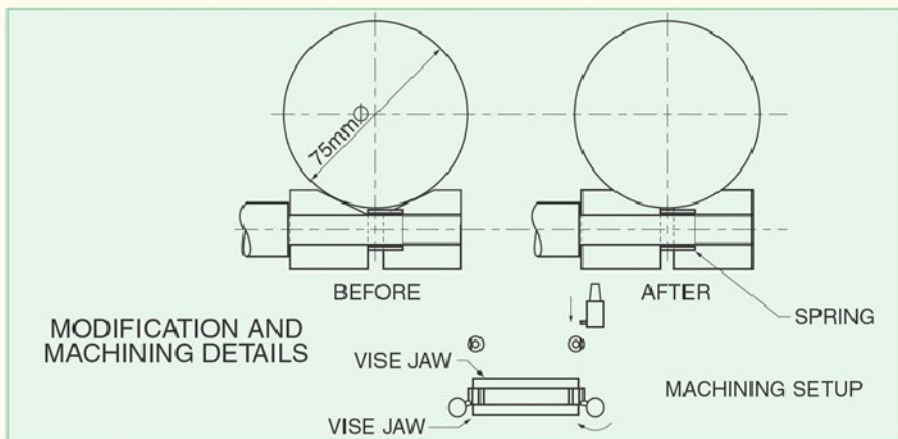
which introduced a self locking effect. To correct this, the cross sleeves were removed and machined with a surface contour to match the quill. In my case this meant a radius of 37.5mm. The required "thin end" thickness was measured by passing a suitable length of silver steel through the clamp housing, and then introducing feeler gauges. The combined thickness was then "miked".

The two sleeves were clamped in opposite ends of the machine vice (see sketch) and with the boring head set to 37mm, skims were taken from the angled face until almost all of the face had been cleaned up. The tool was then reset to 37.5mm, and further cuts taken, ensuring that the "thin end" thickness was correct. The second sleeve received the same attention.

All burrs and sharp edges were removed and the parts cleaned, lubricated and reassembled.

Comment

The clamping is now very positive, and upon release, the quill is instantly free.



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For Sale 6inch four jaw Burnerd chuck, studs, no back plate, £50-00 o.n.o. Please phone 0121 475 2022 (Birmingham)

For sale very old "Barnes" lathe. Motorised and belted, but no chucks or extras. £50-00 Buyer to collect. Please contact Pete Hill on 0116 222 3827 (Leicester)

For sale Watchmakers Handbook, Saunier, trans by Tripplin & Rigg, pub Technical Press 1945 - £25-00; Railroad Shop Practice, Stanley, pub McGraw-Hill 1921 - £20-00. Please phone 01286 678 584 (Caernarfon)

For sale Variable speed drive motor with controller £40-00. Please phone 01322 330556

For sale hefty 100:1 reduction gear, weighs 9Kg hence only £10-00. Also mains 700:1 reduction gear, compact neat unit, 0.4amp motor, integral 3 worm/wheels, weighs 5Kg hence only £10-00. Please phone Pat Twist 01962 880 475 Mid Hants.

For sale Cylindrical square (bottle square) approx 2in. dia. x 13in. high in splendid condition, ex toolroom in fitted case £15-00 plus postage (v. heavy) Also Rupert Mecrin 3 surface texture/finish gauge with standards in case complete with instruction book £15-00 Please phone M. Leafe on 01924 460 864 (W. Yorks)

For Sale, 31 copies of Model Engineers' Workshop numbers 1 - 34 except for numbers 14, 19, 28. These early copies are all in mint condition £50-00. Buyer to uplift or pay carriage please. Please phone Len on 01752 343 074

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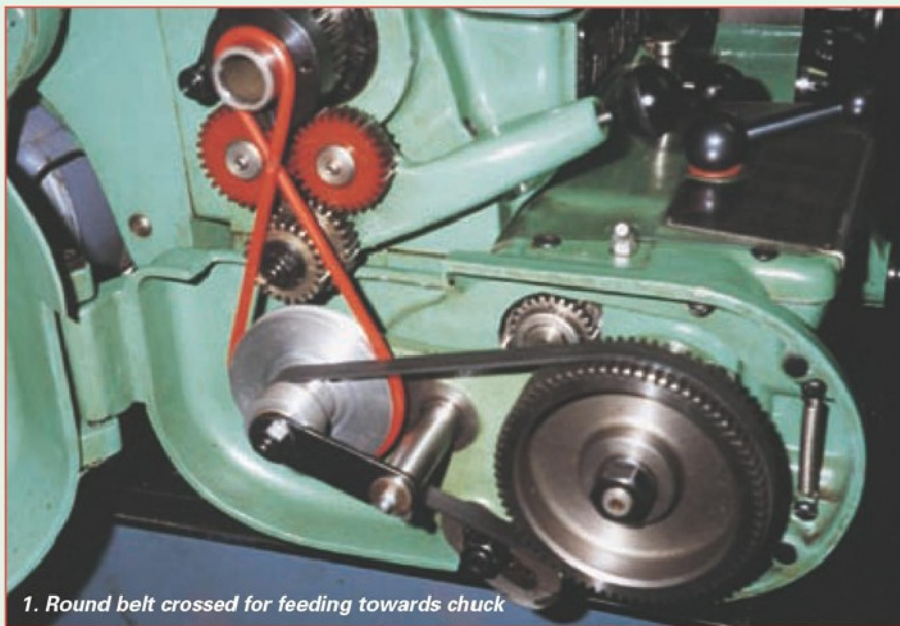
Wanted information//literature on Hobart Mill/G. Walther type R1180 NUL 3890 4135 N10. 88238986. Acquired with mixed up wires. Costs will be reimbursed. Please contact Jim or Jeff by phone or fax on 01908 6111 9117

Wanted - handbook on information for AB Arbogast Whisker Mill/Drill Model W2808 (Switzerland) to purchase or copy. All costs reimbursed. Please phone John 01376 343 6113 (Essex)

WEBS Wanted - "Looking for a good home for your old WEBS? Australia residents kindly ring (02) 9854 9516. Ask for Greg."

Wanted - handbook on advice on the "Grappion" hacksaw machine (18 inch blade). I need to fit a motor and pulleys of the correct sizes please. And how to use machine correctly & safely. Thank you. Phone 01635 444422 or email skyshot46@aol.com

A QUIET LATHE



1. Round belt crossed for feeding towards chuck

Maurice Cunnington from Busselton, W. Australia, has devised a feed drive which delivers lower noise levels at high speeds.

bushes. To machine the rear, put it on a mandrel. The porous bronze bushes are $\frac{3}{16}$ in. OD, $\frac{1}{16}$ in. bore, $\frac{3}{16}$ in. long. The drawing shows a wide vee. I first made a standard vee but the belt moved around a lot on the lathe spindle due to crossing the belt, so the vee was widened to allow the belt to move on the bottom instead of the top.

The length of the round belt is found as follows:-

Leave the quadrant in its original position for the gears, making sure the clamp bolt is tightened. Remove the two gears from the pins and fit the pulley. Now make up the belt in the uncrossed state and you should then be able to stretch it to run it crossed. If the belt slips in the uncrossed state, you will have to shorten it. Do not adjust the quadrant to tighten it or you will have to re-adjust it when setting up for screwcutting.

Operation

If you find that the flat belt wanders and moves out of the groove on the intermediate pulley, it means the gear pin is not parallel to the larger gear. The quadrant clamping bolt, if not adjusted correctly will pull the quadrant out of alignment. The bolt is held into the headstock by a grub screw, and can be adjusted.

You can leave the belts on for all speeds and at the top end you will enjoy a new experience in quiet working, as you will effectively hear only the motor when the lathe is running. This modification can be made in a short time, and the principle is not restricted to Myfords, it can be adapted to any lathe with a quick change box, but the spindle to gearbox ratio will have to be checked.



Background

I use my Myford on top speed range a lot in clock making, and the tumbler gears never seem to me to be happy at those speeds. I used to own a 4in. Swiss lathe and the feeds could be used on much higher speeds. Vee belts were used for the feeds and were almost inaudible when running.

On the Myford, the ratio between the lathe spindle and the input to the gearbox is 1:9, and my set up gives a ratio of 1:10. **Photo 1** shows a similar arrangement I have made up for the Super Seven, and it will be noted that the tumbler gears are not engaged. The round belt drives an intermediate pulley which in turn drives the gearbox by a flat belt. The round belt is shown crossed for feeding towards the chuck, to reverse the feed the belt is

uncrossed as shown in **Photo 2**, taking only seconds to make the change. To revert to screwcutting takes not much more time than usual.

The round belt is $\frac{3}{16}$ in. dia. plastic, the flat one is $\frac{1}{2}$ in. wide, and is salvaged from a Hoover upright vacuum cleaner, but be careful as there are two sizes. We need the one 4.5in. diameter. These belts can be bought as replacements.

When I was planning this exercise, I envisaged a small pulley on the spindle and a large pulley attached to the large gear, but in my eagerness I put the belts on as shown and found the first belt to slip was on the small flat step on the intermediate pulley, so no other pulleys were needed. The intermediate pulley shown in **Fig 1** was made from an aluminium casting that I had in the surplus box, but I think a standard vee pulley could be modified and used with spacers.

Construction

The pulley should be reamed or bored as near $\frac{3}{16}$ in. dia as you can get it to take the

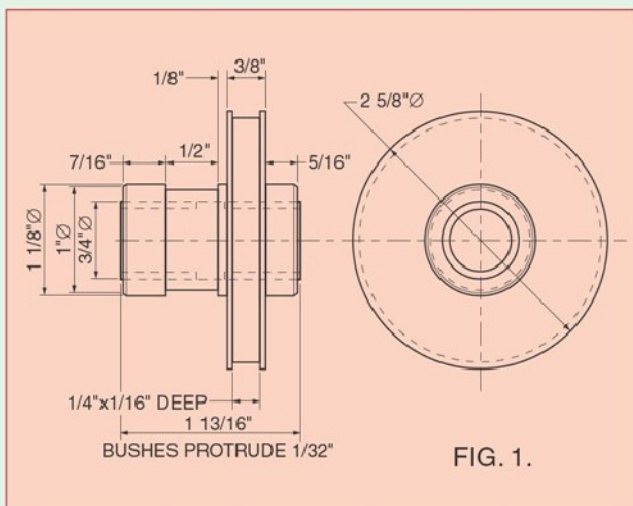
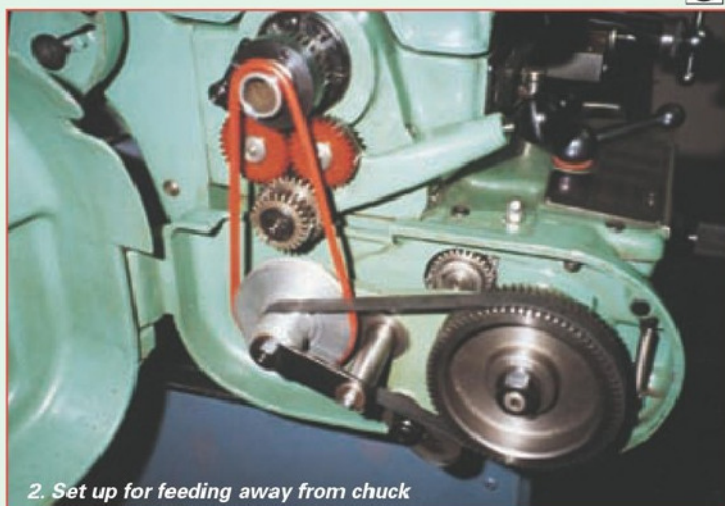
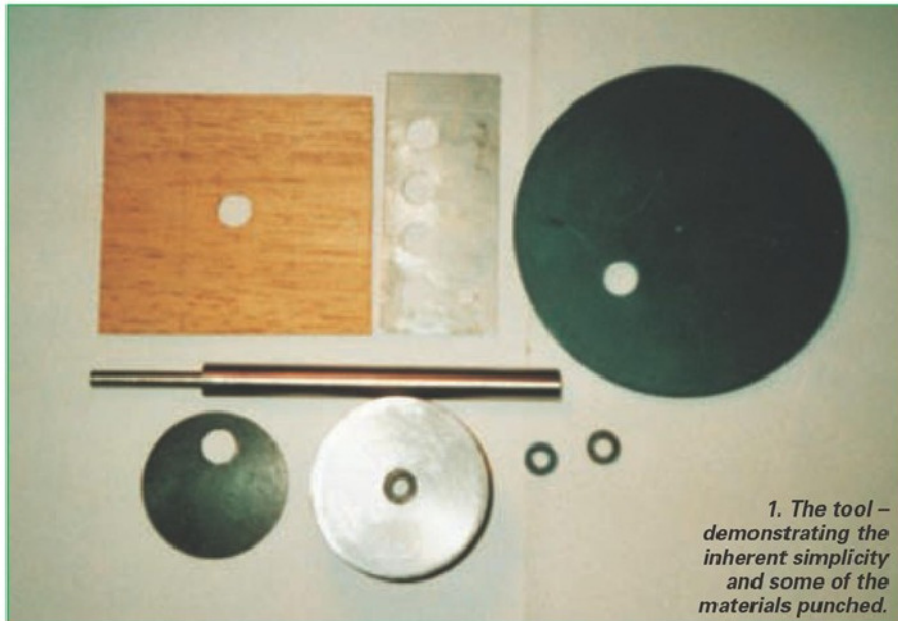


FIG. 1.



2. Set up for feeding away from chuck

WASHER TOOL



1. The tool – demonstrating the inherent simplicity and some of the materials punched.

Background

The tool described here, is similar to one I made several years, ago to punch out a quantity of 81 holes, each 25mm dia. in a one metre square by one mm. thick aluminium plate. Drilling was out of the question, as the clearance at the back of the drilling machine was insufficient to allow the centre of the plate to be reached. Also, the drilling machine I had at the time, would not take a 25mm taper shank drill. Even if the shank had been turned down to a suitable dia and held in the chuck, it would have been rather precarious to say the least, as difficulties can, and do arise when trying to drill thin material, especially with larger dia drills. It should be mentioned that there are techniques for grinding drills in such away, as to allow the material to be drilled supported on a piece of wood.

To produce the 25mm holes, was a simply matter of marking out the 81 positions and pre drilling 6mm dia, with a hand drill, and then opening up the holes to the required size using a punch and die. The 6mm dia. pilot holes, are used to help line up the punch with the die. The disadvantage with the tool, is that after 4 or 5 operations the blanks have to be knocked out from the back of the die with the aid of a small dia rod. A more efficient tool can be made, by securing the die to a base plate, which can then be removed to make it more accessible to remove the blanks by ejecting them through the back of the die. An even better solution is to make a tool suitable for use on a fly press. If you don't have one of these, light work may be undertaken using the drill or mill quill as a pseudo press. If alignment of the punch can be assured, then blanks may be ejected directly downwards

Washer tool

As short time ago, I needed a few plastic washers for the electricity in a model aircraft I was building, and not finding a suitable supplier, I decided to make a few out of some scraps of plastic I had lying about. The setup I used was to make a punch and die, as outlined, and which will always available if I require any more at a later date. In fact, I made a few different size tools, as they are easily made. Photo 11 shows the tool, with the different types of materials that can be punched, plastic, mild steel, aluminium, brass wood etc.

Making the tool

Fig 11, illustrates the tool, which was made from a 2 inch dia scrap bar end of a rod. This was drilled and reamed through 6mm dia, for the pilot pin, (which is the same as the

ID. of the washer) and then opened up to 10mm dia, (the OD of the washer) by 12 mm deep. The punch I used was a short length of 10mm dia silver steel. Drilled and reamed at one end, 6mm dia, about 25mm deep, this wants to be a tight fit for the pilot pin. It is important that the pin is central with the OD. of the punch, otherwise the punch will not line up with the die.

Making the washers

To make the washers, I first drilled several 6mm dia holes in the material to produce the internal diameter of the washers, and then proceeded to punch out the washers by feeding the 6mm dia pilot pin in the end of the punch through the 6mm dia drill hole, and then into the pilot hole in the die. A screw tap with the hammer will then produce the washer. The problem

Mike Tierney gives guidance on making washers from sheet.

now, as I've already explained, is removing the washers from the die. Ejecting them by pushing through from the back is difficult, because there is now, no shoulder to press on to, because of the 6mm hole through the centre of the washer. The revised tool, Figs 2 & 2a show a modified version, which I have not made yet, but do not envisage that any problems will arise. This die is secured to a base; and will allow the die to be removed to release the washers from the inside of the die. Prospective builders may choose their own type of base, round or square, make this about 200mm thick. The first operation is to bore out the recess in the base 3mm deep, to suit the die. I would make the die at least 500 dia, by 25 thick, next bore the 6mm dia pilot hole through the base, as this will centralise the two diameters, this again wants to be a nice push fit for the 6mm dia pilot pin. The punch is made in the same manner as before. To ensure reasonable accuracy, I have suggested reaming the 6mm dia pilot holes, but it will make for a better job by boring the 6mm pilot hole, rather than drill and reaming. If I can pass on a tip to newcomers to model engineering, when reaming a drill hole, the reamer will follow the start of the hole, and therefore, the position may be slightly out. If you don't have a boring bar small enough, then you can improve the situation by using a slot drill. First drill through with a 5mm dia drill, then open up with a 58mm drill, and before running the reamer through, insert a 6mm dia slot drill (the size of the reamer) into the drill hole about 5mm deep, this will position the start of the drill hole accurately, allowing the reamer to run true with the start of the hole. The same applies to jig boring, it will help to keep your hole centres accurate. If you have one, use a machine reamer, rather than a hand reamer, also make sure there's the least amount of metal in the hole for reaming, usually about .007 inch (0.177mm) otherwise, the reamer might behave like a drill. And never reverse a reamer when withdrawing from the hole, it may break! (Also, beware of hand reamers, straight out of the box, they are frequently up on size .0007 inch.)

Fly press

For those not familiar with the fly presses, (photo 3), they come in a variety of sizes, have a means of precisely loading and guiding the punch, with the down force being delivered via a coarse screw thread rotated by the handle and fly weight. The rotating inertia is converted into a punching force which may be of several tons. In addition it is usual to have a fine adjustment of the down stroke travel, which makes possible such operations as repeat bending to precise angles.



