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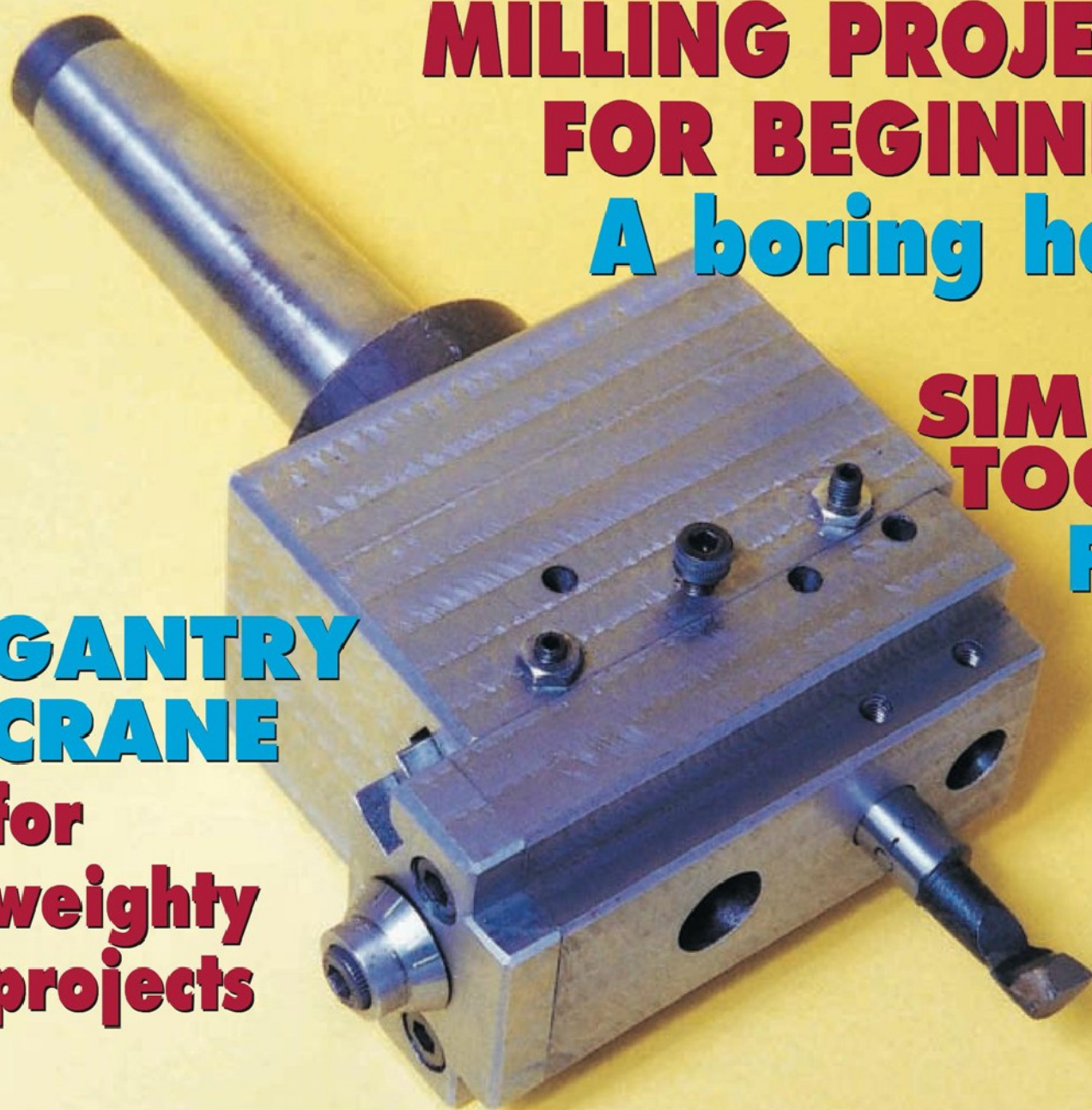
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Front Cover

Construction of this
boring head is described
by Harold Hall on page 12

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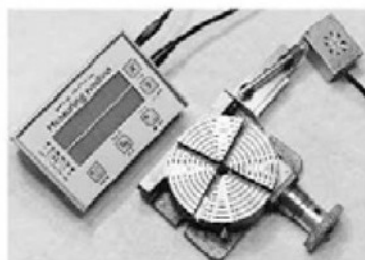
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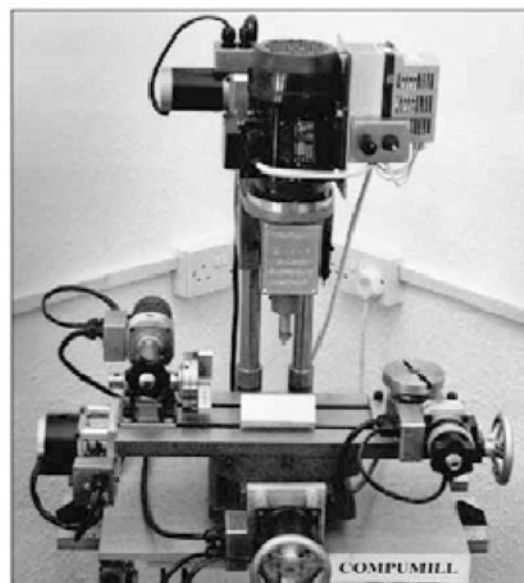
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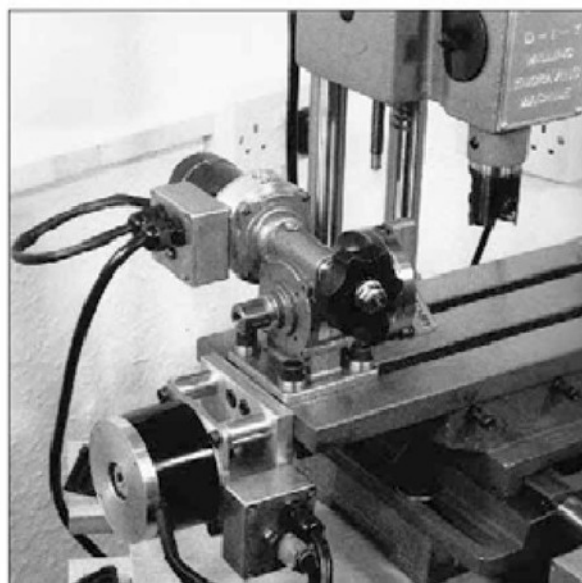
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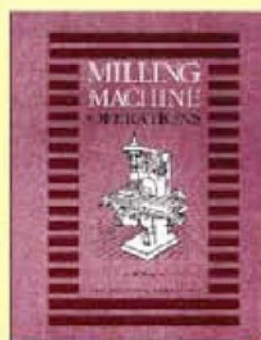
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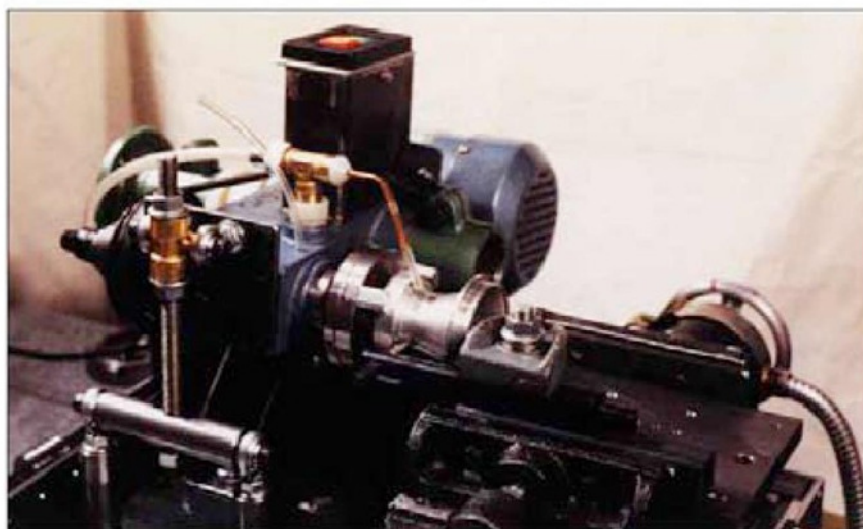
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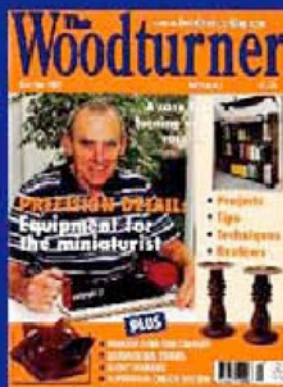
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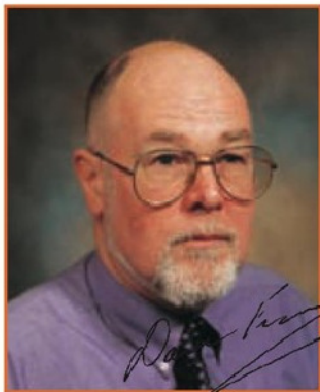
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OVM02



ON THE EDITOR'S BENCH

Gripes at Officialdom

Some readers may, like me, "enjoy" self employed status, and as such have to file the dreaded annual tax return. Some years ago, following the introduction of automatic penalties for lateness, and on hearing reports that the tax authorities managed to lose returns and then impose penalties, I adopted the policy of hand delivering the documents and collecting a receipt. This year, I was told it was no longer policy to give receipts. I pointed out that the clear alternative was to post by recorded delivery, in which case they would be required to sign for receipt. After a further forthright exchange of views, my prepared receipt was duly signed.

A recent news item drew attention to yet another classification of socio-economic group, to be identified as "The Meldreys". Having long since passed the Yuppie and Dinky stages, I am proud to count myself in.

Drawings, Standards, and Attitude

John Brittain's letter to Scribe a Line draws attention to the desirability of adhering to accepted drawing standards, with particular regard to dimensioning. In this specific instance, of course, I have suffered mild indigestion due to an appropriate portion of humble pie. It may, however, be a matter of some debate as to how rigidly BS 308 is being followed in industry at large. Certainly it now seems that some of the CAD packages allow arrangements which although generally unambiguous in communication, may not conform perfectly to the BS. For the purposes of M.E.W., the primary object in drawing presentation has been and will continue to be to give appropriate information for the prospective constructor.

This comment brings to mind an earlier complaint from a reader in Newhaven, that there were numerous drawing errors in a series published in M.E.W. long ago. On reviewing the correspondence, it transpired that the same person had previously complained about errors and missing information on Plans Service Drawing No WE19, (The Drill Grinding Jig by Ian Bradley, published many years ago in Model Engineer). His letter of complaint extended to three typed pages, took issue on some 49 points, and resulted in the plan being withdrawn from sale.

After reading his letter and examining the drawings, I concluded that the gentleman

concerned was probably a professional engineer who, in a typical production shop had been spoon fed complete information for each and every component, on the basis that mating parts are made elsewhere, and there must be full interchangeability. Many of his "missing info. items" were of the form "pitch of holes not given on component X". If our complainant had spent time studying the whole drawing, (rather than the individual parts), and absorbing the obvious fact that component X attaches to component Y then it might have become clear that the dimensions given for Y should also be used for X. Should doubt still exist, then reference might be made to the original M.E. text which would no doubt provide additional guidance.

The bottom line is, of course, that for much of what we attempt in our amateur workshops, a large dose of practical common sense is essential. Frequently, exact sizes are immaterial, what matters is that parts fit. If "Disgruntled of Newhaven" is blessed with a mental attitude that does not accord with these basic requirements of amateur and model engineering, then perhaps he might find painting by numbers a preferable pastime. It was indeed unfortunate that others were subsequently deprived of the opportunity to construct a useful and versatile workshop accessory. The drawing is now again available.

Wrong Method – Right Result

We were part way through tapping a batch of several hundred components with M10 threads, when the tap became noticeably blunt. Of course there wasn't a spare. For this particular job, a spiral point tap is used as it is a through hole, and it is more convenient to drive the swarf downwards. (This in contrast to a spiral flute tap whose swarf is driven back, in a similar manner to a drill.)

As I really did not feel like dusting off and setting up the tool and cutter grinder, I considered putting the job aside until some new taps arrived. It was at that point that I remembered Trevor Marlow's article on drill sharpening, and the suggestion to refresh rather than regrind. The tap was mounted in a bench vice with one spiral edge horizontal. A small grind wheel was fitted to the Minicraft, and this then delicately stroked along the horizontal flute face to recreate a keen edge. The procedure was then repeated for the two remaining flutes.

After some "That'll never work style hilarity", the tap was refitted to the Tapmatic. Suffice to say that the batch was completed without further incident. This tap was of course quite large by model

making standards, and therefore not too taxing to operate on. However it would seem that given fair eyesight and a steady hand, this unforeseen application of the Minicraft may be worthy of consideration for more general tool sharpening, or refreshing. Although I have not yet experimented, it may also be a useful way to generate chip breaker grooves on turning tools.

The Model Engineer Exhibition

Organised by Highbury Nexus Special Interests, this year's show will run from 29th to 31st December 2002 at Sandown Park, Esher, Surrey. The building work which gave rise to some adverse comment last year is long since complete, and the venue which also boasts convenient transport links, copious parking, and good restaurant facilities, is widely considered the premier location for such an event.

I would like to take this opportunity to encourage readers to exhibit items of workshop equipment in competition or loan categories. Unlike most models, which are based on a specific prototype, workshop items frequently are conceived as an answer to a problem, and therefore may display originality of design, which would be scored positively by the judges.

The list of participating clubs is, to say the least, extensive, and, building on last year's success, will appeal even more widely to visiting families. As well as the traditional Model Engineering content, railways in various gauges, boats, and aircraft will all be exhibited. Other interests will include Stirling engines, and the unsung heroes from Remap will be on hand with information on their activities, and how to become involved in their work assisting disabled clients.

New Technology aspects of model and amateur engineering will not be ignored; it is even hoped to arrange a guest appearance by one of the "House Robots" from the television programme Robot Wars.