2. Punching galvanised sheet steel.

Let us now consider how a more elaborate set up may be used. I use the washer tool (shown punching galvanised steel in photo 2) only as an example. If you are the owner of a fly press, then you can, if you wish, produce tools and components of a more sophisticated nature. Figs 3 & 4a illustrate this, with another type of tool that can be used in the fly press. This type of tool also has a pilot in the end of the punch, which locates in the drill hole, which represents the internal diameter of the washer. A stripper plate will be required when using a tool of this type, as this will, on the return stroke of the press, strip the material from the punch ready for the next operation. Figs 4 & 4a indicate a "spring loaded" stripper tool, more typical of industrial use. This will allow greater access around the tool, unlike the fixed stripper tool (Fig 3) that has the material cut to a set width. In a commercial set up, Fig 5 there could be two strip guides, one with a spring loaded

bear, pushing the material against the opposite fixed guide. This will keep the holes in line, and a "trigger stop" (not shown) to stop the strip moving forward to the next pilot hole, until an appropriate point in the cycle.

Die manufacture

Making tools to punch round holes is a relatively simple matter. It becomes a bit more difficult when the geometry of the holes is anything but round, such as, square, half round, oval, diamond, star shape etc. The method used, in days gone by, was to drill out the aperture and to finish the shape by filing to a gauge. We now have wonderful machines that do all the work for us - CAD/CAM wire spark eroders, that produce any shape of hole, and with great accuracy. With the aid of these types of machinery, dies can be drilled, tapped and heat treated before any shape is machined in the die. This allows for total freedom from distortion, which would certainly occur if the die had been heat treated after the shape had been machined. One method open to the model engineer, is to make split dies. Photo 4 shows some of the components I've produced from tools of this nature - Phosphorus bronze laminations, bonnet clips, and special hinges. It must also be noted that for non round holes, some method must be incorporated to ensure that the punch and die remain in an angular alignment. A fly press gives this facility.

Making split dies

Fig 7 illustrates the construction. The dies are made in two sections, screwed together to form a one piece die. This method, in some cases, allows the internal sides of the die to be ground after the die has been heat treated. Thus, removing any distortion from the die form. Two of the die steels where not ground, and worked out satisfactorily in producing the blanks. The die steel for the phosphorus bronze



3. A typical fly press set up for light bending. Note the "rough and ready" bottom tool has not been secured.

component I ground internally. (I did this during my lunch break at work) because of the nature and thickness of the material (4000mm), also no sharp jagged edges were to be produced on the underside of the component, as they were to be stacked on top of each other with no daylight showing between the laminations.

Cutting clearance

In my earlier article "Shim tool" which appeared in issue 88, of this magazine, reference was made to the amount of cutting clearance between punch and dies. For those readers who may not have seen the article, then Fig 6 illustrates this and its importance in producing a clean component. The correct amount of clearance helps to prevent the forming of

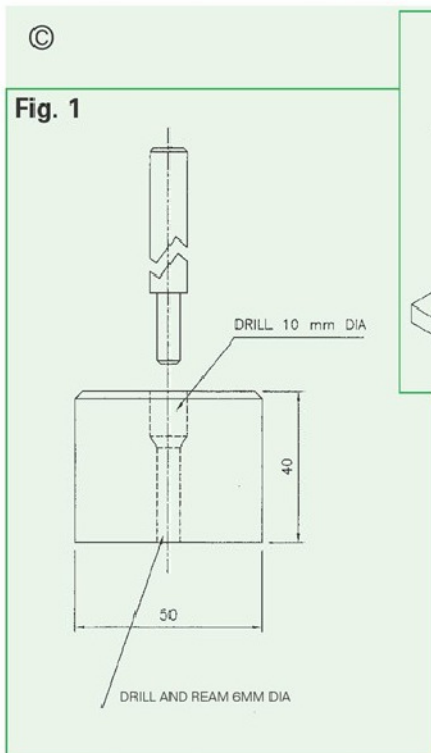


Fig. 1

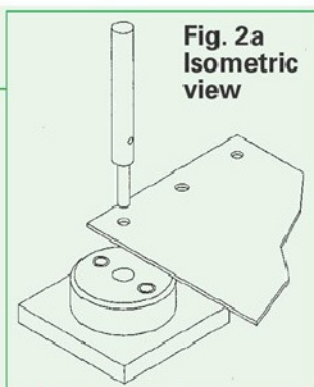


Fig. 2a Isometric view

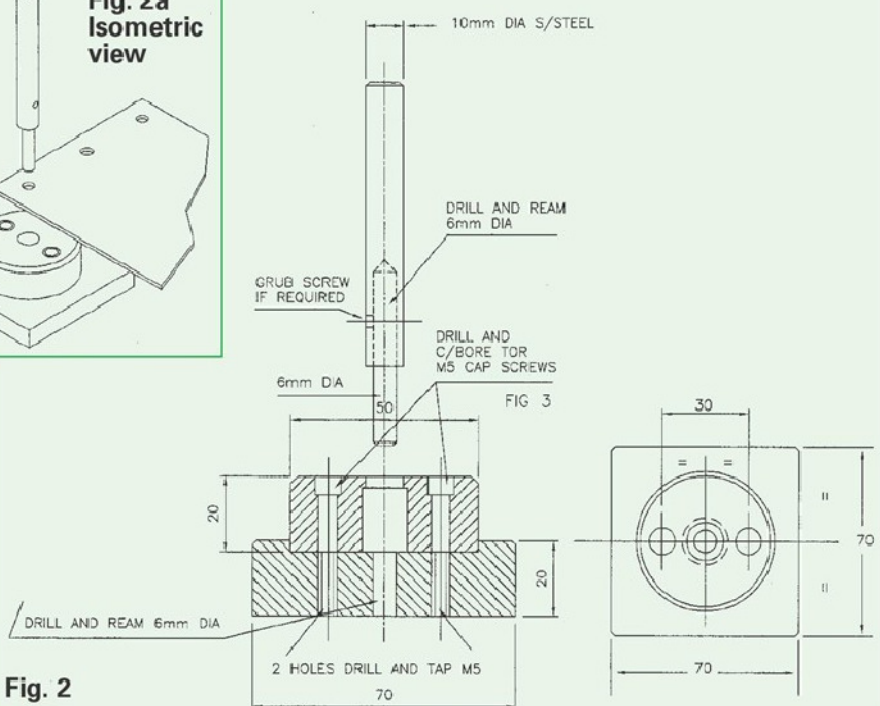
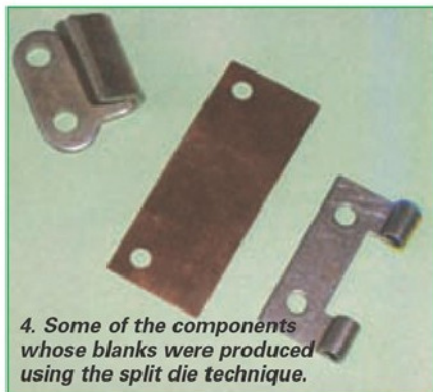


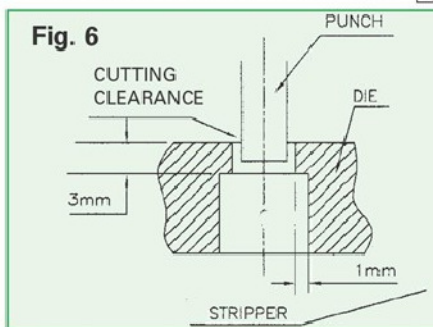
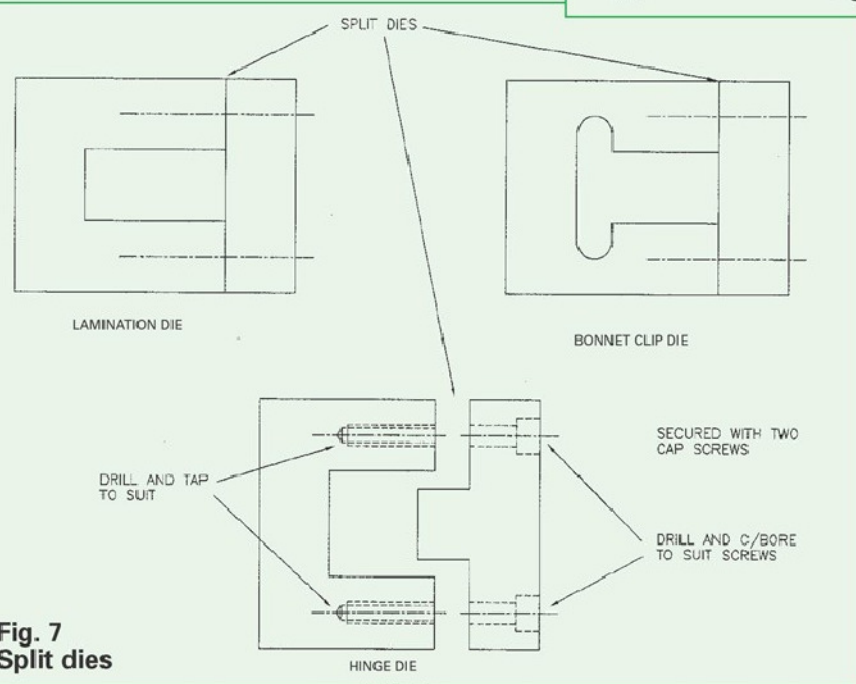
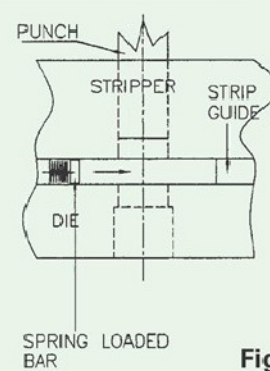
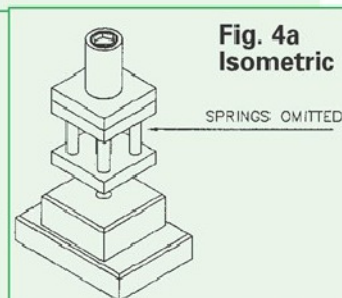
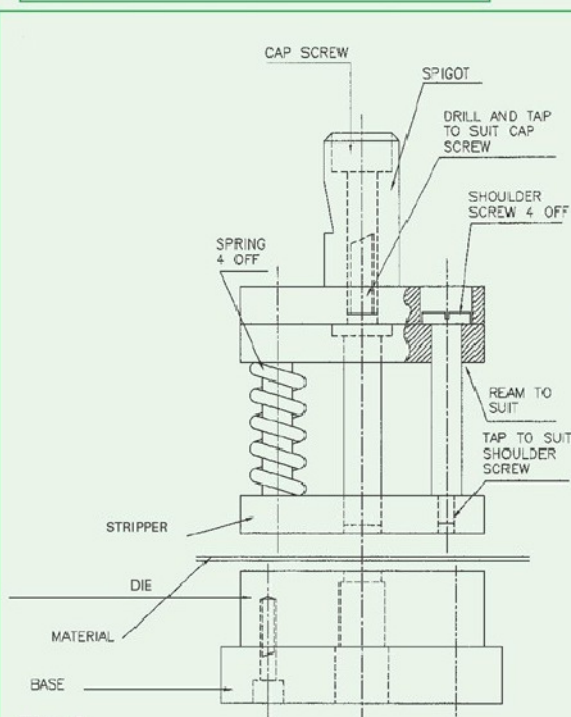
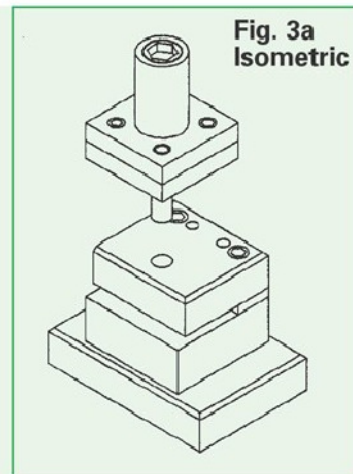
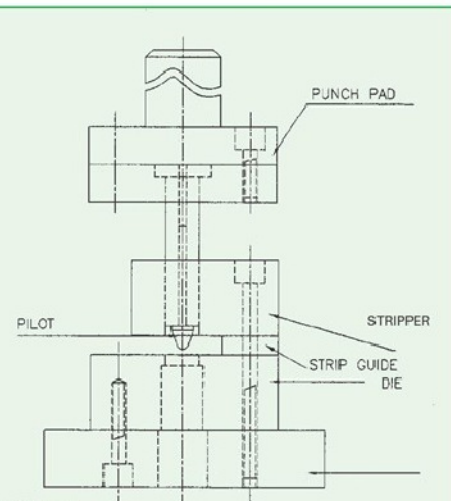
Fig. 2



jagged edges on the underside of the pierced hole or blank. The amount required is somewhat down to experience, but a good rule of thumb, would be, one tenth of material thickness (100%). For example; if the material is 2mm thick, then $2\text{mm} \div 10 = 0.2\text{mm}$ (0.1mm each side). One point to remember, for a blanking tool similar to the three tools I made, the die is made the required blank size, and the punch has the clearance, that is, made smaller. The punch will leave a hole in the material, the size of the punch, whereas the blank will be the same size as the die aperture.

Conclusion

The tools outlined in Figs 1 and 2, were made to suit my own requirements, but I hope that other readers may find them of use, either directly, or to convey some ideas as to what can be achieved with this type of simple tooling. I've also included in this article, some basic press tool manufacturing techniques, which may also be of interest to the reader. A future article will include a look into methods of producing the curls in hinges. Presswork forms an important section of metal goods manufacture in this country, the products being applied in every conceivable manner. The machines employed, on which press work is accomplished are various in type, from a small bench fly press, to huge machines capable of stamping objects many metres long. The tool room has now almost become absent from the world of engineering, and so the decline of the toolmaker is inevitable. Sadly, due to the shortsightedness of successive British governments, engineering manufacture continues on its sad decline, and in a few short years may cease to exist. Cars, buses, and ships etc, are no longer made in volume in this country. Heading the same way also, could be the British defence industries. Will it be from nulling the ways to unable to make aerospace hardware in much less than a century?



ORNAMENTAL TURNING FOR MODEL ENGINEERS

Following interest expressed by readers in the work of the Society of Ornamental Turners as displayed at the Model Engineer Exhibition, John Edwards (then Treasurer and now President of the Society) was asked to write some introductory notes which were published in the December 1998 and October 1999 issues 55 & 61 of MEW. A number of readers have since asked for more information, and John has kindly obliged.

History and Background

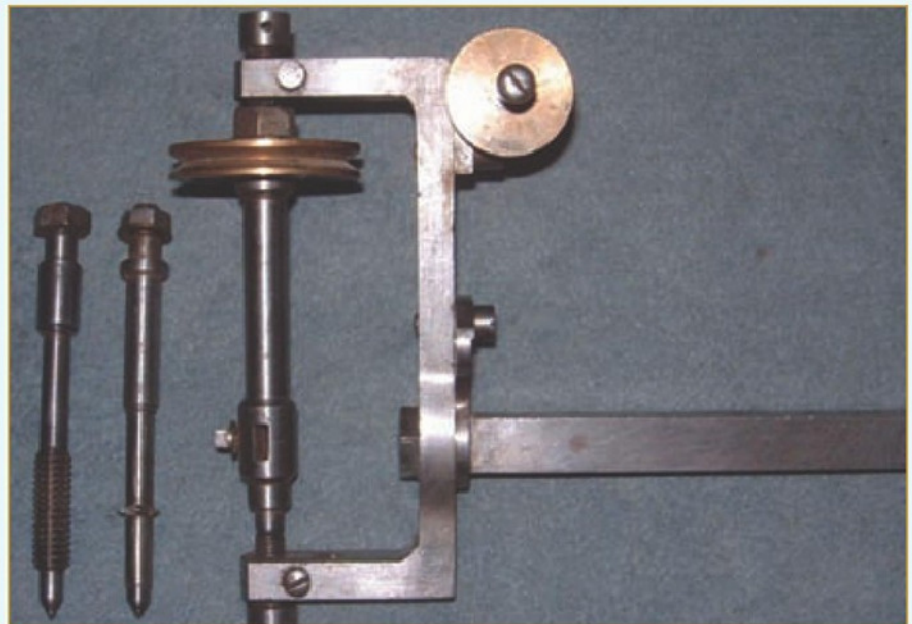
Ornamental turning became a hobby of the nobility in the 17th and 18th centuries when the crowned heads of Europe vied with each other to produce the finest and most complex work. For this purpose they employed the best engineers to copy, improve or invent lathes and other machines for ornamental turning of ever-increasing variety. A fact, of which most people are unaware, is that these inventions provided the inspiration for many of the industrial machines developed in the 19th and 20th centuries, some of which are still in use in our workshops today. In the 19th century the hobby became extremely popular among affluent mechanically-minded amateurs and it remained so until the First World War when it was largely superseded by interest in a new invention: the motor car.

The appeal of ornamental turning for model engineers is threefold; first, there is a fascination with the ingenious machinery invented by our forbears of the 18th and 19th centuries for making unusual shapes and patterns on the lathe; secondly, there is the challenge of making such apparatus for oneself and, perhaps, inventing improvements; and thirdly, there is the joy of producing with one's own hands a work of beauty; at least, in the eye of the beholder.

In the introductory articles I outlined items of basic equipment needed to adapt an engineering lathe for ornamental turning and to cut basic patterns. They are:

- adjustable stops on the main leadscrew and cross-slide screws
- an overhead drive
- a mill/drill spindle and cutters
- a quick-change indexing system.

If you do not have all these facilities you may wish to refer to the article in MEW issue 61. With them it is possible to cut a good range of basic patterns; enough for you to decide whether or not you want to take this pastime further. If you do, your first upgrades should be: a 'Horizontal Cutting Frame' (HCF) with angular adjustment, an 'Eccentric Chuck' and an 'Eccentric Cutting Frame' (ECF). The HCF,



1. The completed Frame with additional spindles.

besides being a useful cutter for ornamental turning, will assist you in making the Eccentric Chuck and these three items of equipment will allow you to cut all sorts of patterns, a few of which are illustrated in the accompanying photos.

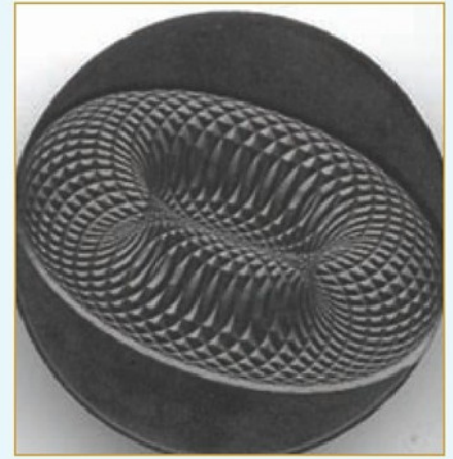
The Horizontal Cutting Frame (HCF)

This device in its simpler form, is a frame containing a spindle that runs vertically and holds at its centre a cutter that runs horizontally. The improved model (see **Heading Photo**) has an angular adjustment so that the cutter may run at an angle other than horizontal. For ornamental turning it is sufficient to have one spindle with a central slot that will hold cutters of the standard size but, in this case, to assist in cutting a wormwheel for the next project, an Eccentric Chuck, it is suggested that two further spindles be made; one to rough-cut each tooth of the wormwheel individually and the other, in the form of a

tap, to hob the teeth so that the worm and wheel will run freely together.