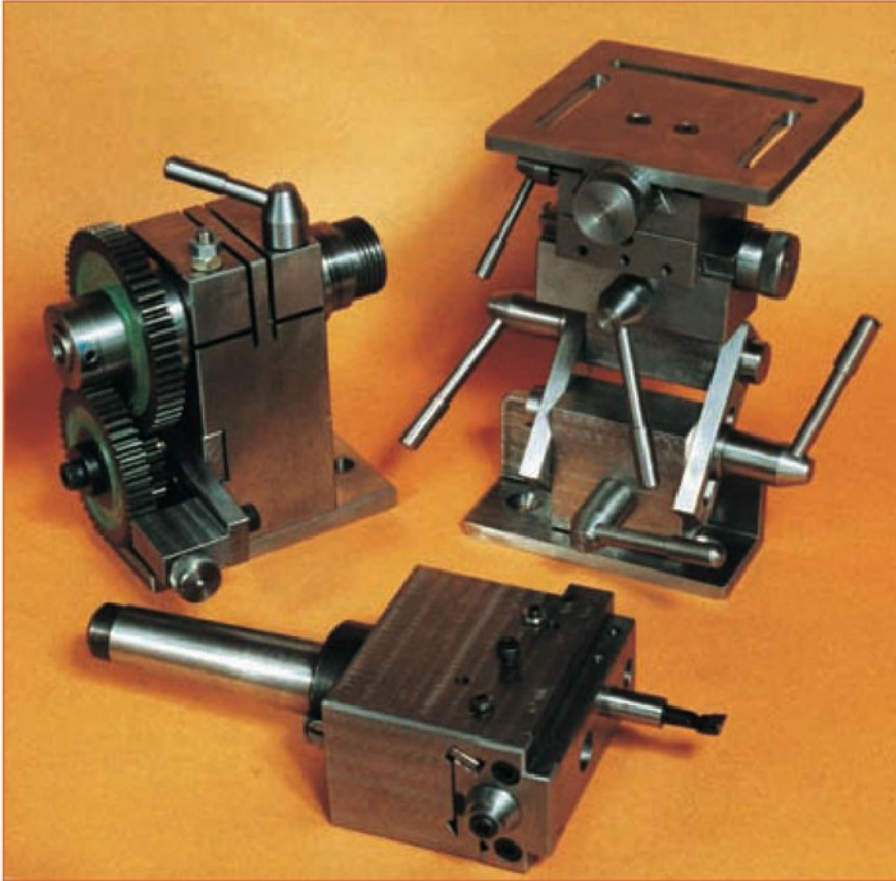
Trade involvement is always an essential ingredient of any exhibition. Many of the well known suppliers will be present, along with an extensive number of smaller specialists.

Access is straightforward by public transport or car, and ample free parking is available. Advance tickets cost £5-50 and the ticket hotline is 01353 654422.

And Finally

As this is the last issue of MEW for 2002, I would like to take the opportunity to extend compliments of the season to all readers.

MILLING PROJECTS FOR BEGINNERS (4)



In this section, Harold Hall describes the construction of a precision Boring Head, made from stock material.

versatile Grinding rest, all three illustrated in the heading photograph

Before going into detail regarding the boring head some overall comment regarding the three is required.

Material

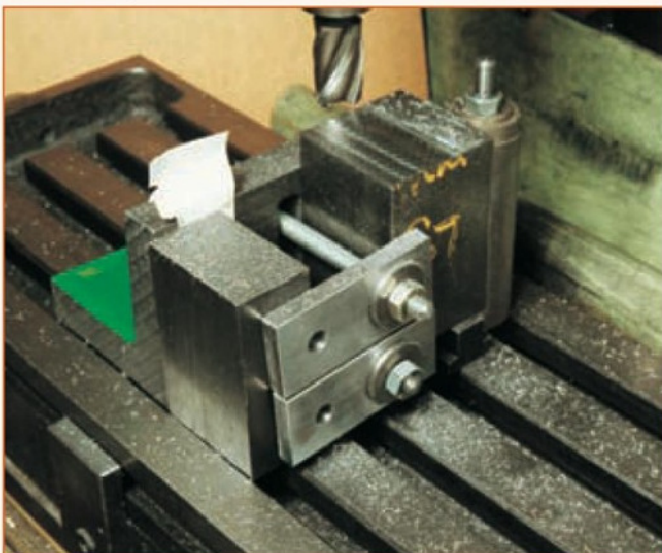
To simplify material procurement the three items have been designed where possible to use the same material sizes for their major components. Secondly, to ease the machining processes, material sizes that can be obtained free cutting (230M07) have largely been chosen. This limits rectangular shapes to squares only. If you have difficulty in obtaining larger size materials in 230M07 from the normal home workshop suppliers it should be realised that there are very many small commercial jobbing workshops that need to purchase larger size materials in small quantities. So purchasing a 400mm length of 50mm square 230M07 from a local stockist should not present a problem. Look in Yellow Pages for your local stockist. Alternatively, the small jobbing shop may be able to sell you blanks cut close to size.

Knowing it would be disconcerting if, having purchased some larger size material for the first project, the same material was then found to be needed for the second, and then the third, I am listing the main material requirements for the

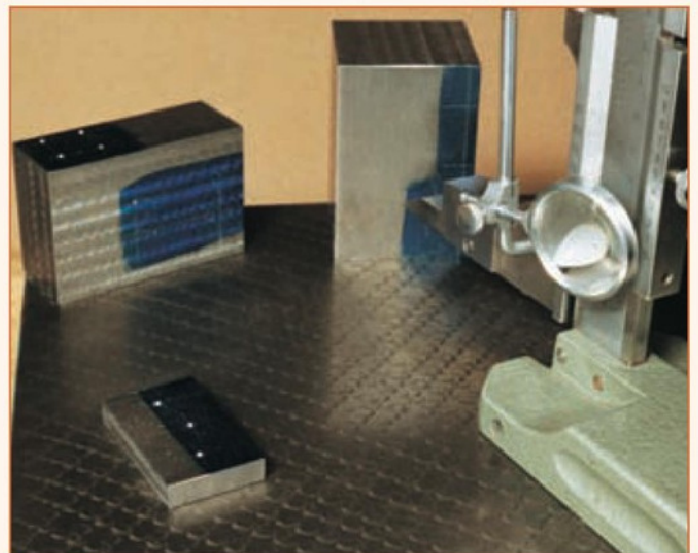
The series now moves into projects that will be very useful and at the same time, because of their size, bring considerable satisfaction to the novice for completing such items. In the same way that the simple items thus

far produced are essential for the manufacture of these major items, so the item in this issue will be essential for the construction of the second, and the second is essential for the third item. They are a Boring head, a Dividing Head and a very

1. Machining the end of the main body. Note the use of the cylindrical square to position the part.



2. Marking out the parts for drilling and slotting.



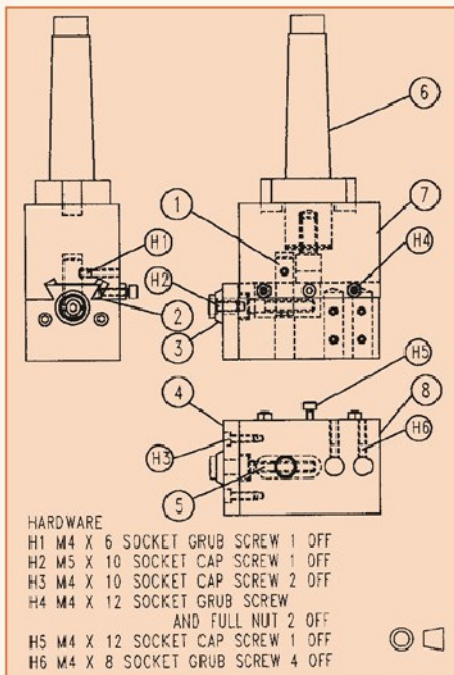


Fig. 1 Boring head general assembly

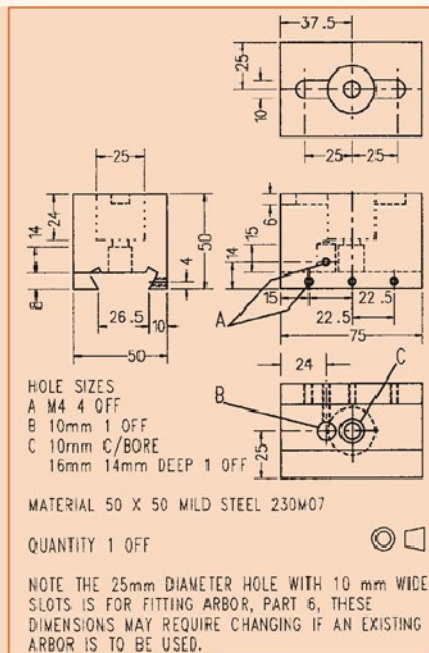


Fig. 2 Body - Part 7

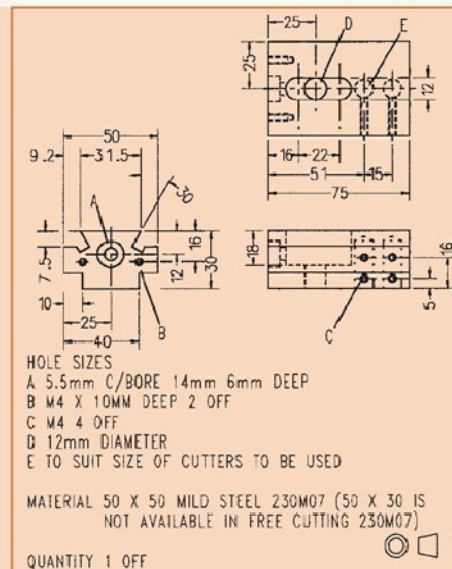


Fig. 3 Cutter carrier - Part 8

three remaining items at this point should you wish to get started. A list of the cut lengths of the various steel sections needed appears as **Table 1**.

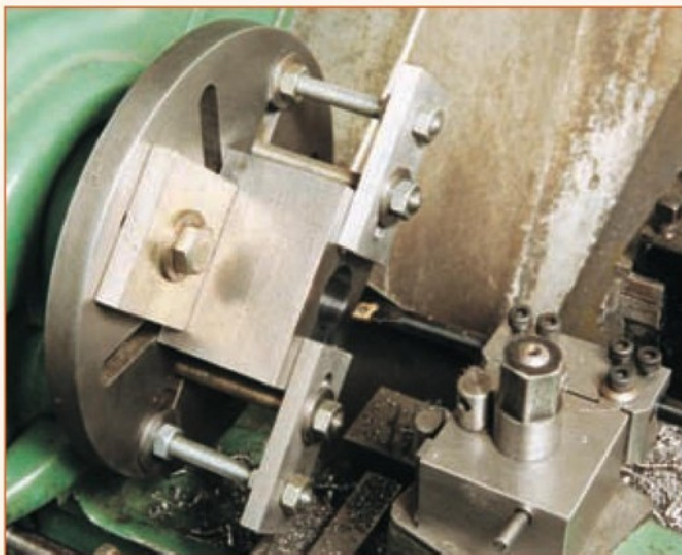
Production planning

You may like to expand the purpose of this series into production planning by making this and the remaining items simultaneously. This will enable a particular setup to be used whilst available for parts in more than one project, reducing the overall time taken quite appreciably. I will of course write each article as if it is being made in isolation., Explanations will be kept brief where appropriate, as I did in the concluding articles of the Lathe Projects series. These final articles are though backed up by a generous number of photographs.

The boring head

The General Assembly Drawing (Fig 1)

3. Boring the body for the arbor.



illustrates the design, and gives a parts listing.

Body 7 (Fig 2) and Cutter Carrier 8 (Fig 3)

Cut 2 lengths of 50mm square, 75mm long, plus an allowance for machining. Mount an angle plate and cylindrical square, clamp the part ensuring it is accurately in contact with both angle plate and square. Machine end, **Photo 1**, reverse, machine second end to 75mm. Repeat for second part. This set up ensures that the end faces are truly at right angles to the side faces and parallel to each other, a requirement for a satisfactory conclusion to later operations. Mark out the positions of the holes and the extremities of the slot in the cutter carrier, **Photo 2**.

Body 7

Drill pilot holes for B and C. Mount on the lathe faceplate, bore to take the arbor, **Photo 3**. A tailstock

centre located in the pilot hole C will accurately position the part on the faceplate whilst clamping. Return part to the milling machine, mount dovetail side up, **Photo 4**. Use an engineer's square off the table front edge to accurately position the part. Remove centre portion to a depth of 8.2mm, working to the dimensions of 10mm and 26.5mm.

In photo 4 we now see the purpose of the hole in the clamp, that is to take a stud to act as packing. The stud is threaded into a T nut (another use for a T nut as intimated earlier) and locked with a nut as seen. A nut on the stud below the clamp, not seen, sets the packing height to just higher than the part being held and a further nut on top make the assembly secure. This is an excellent packing method. Note also the use of a substantial washer over the slot.

Release the part from its clamps and rotate through 90 degrees, this time allowing the clamps to encroach into the

4. Preliminary machining of the body prior to machining the dovetails.



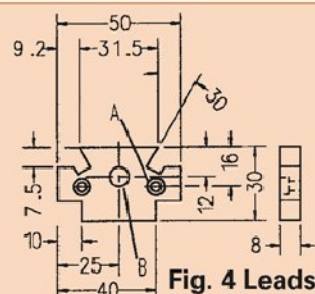


Fig. 4 Leadscrew bearing plate - Part 4

HOLE SIZES
A 4.2mm
C/BORE 7mm 4mm DEEP 2 OFF
B 8mm

MATERIAL 50 X 8 STEEL 080A15

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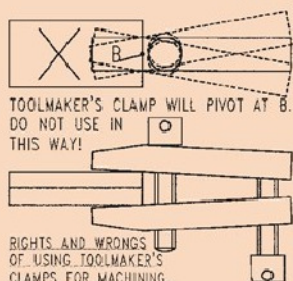
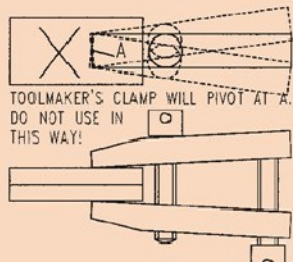
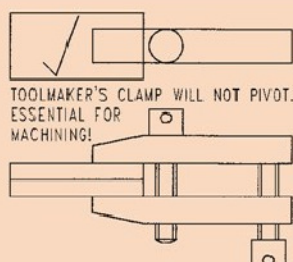
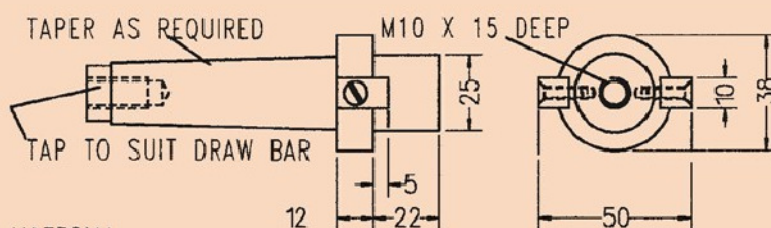


Fig. 5 Rights and wrongs of using toolmaker's clamps for machining



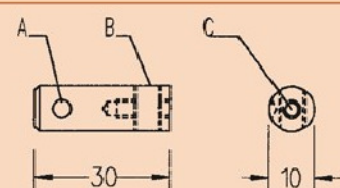
MATERIAL

38mm DIAMETER STEEL 230M07 10mm x 10mm STEEL 080A15.

QUANTITY 1 OFF

NOTE MAY NOT BE REQUIRED IF YOU HAVE AN EXISTING ARBOR.

Fig. 6 Arbor - Part 6



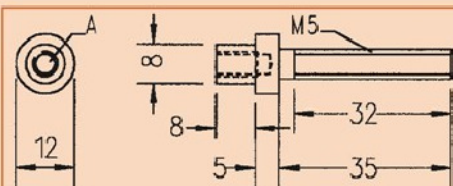
HOLES
A 4mm DIMPLE FOR GRUB SCREW
B M5
C M3 X 12 DEEP.

POSITION A AND B ON ASSEMBLY
HOLE C TO AID REMOVAL OF PART
AFTER ASSEMBLY.

MATERIAL 12mm DIAMETER
STEEL 230M07

QUANTITY 1 OFF

Fig. 7 Leadscrew nut - Part 1

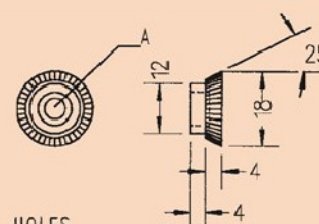


HOLES A M5 X 8mm DEEP

MATERIAL 12mm DIAMETER STEEL 230M07

QUANTITY 1 OFF

Fig. 8 Leadscrew - Part 5



HOLES
A 5.2mm C/BORE 8.5mm 5mm DEEP

MATERIAL 20mm DIAMETER STEEL 230M07

QUANTITY 1 OFF

CALIBRATE WITH 40 DIVISIONS

Fig. 9 Dial - Part 3



Fig. 10 Dial calibration aid

recess just made. Skim the slide faces to achieve the 8mm dimension.

Turn over to machine the two 10mm x 6mm slots. Lower the cutter into the 25mm hole and whilst on the 37.5mm centre line advance the cross slide until the cutter just contacts the bored hole. Lock the cross slide and reverse the handwheel until resistance is felt to take up backlash, release the cross slide and feed by 7.5mm ((25 - 10)/2). Take a very shallow cut and check to make sure no error has been made, make the two slots at 2mm depth increments. Being an open ended slot an end mill can be used rather than a slot drill.

At this point it is assumed that as a novice a dovetail cutter is not yet part of workshop kit, so another method of creating the dovetail is proposed. Even if one is to hand, using the method described would be good milling experience.

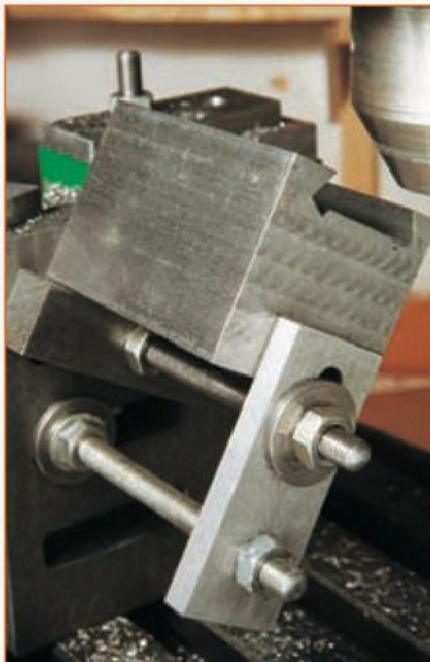
Mount the angle plate onto the table face, end ways on, long clamping studs will be required, **Photo 5**. (See later photo 10 for a better view) Again use an engineer's square as accuracy is vital, using a dial test indicator would be even better (see later photo 8) Take a length of steel say 12mm square, though not critical and about 75mm long, drill in the centre with a hole to take a clamping stud. Fix this onto the angle plate at an angle of 30 degrees using a stud long enough to also clamp the part.

Fit a 6mm end mill and set this to take an initial depth of cut of 2mm maximum. Remember at this small size of cutter a high spindle speed will be required, say 1000 rpm plus. Take a first cut adjusting the cross feed such that a flat of around 0.5mm remains along the length. If previous machining, and the setting of the angle plate at this time is accurate, the flat

should be a constant width. If, an appreciable error exists it will be necessary to investigate the matter. A small error, say 0.1mm, is though probably inevitable and of no great consequence.

Lower the cutter 2mm at a time until the full depth has been achieved. Follow this by making adjustments to the cross feed of 0.1mm, each time taking a skim along the length, repeat until the flat totally disappears. This is a case where direction of traverse can correspond to cutter rotation to achieve the best surface finish, see issue 84 pages 13 & 15. photos 4 and 5

Remove part the from angle plate, turn end on end, repeat the process. Remove and place two pieces of rod, about 10mm diameter, one on either side of the dovetail and measure the distance between them at each end. Even if an appreciable error is apparent it is of no consequence as the gib strip will compensate for this. It will



5. An alternative approach to using a dovetail cutter.

though be nice to know the results of your efforts and if the error is less than 0.1mm you have done very well.

Finally, at this stage, drill and tap holes A and final drill holes B and C.

Leadscrew bearing plate (4) (Fig 4)

Cut a piece of steel allowing for subsequent machining, machine the ends, mark out and drill holes A and B. IT IS IMPORTANT to make B, tapping size for M5 at this stage.

Cutter Carrier (8) (Fig 3)

Having previously machined the ends, cut the 50mm square to 50mm x 30mm plus to allow for machining to the 30mm dimension. Mount the material onto the angle plate as in Photo 6, sawn side up, again it is necessary for the angle plate to be aligned with the cross feed. With the ends accurately machined the part should automatically be parallel with the table's surface length wise but needs also to be parallel back to front. Because of this the

use of parallels is essential.

It is unlikely that the parallels will be firmly held after clamping the part but check that the part sits accurately on them and then remove. machine to 30mm dimension, **Photo 7**. Drill and tap, where required, all holes except A, fit the bearing plate, mount on the machine table as in **Photo 8**. Machine 10mm slot guided by the markings previously made.

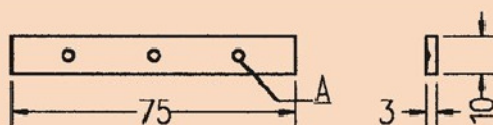
Accurately position the part on the table using a dial test indicator, **Photo 8**. Mounting the dial test indicator off some point of the machine, other than using the drill or cutter chuck, has advantages as it avoids removing a drill or cutter from the chuck that may still need to be used (ref. 1).

Machine the edges as shown in **Photo 9**, in preparation for machining the dovetail, work to the 9.2mm, 31.5mm and 7.5mm dimensions. By way of explanation re the photograph, the clamps were actually made from 1 1/4" material and were therefore just over the 31.5mm width. The pieces of steel either side of the workpiece permit the clamps to be loosened and moved to permit the second side to be machined, without fear of losing accurate positioning of the part. Note also that this necessitated the clamps to rotate a little making it impracticable to locate the packing stud in a T nut, as in photo 4. Using a screw nutted into the clamp and with its head on a piece of packing

overcome the problem, in fact, where the height of the packing is short this is probably as good a method.

With the angle plate reinstated on its end, together with the support bar at 30 degrees, machining followed essentially the same process as for the body, see **Photo 10**. Note that the carrier was additionally held by the inclusion of a toolmaker's clamp, clamping the part to the supporting bar. With the cutter carrier and bearing plate dovetails completed, check the assembly as in **Photo 11**, in this case the sides should be parallel, at least within 0.05mm, as the gib strip will not compensate for any error in this part. Ideally the rod should be at least 10mm diameter so that it rests on the two sliding faces of the dovetail. Corrections with a fine file and or a scraper may be needed on assembly.

Having shown a toolmakers clamp in photo 10 this would seem an appropriate time to discuss their use in machining operations. Whilst it is considered essential for the packing used with a clamp to be just higher than the part being held, such that clamping takes place at the end of the clamp this is not so when using a toolmaker's clamp. With toolmakers clamps the two clamp faces must sit accurately on the faces of the two items being held, (**Fig 5**) seeks to make the position clear. The essential requirement is for the distance between the two arms to



HOLE SIZES

A DRILL DIMPLES AFTER ASSEMBLY TO
TAKE END OF ADJUSTING SCREWS

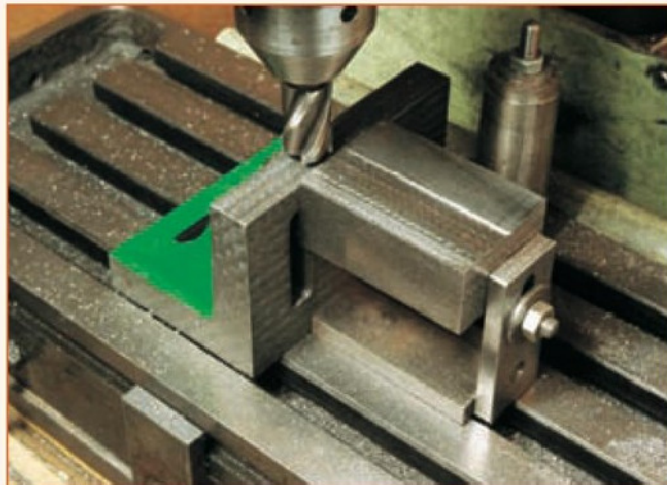
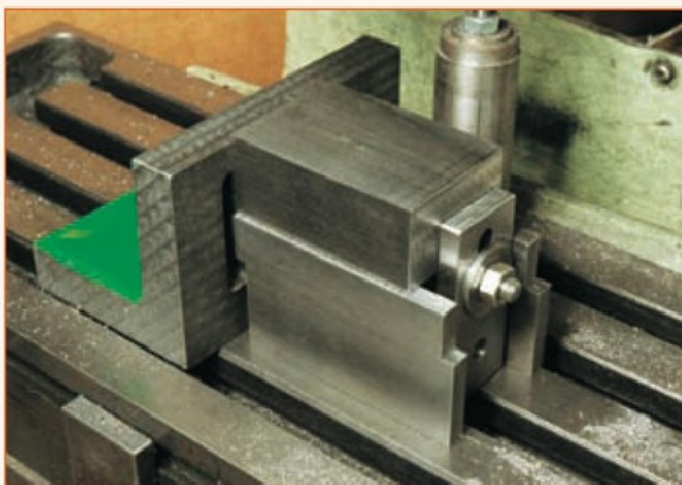
MATERIAL 10mm X 3mm STEEL 080A15

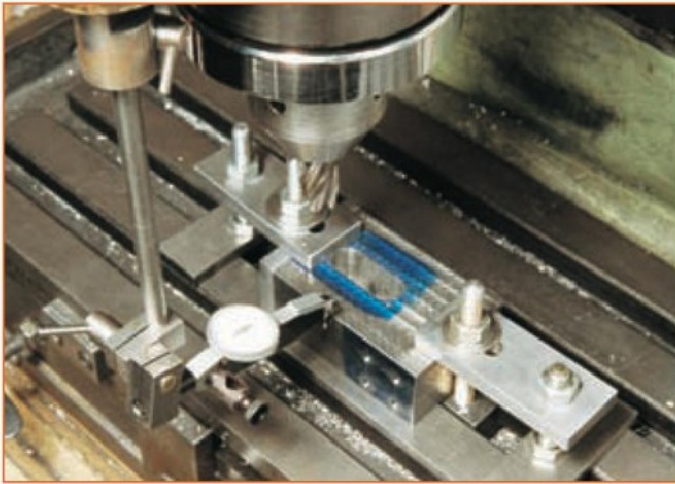
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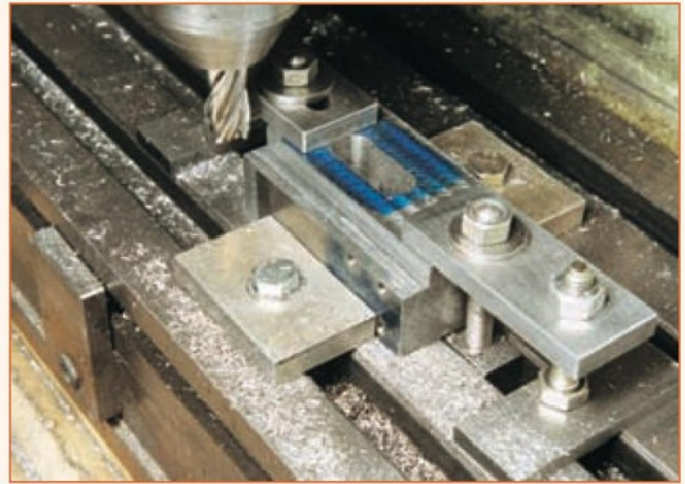
Fig. 11 Gib strip - Part 2

6. and 7. Thickening the cutter carrier having made it from 50mm sq. Note the cylindrical square is not part of the setup, only left in place for a future task.