The component parts of the HCF are shown on the drawings. When in use it is held in a toolslide of the slide-rest (or in a toolpost on a modern compound slide) by its $\frac{1}{2}$ in. square steel shank; this is the standard size for all cutting frames and I would recommend you to follow this standard in case you acquire any original O.T. equipment in the future.

The only other critical size is the slot in the cutter spindle for ornamental turning; standard O.T. cutters are of rectangular section 0.150in. x 0.350in. and if these are to be used the slot should be made to accommodate them. Cutter spindles are quite easy to make so you may wish to make additional useful ones; e.g. with square or round slots to take modern standard cutter blanks. All other dimensions are flexible so you may use whatever materials are to hand but I have shown example dimensions in the sketches for any reader who may wish to copy the one illustrated. As ornamental turning was



Examples of complex patterns generated in Ornamental Turning work.

primarily a 19th century pastime (and because I find it difficult to think in metric!) I have taken the liberty of using the imperial system of measurement.

Square shank and sector plate

(Fig 1)

The shank terminates in an accurately sized spigot plus a screw-threaded end. The sector plate is fixed to the larger diameter section of the spigot, and the reduced diameter section which should be held to close tolerance, passes through the Frame, which should be drilled and reamed to fit, so that when a nut is screwed on the end of the shank it will be held to the frame without slop. By slackening this screw the frame may be adjusted to any angle within the range of the sector; the nut is then re-tightened and

a screw passing into the frame through the slot into the sector plate is also tightened to fix the instrument at the desired angle. It may be noted that while a parallel spigot location diameter has been shown, traditional OT equipment frequently features a taper fitting.

The **Sector Plate** is milled from a flat steel plate to leave a rim around the top of the sector which is then engraved with a short line for every degree and a longer line for each 5th degree of angle from centre; the plate is then press-fitted (or silver-soldered) over the front end of the shank. When the instrument has been assembled it is adjusted until the spindle is running exactly vertical at which point a datum mark is engraved upon the shank opposite the engraved zero line on the sector plate. The instrument as illustrated has a sector of just 30degrees so it may be set to the helix angle of any wormwheel to be cut. Whilst this is also sufficient for some O.T. applications, a sector of

90degrees would be more versatile, although an additional double pulley would need to be fitted to control the driving band which would otherwise slip off when an angle of more than, say, 15deg. in either direction is set.

Frame

The frame (fig 2) may be made by several methods: fabricated by welding, bolting or pinning and silver soldering, forged into shape from a steel bar or, the shape may be cut out from steel plate. The frame illustrated was cut from a bar 1in. x 0.375in. and forged to give inside dimensions of 4.75in. x 1.875in. (outside 5.5in. x 1.25in.).

Vertical holes are drilled and tapped into each end of the frame (1/4in. BSF or similar). These tapped holes must be in line as they will position the bearings, and hence the spindle which should be set accurately vertical. The bearings, take the form of

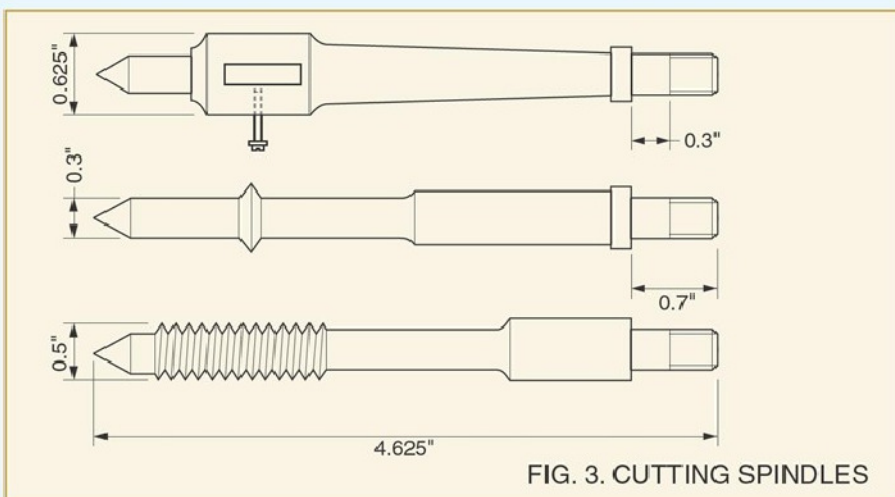
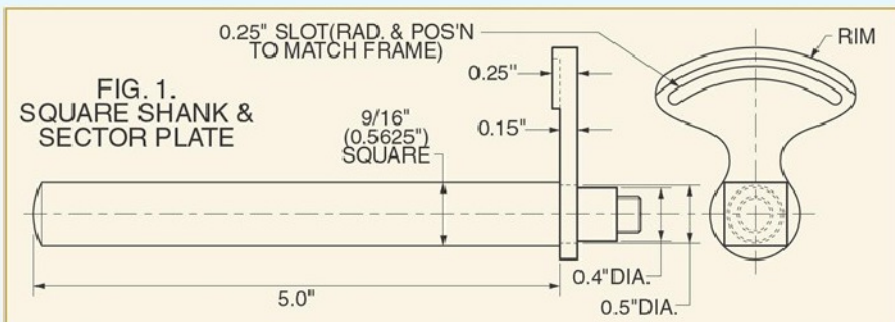


FIG. 3. CUTTING SPINDLES

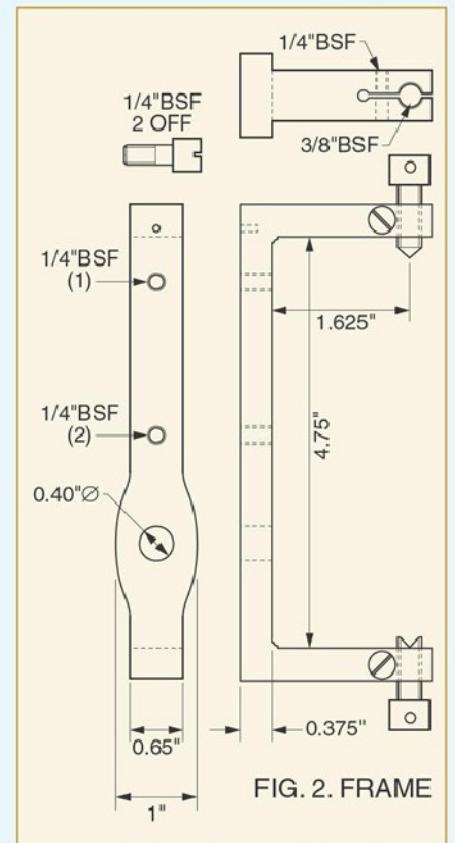


FIG. 2. FRAME

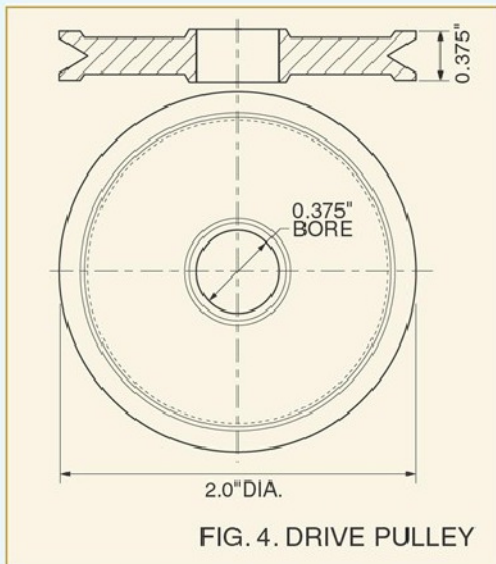


FIG. 4. DRIVE PULLEY

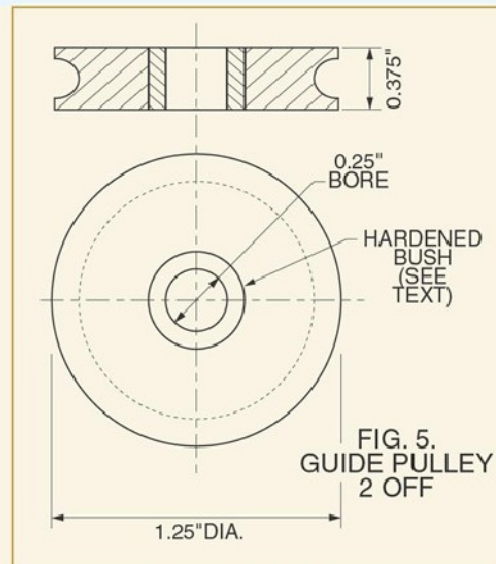


FIG. 5.
GUIDE PULLEY
2 OFF

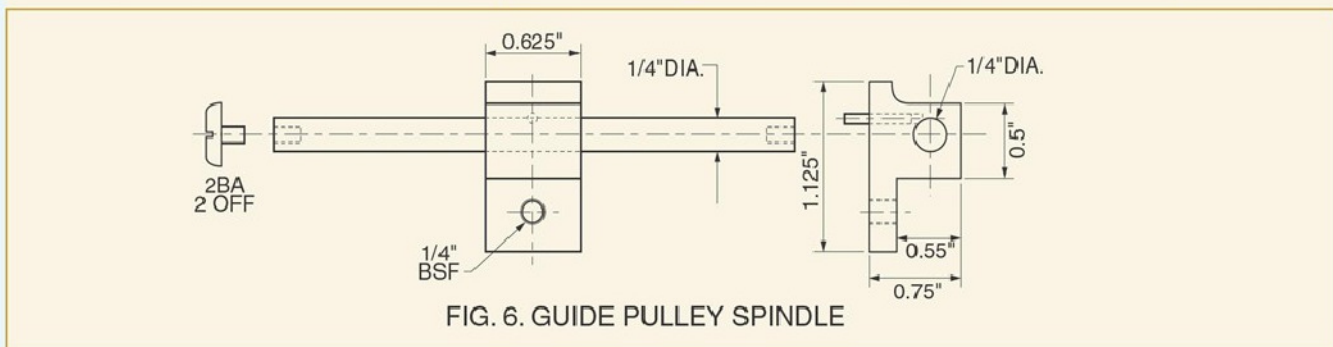


FIG. 6. GUIDE PULLEY SPINDLE

capstan-head screws, the top one with a male and the bottom one with a female cone bearing, are fitted into them; this arrangement is designed to trap the lubricant in the female cones. Smaller secondary vertical holes are drilled behind the bearing holes and vertical saw-cuts are made through each end of the frame splitting the pairs of vertical holes. Horizontal holes are drilled midway between the pairs of vertical holes and tapped to receive pinch screws so that when the bearing screws are properly adjusted the pinch screws will hold them firmly in place. About 1in. above the bottom bearing, a horizontal hole is drilled through the back of the frame and reamed to fit the spigot on the shank. Two further holes are drilled and tapped (1/4in. BSF or similar) into the back of the frame, one (about 1.25in. above the spigot hole) for the sector plate fixing screw, and the other (about 3.0in. above the spigot hole) for the Guide Pulley Spindle fixing screw. About 0.625in. above the last hole a pin-hole is drilled and when the guide pulley spindle has been screwed into place and set at right angles, this hole is drilled through into the central block and a pin driven in to locate the spindle in this position.

Cutting spindles

These must be made proportionate to the frame; for example, if the gap in the frame is 4.75in. the spindles should be about 4.625in. long. The cutter slot must be positioned so that the cutter will run accurately in line with the axis of the shank and the bearing screws are adjustable to enable fine centre adjustment and to ensure the spindle runs freely and without

play. If the cutter slot is offset so that the face of the cutter is on or near the centre line of the spindle, it will cut more effectively than if the slot is merely cut in the centre of the spindle. The spindles and the bearing screws need to be made from high carbon steel e.g. silver steel, so that the ends of the bearings may be hardened. Three spindles are shown in Fig 3.

Cutting Spindle No.1 is made with a rectangular slot into which the standard size of O.T. cutter (0.350in. x 0.150in.) may be fixed in place with a grub screw.

Spindle No.2 can be made with a single toothed cutter passing through a hole in its centre or, alternatively, by using larger diameter steel rod (say 1/2in.) to start with, a multi-tooth cutter may be formed on the spindle by leaving a disc-like section unturned in the centre, then forming it into teeth and hardening them. **Spindle No.3** is made similar to the worm that will be made for the Eccentric Chuck; screw-cut at 0.5in. diameter x 10 t.p.i. The threaded section of the spindle is then slashed along its length with a narrow grinding wheel and the teeth may be backed off by filing to form it, like a screw-tap, into a hob. The finished spindle is then hardened.

Pulley system

A brass **Drive Pulley** (fig 4) is fitted on the top end of a cutting spindle and held in place by a washer and nut. If necessary a key may be inserted to prevent the pulley from rotating on the spindle when under load. The groove in this pulley is 'V'-shaped for better grip of the driving band.

Brass **Guide Pulleys** (fig 5) with plain hardened steel press-fitted bearings, are mounted on a hardened steel **Guide Pulley**

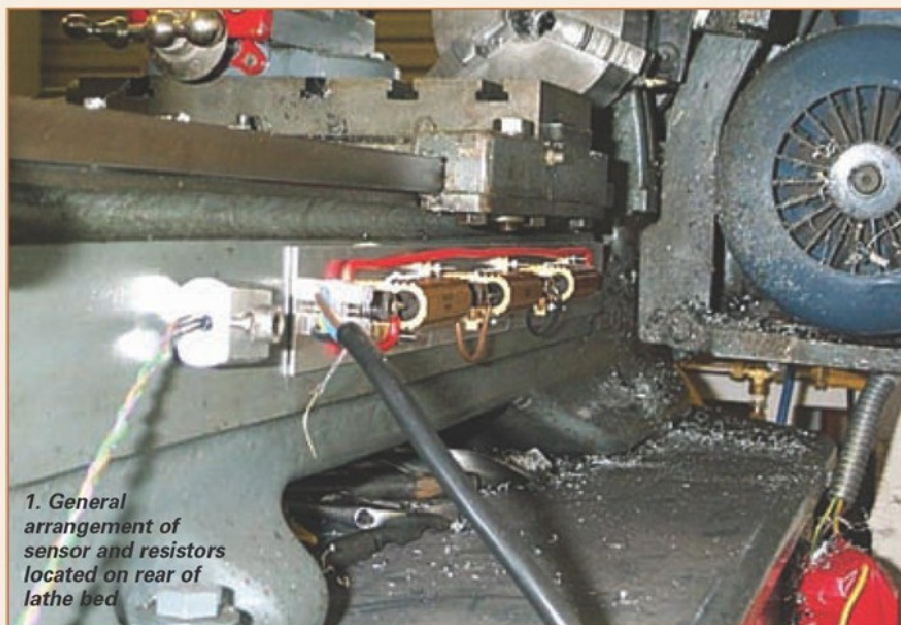
Spindle (fig 6) (about 3in. long) fixed in a block at the back of the frame. The rod is drilled and tapped (2 BA or similar) at each end and screws are made with heads large enough to prevent the pulleys from falling off. The grooves in these guide pulleys are 'half-round' as they are not required to grip the band. A band from the overhead drive passes around the guide pulleys to the drive pulley so the diameters of the guide pulleys should be proportionate to their position with regard to the drive pulley. For example, if the outer diameter of the guide pulleys is 1.25in. and their pitch diameter (centre of the band) is 1.125in., the guide pulley spindle should be half that distance (0.562in.) above the centre line of the drive pulley; so, if the instrument is made in the proportions suggested, the centre line of the drive pulley will need to be about 2.75in. above the axis of the shank (i.e. centre line of the cutter). The guide pulley spindle is made long to allow the pulleys to slide apart so they may accommodate a drive pulley of any size within the capacity of the frame; the one illustrated is 2in. diameter which gives sufficient torque to cut a wormwheel. A smaller drive pulley, of 1in. or 1.25in. diameter, should be sufficient for the faster, lighter cuts taken in ornamental turning.

Eccentric chuck

My next article will describe this accessory, a work-holding chuck that fits on the lathe spindle and gives the facility of moving the workpiece eccentrically in relation to the axis of the lathe spindle. With this chuck it is possible to make cuts based on multiple centres without removing the workpiece from the chuck.



KEEPING RUST AT BAY



1. General arrangement of sensor and resistors located on rear of lathe bed

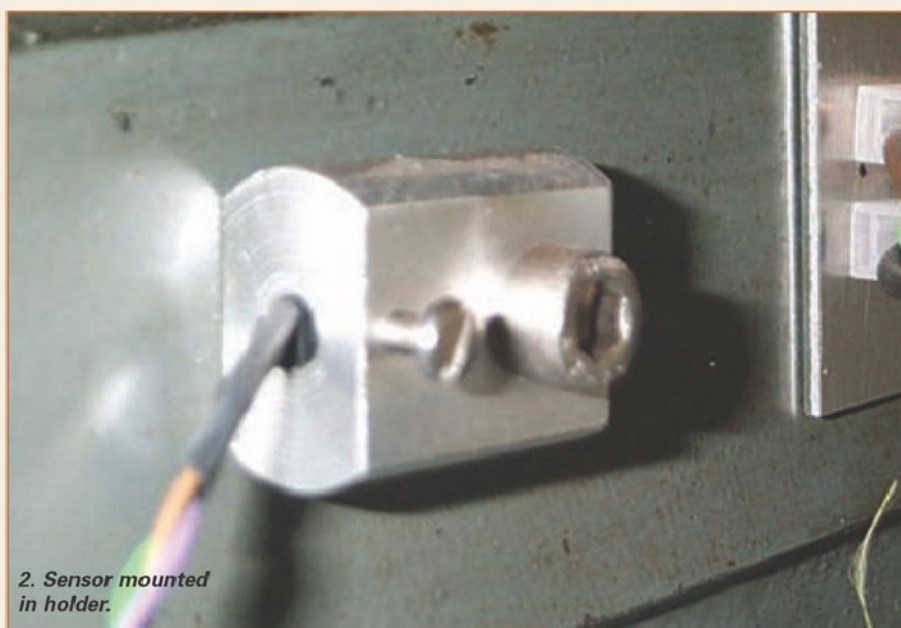
This article describes a simple controllable heating system which was found necessary to reduce the amount of surface rust appearing on my Myford ML7 lathe. The lathe is kept and used in an outside garage/workshop. The whole system runs from a low voltage supply (12-14 volts D.C.) provided by an easily obtainable power unit.