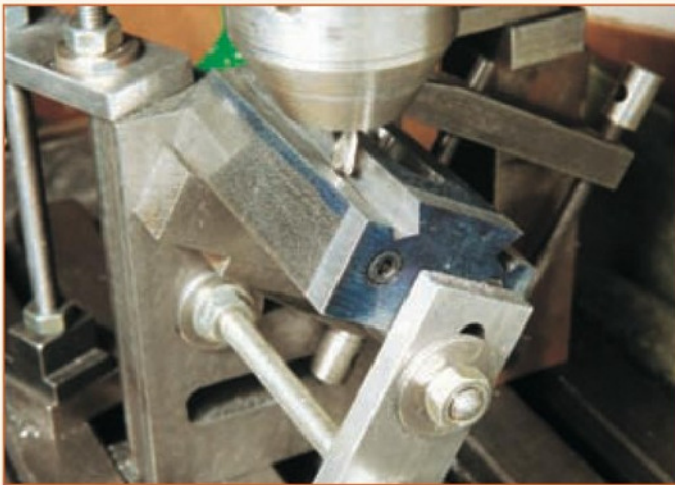




8. Positioning the cutter carrier for machining the dovetails.



9. Preliminary machining the cutter carrier prior to machining the dovetails



10. Making the dovetails on the cutter carrier.



11. Using a micrometer and two rods to check if the dovetail sides are parallel.



12. With the unit partially assembled, the lead screw nut is drilled with a tapping size hole using the assembled parts as a guide to ensure alignment.

be accurately set using the screw nearest the clamping point with the outer screw being used to apply the clamp force. Some

reservation though should be considered when rough castings are being clamped, though in the case of photo 5 issue 85 page

Table 1							
Material size/grade	Boring Head		Dividing Head		Grinding Rest		Total
	parts	qty	parts	qty	parts	qty	
50mm Sq.	7,8	180mm	1	120mm	9,17,18	120mm	420mm
230M07							
50mmX8mm	4	40mm	3	150mm			190mm
080A15							
20mmX8mm			2,8	220mm	20	180mm	400mm
080A15							
32mm Sq					4,8	150mm	150mm
230M07							
100mmX6mm					1	120mm	120mm
080A15							
38mm Dia	6	150mm	12	150mm			300mm
230M07							
50mm Dia			14	60mm			60mm
cast iron							
40x40x6mm					7	200mm	200mm
bright angle							



13. Machining the cutter carrier for weight reduction and better visibility when in use.



14. Skimming the sides to level up the two parts and improve appearance.

16 the fact that one surface was a round pillar made it a special circumstance.

The turned items

You may, as I did, use an existing arbor in which case dimensional changes are probable, otherwise make the Arbor (6) (Fig 6) as per drawing. The essential feature is that the 25mm diameter and the taper are concentric. Holding one end in the chuck, supporting the other with the tailstock centre, turning the taper at the tailstock end and the 25mm diameter with a left hand knife tool will achieve this.

The remaining turned items need little comment. Note that the Leadscrew Nut (1) (Fig 7) holes A and B are drilled on assembly. The 8mm length on the Leadscrew (5) (Fig 8) should be just longer than the thickness of the bearing plate to permit rotation with minimal backlash. Calibration of the Dial (3) (Fig 9) may be a problem due to the absence of a dividing head, in which case use Fig. 10 as a temporary method as follows. Mark the sloping face of the dial with marking blue, centralise the dial over the sketch and make the calibration lines using a scriber. Final calibration can be done when the dividing head that follows has been completed. It will be noted that I have chosen 40 divisions, which in conjunction with the M5 pitch of 0.8mm, gives a slide movement of 0.02mm per division. For those wishing to stay with imperial measure, 32 divisions and the same leadscrew will give a close approximation to one thou per division. (The error is around one and a half percent).

Final assembly

Cut a length of 10mm x 3mm steel, 75mm long and trim the ends to make the Gib strip (2) and assemble together with the body and the cutter carrier. Fit the gib strip screws and tighten. Loosen screws, remove the gib strip, centre punch in the marks made and drill the dimples 4mm diameter to take the end of the screws. Reassemble and fully tighten the gib strip screws. Fit the leadscrew nut through the hole provided for this in the cutter carrier and tighten its fixing screw (H1). Loosen screw, remove leadscrew nut using a long M3 screw to achieve this, centre punch where marked and drill 4mm dimple. Refit the leadscrew nut and fully tighten its

fixing screw ensuring that it is located in the dimple just drilled.

Next task it to drill through the assembly with an M5 tapping size drill as seen in Photo 12. Ensuring that the machine table is clean and the cutter carrier is standing firmly on the table will ensure that the hole is aligned accurately with the dovetails. Most tapping drill charts are very poor as they give no indication as to the depth of thread being achieved thereby making it impossible to make informed choices as to the drill size to be used based on the material being tapped, the quality of the tap being used and the drill sizes available. For these three reasons I do not give tapping size holes in my articles but would suggest you refer to the Model Engineers' Workshop Data book section C.

Open up the hole to 5.5mm through both the bearing plate and the cutter carrier and whilst still assembled tap the leadscrew nut M5. Dismantle, make the 14mm counter bore in the cutter carrier and open up the hole to 8mm in the bearing plate. Assemble once more and, with the gib strip screws preliminarily adjusted, check that the slide works satisfactorily when turning the leadscrew, some scraping of the slide surfaces just may be required. If OK, lock the slide by fully tightening the gib strip screws and

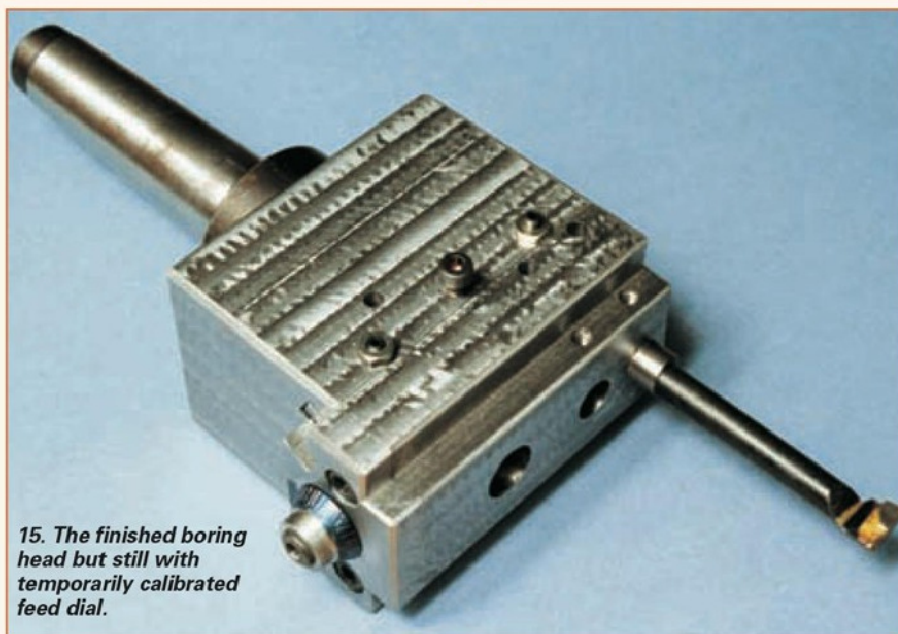
once more return to the milling machine as in Photo 13 and machine the edges of the cutter carrier as per drawing. This reduces the weight of the unit and improves visibility of the cutter and workpiece.

I was pleasantly surprised how accurately the sides of the cutter carrier and body lined up, but still decided to machine the side faces for appearance purposes. This is shown being done in Photo 14 whether you do this yourself the option is yours. If you do, parallels are required under the assembly. Finally, dismantle, debur sharp edges, making this a generous chamfer on the prominent edges when assembled. Clean all parts, especially sliding surfaces, reassemble with a touch of oil where appropriate and the boring head is finished, Photo 15.

In the next issue the project to be started is a dividing head, this immediately making use of the boring head just completed.

References

1. Dial Test Indicator Accessories. M.E.W. issue 14 page 34
2. Milling Machine Downfeed Modification. M.E.W. issue 11 page 67



15. The finished boring head but still with temporarily calibrated feed dial.

THE BH600-G THE LITTLE BIG LATHE FROM WARCO



The BH600-G installed and running.

Background

I was asked - would you like to do a report on your new lathe? Before I could really think about it I said yes. I had just returned from the National Model Engineering and Modelling Exhibition at Harrogate show when by chance our Editor in the course of conversation enquired as to what I was up to in the workshop, it so happened that I was in the process making space for a new lathe which I had ordered at the exhibition. My old Empire lathe (see M.E.V. issue number 37) was being dismantled to make room for the new machine.

Earlier, I had been contemplating the purchase of another lathe, not quite as big, and, as my annual pilgrimage to the Harrogate exhibition was due, I thought it would give me the opportunity to look around and see what was on offer. Shortly after my arrival I had been discussing various lathes with a colleague when the BH600 -G was mentioned. Up to that point in time I hadn't examined it but that was soon put right the following morning.

First Impressions

I paid a visit to the 'WARCO' stand (Warren Machine Tools), and I must say when I first saw the BH600 -G I was impressed, it was very compact and on the face of it seemed to be a lot of lathe for the money, and being only 51 inches long, finding space for it was certainly not going to be a problem, the BH 900-G is the long bed version for those who require extra length.

My attention was drawn to the fact that the lathe had a removable gap in the bed, to me, a very big plus. Another was that all the feed screw slides were calibrated both in imperial and metric. Even the hand wheel for the saddle feed and that for the tailstock were calibrated - a nice

little touch. Like most model engineers of my generation I am a 12 inches to the foot person but now and again metric does crop up occasionally, and so dual measurement in this instance gives you the benefit of both worlds. It also had a Norton gearbox complete with a RH screw cutting indicator, catering for both metric and imperial threads. Power to the spindle was by belt, giving a good range of 12 speeds, 50 to 1200 rpm, and incidentally it is worth noting that it had a larger speed range than the equivalent geared head version.

Personally speaking I like the belt drive, it is flexible and usually quieter in operation than a geared head lathe.

Needless to say if your workshop is within the confines of the house quiet machinery is highly desirable. For many years I operated a 6" Harrison geared head lathe, and when it was going full chat it sounded like a turbine. Another big plus was that it had a hardened bed and came complete with a 6 inch three jaw and an 8 inch four jaw chuck, other accessories were also included that are sometimes regarded as extras by other manufacturers.

The lathe's appearance gave the impression of rigidity and quality but that could only be finally put to the test in the workshop, you could put 1½ inches diameter stock down the mandrel and swing approx 16 inches in the gap, it had chrome in all the right places and all the working surfaces appeared to operate very smoothly, the temptation was too much for me - I must say I liked it very much - so much so that an order was placed.

Getting to grips

The lathe was delivered in a very large crate and pallet which in total weighed in at 400KG, (Photo 2) incidentally the carriage charge to Northern Ireland was very reasonable. It was found to be carefully packed inside with adequate precautions to protect it from damage and moisture. Unpacking it was easy - my problem was how to get it up on to its stand, it was almost 28" from the floor to the top of the swarf tray. The easiest and recommended way was to hire one of those compact garage type hydraulic lifting cranes, but as space was at a premium it was decided to do it the hard way. To make things more manageable the tailstock - tool slide - gear quadrant - covers etc., were all removed. The electric motor along with platform was also removed, disconnected wires being very carefully labelled for reconnecting later. This item is particularly heavy, and because it was fitted to the rear of the machine, my thinking was that its removal would improve the balance thus making things safer to handle. As it turned out this was indeed a very good move.

The lathe stand was the first item to be attended to, it consisted of two strong metal cabinets with a central steel spacer plate, the steel tray simply sits on top, when the lathe is in place every thing is through bolted. To stop the tray from moving while setting up, I was advised to spread a little silicon rubber on the tops of the cabinet so that the tray would stay in place while positioning the lathe on to it. This turned out to be good advice. The lathe headstock was supported on a four

wheel bogie while the tail stock end was supported on a car trolley jack, the whole unit was aligned up and positioned with its tail next to the assembled stand. I don't wish to go into all the jacking up details that followed but suffice it to say it was a very long and tedious operation not to mention a challenge involving twenty-two concrete blocks and quite a substantial amount of timber. See **Photos 3 & 4**. Care was taken to have additional supports in place so that if anything untoward happened the whole lot would not come tumbling down. Eventually the lathe was in place much to my relief, the bits and pieces were put back together again and the machine was wired up (**Heading photo**).

Great expectations

The great moment for the switch on arrived but unfortunately much to my disappointment it proved to be a non event! Nothing happened, after looking inside the main electric control box - I soon closed the door - all those wires! I went in search of something simpler. I began with the cut out safety micro switch for the headstock and gear box end cover, subsequent testing proved it to be ok. The next ones to be examined were the control switches that switched the motor on and off along with direction control, the plastic cover was removed, one was found to be suspect, at the time it was thought that some of the protective oil that was on the lathe had found its way into one of the switches, it was later discovered that the fault originated from the headstock lubricating system, there are two oil sight glasses for the taper bearings, removable so that the oil can be drained off and replenished. It was discovered that the "0" ring in the RH glass had been damaged, possibly during assembly. A new "0" ring was soon found. Apparently the leaking oil from the sight glass found its way into the micro switch, if you pardon the pun - a fault that can happen in the best of regulated circles! The switch was subsequently dismantled, carefully washed out, and refitted. I was quite confident that the fault was found. Switching on once more, still nothing happened. I went back to the main control box and went through the wiring to see if there was anything obvious. Nothing untoward was found, however I was able to start the motor up forward and reverse by pressing either one of the two relays. Progress? Further examination still did not reveal the source

of the fault. In the end a phone call was made to Warco, the subsequent conversation went like this - its got to be something simple! Is the chuck guard down? answer - NO - don't tell me it is micro switched as well - answer -YES - GULP! Think's - where is the nearest hole? Hang on a tick to I try again - did you hear it start up? answer YES - Nuff Said - thinks again - special fiendishly clever built in Chinese trick at no extra cost!

Strange to say there was no mention in the manual about the guard let alone the micro switch -honest! my other excuse your Honour was that the wire to the micro switch was hidden when viewed from the front. That's my story and I am sticking to it! The micro switches all operate a 24 volt safety and control system which is used for directional and start up procedure for the 2 HP electric motor, it is a simple and quite a clever idea.

Up and running

The first job after lubrication was to run the lathe at the various speeds. On the subject of lubrication the gear box gears do not run in an oil bath. A thick felt pad retains the oil which eventually finds its way down through tubes and on to the gears, use too much oil and it ends up in the swarf tray below. Grease can easily be applied directly to the gears from underneath with the help of a mirror and a light. I must say I was quite pleasantly surprised how quiet the machine was. When the tumbler reverse was engaged the corresponding gear train added only a light whine, and the back gear also proved to be very quiet, no doubt helped by having skew cut gear teeth. Provision is made for mesh adjustment if necessary in later life.

The spindle bull wheel has an odd number of teeth -75 so direct indexing in the "60" tradition is not possible, however all is not lost as there is just space enough to mount another suitably divided disc wheel in front of the bull. Personally I would avoid removing the spindle in order to fit it and see no reason why a split wheel could not be used. It would then be an easy matter to mount a spring loaded plunger to do the indexing. Bringing the tumbler reverse into play was very simple, it works on the same principle as my Myford, and changing over the belt speeds from the counter shaft to the chuck spindle is also quite easy, the latter being operated with a simple cam lock lever for belt

tensioning. The motor has a two speed pulley system which is not quite as easy to change. I found it more expedient to lift the swinging motor platform at the rear which made belt changing a lot easier. Incidentally I recommend that you don't put your lathe tight up against a wall, if you do you will lose out on valuable storage space to the rear within the stand, and make maintenance more awkward..

The on and off lever control switch for selecting motor forward and reverse was found to be very positive, the lever itself is situated to the RH side of the saddle. I must say I felt very much at home with this arrangement as its position was similar to that of the Harrison I once used except in the Harrison's case it was a clutch.

There is a separate drive shaft for the power cross feed - in other words it is independent of the screw cutting leadscrew. Selection for either is very positive through what seems to be a dog clutch arrangement, a small engagement lever is then used to select traverse or cross feed, the engagement of which again is easy and positive.

The saddle movement along the bed was found to be very easy, the gearing and feel for traversing it is just right; tool slide and cross slide movement were all found to be quite smooth, adjustment being effected by taper gibs in the normal manner. All these items were tested for side deflection with a dial gauge and were found to be fine. The cross slide base surface appeared to be hand scraped, possibly for the retention of oil on the working surface, and featured two tee slots. The topslide could be rotated 360 degrees, these latter facilities being very useful assets. Although there are only two tee slots there is no reason why the circular slot could not be utilised as well for clamping purposes when flycutting large castings etc. The top slide has one long and one short chrome finger handle, while this in itself is a good idea I think it would be better if they did not feature the screwdriver slots, which tend to catch on your fingers. Admittedly this is somewhat dependant on how you use your fingers and their position on the handle.

Dimensional checks

I paid particular attention to the removable gap bed, as maintaining alignment is the Achilles heel in any lathe having this particular feature. I was very pleased to



2. 400 Kilos in box on pallet.



3. The "Jacking up" process.



4. Starting to slide on to cabinet.

see that the removable gap was extended beyond the nose of the chuck by 27 inches. Many times I have come across the situation where one is limited to using only the faceplate for gap work, the chuck being useless because its jaws extended over and beyond the gap.

Alignment for the removable gap is dependent on two large taper pins, these are fitted with screwed ends so that they can be jacked out of their holes. Four cap head Allen screws retain the casting in place, all the mating surfaces appear to have been carefully hand scraped. The manual recommends that the taper pins are tapped home followed by the tightening of the 4 bolts, and needless to say, all the holes and mating surfaces have to be scrupulously clean. Before initial dismantling it was carefully noted that the mating surfaces were in absolute alignment, it appeared that the machining and grinding was carried out in situ. After removal the instructions for replacing were followed, alignment was almost perfect but not quite. One surface of the raised V appeared to be out of line, this was checked consistently without any rational explanation for the error, the underside of the removable section was checked for flatness on a precision surface plate, it was found to be A1, the surface that it bedded on was also tested for flatness, it was also A1. In view of this I decided to test the saddle for any deflection that might occur when traversing the joint, the dial gauge registered only 0.001in. My conclusion at this point was that after machining and grinding in situ, removal of the gap may have released some inbuilt stresses within the casting. After this I tried various assembly sequences, and it was eventually found that if the taper pins were inserted as instructed then followed by tightening up the two Allen bolts nearest the tailstock first - proper alignment was secured once again. The other two screws could be then locked up solid. It appeared that the two screws nearest the headstock were capable of twisting the casting to one side very minutely thus causing misalignment. Subsequent dial gauge tests showed that there was no longer any saddle deflection when traversing the joint.

As the dial gauge was on the go I tested the surface of the face plate; on rotation it sat at zero. A ground and polished large gudgeon pin was placed in the three jaw chuck, rotational error was less than 0.001in. Oh, if only all my chucks were like that! Incidentally the three jaw chuck will take 17in. diameter stock down its middle until you make contact with the number 5 taper of the mandrel, a precision ground mandrel adaptor is supplied so that you can use your number 3 MT centres etc., in

the headstock, a very neat number 3 to 2 MT adaptor is available as an extra accessory for use in the tailstock. It also has a very useful threaded collar for ejection purposes.

A piece of 1½in. dia. precision ground steel was mounted in the three jaw, a dial gauge was run along its 11" length - it registered only 0.001" run out.

The tailstock barrel was run out a few inches, a dial gauge was again run along its length - zero. I then thought I would catch it out - measure for any side deflection when the barrel locking handle was tightened up. I should have known better - Zero. I think that says something about the fit of the barrel in the hole!

The micrometer dials on the slides use the time honoured method of a spring loaded friction ball, and appeared to work well although one was a little stiff. Only the cross slide dial and hand wheel seemed to have a little run out. Removal of the assembly ascertained that the slight misalignment may have been caused by a bit of over generous filing of the feed screw spindle around the area of the deeply machined grubscrew flat in order to remove possible burrs that may have been present, it was found by re positioning the assembly on the spindle, run out became negligible. So a new shallower flat for seating the grubscrew was carefully filed with a needle file. Out of interest and curiosity I tested the calibration of all the imperial dials against a dial gauge for correct movement - they all passed.

Each lathe comes complete with its own factory inspection test record, quoting actual tolerances as against permissible, and this is shown as Fig 1. I think the information contained within will dispel any qualms about the lathes quality and accuracy etc. Naturally it will take time to evaluate its full capabilities but initial turning tests have proven to be excellent, turning a short billet of steel with a generous cut the saddle was wound back without backing the tool away from the surface, there was no re cutting of the surface metal from the tool on its return. On another occasion I machined a chuck register on a WARCO - 8in. cast iron back plate, this was for another large four jaw chuck which I had. With standard tooling, back gear and power cross feed, it produced a surface finish that could not be bettered; the quality of the cast iron was superb. I thought this augured well if all the lathe castings originated from the same foundry. As these notes were being penned I machined an inner steam dome casting for a 5" gauge pannier steam locomotive. As they say - it was wee buns!

Conclusions

To sum up so far I think the BH600 - G is an excellent machine and surely represents great value for money in this day and age. It would not be useful to compare it with my Myford as they are two entirely different machines, but you may well ask "could it be improved or added to?", my answer would be yes.

The micro switch box and spindle for the safety visor could, in my opinion, be better positioned, perhaps further back to the rear away from the chuck, this would mean a slightly different shaped visor. As presently positioned it is in the way for

turning large diameters or awkward castings, particularly if one wants to make full use of the removable gap. An alternative would be to cut the spindle an inch beyond the box and use another tube for re connection. The visor and part spindle could then be temporarily removed for those odd occasions as required.

Personally I would gladly pay extra to have a clutch fitted - mind you the switching control unit works well but I am always a little conscious of that little disc in the electric meter box galloping round those extra few revs every time you have to start up the motor; 2HP is a serious bit of grunt!

The lathe comes with a basic tool kit, spanner and Allen keys etc. Not included, which I would have liked, would have been the two C spanners that are necessary for spindle adjustment etc., although I suspect it will be some time before the spindle will need attention. Strange to say the lathe does not come with a driving plate for turning between centres however if a suitable driving peg was turned up I have no doubt the faceplate could be soon utilised for the purpose.

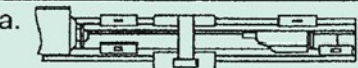
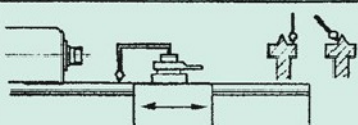
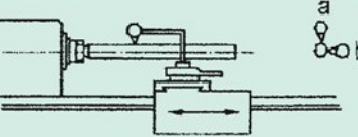
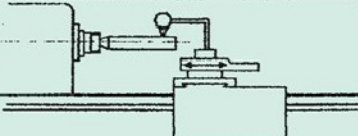
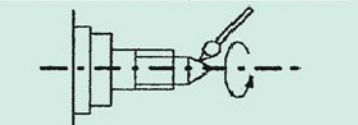
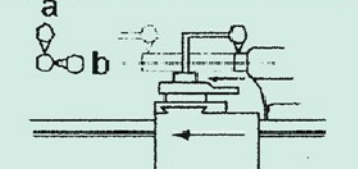
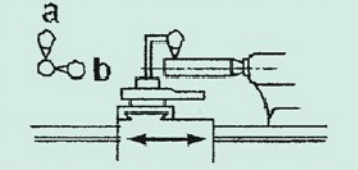
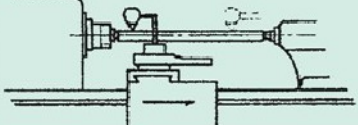
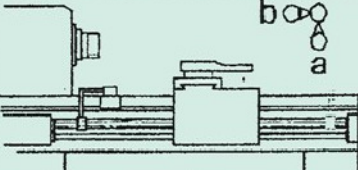
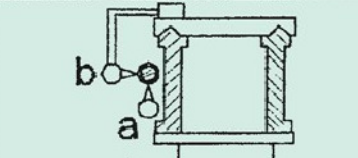
Buying a lathe is an investment for your hobby, which, if looked after, will last a lifetime. Beginners, quite naturally usually start off with a small project and a small lathe, however in a short space of time they soon realise that they should perhaps have gone for that slightly larger lathe, perhaps to advance from building 5in. gauge locomotives to 7½ in. or even a large traction engine. This "Little" lathe as referred to in my heading is only 51 inches long, a little longer than my Myford but it has the extra capacity for handling the larger stuff that may want to be built in the future. Capacity and being able to remove metal efficiently and accurately is really what it is all about. It is light years ahead of the old Drummond that I first owned almost 45 years ago. It originally came out of a coal basement and I operated it in a glass house during the winter with my hat and overcoat on - those were the days! But that's another story!

I must confess I am looking forward to making more use of the new lathe. I have no doubt after undertaking the various tests, it will do all I will ask of it. Evaluating the lathe was an interesting experience. I tried to be as objective as possible, but at the end of the day we all have our own ideas as to what makes up the perfect lathe. Perhaps there is no such thing as the perfect lathe, they all have their shortcomings and limitations in one way and another. However I trust that my observations and comments will be of help to anyone who is contemplating a purchase in the future.

Footnote

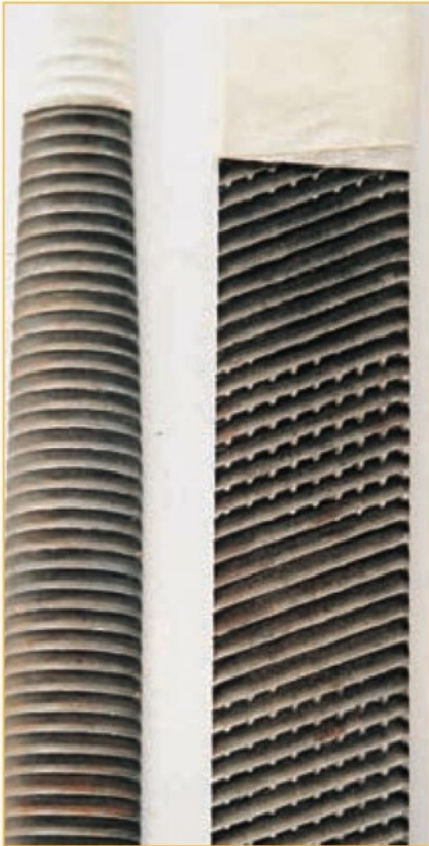
Since writing the above I have repositioned the visor micro switch which includes a slight alteration to the visor, and I am now operating the lathe with a pseudo clutch system so that the motor does not have to be switched on and off in order to take measurements etc. This modified drive will be covered in a future article. In closing I might add that I have no connection with Warren Machine Tools although over the years I have come to know Roger Warren through various purchases made at different exhibitions.

FIGURE 1

NO.	INSPECTION ITEM		DIAGRAM	TOLERANCE(mm)	
				PERMISSIBLE	ACTUAL
1	Straightness of bedways	a. Longitudinal direction (In vertical plane)	a. 	0.04	0.04
		b. Transverse direction (In vertical plane)	b. 	0.06/1000	0.06
2	Parallelism of bedways			0.03	0.02
3	Spindle taper hole runout	a. At or near spindle nose		0.015	0.01
		b. 300 from spindle nose		0.03	0.017
4	Parallelism of center line of main spindle to longitudinal motion of carriage	a. In vertical plane		0.025 IN 300	0.02
		b. In horizontal plane		0.025 IN 300	0.022
5	Movement of compound slide parallel with main spindle in vertical plane (Hand feed)			0.03 IN 75	0.03
6	True running of center point of main spindle			0.015	0.01
7	Parallelism of tailstock quill with bedways	a. In vertical plane (feed end rising)		0.02 IN 100	0.01
		b. In horizontal plane (directed towards headstock)		0.02 IN 100	0.01
8	Parallelism of bedways with center line of tailstock spindle hole	a. In vertical plane (feed end rising)		0.03 IN 100	0.02
		b. In horizontal plane (directed towards headstock)		0.03 IN 100	0.019
9	Difference in center height between headstock and tailstock (Mandrel rising towards tailstock end)			0.05	0.03
10	Parallelism of center line of bed screw end bearing to carriage bedways	a. In vertical plane		0.15	0.13
		b. In horizontal plane		0.15	0.11
11	Deviations in alignment of center line of leadscrew end bearing with center line of half nut	a. In vertical plane		0.2	0.09
		b. In horizontal plane		0.2	0.13

SIMPLE TOOLS – S or hand tools for

Bob Loader concludes his examination of basic techniques by considering the humble file.



19. Two millenicut files, note the chip breakers in the flat one.

Files are other simple tools which are indispensable. There are so many shapes and sizes, that I shall concentrate on the ones I consider to be the most useful, beginning with my favourite for heavy work.