With some minor modifications the system can be used for basic temperature control in many applications for example plant propagators, hot plates etc. I have also used the same idea to make a heated box in which to keep often used bits,

chucks, drills and cutters. The system falls naturally into three parts:

The heater

This is an aluminium plate approx. 1.5 inches wide by 15.5 inches long with three power resistors (one of one ohm, and two of half ohm resistance and 50 watt rating) bolted on with counter sunk screws. There must be a coating of thermal compound between the resistors and the plate to aid thermal transfer. The complete plate is then bolted to the bed of the lathe (Photo 1), again with a layer of thermal compound.



2. Sensor mounted in holder.

The approach of winter signals plummeting temperatures and dreaded condensation. Iain Manson of Livingston, outlines his system for rust avoidance.

Make sure the surface of the lathe and the rear of the aluminium plate are free from burrs etc. to ensure good thermal contact. The 1 ohm resistor should be positioned so it is at the chuck end of the lathe. My lathe has 6 holes on a 4 inch pitch which seem to be tapped M6 or similar. These may not be original, and yours may be different, so see the picture for general layout.

There may be some concern that as heat is being applied to the rear of the lathe this may cause some inaccuracy. I have not seen any errors due to this myself, and we are only raising the temperature to just above the point where condensation occurs. Most machines tend to increase in temperature during normal use in any case due to friction and heat from motors etc.

The control electronics

A simple comparator control circuit is used, (Fig 1) which drives a solid state switch, hence no moving parts. The temperature sensor connects to this unit and is physically mounted on the rear of the lathe next to the heater, again with some thermal compound. The main requirement is that the power FET is mounted on a heat sink. This can be a separate heat sink or you can use the box if a metal box is used. The circuit description below gives more details of the electronics.

The power supply

This is a simple 12 to 14 volt regulated D.C. power supply, rated at greater than 7 Amps. The most economical type I can find is the type normally used by CB or amateur radio enthusiasts. Mine came from CPC, which is a part of the Farnell group. Maplin also stocks them.

A holder for the temperature sensor needs to be made. See photos 2 & 3 for my holder. Be careful not to tighten the clamp screw too much. Alternatively the sensor could be glued in but make sure it is secure!

Lastly a cover for the lathe helps greatly. I use a double layer of bubble wrap! The design is offered as is, and has to be built with care and safety in mind. I can offer no guarantees except to say I have built three

for various uses and am happy with their performance. As with all things electrical, one or two safety points should be mentioned. Although the system uses a safe low voltage power supply please make sure ALL metalwork is properly grounded and switch the controller off when machining. Insulate all connections fully so swarf cannot cause a problem.

Heater circuit description

IC1 (7805) is a standard 5volt regulator which provides a stable voltage for the comparator IC2 (CA5160) and the temperature sensor IC3 (AD22100KT). This sensor provides a relatively high output of around 22mV per degree C.

The output from the temperature sensor is compared with a set point provided by the potentiometer VR1.

The output from IC2 drives the gate of the logic level MOSFET TR1 which controls the power to the heater made from resistors R4-R6. The LED is an indicator to show when the output is active.

The MOSFET dissipates approx. 1.5 watts, so needs to be mounted on a heat sink of at least 5 degrees C/watt. To maximise efficiency, make the heat sink as large as possible. I used an old 486 CPU heat sink and connected the fan in parallel with the heater output. IC1 does not require a heat sink.

As this circuit is switching around 7 Amps, all 12 volt wiring should be heavy enough to carry this load and be as short as possible. The original was built on strip board with heavy wires added to the high current parts.

In this design the load is approx. 2 ohms, this is equivalent to around 70 watts being available to heat the lathe. I have

3. Detail of sensor and holder.



found this is enough to keep the lathe above the dew point even on a cold winters day. I aim to keep the bed at around 15 Degrees C. As noted above, a good cover over the lathe is essential.

None of the components are particularly special and are available from RS Components, Farnell or your normal supplier. If sufficient interest is expressed, it may be possible to produce a printed circuit board for the unit.

Suppliers

RS Components	01536 201 201
Farnell	0113 263 6311
Maplin	01702 554 001

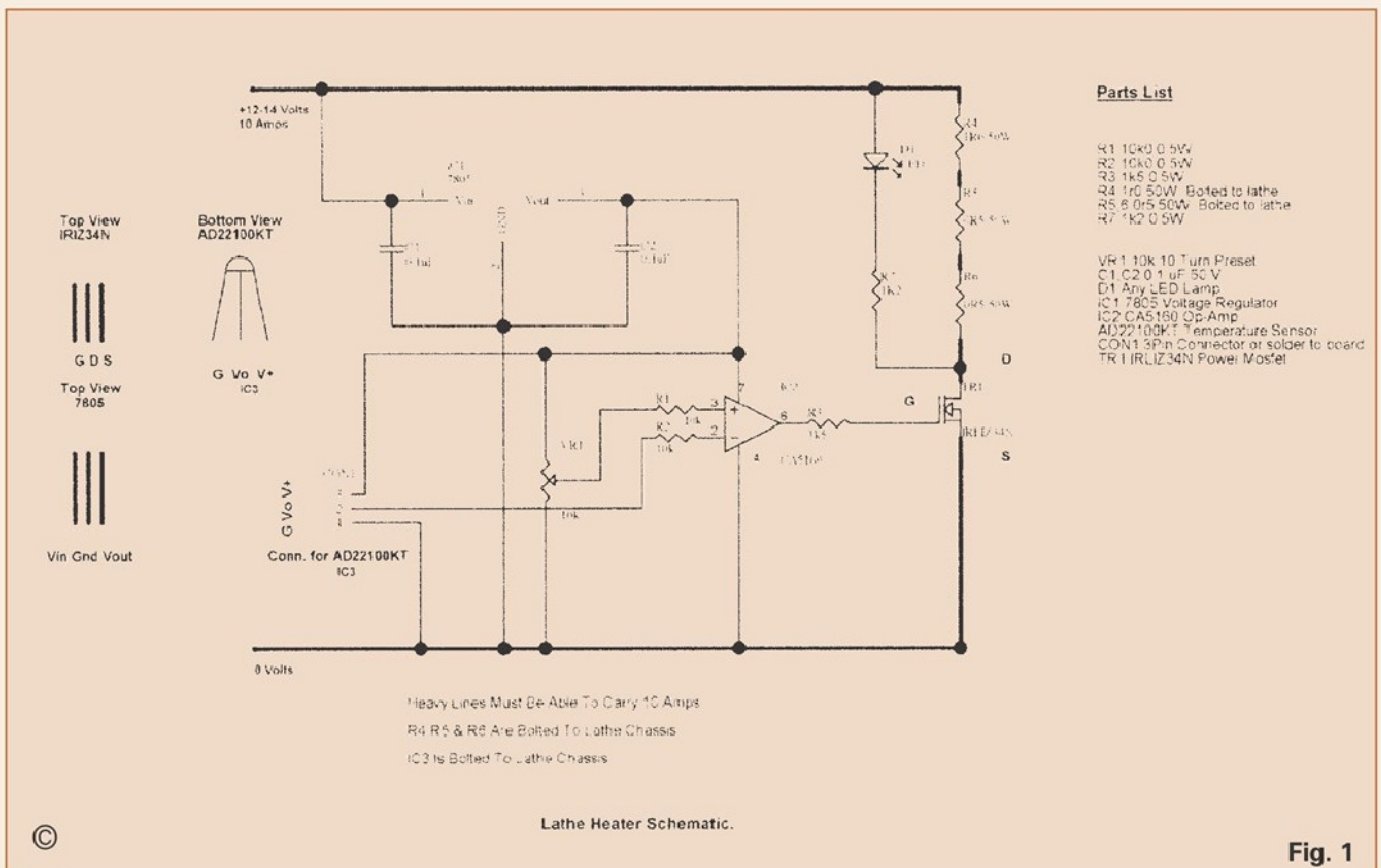
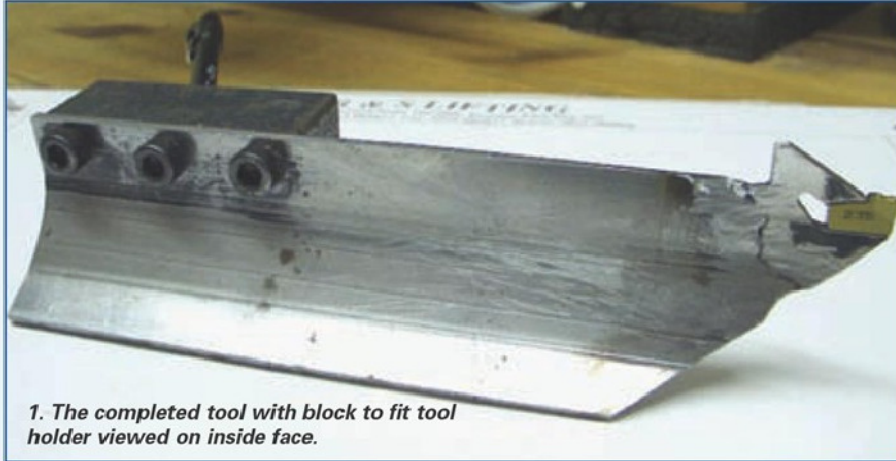


Fig. 1

"TREPANNING" IN THE LATHE



1. The completed tool with block to fit tool holder viewed on inside face.

Background

Trepanning is probably a misnomer as it is usually associated with a rotating cutter, and stationary workpiece. Consulting the dictionary draws a parallel with "Trepine" which is the surgeons saw for cutting a hole in the skull. However we as engineers use these types of device for many other uses and frequently as a single point tool. There are also some special types produced by "Sandvik", and probably other manufacturers that are intended for use in the lathe, and others may be made for use in the hand held drill or the bench drill. In addition there are a number of related tools including the many multi toothed hole saws for cutting thin sheet and in a more modern vein, the various forms of the Rota Broach type of cutter.

Readers of my earlier articles may have read in issue 90 of my efforts to bore a hole in some 115mm diameter nylon but to a depth of 60mm. the hole being some 90mm dia. At that time, the operation was carried out using a standard 85mm dia hole saw, but this proved to be very slow going and took nearly two hours. This was because the saw had to be withdrawn after only a tenth of a millimeter or so as the teeth clogged very quickly. It also required to be liberally soaked in coolant to prevent the nylon from melting, and of course the hole had to be cut from both ends due to the limiting depth of the saw.

Shortly afterwards I wanted to make two more similar parts, but started to wonder if there was not some better way as I hate slow repetitive jobs and would rather spend my time on a jig or tooling.



2. Tool fitted to lathe tool holder

Peter Rawlinson offers an improved method for creating large holes with less swarf.

Existing tooling and a modification

I have in my tools a "Sandvik" holder and two fitments to use in the lathe. These will end cut or trepan but would only give a depth of 20mm. They are also very limited in the actual cut diameter due to the clearance. (The support for the tip must follow into the groove being cut, with clearance.) I also have one tip fitment with no holder.

I decided that a special holder could be made and the fitment welded into place on the holder. The first job was to press a piece of 1/8in. mild steel into a part circle of the correct radius, (this would follow into the groove with clearance) and then to fit a block of mild steel which was then bolted into place and would then fit into my standard lathe tool holding system.

The front part of the tool fitment was then cut from its base, and the holder cut to correspond to the fitment. Both parts were then beveled, welded together, and then cleaned up using a mini grinder.

Initial experience

I had decided that the total bore depth would be 75mm, and initially made the tool with sufficient overhang to go to the full depth, however, it was again found that swarf clearance was a problem. I therefore decided to cut in from both ends, which solved the swarf clearing problem. With the benefit of 20-20 hindsight vision, the tool could have been made to have an overall overhang length of only 40mm.

The cutting was straight forward, coolant was still required and the cut was carried out to a depth of 10mm. and then withdrawn for clearing. Further cuts were



3. Tool viewed on outside face



4. Now about 10mm deep



5. Bored parts and reusable "scrap"

then taken until the tool had progressed beyond the half way point. The block then turned around and cuts taken from the opposite face.

As an exercise, the tool turned out as a great success. Whereas one part had previously taken around two hours, with the new device, two parts were successfully completed in some 20 minutes. The added bonus, (as with the hole saw method) is that I still have two potentially useful pieces of nylon some

85mm dia. and 75mm long which I see as preferable to throwing away a sack full of swarf (and it does make a considerable bulk).

Further thoughts

The method adopted here was, in effect, prompted by the contents of my tool box and scrap box. It would be equally possible to produce a similar tool by brazing or silver soldering a carbide part

off tip directly into a strip of 1/8in. mild steel, the latter being pre-bent to suit the diameter to be cut. A little attention with a grinder would probably be needed to ensure that clearance exists where needed.

I hope this little excursion into specially made tools will be of interest and I can be contacted on the number below, if I can be of help.

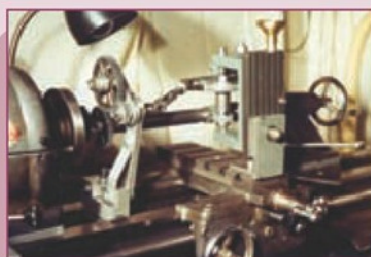
Peter Rawlinson, Charing Kent,
01233 712158.

IN OUR NEXT ISSUE

Coming up in Issue No. 95 will be

Travel Stops for a Mill/Drill

Philip Amos details an upgrade for a budget machine.



Hobbing Attachment for the Lathe

Cut gears with this useful device from John Whalley

Wire Eroder

Peter Rawlinson describes his novel CNC machine.



Issue on sale 12th December 2003

(Contents may be subject to change)

BRISTOL EXHIBITION 2003



1. Diminutive high precision lathe by Howard Harvey

When your editor heard I was planning to attend the Bristol Model Engineering and Hobbies Exhibition he invited me to jot down a few words and take a few photographs for Model Engineer's Workshop, as he knew I would be preparing a full report for Model Engineer. "Not much of a job"; I said to myself: "I can soon run off a few words on the small number of tools and workshop equipment I am likely to see there". Well, things turned out a little differently than planned and, in the event; there were quite a few items of potential interest to MEW readers. I hope therefore, that your editor will be able to find enough space in the magazine for this longer than expected article.

Lathe and attachment

Few home workshop practitioners seem to make their own lathes these days but Howard Harvey of Newport Model

Engineering Society obviously felt the need for one of the small, high precision lathes once popular for horological work. Although described as freelance, it seemed to follow the well-known Webster-Whitcomb pattern with the inverted V bed for headstock and tailstock location. It was nicely finished using, what appeared to be, a chemical blacking process and the compound slide was scraped on all the main surfaces (photo 1). Mr. Harvey appears to like tool making as he was also exhibiting a long stud making attachment (photo 2). This appears to be designed for use on a larger lathe than his small, precision machine and was designed for the production of 6 to 10BA studs. He uses it to make the long fixing bolts used in the construction of model wagons.

Ornamental Turners

The Society of Ornamental Turners had a couple of machines on display and some

Neil Read, Technical Editor of Model Engineer reports on the tools and workshop equipment at this popular event.

members were demonstrating a few of the techniques used in the mystery and art of ornamental turning. The first was a genuine Holtzapfel, No. 1618, of 1837 (photo 3). It was sold to a Mr. Rackstraw on 28 February of that year for the princely sum of £18. Since then it has had seven owners and it is known that the fourth owner sold it for £3-10s-0d (three pounds and ten shillings) in 1938. It was purchased by the Society at auction for £2,500 and partially restored. Being of relatively light construction and easily dismantled it is regularly used by the Society for demonstration purposes.

A few of the many attachments once available for these machines were on display and demonstrated during the course of the exhibition. Photo 4 shows the elliptical chuck, which as the name suggests is used to generate elliptical forms. I do not think this device has any direct equivalent in general engineering and probably it could not be readily used on metal work pieces as the clearance between the working surfaces may promote chatter. Its designer intended it for work on ivory or exotic hardwoods. Photo 5 shows the simpler eccentric chuck, which can be used to generate patterns comprising of inter-linked circles and similar work. Photo 6 is the dome or spherical chuck shown with a partly formed work piece. This chuck is designed to mount on the lathe mandrel but it is not really intended that it should be rotated at high speeds, as the out of balance forces would be too high. Usually, when using this chuck, the lathe mandrel is used as an indexing device and cutting tools are applied to the work piece via a driven spindle mounted on the slide rest.



2. Howard Harvey's stud making attachment for 6 to 10 BA.



3. Holtzapfel lathe No 1618 demonstrated by the Society of Ornamental Turners



4. Holtzapfel Elliptical Chuck

The second machine on this stand was a Rose Engine built up round a Grayson lathe and fitted with a homemade slide rest of the traditional ornamental turning pattern (**photo 7**). This modifications and slide rest were the work of Michael Bain who was on hand at the show demonstrating the capabilities of this unusual machine.

Rotary tables

Making a rotary table appears to be a common goal for many model engineers and there were several examples on display at the exhibition. The little 4in. dia. unit of Alan Pearce (**photo 8**) of Bristol SMEE was nicely made and finished and could be used in vertical or horizontal mode. Larger rotary tables were exhibited by David Hockin (**photo 9**) and Laurie Tann (**photo 10**), who are also both members of the Bristol society.

Former editor of MEW, Geoff Sheppard, who is on the organising committee of the exhibition, had a couple of handy pieces of tooling displayed at the event. **Photo 11** shows Geoff's versatile dividing head made to the well-known design of George Thomas. **Photo 12** shows Geoff's large capacity fixed steady for a Myford Series 7 lathe.

Bristol SMEE member Roy Simmons exhibited a well made milling device (**photo 13**), which I suspect may have been constructed for generating large radius, curved surfaces (locomotive valve gear links?), but otherwise defeats its powers of deduction in determining its exact purpose. If Mr. Simmons chances to read this perhaps he could get in touch and satisfy my curiosity. If my guess as to its function is correct then some constructional details would, I am sure, be of interest to many readers.