Millenicuts

These are special and the two shown in **photo.19.** are a sample of several shapes. They are intended for moving a lot of metal quickly, the flat one works a treat on the softer metals like aluminium alloy. It will also deal with mild steel, but less well on the skiddy metals, hard brass and cast iron, where the teeth have a job to grip the metal. Notice that there are chip breakers every few teeth, if it were not so the large teeth would be making too much contact and the file would be extremely hard to push. Note also, the masking tape where the fingers or the heel of the hand will press. Leave this area unprotected and you find that the last few teeth will go a lovely red colour where your fingers begin to leak. These files are very good for wood and some synthetics but will skid on tufnol.

Favourite shapes and sizes

Because of the nature of model engineering it is rarely necessary to use files larger than 8 or 10 in. though they will have their uses, for example **photo.20** shows a 10in. square one used to rough out

a vee in a cast. iron block. I have, when I used to earn a living doing such work, used files up to 14in. My favourites these days are mostly 6in. and 4in. ones in the shapes of hand, flat, pillar, square, round, half-round and three-square, in smooth and second cut. **Photo. 21** shows a selection, from left to right, half-round, flat, hand, three-square, square and round. Two which are not shown are, pillar, which is like a hand but narrower, and warding, like the flat but thinner, each of these are good for getting into restricted places. **Photo. 22** shows the proportions of a pillar file, here being used to file flats on the sides of a stylus held in a sprung screw holder. **Photo. 23** shows three of the cuts files can have, from left to right, second cut, smooth and dead smooth. They are all 6in. hand files. Notice how badly pinned the dead smooth one is, more about pinning later. The cuts are, dead smooth, smooth, second cut and bastard, there is a rough one but I have never come across it. Obviously, the size of the file will determine the number of teeth per inch, for example, a 4in. smooth file will have 60 teeth per in. The same length in a bastard cut will have 40, this applies to most shapes.

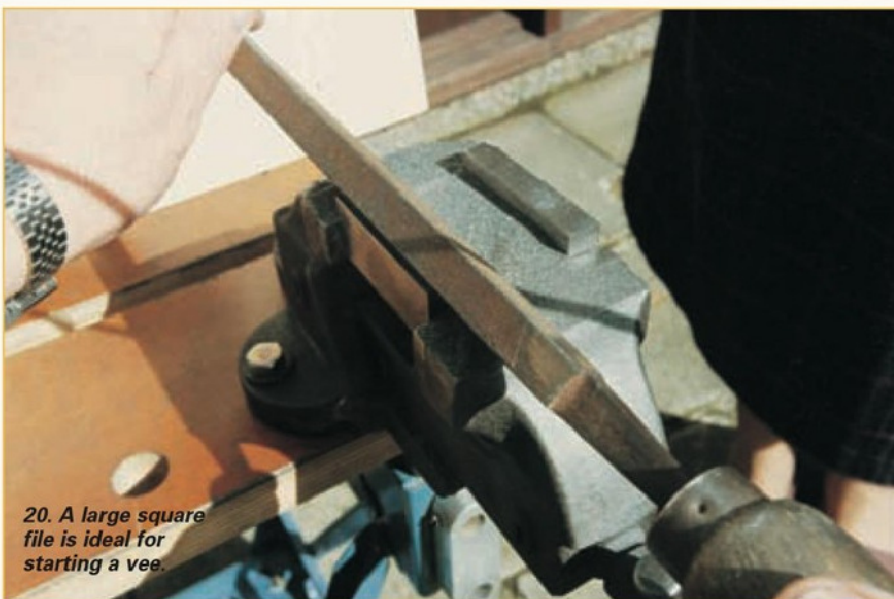
Different jobs need different shapes, round, square and three-square need no explanation. The job shown in **photo.24** is an ideal shape for the half-round, which is the right one. Other shapes could be used but would not be so effective.

Using the files

The ones I could not do without are the hand and pillar shapes which will get into corners and cut them out precisely because they have a safe edge with no teeth on one edge. **Photos 25 and 26** show the safe edge tucked into the corner of the work to square it out. Note in 25 the correct grip for light filing. For heavier work like that in **photo 27** the front hand applies more pressure. The master hand always shows the thumb on the top.

Good though they are, beware of hand or pillar files which have safe edges which are not safe, see **photo 28**. The file on the right has had its teeth cut after the safe edge had been made, this raises a burr on each side. A finger gently run down the edge will detect it. I got caught once where a nicely squared edge was scored just on the last few strokes. Since then I always check, the remedy is easy, a few minutes with a stone or a diamond hone will smooth it off, so that it looks like the one on the left.

There are some special ways of using files:



20. A large square file is ideal for starting a vee.

SIMPLE METHODS for beginners (2)



21. A selection of commonly used files.



22. The pillar file used edge-on to file a small flat.

Draw filing

Photo 29 is an example of draw filing, the grip is different with the file held at 90deg. to the normal. Its main use is to smooth a finished surface with all the filing marks the same way. The file can be tilted to clean up where it may not be quite flat: this is being done in the photo. It is a good way of cleaning up the external radius on the end of the work in the photo.

Other special methods

Remember that most files have a 'belly', thicker in the middle than the ends. This can be used, (**photo30**), where if there is a

slight hump or other imperfection on a surface. It can be flattened by using very short strokes and pressing down on the bit which needs flattening. Sight along the file first to convince yourself that the belly exists, and also to check that you have not got a file which is bent, they do sometimes get through the inspection. If you have a bent one, it will file hollow even better.

Getting things square

One way of getting a face or edge square with a finished one is shown in **Photo 31**. The work is held firmly against the vee block and rubbed gently on a blued

surface plate. The blue will mark where the work is high, then the high areas can be filed off. This is a blast from the past when, as a first year apprentice I had the introductory task of filing a one inch cube. We had a selection of materials and the one I had chosen for me was a fairly soft aluminium alloy. Among the many learning processes I came to understand how files can pin and how the pins can ruin a surface which was almost finished. Pins are bits of metal which get wedged in the file teeth. They can be removed by using a file cleaning brush which is a piece of carding cloth used in the woollen industry for teasing out fibres. When it

23. Three files of different cuts.

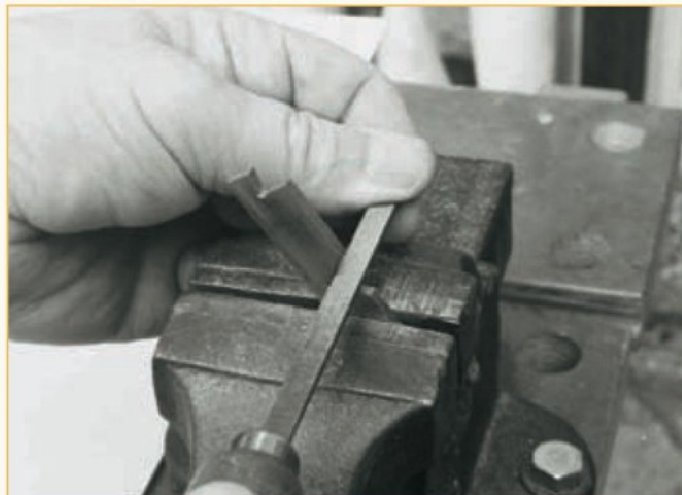


24. Filing a curve with a half-round file. (Photo by Pauline Loader)





25. Using the safe edge of a file. (Photo by Pauline Loader)



26. The safe edge used to file one side of a vee. (Photo by Pauline Loader)



27. The correct grip for heavy filing. (Photo by Pauline Loader)



28. Safe edges, one is and one isn't. See text.

gets too worn to do the teasing, they hand it over to engineers to clean their files. Stuck to a wooden backing it does the cleaning very well until a pin gets wedged. Pins can be dislodged by rubbing along the teeth with a piece of scrap, brass is the recommended metal but I've found that steel is just as good. Fine files pin more readily than coarse ones.

Breaking up a surface

There is often an amount to be removed which is too small to saw and hard to file. **Photos 32 and 33** show a way of making the removal easier, the surface is broken up by filing grooves with a large file just down to the marked line, photo 32. If the first lot of grooves are crossed by another set, **photo 33**, the filing is quicker and easier.

Slots

Smaller files can be used to open up or finish slots, like the one in **photo 34**, which is being opened up to fit a 1/8in. link. The roughing out can often be done by putting two or even three hacksaw blades in the same frame. The file in the photo is a 4in. smooth hand: narrower slots can be filed using a warding file which is thinner. It is

29. Draw filing. See text.



30. Precision filing to remove irregularities.

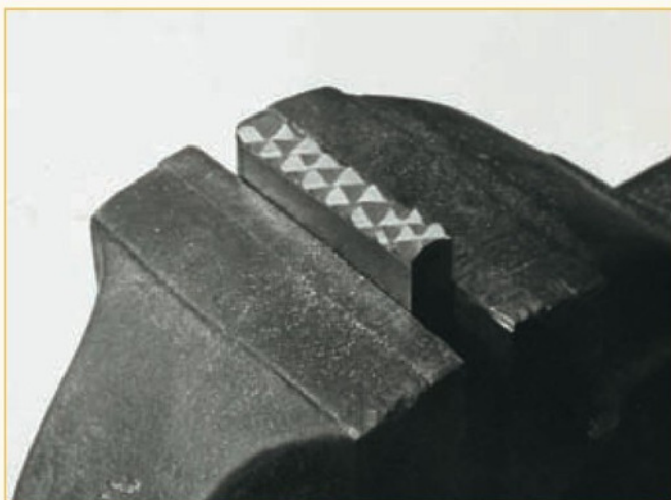




31. A way of checking a filed surface for accuracy.



32. Roughing up a surface to make filing easier.



33. The surface in photo. 32 ready for filing to size.



34. Filing out a slot.

called a warding file because one of its uses is to cut the wards in keys. In the photo the hand file is used mostly because with the safe edge to the bottom of the slot, the sides can be worked on.

Warding files in the smaller sizes can be fragile, so need a bit more care when using them.

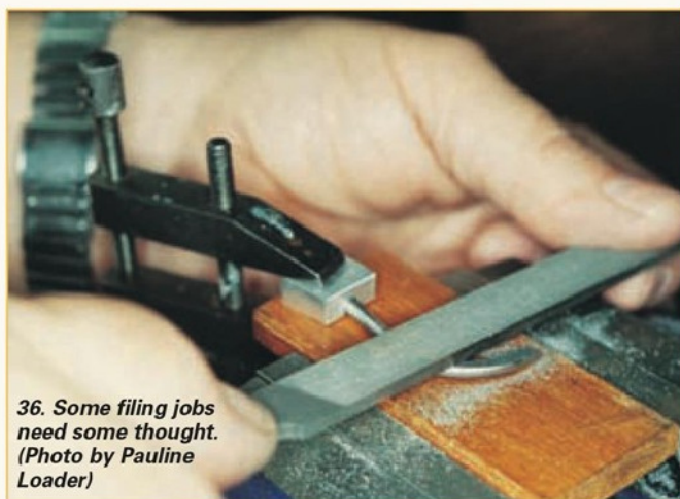
Using a fence

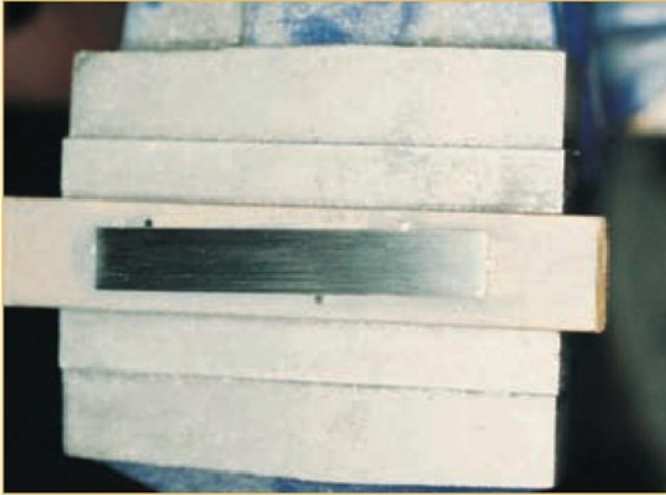
When an edge or face has to be truly flat and square, a fence is useful. It can

be any piece of metal, usually mild steel, which is already flat. Held in a vice or clamped to a strip it will keep a file straight and steady while filing to an edge, like the one in **photo 35**. When the file just rubs along the face of the fence, the job is done. Do not use a tool bit, the top of the vice jaws, or anything hardened, it will not do the file teeth any good. A similar method can be used for filing radii and other curves by using a washer or other disc of the right profile.

Holding awkward shapes

Sometimes it is difficult to work out how to hold some shapes. One such job is shown in **photo 36**. The calliper leg had to be flattened off at the tip. It took a bit of thought, the filing was no problem, the holding another thing. The solution worked well. Another variety of work which is hard to hold is very thin pieces.





37. Filing the surface of a thin component.



38. Old files never die, they get turned into other useful cutters.



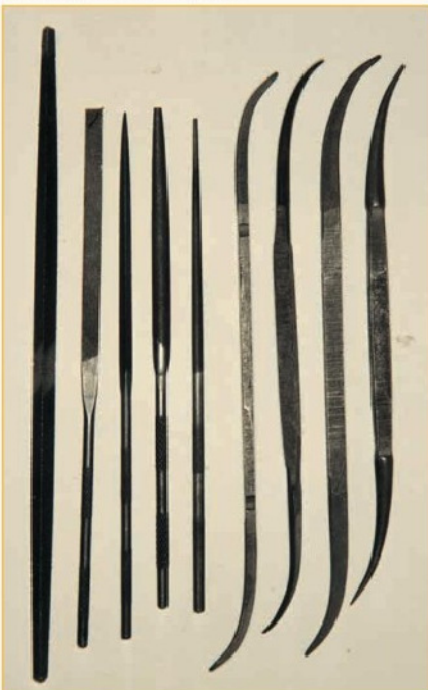
39. A small scraper made from an old file. (Photo by Pauline Loader)



40. A square Swiss file used to finish the square in a small tap wrench. (Photo by Pauline Loader)

One way to get over this is to fasten the thin material to a block of wood which can

41. A selection of Swiss files on the left, and rifflers on the right.

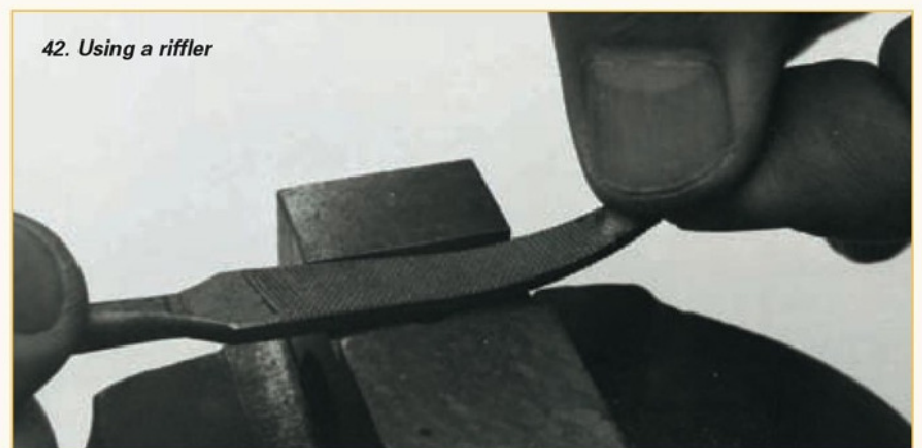


then be held in a vice. **Photo 37.** shows this being done, the piece is the blade of a 3in. square, it is held in position by panel pins driven into the wood against the edges.