Tool & cutter grinders

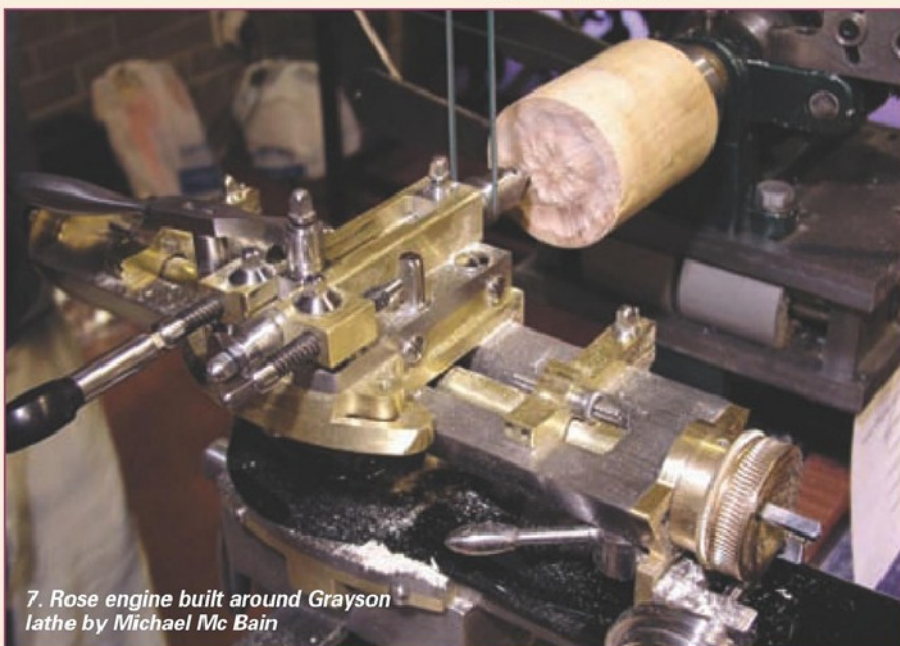
Several tool and cutter grinders were in the exhibition. **Photo 14** shows a neat Stent although I regret I am unable to accurately credit the maker as the label was missing. The neat little tool and cutter grinder built by David Caseley (**photo 15**) was unusual in that it did not appear to follow any of the usual designs favoured by home workshop enthusiasts. The Quorn tool and cutter grinder (**photo 16**) exhibited by Martin Gregory was a remarkable machine and so heavily



5. The Holtzapfel Eccentric Chuck



6. Dome or spherical chuck with part formed workpiece.



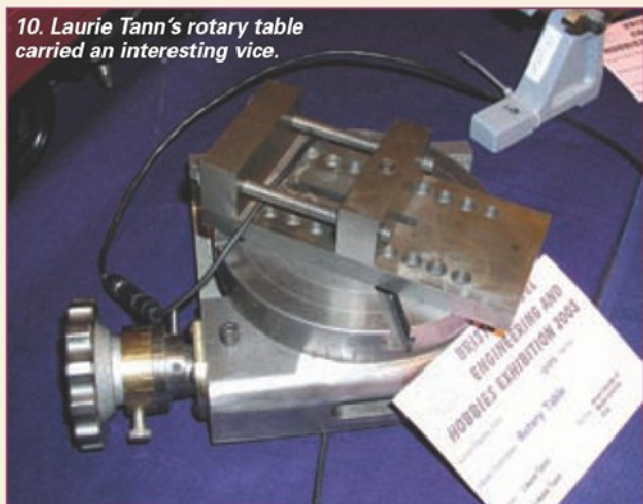
7. Rose engine built around Grayson lathe by Michael Mc Bain



8. Horizontal/vertical four inch rotary table by Alan Pearce



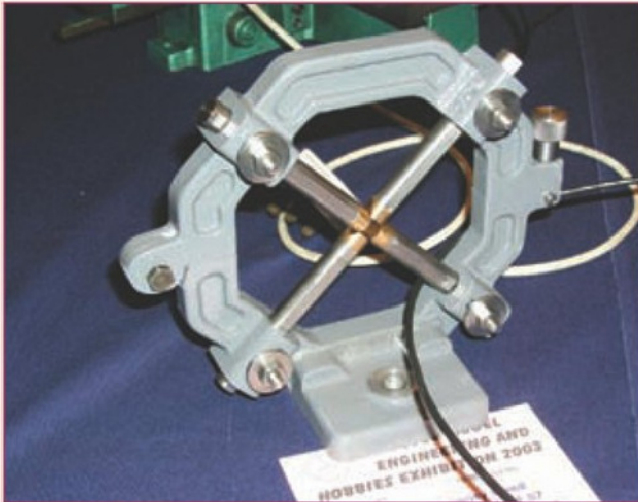
9. Six inch rotary table built by David Hockin



10. Laurie Tann's rotary table carried an interesting vice.



11. The GHT versatile dividing head shown by Geoff Sheppard



12. Geoff also exhibited this large capacity fixed steady for Myford seven lathes

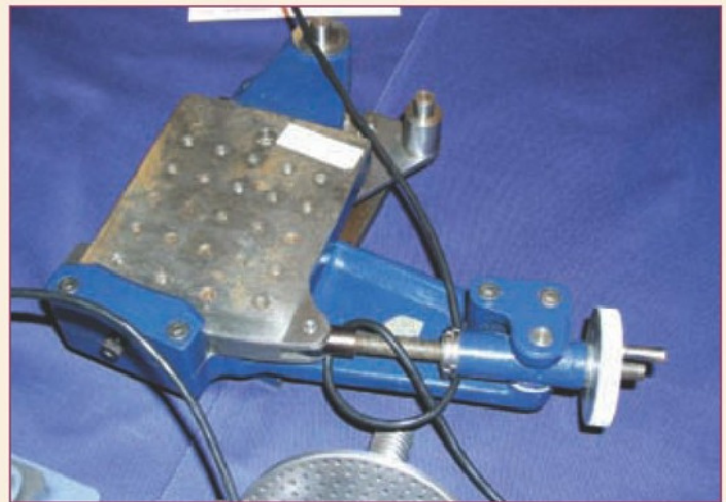
modified it was difficult, at first glance, to be sure it was a Quorn. Each of the modifications made had been well designed and executed and the workmanship was beyond reproach. Well fitted out and painted it does much credit to Mr. Gregory and is, I am sure, a valuable asset in his workshop.

Tooling display

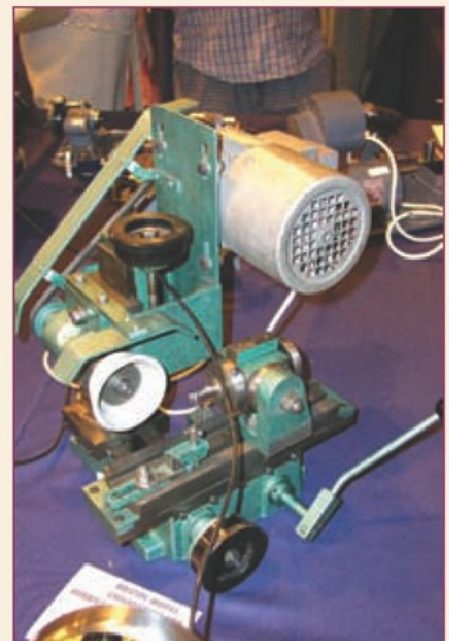
Private entrant David Spooner had gone to some trouble to display his tooling items as advantageously as possible and had built up a display board (photo 17). The well made collection consisted of a sensitive drilling attachment, a simple dividing head, a knurling tool and a lathe saddle stop.

Universal Dividing Head

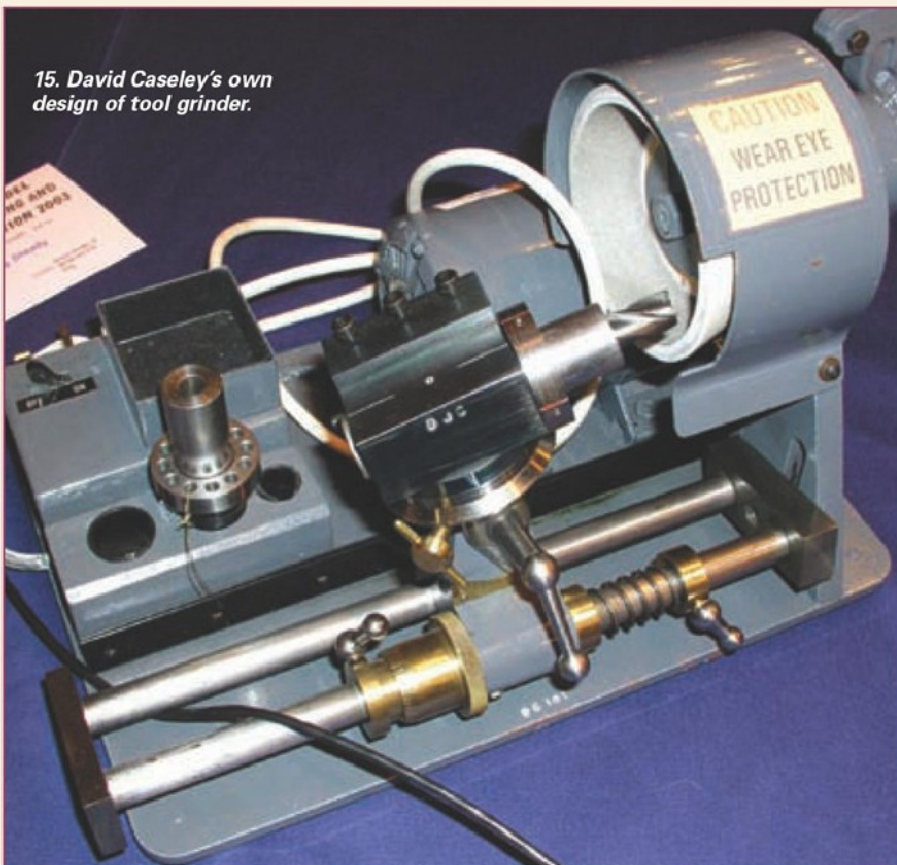
Ivan Law, chief judge at The Model Engineer Exhibition at Sandown, brought along his universal dividing head (photo 18). This has the capability not only to generate any number of divisions between 1 and 1008 using differential indexing but can also be used for spiral milling i.e. the generation of helices. Ivan designed the unit to be machined on a Myford Series 7 lathe and its normal equipment includes a set of five index plates and twelve change gears. One pattern was made for the differential housing. A special set up was used to machine the worm wheel on the lathe and this was described in detail in Model Engineer (series starts M.E. 4050, 12 September 1997).



13. Ingenious radius milling device designed and built by Roy Simmons



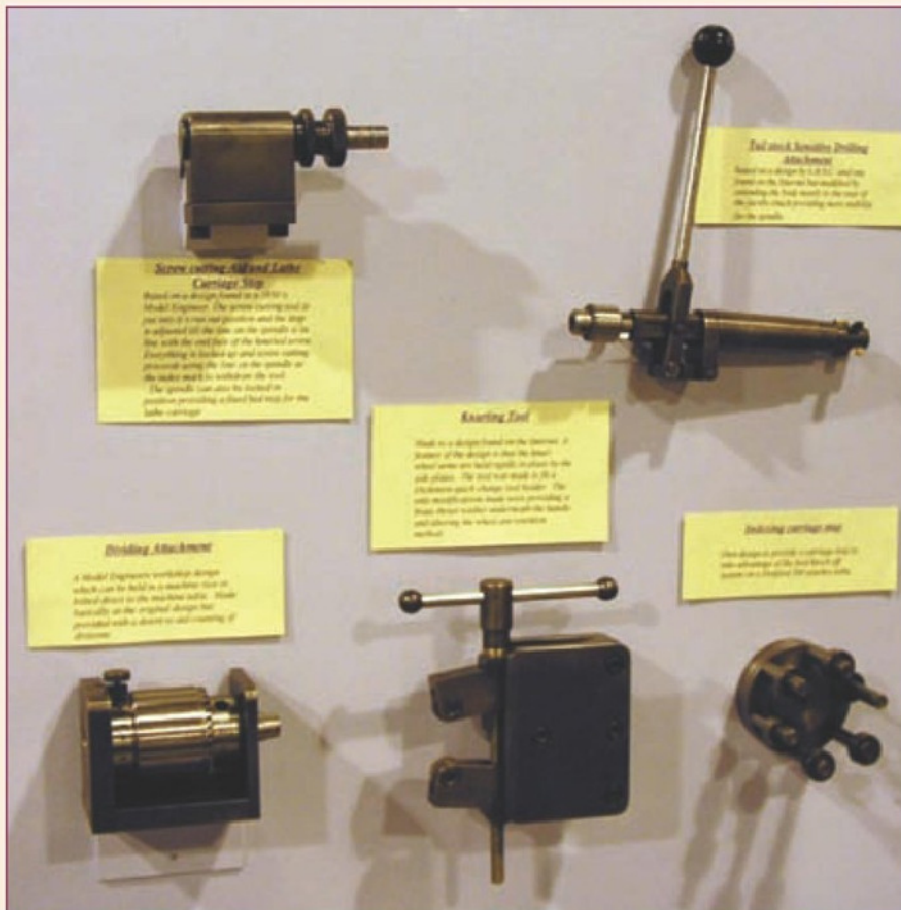
14. This well made Stent T&G grinder attracted complimentary comments.



15. David Caseley's own design of tool grinder.



16. Almost belying its parentage, the much modified Quorn of Martin Gregory



17. A fine display of tooling items by David Spooner



18. Universal dividing head designed and built by Ivan Law

Well, that concludes my report on the tooling items at the Bristol exhibition for 2003. I am sorry if I missed your favourite item but in such a well-stocked exhibition it is easy to miss things. If you want to learn a little more about the models on display then keep a look out for my report in Model Engineer – but I am sure you were going to do that anyway weren't you?



TRADE COUNTER

Please note that, unless otherwise stated, Trade Counter items have not necessarily been tested. We give news of products and services which have been brought to our attention and which we consider may be of interest to our readers.

Simply CNC

A new company specialising in the supply of CNC hardware and software has been launched by partners Remo Campagna and David Lovern. It came about after spending years working with CNC in the home workshop, after making many mistakes and a never ending effort of sourcing parts around the world. They aimed to reduce the cost to "hobby level", and pass on the benefits of their experience, to offer a turnkey system and also parts for everyone who wanted to build their own systems at a reasonable cost. The company is internet based but with telephone support for the products.

On the hardware side, products include Xylotex motion control systems. Xylotex is a young American company, headed up by Jeff Rolland, whose positive attitude was much in line with the requirements of Simply CNC.

Their software, Artesoft mach 1, is the brainchild of Art Fenerty from Nova Scotia. He has less effort over some three years has seen the spread of this Windows based system increase from 50000 pulses per sec to 450000 pulses per sec. in Windows 2000/XP, making for turbine smooth motion via a Xylotex driven board.

Initially, systems, which are all bipolar, range from Sherline/Taig 3 axis to Bridgeport size, with prices from £495 to £22000, the Artesoft CNC software costing £394.

Simply CNC can be contacted by phone on 01292 3111 3777 or by visiting the website www.simplycnc.com



A selection of stepper motors and other components at Simply CNC

Not only tools – but also machines, at Greenwood

Our friends at Greenwood Tools Ltd have been asked so many times over the years whether or not they sell machine tools, they have decided to do so! Most engineers will be pleased to know that they are interested in buying good quality used lathe and milling machines to put in their Worcestershire showroom for demonstration to potential buyers.

Experts in turning and milling, Greenwood Tools are well placed to show customers how to get the best from their machines using up to the minute tooling technology.

Buyers and sellers can contact

Greenwood Tools as follows:

Post: Greenwood Tools, 2a Millfield Rd,

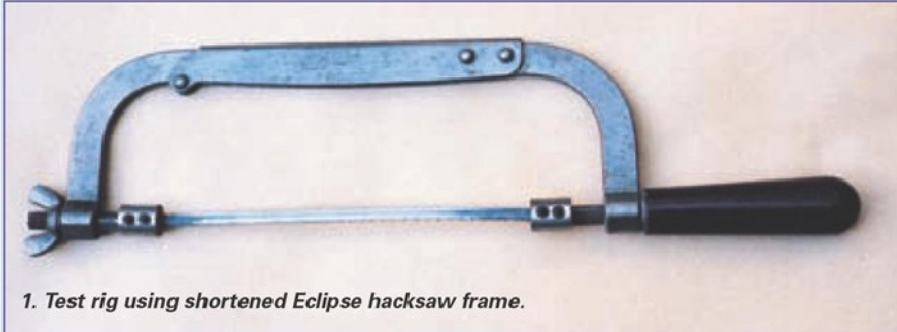
Road, Bromsgrove, Wincs B60 2PAW.

Tel: 01627 877876 Fax: 01627 578885

Email: sales@greenwoodtools.co.uk

Web: www.greenwoodtools.co.uk

A POOR MAN'S BANDSAW



1. Test rig using shortened Eclipse hacksaw frame.

Background

The model engineering fraternity appears to be much more affluent these days than way back, several decades ago, when I first began to read "Model Engineer". Bandsaws are common items now in amateurs' workshops, but there must be many who, like me, would only have occasional use for one, or would not have the space to accommodate it. There is also, of course, the question of finance. The tool I now describe may interest such people.

Serendipity strikes

Many years ago, a few yards of $\frac{1}{4}$ in. wide x 14 t.p.i. HSS bandsaw blade came my way, and I thought that if I could mount a length in a hacksaw frame, I could use it to cut tight curves. The mounting proved to be a case of "easier said than done". Gradually I realised that there was no shortcut available so I made a pair of adaptors to replace the drawbolts in an Eclipse 60B frame, which held the bandsaw blade in simple clamps. With the frame at its longest setting, to accommodate 12in blades, I found that the blade rapidly became curved as I could not generate enough tension. I tried again at the 10 in. setting without success. By filing two more notches in the frame, I was able to adjust the frame to take (imaginary) 9 in. and 8 in. blades. At the 8 in. setting I had success (Photo 1), and concluded that a clear blade length of about 8 inches would be O.K.

Design and manufacture

I wanted a deeper throat than is usual in hacksaws, and I also wanted to be able to swivel the blade to any angle like the blade of a coping saw. Handles in the line of the blade, like a carpenter's bowsaw, would make the saw feel much the same whatever the angle of the blade. From these thoughts I arrived at the design shown in Photo 2 and the drawings. The frame consists of three pieces of 25 x 5 mm mild steel (Parts 1 and 3), welded to two corner pieces (Part 2) cut from 5mm plate (Fig 1). The lightening holes give 74% of the strength and stiffness of a solid beam for 62% of its weight. The holes in the corner pieces are smaller to allow for stress raising effects there. The joints should be vee'd on both sides before welding to be sure of full penetration. This is particularly important if the welds are to be dressed off

If space or funds are at a premium, this approach from Amhlaoibh Hennessy may inspire some cutting round corners.

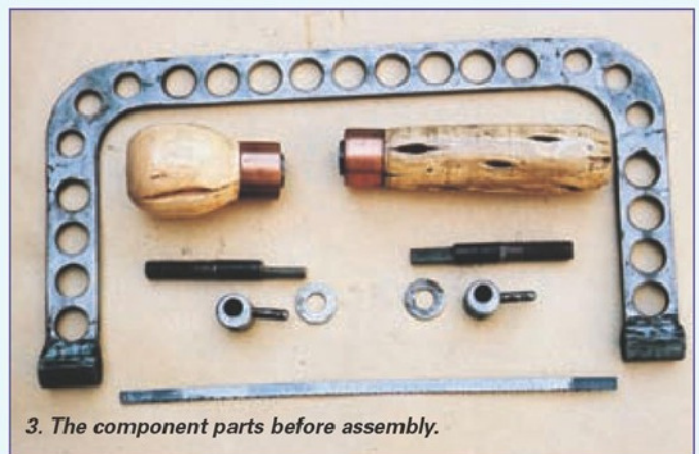
flush as I have done. When the drawbolt sleeves, Part 4, are being welded to the frame, a straight $\frac{1}{8}$ in. rod should be run through them to set them in line.