Things to remember

1. Keep files clean by using a file brush.
2. Always use a handle and try to use one which suits the size of the file.
3. Use the newest files on the skiddy metals like hard brass and cast iron, the sharp teeth will grip better. Tufnol is also skiddy.

4. When the files have been used a bit they will be all right for steels and wrought metals.
5. When files are worn out, which takes a lot of doing, they can be re-cycled. They make excellent scrapers and chisels, see **photo 38**, the half-round scraper was made by softening a file, filing the relief in the middle and re-hardening and tempering. The three-square one was an easy one to make from a double-ended saw file, a special one which is used by saw doctors to correct the teeth of wood



42. Using a riffler

saws. All that was done was to grind off some of the teeth and stone it to a fine finish, it makes a brilliant deburring tool. The other somewhat rusty object is a wood chisel, very good for the bit of woodwork I sometimes have to do.

My best scraper for flat scraping small work, **photo 39** was an old file. It just needed forging out a little on the end, re-hardening and stoning to dead sharp edges. The teeth will have to be ground off the edges too, so that it is comfortable to hold.

Apart from re-cycling into scrapers and other almost ready made cutting tools, old files are a valuable source of carbon tool steel, quite as good as silver steel and gauge plate. Most will have to be softened first by heating to bright red, keeping the heat on till the metal begins to blister and leaving it to cool as slowly as possible. It needs a substantial heating source so, if you haven't got one, beg or borrow one, or get to know a blacksmith.

I haven't mentioned Swiss files, they are good for some things, like opening up the square hole in the small tap wrench in **photo 40** but there is not a lot which cannot be done with larger ones and they are rather fragile. Many of them are the same shapes as the larger ones but there are a lot of special shapes. They are called Swiss files because a lot of them are shapes and cuts which were made for the Swiss watch and clock industry.

Rifflers are another sort of special file. They are double-ended and bent into a curve, very useful for spot filing, filing

round corners and other awkward jobs which standard files won't manage. **Photo 41** shows a selection of Swiss files on the left and rifflers on the right. The

odd one out is a double-ended saw file, mentioned elsewhere. **Photo 42** shows a riffler in use.



Safety considerations when filing

Always use a handle and make it fit nicely, not like the one in photo 20 more like the one in photo 25. It is expensive to have a handle for every file and one handle will usually fit several different shapes of similar size.

Handles should be fitted by burning them in, a simple but worth-while operation. New handles are rarely drilled deep enough, so the first thing to do is to step drill them. For the first drill, choose one as big as the end of the tang and take it almost to the depth of the tang, then follow with successively larger ones at about half in. intervals if it is a large file, (10in. or bigger), less if it is smaller, finishing with a drill almost the width of the tang at the heel of the file.

Next, heat the end of the tang till the first quarter of the length is red hot and press the handle on, tapping it down gently till it stops just short of the end of the tang. If you are happy with the fit, leave it, if not, repeat the process. When it fits correctly, leave it alone to cool.

Do not try to bend a file, you will soon find out how brittle it is. I have known a 10in. one break into two pieces, just by being dropped on a concrete floor.

Do not use a file tang as a drill drift.

Cutting speed should be as for hacksawing and files cut on the forward stroke. Use a file like a scrubbing brush and you will soon wear it out.

Look out for imitations

Beware of market stalls when buying tools. I cannot speak for chisels and files, but I have been caught on saw blades. They will use all sorts of tricks, like colouring hacksaw blades blue to make them look like high speed steel ones. So when you buy blades, look for a recognisable name such as, Eclipse or Spear and Jackson and other trusted names.

Avoid coping saw blades which have no colour and look like mild steel, because that is probably what they are made from.

One last thought, there is such a thing as a blunt file. It is a technical term which means that the cross-section is the same all through the length. I only have one blunt file, my millenicut. When I think of how it cuts my finger ends if not shielded, I wonder if they have got the name right!

A filing rest in a hurry from scrap

Your Editor makes more swarf in the workshop.

The thought process started with John Brittain's dividing article in issue 86, and was prompted further by Bob Loader's above. Filing rests have of course been around since the year dot, and many designs have been suggested. Published plans by E. T. Westbury and L. H. Sparey were examined, together with the contents of the scrap box. Now it has to be noted that in thirty odd years of workshop fiddling, I have managed to get by without a Filing Rest, principally because I have always enjoyed the luxury



of a mill, with some form of dividing equipment, and when you are working with sizeable components, it's easier to use power for removing metal. However if you simply want to put a hex head or a couple of flats on a small bolt, then it can be a lot quicker and convenient to reach for the file.

A couple of rough sketches were made on the back of discarded envelopes, and components made as follows: Cradle base - 20 x 8 mm bright flat, drilled 10mm for column, drilled and tapped for attaching sides; Cradle sides - 3mm steel, one drilled through, one tapped for pins; Rollers - silver steel turned half inch dia. with 9/16 inch flanges; Pins 3/16 inch dia silver steel one end threaded 2BA; Column 12mm dia EN1A, 80mm long, top turned 10mm dia. to locate cradle, split, drilled, tapped M5 for expansion grub screw, and threaded M12 x 1 for height adjustment; Clamping screw - brass, a left over from a batch made 10 years ago; Support block - 30 x 20mm bright mild steel, bored 12mm for column, drilled and tapped for attachment; Support angle 50 x 40 x 6 cut about 3 inches long from redundant drill jig; Bottom Clamp - 20 x 10 flat mild steel cut

to length to fit under bedways, profiled to allow quick release, drilled and tapped M6. The pins and rollers were hardened.

The M12 x 1 thread gives about 40 thou per rev. for height setting, at present using the hex nut, a properly graduated substitute may follow. The photos show the dismantled parts, and the assembled rest on the lathe. This may give adequate information for other filing devotees to design around their personal scrapboxes.

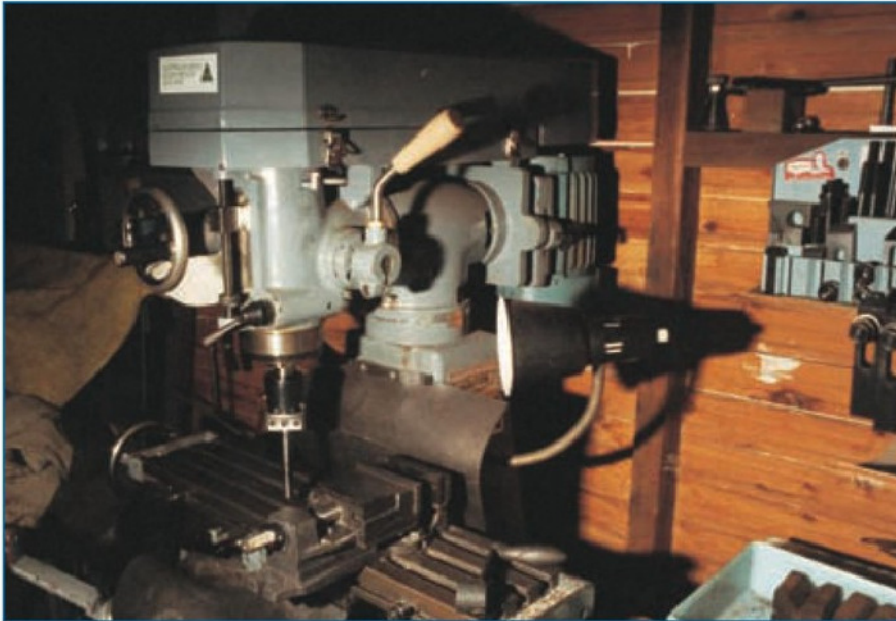
References

Lathe Accessories: E. T. Westbury
A Man and His Lathe: L. H. Sparey



A MILLING MACHINE

Adrian Kruger of Queensland, Australia describes his solution to "Machine Stretching"



1. The Mill in standard form.

Here, in Australia, there are several brands of machine tools which are available to the model engineer, which are direct copies of the "Tried and trusted" long standing brand names which are manufactured in the Asian countries with a reasonable cost price to go with them, and a good range of accessories.

About three years ago, I purchased a milling machine to complement my 5 $\frac{1}{2}$ inch Hercus model A centre lathe. The mill bears a strong resemblance to the Myford "VMC" and is called an "Acraturn VM-C". When trying to bore a deep hole on one of

the projects, I hit a bit of a problem due to the height limitation. It can be seen from **Photo 1**, that with the boring head and tool in position, relatively little headroom remains for the workpiece. An extension piece would be required. The completed item is sketched in **Fig 1**, however as will be seen, the finished dimensions differ a little from those originally envisaged.

Material and Facilities

A piece of 150mm round steel was obtained, more than long enough to suffice. As it was felt that the Hercus was a

touch on the small side to handle this, arrangements were made to deal with the job on a somewhat larger lathe.

Method

It was decided to turn between centres rather than rely on unknown chuck accuracy, and thus the work commenced with marking out the centres by means of the traditional method using a centre square. The positions were then drilled out with a large centre drill in a bench drill to accommodate the centres for the turning operation. Next a $\frac{1}{2}$ inch bolt hole was tapped in both ends to take a drive dog arrangement to facilitate turning the recess at the top of the extension and the locating shoulder at the bottom. One of these tapped holes is visible in **Photo 2**.

Turning

Firstly the recess (**Photo 3**) was turned to take the upper part; this needs to be a good fit as any free play means reduced rigidity because of the extended height.

Next the job was rotated and the other end turned with a shoulder to the same dimension to fit the base of the machine. Needless to say good fits all round are required, and the outside diameter was finished at the same setting.

As this was the first time I had tried anything like this, there was a bit of trial and error, which is why the work-in-progress photos 2 and 3, show a piece of steel longer than the finished article. The finished result turned out to raise the height by 65mm. This, in use has turned out about right, as can be seen in **photo 4** which shows an adjustable angle plate having $\frac{1}{2}$ inch slots cut in it.

After it was discovered that the final height would be much smaller, the job was trimmed and the locating shoulder was turned again at the required end and to the same measurements.

Milling

The extension was then marked out for 3 equi-spaced slots 27 mm deep & 51 mm wide, to be cut with a 28 mm diameter end mill. These provide spanner access for the clamping nuts for upper and lower faces. Three holes are drilled 11mm dia. lower section to accommodate the bolts clamping to the machine base, and tapped M10 upper section to take the studs which hold the top of the machine, above the extension, in place, at final assembly. On my machine, as manufactured, these were M10 but if I was doing it again I would increase the size to M12.

Next it was placed under a milling machine and the slots cut, when this was finished the holes were deburred and other finishing "nicety's" were carried out. After a clean down with degreaser to remove the cutting fluid residue it was

2. Work at an early stage on a Colchester Triumph 2000 lathe.



MINE EXTENSION



3. The location recess taking shape.

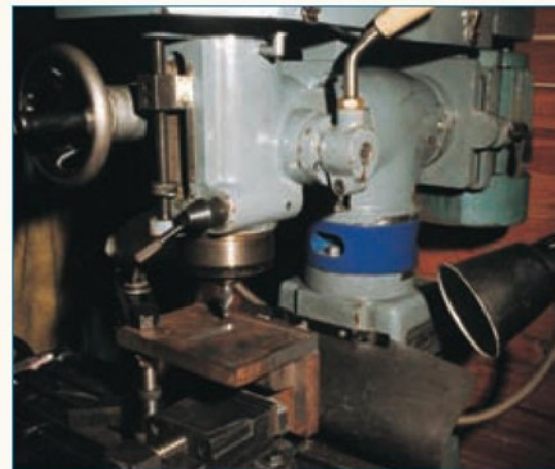
primed, undercoated and finished in a shade of blue, the details of which I can't remember, but it finished the can off and contrasts well with "Machinery grey".

Conclusion

The time it took to make this little item, I

feel was well worth it. Mine was made to "what ever looked right" there is no reason why it could not be made bigger although the higher you go the less rigidity of your machine.

I still have the left over off cut so if anyone is interested or would like to have a chat I can be reached in Australia on

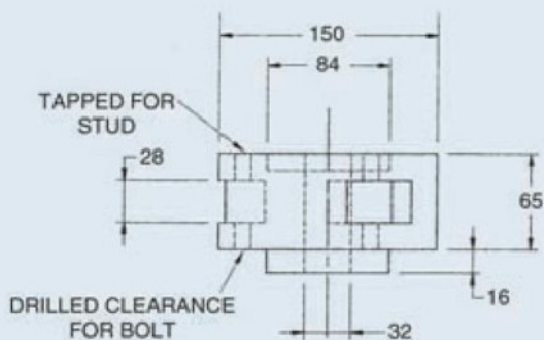


4. The mill with extension fitted now has sufficient daylight to accommodate a taller workpiece.

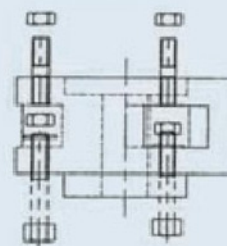
0746352707 (after hours answering machine available), email is arkruger@optusnet.com.au just leave a message. The total construction time took approximately 8 hours from the time I turned off the miller, pulled down, part manufactured, reassembled, and turned back on to finish machining the adjustable angle plate as shown.