The other steel parts (Fig 2) require little comment. The inserts, Part 7, should be roughed up on the outside by filing a few notches with a coarse round file, to give a grip when they are glued into the handles. Alternatively, they could be turned slightly smaller and knurled. The little rod Part 10, indicates the direction of the blade, so care should be taken to drill and tap Part 9 for it at right angles to the two grub screws. Of course, where I have used $\frac{1}{8}$ in. B.S.F. M5, or 2 B.A. would be suitable alternatives.

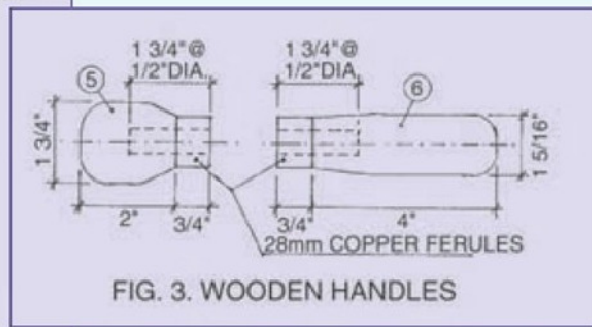
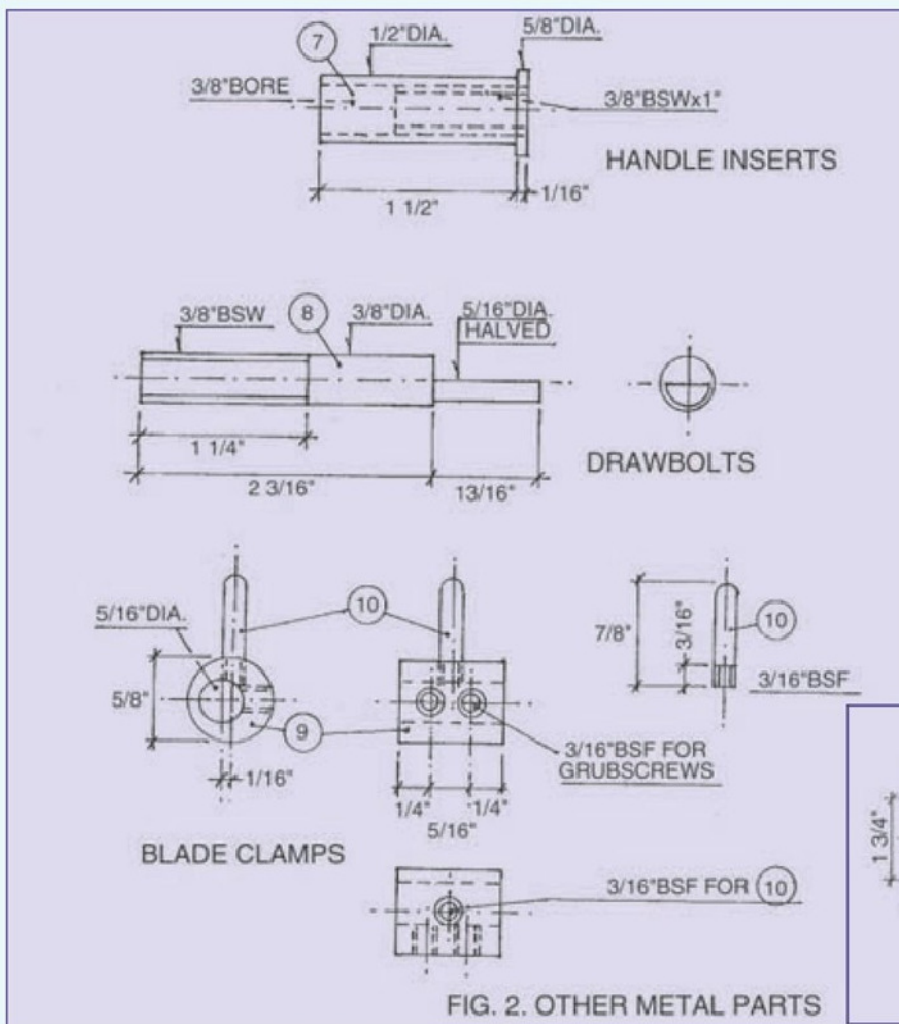
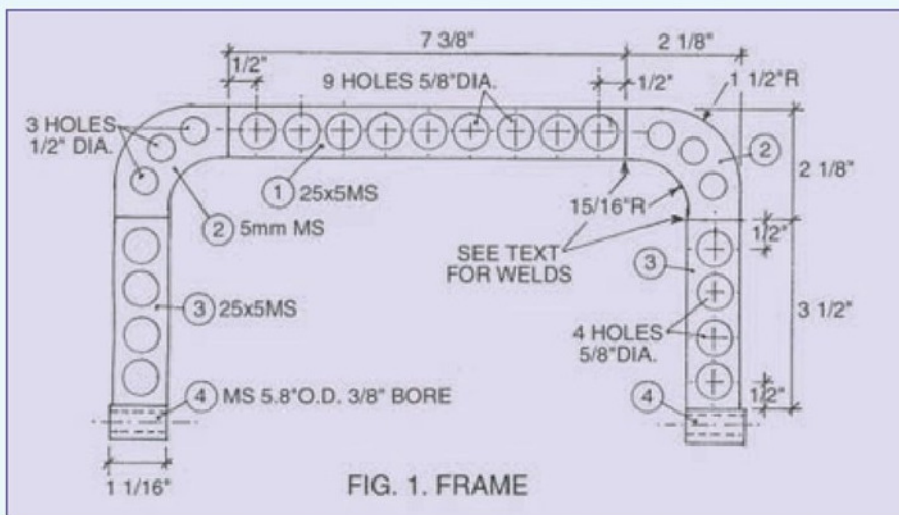
Any hardwood will suit for the handles, (Fig 3) including apple, cherry, laburnum (especially fine), whitethorn, blackthorn, etc. I have used my favourite, furze, which, depending on where you come from, is also known as whin or gorse. It is difficult to get large pieces without splits but I find it interesting to look at and pleasant to hold. I am by no means an expert woodturner but it is not difficult to make these. Expert woodturners should look away at this point). Were I making them again, I would start with a piece of hardwood about 9 in. long and about 2 in. diameter. Both ends would be cut decently square and have centres indented with a centre-punch. I would mount the piece in the lathe with a woodturning driving centre (the only piece of specialist equipment required) in the mandrel and a running centre in the tailstock and then rough down the diameter overall to a little over $1\frac{1}{4}$ in., and then down to about $1\frac{1}{8}$ in. dia. for about $5\frac{1}{2}$ in. from one end, with a



2. The finished "Poor Man's Bandsaw".



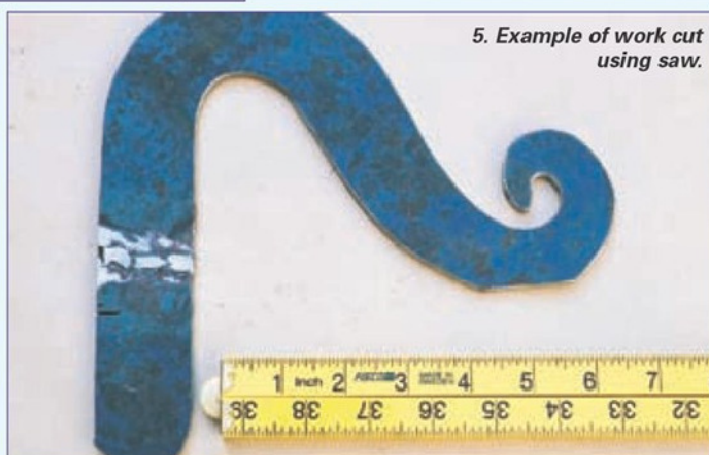
3. The component parts before assembly.



sharp knife tool. I would then turn down the tailstock end to fit the ferrule, reverse the job and repeat at the other end. I would then glue on the ferrules with epoxy. If the ferrules are cut with a pipe-cutter the internal burr will have to be removed from one end. The piece would again be mounted between centres, and using a sharp tool with a large radius nose (about 1/4 in.) the general shape of the handles can be worked over. The waist between the two can be worked down to about 3/4 in. diameter safely. Abrasive belts such as can be found in woodworking shops come in handy here: by holding one against the rotating handles a fine finish can be easily achieved. The next step is to face the ends flush with the ferrules using a half centre, but leaving a small island containing the centre. Then one ferrule can be held in a three-jaw chuck while the 1/4 in. hole is drilled from the tailstock in the other end (beginning with a short pilot hole of about 1/4 in. dia.), and the process is repeated for the other end. Saw apart, finish the ends with knife or chisel and sandpaper, glue in the inserts, Part 7, with epoxy, and finish if desired with quick drying varnish. I use the stuff that does what it says on the tin.

In use

A piece of blade 9 in. long suits this frame, but when the blade is fully tensioned there should be some clearance between one of the clamps, Part 9, and the corresponding sleeve, Part 4. **Photo 3** shows the components ready for assembly. **Photo 4** shows the blade swivelled at a right angle to the frame. **Photo 5** shows an item (a finial for a gate), which was easily cut from 6 mm steel plate with this saw. The saw can also be used on wood, of course, and will cut even tighter curves than in metals.



SCRIBE A LINE

Chris Boucher of Wellingborough writes:

I read with interest Chris Fouweather's article on injection moulding in issue no 92 and can add one or two pointers which might assist anyone contemplating building such a machine. Chris quite rightly draws attention to the electrical health and safety implications, but this is only one area of concern as far as injection moulding machines are concerned. Commercially these are considered to be so dangerous that the code of practice issued by the British Plastics Federation calls for daily checks on all safety devices! Fortunately some of these will not affect the model engineer. For instance with the mould clamped shut, there is no risk of a crushing injury as the two halves close. Burns, however are still a potential hazard. Molten plastic sticks to the skin and will cause a nasty burn. If there is any possibility of leakage at the point where the injector block meets the mould, some sort of shield should be provided.

Chris suggests sources of raw material. If only recycled material is used the mouldings are likely to be

brittle and it is far better to use at least a proportion of virgin material. A visit to a local injection moulding firm, cap in hand will probably result in a few handfuls of material being made available! Another problem with using recycled material is that you cannot be sure of the base material. There are literally hundreds of materials on the market each with its own moulding parameters. The table below gives some idea of the uses of the most common. Each will have its own recommended moulding temperature. Chris does give some guidance, but depending on the heaters and thermostats used, normal temperatures may be exceeded. Some materials will give off toxic fumes if overheated. A well ventilated area is therefore essential. It is also extremely important to purge the machine when changing materials. Polypropylene is a good all round material to use for this. The risk of toxic fumes is higher if materials are mixed and in the worst case, it is possible to form an explosive mixture!

Material type	Description	Typical Uses
Acetal	Naturally opaque/white and very tough	Gears, bearing taps and aerosol valves
Acrylic	Transparent, brittle	Lenses, car light housings and reflectors
ABS	Natural opaque and very tough	Telephone handsets and vacuum cleaner housings
Nylon	Almost opaque or white and very tough	Bushes and bearings for many products, curtain runners and combs
Polycarbonate	Transparent, very tough and resilient	Street lamp covers and safety helmets
Low density Polyethylene	Natural waxy appearance. Tough and stiff	Kitchenware and many sealing lids and closures
High density Polyethylene	Natural waxy appearance. Tough and stiff.	Chair seats and milk crates
Polypropylene	Natural waxy appearance. Tough and stiff	Beer crates and spade handles. Boxes with integral hinges
General Purpose Polystyrene	Transparent and brittle	Cosmetic packaging and ballpoint pen barrels
High Impact Polystyrene	Natural translucent and tough	Food containers, cotton reels, toys and model construction kits
Rigid PVC	Transparent to opaque. Tough and rigid	Plumbing, window profiles. Floor tiles
Plasticised PVC	Transparent to opaque. Tough and flexible	Shoe soles. Inflatables
SAN	Transparent and brittle	Kitchenware. Instrument housings

Mr A C Prior of Malvern writes:

Following Chris Fouweather's article on plastic injection moulding, I have now placed this on my list of things to try. However I foresee difficulties. One of my most useful applications, if possible, would be moulding of small parts, difficult

to make by machining PTFE, to be used for its low friction properties.

I cannot remember ever having seen explicitly that PTFE is a thermoplastic, but in view of its chemical similarity to polythene, I would expect it to be so. I am, however, under the impression that under atmospheric pressure PTFE decomposes thermally at a temperature below that at

which it would flow adequately for moulding. Its thermal decomposition products will contain fluorine compounds, and in view of the extremely dangerous and corrosive nature of fluorine and some of its compounds, substantial hazards seem likely. (But what about an overheated non-stick frying pan?) A sufficiently high pressure might inhibit thermal decomposition, and if so, I guess that the moulding apparatus is so designed that the PTFE is constantly maintained at an adequate pressure when its temperature is elevated.

Has any reader any relevant information on the moulding of PTFE

Mervin Latimore writes by email:

Anyone wanting a reasonably price CAD program should try www.cadstd.com on the web. The Lite version is free. The Pro version costs \$25 US and has more useful features.

Mark Noel writes by email:

I have been following with interest recent correspondence regarding the various Computer-Aided Drawing (CAD) packages on offer. Many would agree that such software will eventually displace pen, ink and smudgy paper, particularly since most of us now admit to having a PC and printer at home or at work (where in any case most model engineering projects are conceived!). CAD brings clear advantages of speed and accuracy; reusability of drawings and graphical components; plus the chance to share design ideas instantly via the Web. Eventually, our digital drawings will cut metal directly via the more affordable numerically-controlled machines and conversion kits that are appearing on the market. Some see the emergence of a new class of hobbyist whose main interest and skill is in the CAD/CAM side of things, with the machine shop then a compact, multi-axis milling tool in the shed, connected by umbilical to a snug 'design space' of PC and kettle on the kitchen table!

For my own part, I have been using Evolution Software's EasyCAD and FastCAD for DOS to prepare survey drawings and instrument designs in my job as a geophysicist. Recently, I upgraded to FastCAD for Windows which is now also used for design work in my model workshop. This superb package contains all the tools needed to prepare the most complex 2D engineering drawings, including auto-dimensioning, component and symbol libraries, embedded images, multiple views, and more. Because the software is written in microprocessor code, all drawing functions happen instantly and the file sizes are very small. It can be tried for free via a download from www.Fastcad.com which arrives with some impressive examples of complex mechanical drawings. FastCAD for

Windows costs £599 but most hobbyists will find more than enough functions provided in its baby brother - EasyCAD for Windows at £199. A FastCAD 3D version is also available at £899 for those who want to see a photorealistic version of their latest steam boiler project rotating on the screen!

FastCAD and EasyCAD both import and export files in dwg and dxf format and hence are compatible with most NC software packages for mills and lathes. Although more expensive than the likes of DesignCad and TurboCad, neither program has crashed on me once in 10 years of heavy use and is well supported by the US company and UK supplier CAD Ltd on (01427) 873163.

Peter Fedoroff writes by email:

With reference to the article in your publication issue No 92 by Philip Amos on the above subject, I have used a similar method to set the vertical alignment on my "WARCO" VMC Mill. I have been able to obtain a piece of 10mm thick plate glass 30cm square which I understand is known as float glass. The measured variation in thickness in one axis was only 0.015mm and in the other zero. Apart from the difficulty in moving the mill head and re-tightening without disturbing the setting I find that laying the glass on the table and using a dial gauge as shown in the article will give me very good results for a nice flat vertical milling cut.

Peter J King of Christchurch, New Zealand, writes:

I refer to issue 92 page 16 "Table router", and regret to inform you that the assumption by Peter Rawlinson concerning patented inventions and designs is quite incorrect. Worldwide, the law is quite clear and if he (and anyone else) manufactures a copy of another's invention, he is (or they are) liable to an infringement action. Such actions are expensive to the loser and can result in the article being surrendered by court order. Advertising ones actions in a magazine is also "asking for it"

This particular assumption has been circulating for many years, and is particularly pernicious, as unfortunately most people unversed in law believe it.

Peter Rawlinson replies:

After being advised of the letter from Mr King, I contacted the UK Patent Office for clarification. The relevant clause of Section 60 reads:

(5) An act which, apart from this sub section, would constitute an infringement of a Patent for an invention shall not do so if:-

(a) it is done privately and for purposes which are not commercial:

This is "word for word and comma for comma", so it seems to me to be clear enough.

Editorial comment:

Is patent/intellectual property law standardised throughout the world, or are there national variations?

Shelley Curtis from Hinckley writes:

For some time I have been looking at available CNC vertical milling machines and the two readily available in this country seem to be the MicroMill 2000 and the Wabeco CC-F1210. The MicroMill is rather on the small side for the use I envisage but it operates with the excellent Dolphin Partmaster CAD/CAM and MillWizard software. The Wabeco would be ideal, but my decision to purchase has been delayed by an inability to master the software provided (PCLathe and Mill Plus).

I would very much like to talk to anyone who has experience on the Wabeco Mill, and its software, and can be contacted by telephone on 01455 634 550 or email sjcurtis@btinternet.com

Kevin Hutchinson, of Bedford writes:

It is only now that I have found the time to read Philip Amos's article on friction in the July 2003 edition. As I was reading the chapter on machine controls, it was with a growing feeling of recognition that I realised that I had encountered "dither" before. While working on the English Electric (later BAC) Lightning aircraft, various airframe technicians explained to me that dither was used on the fully-powered flying control surfaces - aileron, tailplane and rudder - to increase their sensitivity to the pilot's commands. The dither in this case was in the same plane, and not at right-angles to, the natural directions of movement. Part of the rigger's (airframe technician's) job was to measure and adjust the amount of dither, which was a matter of only a few "thou" as I recall.

Now that fully-powered flying controls are commonplace I have no doubt that dither still plays its part.

Guy Hawksford of Kinross writes:

I am in the process of building a 7 1/4" gauge locomotive and had decided to use "oilite" bushes in various places. Typically, putting the cart before the horse, I had designed and made the various parts and then had to source the bushes.

A very long search on the internet finally came up with a company called Orbit Bearings and Transmission Ltd. of Warley. My email to them received a very prompt response. They sent me by email full, clear details of the sizes available and they were quite happy to handle small orders.

When I telephoned them to enquire about ordering the bushes they could not have been more helpful. They were not put out by the small assortment I needed and they accepted credit card orders. I would say that their service has been second to none.

It is very refreshing these days to find a company that takes a pride in its business and is not adverse to helping us small users.

Frank Chambers writes:

Re Scribe a Line issue 91. All I can say in answer to Dr. J. Ponsonby's criticism in Scribe a Line MEW 91 of my article "A New Design of Oval Chuck" (MEW 89) is that the centre of a tool in my chuck will describe an ellipse and the working edge of the tool will cut a curve which is equally spaced at all points from that ellipse by the tool radius. For ornamental work such as lockets, picture frames and the like, this is exactly what is desired. I apologize if any reader feels that I was recommending that they "ignore the fundamentals of geometry", but I felt that errors such as the 0.007in. he gives in his example were not worthy of discussion.

Stanley Folb of Woking writes:

Following my request for information about microscope making, which you kindly printed in MEW (issue 91), I have received several very interesting phone calls from other readers. A retired pathologist from Yorkshire has told me of the example he built based on articles in ME in the 1950's; a marine engineer has offered copies of the plans and drawings from a model he had built. What I needed was something reasonably straightforward that I could get my brain round, and a reader in Sussex has kindly loaned me his copy of 'How To Make Microscopes And Accessories', which is part of the 'Work' series from the 1900's. So from an amalgam of this and other bits of information I have collected, I will plod on and see what happens. The 'Work' series was, incidentally, an amazing collection of books. For one shilling and sixpence (7½ p) you could learn about Camera Making; Conjuring, Poultry Houses, and much else.

My interest in small engineering projects started some years ago when I retired as a professional photographer and closed my studio, then took up restoring old wood and brass cameras as a hobby. Often finding brass bits missing, I took myself to evening classes at the local technical college, which was an eye opener to me. Some of my colleagues there had been engineers or machinists as young men, and now in retirement have come back to make their model engines and other clever bits. I don't think I could quite do that, so I am going to try for a microscope. We shall see.

Peter J. King writes:

I have just fitted a "Newall" Digital Read Out to my lathe, having been encouraged to take the plunge by the articles written by Barry Harrison in Model Engineer's Workshop last year. I also liked the look of this one. The first task was to check the cross slide gib and adjust this, as there is no point in fitting a DRO to a wobbly machine, and yes, it did need a slight adjustment and after fitting the DRO it got adjusted again.

Barry's articles plus the maker's handbooks made the fitting of the scales a reasonably quick and easy task. The only really slow part was mounting the "Spherosyn" reading head to the lathe saddle rear 'keep' and true to the bed for the "Z" axis, this was an exercise of the +0.010in. - gently tap mounting - now -0.010in, curse, gently tap other end now +0.012in variety. Eventually vertical and horizontal faces were within +/-0.001in. (factory handbook says +/-0.002in.). It was not possible to fit the guard close up to the lathe bed due to the design of the saddle and the resultant mounting of the reader head, however the scale is almost under the overhang of the shear. The guard when mounted using the pillar mounts on the end mountings for the scale, would have left a horizontal gap of about 0.75in./20mm immediately above the scale creating a swarf trap and required a completely new suds standpipe mounting, so was placed in the 'useful bits store'. Swarf can now fall clear and it is unlikely that anything can or will strike the scale where it is.

I fitted the scale for full length of the bed as I have never removed the 'gap piece' and do not intend to (the lathe swings nearly 14in. dia with it in), so it measures right up to a faceplate - over 5in. more than with a chuck. The only real difficulty was that due to the lathe bed casting having a slight overhang from the draft on its pattern, it was necessary to spot face both drillings for the scale end mountings (the type used being that shown in Barry's article fig. 1). This was a horrible job, as not wanting to move 1 ton of lathe (or hang upside down while doing the job), after removing the splashguard I had to fit myself into a very cramped space between the tray and the wall. After drilling tapping size for M8 and counter boring for a very short distance I set to with a home-made spot facer in an old slow - 400rpm - gut-buster electric drill and faced square! (liar - but it looks square). Tapping the holes was the easiest bit. These fittings for a 40in Spherosyn are substantial as the scale is about 1/2in. dia.

The "X" axis proved that there is a kindly overseer who (sometimes!) looks benevolently down on Model Engineers. There is available a right angled 'Newall Microsyn' mounting plate with similar slots and holes to the 'plate A' of the articles (I had one of these too) except the larger slots are open ended. I used this to mount the X axis "Microsyn" reading head to the saddle below the cross slide and between the lathe bed sheers. The saddle is un-machined here so I marked out, centre punched, drilled and tapped two holes for cap screws - rattled three thick washers (agricultural) on each (two under, one over bracket to give clearance for the guard from the cross slide to the reader). Then fitted four jacking grub screws into their designed holes and dropped the slots of the bracket plus reader into place, tightened the cap screws enough to still allow adjustment and placed the DTI on the cross slide and adjusted it to check the top side of the reader. The DTI read "0" on all four recommended points of measurement, disbelieving this I checked the DTI, it still read "0" and none of the jacking screws was in contact. I went away and had a cup

of coffee, tiptoed back and checked again - still "0" so I carefully tightened the cap screws, checking the while until it was fully tight. I still do not believe it - that expurgated thing never moved, perfect first time - though I reckon I spent longer checking and re-checking it than mounting the other one. I carefully removed the jacking screws and then fitted the scale through the reader and to the cross slide with a single end mount the same as shown in Barry's article Fig.3.

I cut down the width of the guard slightly to clear the saddle lock and fitted it to the cross slide with a couple of M3 cap screws. This entire bit was tricky as the gib strip and its longitudinal adjusting screws are on this side of the cross slide and there is not much room for fixing screws. To stop the tailstock crashing into the reader, which is slightly exposed, I drilled and tapped into the lower front face of this and fitted a substantial machine screw and lock nut to stop against the lower saddle.

I fitted a light stainless swan neck bracket to the saddle to hold the leads clear of the lathe tray and carry them up and over the back splashguard, where they hang clear to the display mounting. This keeps them completely out of the mess that the tray usually accumulates. Due to the design of my lathe I was able to retain access to the saddle lock, oiling nipples and retain the suds stand pipe.

I agree with Barry's comments that it is an expensive exercise, however I can now read the settings without using both normal and 'reading' glasses and the accuracy of work has much improved. I have particularly found the precise Z axis measurement a boon; being an inverted 'V' bed tool room lathe the X axis was already accurate to dial reading - when I could see it properly, but now that I have adjusted the split cross slide feed nut and the gib strip again this axis is now clearly accurate to 0.0001in. These devices really show up any part of the lathe saddle assembly that needs adjustment - medium pressure on the cross slide altered the figures on the display until properly adjusted. I also agree with his sentiments - it is very definitely well worth it - and I also will get homicidal if anyone tries to take my new toy away! I will have to investigate fitting something similar to the tailstock.

I have yet to 'do' the vertical mill as I am considering replacing my one. It is a twenty plus year old RF20 Taiwanese job that I am now consistently finding too small for the job in hand. It is an old friend that I spent a lot of time on when new, putting in the accuracy that was latent but poor fitting had rendered non-existent, however it was very cheap and I could afford nothing else at the time.

Alan G Furness writes:

I was very interested to read the article by A. J. Lewis in issue 91, as prior to retirement I was a non ferrous metallurgist with many years experience in designing, building and operating largely aluminium melting furnaces, in the size range 0.5kg - 80 tonnes. The design, materials and construction expounded in Mr Lewis's article were little different to those which I may have employed myself for such a vessel, except for one fundamental item,-

his photos and sketches showed that no flue or fume removal duct had been included.

As the removal of fume, which results during the melting or subsequent liquid metal treatment of all non ferrous metals and aluminium in particular, needs to be efficiently removed from the heating chamber, I was at a loss to understand why no fume exit duct was included in this otherwise good pit furnace design.

In view of the fact that Mr Lewis seemed to have relied heavily on the writings of B. T. Aspin, (his references 2 & 3) regarding his selection of furnace design features, out of interest, I obtained copies of these two books to see if fume ducts or chimney features were also absent from the preferred Aspin equipment.

It was pleasing to discover that on pages 81 of Aspin's 'Backyard Foundry', he has sketched a most satisfactory pit furnace complete with a suitable flue, also a freestanding version on page 85. Thus it seems that in this particular area, Mr Lewis tended to deviate from his 'mentor's' design, most likely I assume, for the following reasons: a). Because electric heating was to be used he believed that no products of combustion would need to be removed; b). He thought a flue aperture would simply present the potential for additional heat loss.

If the reasons postulated are in any way accurate, it is anticipated that the need to correct a). would become evident once non ferrous melting and treatment was routinely undertaken, thus a flue would become essential. Regarding possible concern over minimising heat loss, it is very doubtful if the presence of a properly sized flue in this type of furnace would adversely affect either the fuel bill or the satisfactorily low cold face case heat loss he seems to have achieved.

Having been redounded from the British Aluminium Co Ltd Research Labs on their takeover by Alcan, in 1983, I spent the next 15 years supplying metallurgical and refractory materials consultancy services to aluminium companies in the U.K and overseas, also other aluminium users or fringe organisations, including sculptors and schools that were teaching metalwork or in some instances, aluminium melting and casting.

It was noticeable that fringe participants involved in aluminium melting and casting, which in this context could also include hobby founders, seriously misunderstood the need to select suitable scrap for melting, also the need to determine metal temperature after melting and before pouring. Furthermore, they often failed to preheat their (iron/steel) gravity dies above 150deg. C to remove condensation, thus running the risk of an aluminium/moisture explosion.

Not unusually these keen amateurs were found to be trying to make gravity die or sand castings from totally unsuitable wrought aluminium scrap such as double glazing window frame offcuts. Even worse, empty drinks cans were also being used which virtually consist of more laquer/anodising coating than actual metal and almost always contain enough inherent moisture to cause an explosion if melting is attempted without serious scrap preheating.

In this day and age there exists a whole new range of highly complex aluminium alloys, such as those containing carbon and other filament reinforcement; lithium (highly combustible) to achieve lightweight castings; high zirconium to achieve super plasticity; or high levels of zinc to act as anodes for cathodic protection, as well as others too numerous to mention. Unfortunately, to the layman or amateur foundryman these new alloys still look like the ordinary aluminium to be found in any scrap yard and if by accident some of this metal is obtained and melted, either most unsatisfactory castings will result which will probably be un-machinable, or in the worst case aluminium/lithium alloy scrap will react on melting and become a serious safety hazard. For the home foundryman, the best solution to the problems that now surround aluminium scrap selection is to obtain old auto crankcases or cylinder heads and cut them into suitable pieces to fit into the crucible without wedging in tight or 'bridging' it. Also great care must be taken to avoid old 'Beetle' (VW) engine case components, as these were often cast in magnesium metal alloy, which is liable to burn if melted under the wrong conditions.

The usual auto engine alloy is B.S 1490 LM 6, or A.S.T.M equivalent and this is certain to be satisfactory for making virtually any type of casting. What is more, it is liquidus at about 580deg. C and its best casting temperature is 725deg. C, thus considerable savings in energy, fuel and oxidised metal (dross) loss can be obtained if some of the hobby budget is expended on a good 0 - 1000deg. C pyrometer, plus a mineral insulated T1/T2 thermocouple. With this essential tool it will become much easier to keep the liquid metal temperature at 725deg., rather than relying on unskilled attempts to ascertain it by extrapolating from the furnace body or roof temperature.

Without wishing to over complicate the horizon of the hobby founder, it is fair to say that whilst a considerable number of articles exist to assist him in making patterns, sand moulds, gravity dies, or melting/casting "clog iron", little if anything appears in print regarding the safe and satisfactory melting, handling and casting of aluminium alloys. Hopefully, in the near future, this gap in essential information relevant to the keen home foundryman will be rectified.

Mr G F Everett writes:

In trying to obtain spares for my Burgess bandsaw, I contacted Messrs. Burhouse of Dunkeld on 01350 727 723, and have found them to be most helpful.

Mr C Leigh of Upper Hutt, New Zealand writes:

From the photo of the Piddington toolholder shown in issue 92, I notice that use is made of Allen screws as a locking medium. This is a common and useful practice, except for the tendency of the socket hole to fill up with swarf. My remedy is to Loctite a short length of Allen key into the socket hole so that it stands about 3/16 in. proud, then making a Tee wrench for tightening purposes, using an appropriate socket screw as a driver. I make no claims of originality for the method, but feel that it may be a useful reminder to other readers.

A Note on Dog Clutches

It took a little time, but the penny finally dropped for your editor.

Some years ago I acquired a Yamazen Watchmaker CNC mill. In addition to needing renewal of the CNC control system, it had also lost, on its travels, the odd basic item such as the handle for manual knee elevation. Making a replacement involved mating up to the existing half of a seven segment dog clutch. Looking at this, I wondered why those inscrutable Japanese had chosen the number seven, obviously not the optimum number for easy division. On the face of things, it would seem easier to opt for four, six or eight, all very much more user friendly division numbers.

The underlying rationale became apparent when you get around to the nitty gritty of actually cutting metal. With an even number of teeth, you cannot avoid having to make two sets of passes to cut the two flanks of each tooth. However if an odd number is chosen, then each pass will cut one front flank, and an opposite rear flank, cutting down the machine repositioning.

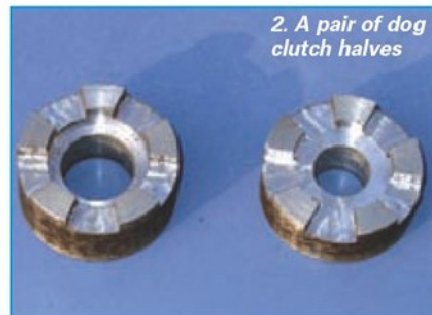
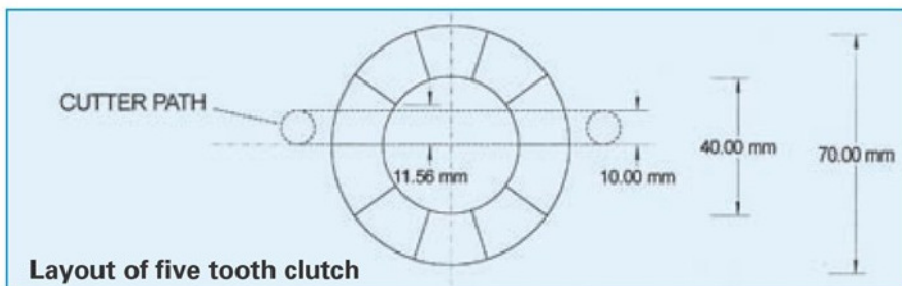
In the case of the Watchmaker handle, the clutch was first drawn to scale, and from the drawing (with a quick check by trigonometry) it was determined that a

10mm endmill would pass between the inner ends of the finished teeth. The set up for milling is quite straightforward given a rotary table. First set one side of the cutter on the X axis centre line of the workpiece, and then take a cut across the full diameter. Depending on the power and rigidity of your machine, you may choose to chop out the full depth in one pass or to take a series of nibbles. The cutter forms the front face of one tooth and the reverse face of another. After indexing around all teeth, move the cutter a couple of thousandths over the centre line and repeat with a finishing cut. If this is repeated on both halves, then about 0.004 in clearance should result.

When later making a manual handle for the machine, I decided that dog clutches would again be a good idea so that the new handle could be decoupled. This would avoid causing inertia/resonance problems for the stepper drive system. On this occasion, I did not have to make up with an existing component, and as seven is an awkward division and the machining technique works with any odd number, I settled on five. The sketch drawn at twice size, shows



the general layout for the five tooth, and the path taken by the cutter. A quarter inch endmill was used this time, slightly larger than the inner end clearance, which had the effect of chamfering the inner edges of the teeth. Using the Vertex rotary table, it was then possible either to count the eighteen turns between cuts, or disengage, rotate 72 degrees, re-engage, and check carefully before cutting. Getting the cant before the horse, the ID was later opened up to accommodate a spring, thus losing the chamfers.



TO HELP YOU GET THE BEST FROM THE MODEL ENGINEER EXHIBITION

These notes are written purely for guidance. Full information is contained in the Competitors' Information booklet which is sent to every entrant as part of the information package. If you have an item and are unsure as to the Class into which it should be entered, leave that section blank and we will take care of it. The Judges have the right to move any competition exhibit into another class if they feel that by doing so its chances of gaining higher marks or a more appropriate award are improved.

If the item is offered as a Loan exhibit please indicate this by writing Loan on the form in the box identifying the Class. Loan models are not judged but carry all other privileges associated with competition entries.

Part built models are particularly welcome in the Loan Section; visitors like to see work in progress, and entry does not preclude the item being entered in competition when completed.

The classes listed below are those associated with mainstream model engineering.

Club exhibits

Where a club is exhibiting, each model should be entered on a separate entry form and clearly identified as a club exhibit by entering Loan/Club in the class section box. This ensures that we have a full record of all models on display during the show and facilitates matters of administration and insurance.

Additional forms

If you do not wish to deface your copy of the magazine we are happy to receive photocopies of the entry form, one for each model. We will be pleased to send out extra forms if required, so if you know of a modeller who is not a reader of one of our magazines but who you think may wish to participate, please advise them to contact our Exhibitions Office (01322-660070), or simply photocopy the entry form for them.

The success of the show depends largely on the number of models on display. Your work could well be the stimulus which inspires someone else to start in the hobby. There can be no doubt that this event is our showcase on the world of modelling in all its aspects. Every modelling discipline needs more and more participants, and it is by displaying not only the crème-de-la-crème, but also examples of work of a more achievable standard, that people are encouraged to join into the wonderful world of modelling, in whatever aspect.

We look forward to seeing a sample of your work at the show!

COMPETITION CLASSES

Engineering Section

- A1 Hot air engines.
- A2 General engineering models (including stationary and marine engines).
- A3 Internal combustion engines.
- A4 Mechanical propelled road vehicles (including tractors).
- A5 Tools and workshop appliances.
- A6 Horological, scientific and optical apparatus.
- A7 General engineering exhibits — not covered by the above

Railway Section

- B1 Working steam locomotives 1in scale and over.
- B2 Working steam locomotives under 1in scale.
- B3 Locomotives of any scale, experimental, freelance or based on any published design and not necessarily replicas of full size prototypes, intended for track duties.
- B4 Scratchbuilt model locomotives of any

scale, not covered by classes B1, B2, B3, including working models of non-steam, electrically or clockwork powered steam prototypes.

- B5 Scratchbuilt model locomotives gauge 1 (10mm scale) and under.
- B6 Kitbuilt model locomotives gauge 1 (10mm scale) and under.
- B7 Scratchbuilt rolling stock, gauge 1 (10mm scale) and under.
- B8 Kitbuilt rolling stock, gauge 1 (10mm scale) and under.
- B9 Passenger or goods rolling stock, above 1in scale.
- B10 Passenger or goods rolling stock, under 1in scale.
- B11 Railway buildings and lineside accessories to any recognised model railway scale.
- B12 Tramway vehicles.

Marine Models

- C1 Working scale models of powered vessels (from any period). Scale 1:1 to 1:48
- C2 Working scale models of powered vessels (from any period). Scale 1:49 to 1:384
- C3 Non-working scale models (from any period). Scale 1:1 to 1:48
- C4 Non-working scale models (from any period). Scale 1:49 to 1:384
- C5 Sailing ships and oared vessels of any period - working.
- C6 Sailing ships and oared vessels of any period - non-working.
- C7 Non-scale powered functional models including hydroplanes.
- C8 Miniatures. Length of hull not to exceed 15in for 1:32 scale; 12in for 1:25 scale; 10in for 1:16 scale; 9in for 1:8 scale. No limit for smaller scales.
- C9 For any model boat built from a commercial kit. Before acceptance in this class the kit must have been readily available for at least 3 months prior to the opening date of the exhibition and at least 20 kits must have been sold either by mail order or through the retail trade.

Scale Aircraft Section

- D1 Scale radio control flying models
- D2 Scale flying control-line and free flight
- D3 Scale non-flying models, including kit and scratch-built
- D4 Scale flying radio controlled helicopters

Model Horse Drawn Vehicle Section

- G1 Carriages & other sprung vehicles. (Omnibuses, trade vans etc.) Wagons, carts and farm implements. Caravans.

Junior Section

- J1 For any type of model, mechanical or engineering work, by an under 14 year old.
- J2 For any type of model, mechanical or engineering work, by an under 16 year old.
- J3 For any type of model, mechanical or engineering work, by an under 18 year old.

All entries will be judged for standard of craftsmanship, regardless of the modelling discipline, i.e. a boat will not be competing

against a military figure. Providing a model attains sufficient marks it will be awarded a gold, silver or bronze medals

Model Vehicle Section

- K1 Non-working cars, including small commercial vehicles (e.g. Ford Transit) all scales down to 1/42.
- K2 Non-working trucks, articulated tractor and trailer units, plus other large commercial vehicles based on truck-type chassis, all scales down to 1/42.
- K3 Non-working motor bikes, including push bikes, all scales down to 1/42.
- K4 Non-working emergency vehicles, fire, police and ambulance, all scales down to 1/42.
- K5 Non-working vehicles including small commercial vehicles (e.g. Ford Transit). Scale from 1/43 or smaller.
- K6 Any available body shells including Concours, in any scale or material, to be judged on appearance only.
- K7 Functional model cars/vehicles which must be able to move under its own power of any type. Can be either free-running, tethered radio controlled or slot car, but must represent a reasonable full size replica

DUKE OF EDINBURGH CHALLENGE TROPHY

Rules and Particulars

1. The Duke of Edinburgh Challenge Trophy is awarded to the winner of the Championship Award at the Model Engineer Exhibition.
2. The trophy remains at all times the property of Nexus Special Interests.
3. The name of the winner and the date of the year in which the award is made will be engraved on the trophy, which may remain, at the discretion of Nexus Special Interests Ltd, in his/her possession until required for renovation and display at the following Model Engineer Exhibition.
4. Any piece of model engineering work will be eligible for this Championship Award after it has been awarded, at The Model Engineer Exhibition, a Gold or Silver medal by Nexus Special Interests Ltd.
5. No model may be entered more than once.
6. Entry shall be free. Competitors must state on the entry form:
 - (a) That exhibits are their own bona-fide work.
 - (b) Any parts or kits that were purchased or were not the outcome of their own work.
 - (c) That the model has not been structurally altered since winning the qualifying award.
7. Nexus Special Interests Ltd. may at their sole discretion vary the conditions of entry without notice.

COMPETITION RULES

1. Each entry shall be made separately on the official form and every question must be answered.
2. Competition Application Forms must be received by the stated closing date.

LATE ENTRIES WILL ONLY BE ACCEPTED AT THE DISCRETION OF THE ORGANISERS.

3. Competitors must state on their form the following:

- (a) Insured value of their model.
- (b) The exhibit is their own work and property.
- (c) Parts or kits purchased.
- (d) Parts not the outcome of their own work.
- (e) The origin of the design, in the case of a model that has been made by more than one person.

NOTE: Entry in the competition can only be made by one of the parties and only their work will be eligible for judging.

4. Models will be insured for the period during which they are in the custody of Nexus Special Interests Ltd.
5. A junior shall mean a person under 18 years of age on December 31st in the year of entry.
6. Past Gold and Silver medal award winners at any of the exhibitions promoted by Nexus Special Interests Ltd. are eligible to re-enter their model for the 'Duke of Edinburgh Challenge Trophy.'

Past winners at any of the exhibitions promoted by Nexus Special Interests Ltd. will not be eligible for re-entry into the competition unless it has been substantially altered in any way.

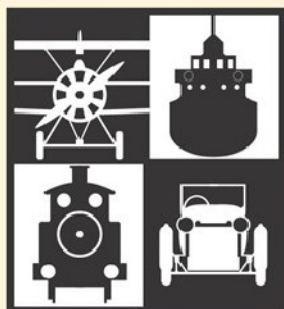
7. Nexus Special Interests Ltd. reserve the right to:
 - (a) Transfer an entry to a more appropriate class.
 - (b) Describe and photograph any models entered for competition or display and to make use of any such photographs or descriptions in any way they may think fit.
 - (c) Refuse any entry or model on arrival at the exhibition and shall not be required to furnish a reason for doing so.
8. Entry into the competition sections is not permitted by:
 - (a) Professional model makers.
 - (b) Anyone who has a financial interest in the direct supply of materials and designs to the public.

NOTE: If unsure, please contact the Competition organisers, prior to the show.

9. The judges' decision is final. All awards are at the discretion of the judges and no correspondence regarding the awards will be entered into.
10. Exhibitors must present their model receipt for all models collected at the end of the exhibition and sign as retrieved.
11. The signed release for each model must be presented to security staff when leaving the exhibition complex with display model(s) after the close of the exhibition.

IMPORTANT NOTE PLEASE MAKE COPIES, INCLUDING PHOTOGRAPHS, OF ALL INFORMATION RELATING TO YOUR MODEL, AS NEXUS WILL NOT ACCEPT LIABILITY FOR ANY LOSS.

CLOSING DATE 16TH DECEMBER 2003



THE MODEL ENGINEER EXHIBITION

Please return completed form to:
Model Engineer Competition, The Leys,
Church St., Twyford, Bucks. MK18 4EU

ENTRY FORM - COMPETITION & LOAN MODELS

ENTRY NO.

OFFICE USE ONLY

CLASS	ENTRY NO.

PERSONAL DETAILS (Please print)

Surname Forename(s) Age

Address

Post Code Home Tel: Daytime Tel:

Model Club or Association

Have you entered before? (Y/N) Do you purchase or subscribe to a Nexus magazine? (Y/N)

How many years have you been a modeller?

Mail Order Protection - please tick this box if you would prefer not to receive mail from other companies which may be of interest to you ☐

MODEL DETAILS - PLEASE TICK BOX IF MODEL IS FOR LOAN

Entry Class (competition entries only)

Model Title (to be used for catalogue and display card)

Model Description

Model Scale Length Width Height Weight

Type of construction

Parts not made by you and commercial items.....

Have you supplied a photograph? (Y/N)

Are you supplying Judges Notes? (Y/N)

Value of model (Highbury Nexus will not insure the model unless a value is entered) £

Name and address of local newspaper

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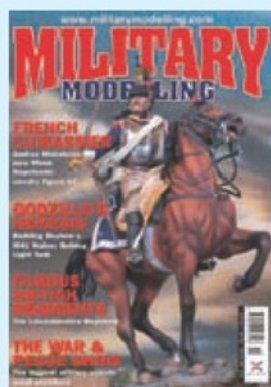
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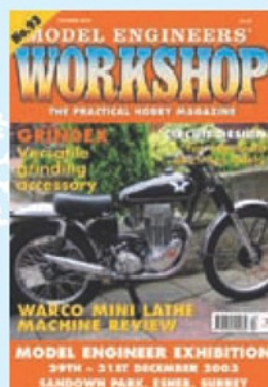
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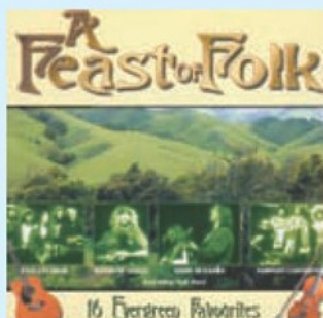
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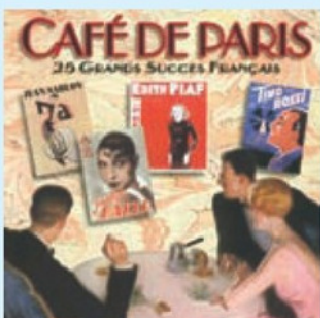
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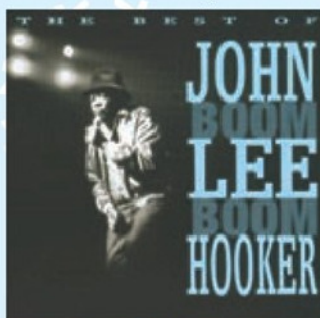
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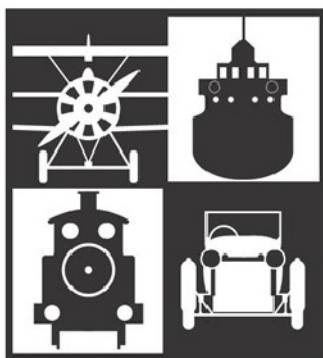
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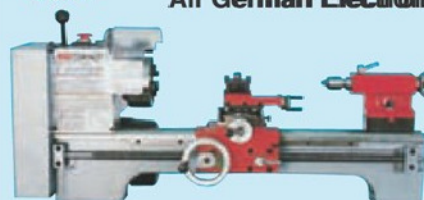
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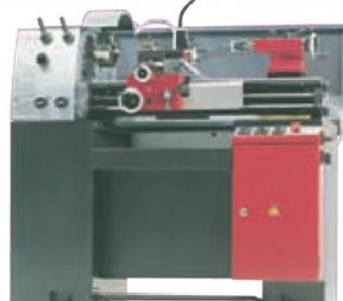
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Wadkin & Bursgreen Planer 12"x70" Table -	£350
Zyto Tyzak Table saw 10" 19" x 19" Table -	£240

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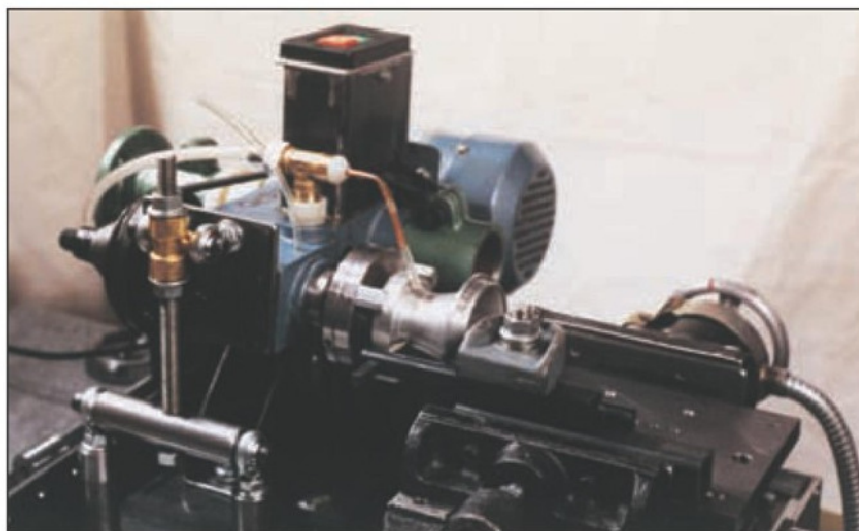
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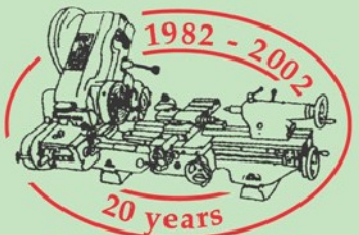
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SIP 7" bandsaw, horizontal & coolant.....	New £750
DUPLEX D29 toolpost grinder.....	£345
BOXFORD (imperial only) thread dial indicator.....	£65
BURNERD, D14 lever collet chuck + collets.....	£400
BURNERD, L0 lever collet chuck + collets.....	£400
VERTEX Dividing head.....	New £245
VERTEX 6" - 8" - 10" rotary tables good value equipment.....	New From £135
MYFORD ML7 / Super 7 rear tool post.....	£400
MYFORD 254- rear tool post.....	New £40
MYFORD Vertical slide / fixed type (copy).....	£99
LOCKWOOD Quad headed 2mt Die Holder quality equipment.....	New £40
LOCKWOOD Quad headed 3mt Die Holder quality equipment.....	New £40
LOCKWOOD Test Bar / 2mt Boxed quality equipment.....	New £39
UNION tool and cutter grinder stand.....	£135
50 INT Tooling: Selection.....	Just in
STARTRITE 352 woodworking band saw.....	£975
STARTRITE 14-5-5 woodworking band saw.....	£775
ALCOSA GF 080/1 Rapid Melting Furnace.....	£300
COLCHESTER D13 Burner 4 Jaw 8" light body independent chuck.....	one off £225
MICROMETERS and associated measuring tools.....	Still packaged as new
HARRISON L6 metric gearbox.....	As is £250
HARRISON L6 tailstock.....	£245
SIP 1 TON MOBILE CRANE Manufactured 2000 (used just once).....	As new £375
MITUTOYO grade A set of slips.....	£245
Large bench vice.....	£70
LINK1.5 ton vehicle crane + top hat.....	£625
MITUTOYO 103-913 metric set micrometers.....	£275
NORTON / EDWARDS arbor presses.....	£75 / £145
AJAX 6" hacksaw.....	£425
SURFACE plates from 12" x 12" to 36" x 36".....	Very nice from £30
WEBER 11/2 ton mobile garage crane, late blue colour.....	£495
ELLIOTT 1250 STURDYMILL vertical head.....	One off (rare) £525
RJH linsner 4" wide belt, pedestal.....	£345
STEEL STOCK different stock rolling in almost daily.....	to callers only
ELLIOT U1 / U2 Slotting Head.....	£475
SWAGE BLOCKS.....	£125 / £145
J & S Universal grinding vice.....	Choice £275 / £325
BOX TABLES: Grade A and B, many sizes.....	£40 - £150
SLIPS / GAUGES Metric / Imperial, New Sets; 87 / 81 piece.....	£215 / £145
HORIZONTAL METAL BANDSAW 6" x 41/2" capacity.....	New £170
COLCHESTER STUDENT / MASTER Round head, face-plates, small / large.....	£50 / £80
QUALTERS AND SMITH 6" Hacksaw.....	£345
BORING HEADS 2 / 3 Morse, R8 Taper, Max. Capacity 41/2" round bar.....	New, each £90
ODONI Machine Bed Clamps (pair).....	Special £24.50
HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright.....	From £95
DIE BOXES.....	From £45
TRANSWAVE 3HP Converter.....	New £295
TRANSWAVE 5.5HP Converter.....	New £385
TRANSWAVE MT & RT rotary converters.....	From £400
CROMPTON PARKINSON HP, resilient mount, Boxford / Myford Super 7 Type motor.....	New £140
CROMPTON PARKINSON SINGLE PHASE start / stop switch model DL1 2000 series (4.5-7.5amps).....	New £69

SPECIAL!!
Compton Parkinson 3/4hp
motors, new for Myford/Boxford
etc £140+VAT (free delivery UK
mainland)



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THAN THE ADVERTS CAN KEEP UP WITH US!!

PLEASE PHONE 020 8300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST

DISTANCE NO PROBLEM!! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF V.A.T.

LET US KNOW
WHAT YOU WANT US TO
BRING TO SANDOWN
20TH - 31ST DECEMBER
2003

- 2-Axis DRO from **£615** inc vat
- Made in the UK
- 5 year No-Fault Warranty
- 10 micron Accuracy



£289

Cobra Lathe

- Centre height: 70mm • Distance Between Centres: 250mm
- Speed Range: 100-200rpm • Metric or Imperial Leadscrews



Cobra Mill

£339

- Variable Speed Control
- Spindle Taper: MT2
- Table Size: 145 x 240mm
- Metric or Imperial Leadscrews



DB8 Lathe

£850



- Centre Height: 1105mm • Distance Between Centres: 400mm • Complete with 3 & 4 Jaw Chucks, Fixed & Travelling Steadies & Face Plate
- Hardened & Ground Bedways • Accuracy Report

DB10G Lathe

£999



- Centre Height: 1125mm • Distance Between Centres: 550mm • Thread Cutting Gearbox • Complete with 3 & 4 Jaw Chucks, Fixed & Travelling Steadies & Face Plate • Vee Bedway • Accuracy Report

Model B Super

£670

- Maximum Swing: 420mm
- Distance Between Centres: 520mm
- Cast Iron Construction
- Metric or Imperial
- All Tapers MT3
- Supplied with 3-Jaw Chuck, Drill Chuck & Arbor and more!



£1100

Centurion

- Distance Between Centres: 5920mm
- Centre Height: 2110mm • Spindle Bore: 28mm
- Powered Crossfeed • Separate Motor for Lathe/Mill
- Complete with 5" 3-Jaw Chuck, Lathe Tools, Change Gear and more!



Conquest Lathe

£395



- Centre Height: 90mm
- Distance Between Centres: 325mm
- Large MT3 Spindle Taper
- Spindle Bore: 19mm
- Now C/W Quick Change Toolpost
- Variable Speed Range 100-2500rpm
- Metric or Imperial Leadscrews

626 Turret Mill

£1340

- Table Size: 156 x 745mm
- 1.5HP Motor
- MT3 or R8 Spindle
- Metric or Imperial graduations



Champion Mill/Drill

£585



- 1/2HP Motor
- Table Size: 150 x 630mm
- Complete with Drill Chuck & Arbor
- Ground Cast Iron Column
- MT3 Spindle

Craftsman Lathe

£1550



- Centre Height: 150mm
- Distance Between Centres: 570mm
- Swing in Gap: 450mm
- Powered Crossfeed • Spindle Bore: 36mm
- Complete with 3 & 4 Jaw Chucks, Fixed & Travelling Steadies, Face Plate, Machine Stand, Accuracy Report & much more!