©

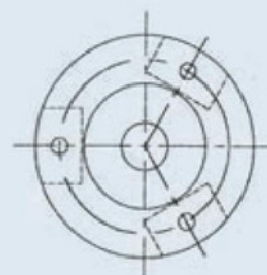
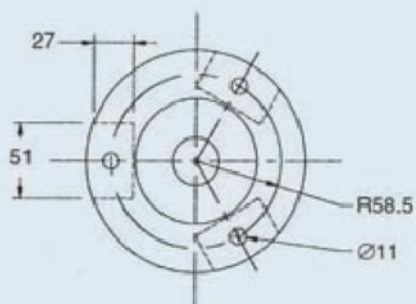


UPPER PART OF MACHINE LOCATES HERE



STUDS & BOLTS OF SUITABLE SIZE (SEE TEXT)

LOCATE IN BASE OF MACHINE



A GANTRY CRANE



1. Gantry (portal) crane.

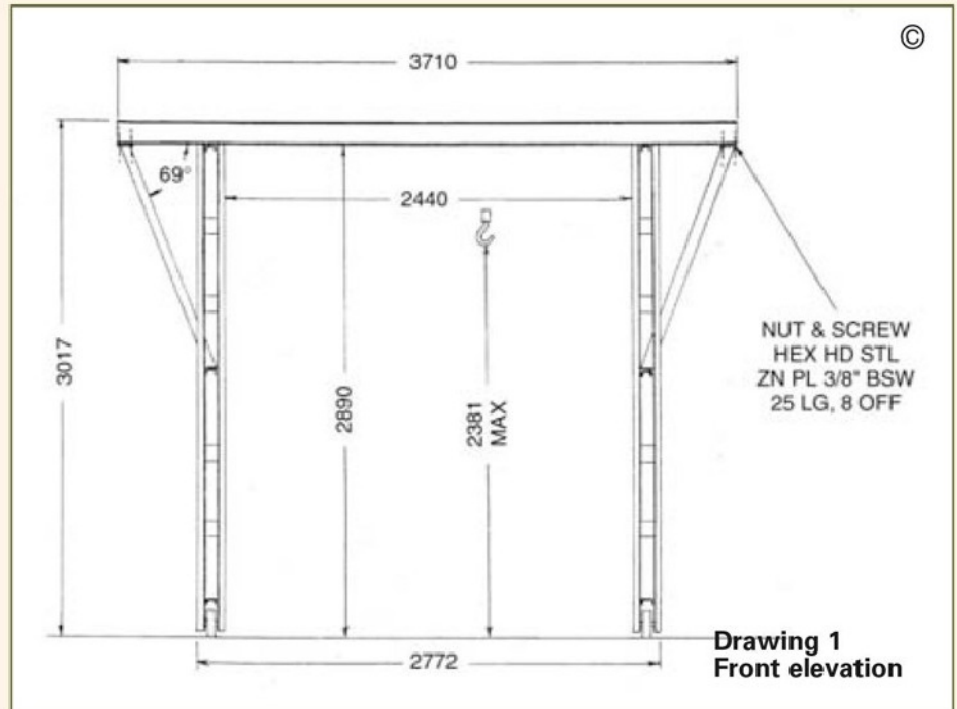
Depending on one's specific interests, workshop projects vary immensely in physical size and weight. An '0' gauge locomotive can be probably be moved on and off the bench with one hand; while a 7 1/4 inch gauge engine may be impossible for one person to lift.

About 15 years ago I encountered a

2. Crane lifting slasher implement.



Philip Amos offers a "moving and handling" solution for those involved in heavyweight projects

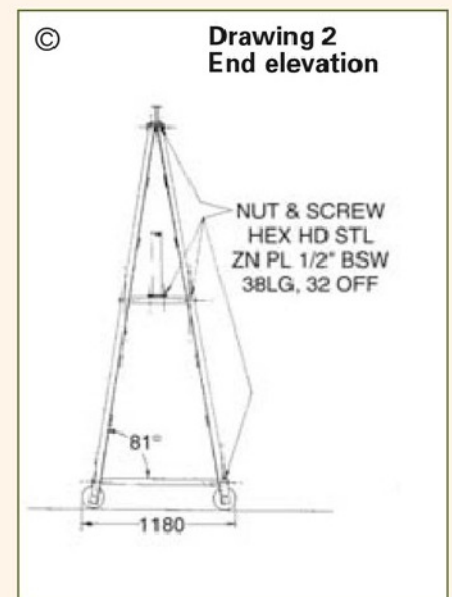


similar problem on my small farm. I had acquired a 25 HP 2 cylinder diesel tractor, with an assortment of implements which attach to its 3 point linkage. After wrestling with these getting them on and off the tractor for some time it became clear that I needed some sort of crane to assist in the process. Initially I contemplated the use of a chain block hoist hung from the roof of the machinery shed. But after doing a few sums I decided that this would probably result in the roof coming down rather than the implement going up.

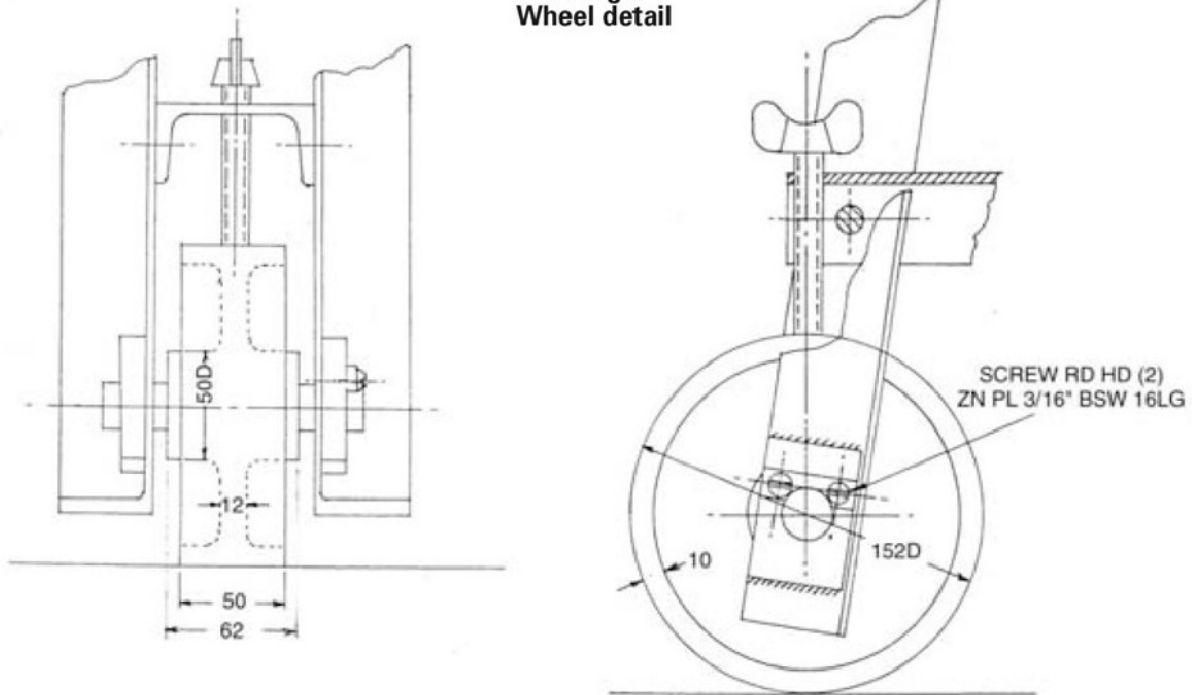
A post and beam type crane fixed in position seemed to be unduly restrictive in application; so after some cogitation I decided on a portal or gantry type on wheels.

Design

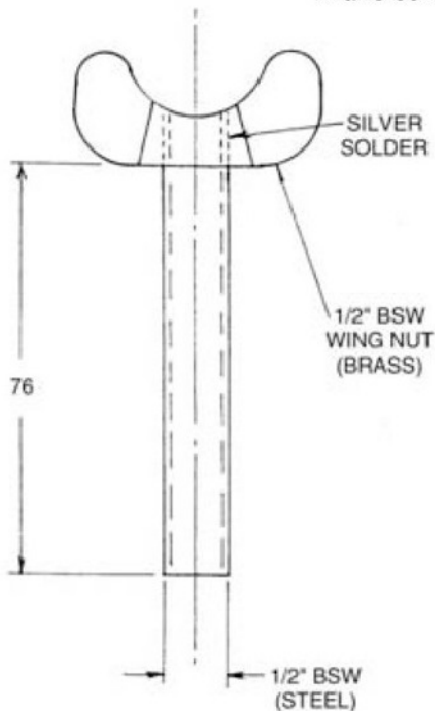
Essentially the crane consists of two 'A' frames whose uprights are steel angles, held in place by horizontal steel channels at the bottom, middle and top. Joining these and projecting beyond each side is a steel beam,



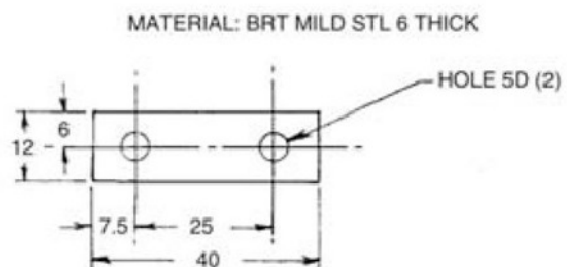
Drawing 3
Wheel detail



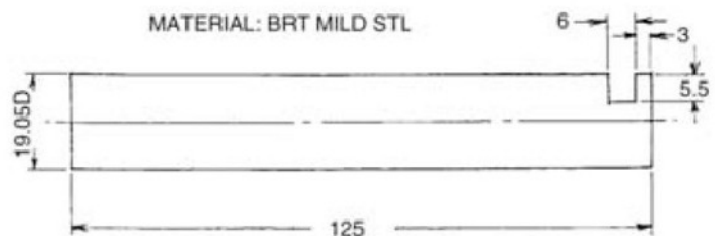
Drawing 4
Brake screw



Drawing 5
Key



Drawing 6
Axle



which has steel pipe bracing from its ends down to the middle channels. A chain block hoist hangs from a carriage which runs on the lower flange of the beam. Hoist and carriage are normal commercially available items. There are cast iron wheels at the bottoms of the 'A' frames. These wheels are also finished commercial products. The

wheels are fixed in direction. There are plates welded on the angles to stiffen the legs in the transverse direction. **See photo 1.**

Fabrication

The design is such that the components could be made in my workshop (and

driveway) at home, and then carried on/in a 6 x 4 foot box trailer for 100 miles to the farm towed behind the car. It was then assembled there with nuts and bolts. Finally it was given a coat of primer and two coats of oil based enamel paint. S.W.L. 1 TON (Safe Working Load) was stencilled on the beam.



3. Chain block hoist and rolling carriage.

Use

Because the concrete floor of my machinery shed is dead level in both directions I now have a facility which allows near complete coverage of one bay of the shed - nominally 20 x 10 feet, but actual coverage about 16½ x 8 feet - laterally by the movement of the chain block hoist carriage and in depth by movement of the crane itself on its wheels. See photo 2.

This crane has allowed me to operate all my equipment on the tractor single handed as well as loading fertiliser into the spreader from 50 kg bags without straining my aged back.

The clearance under the hook with my particular block and carriage is 7 ft 9½ in.

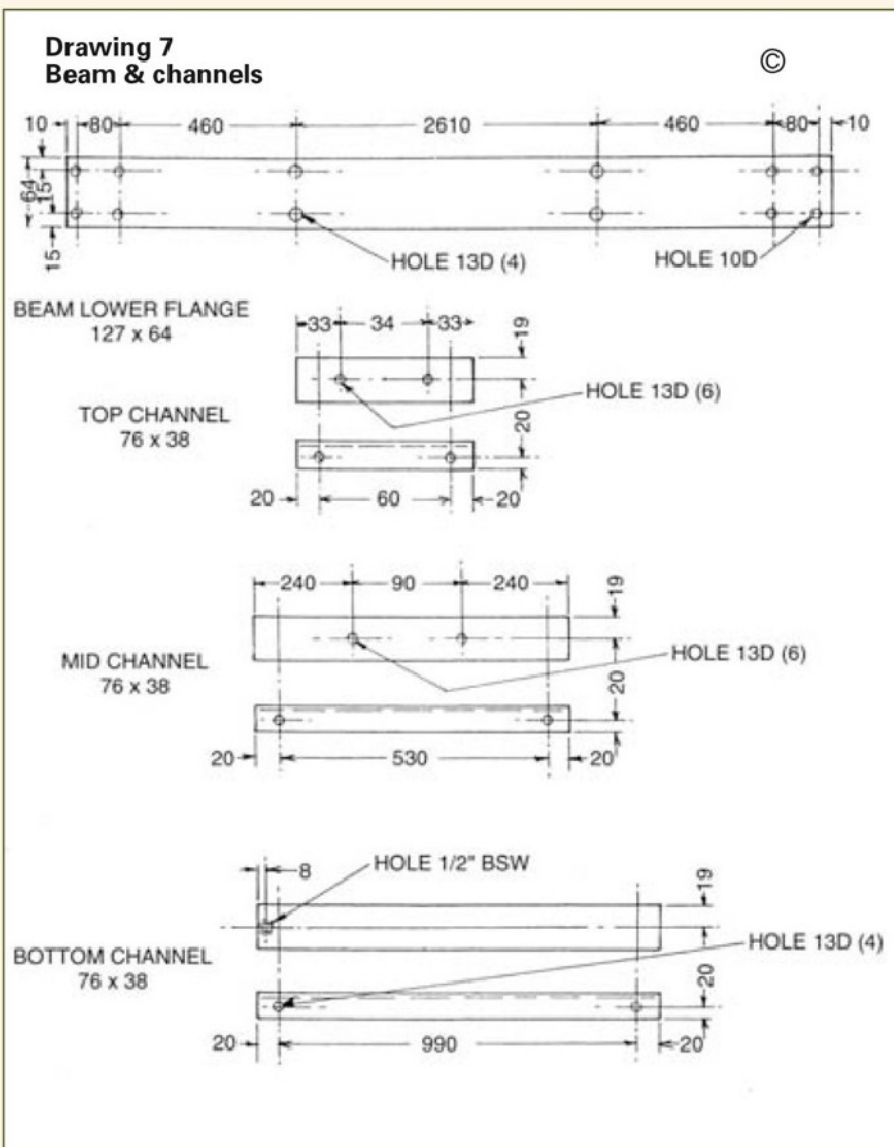
Detail

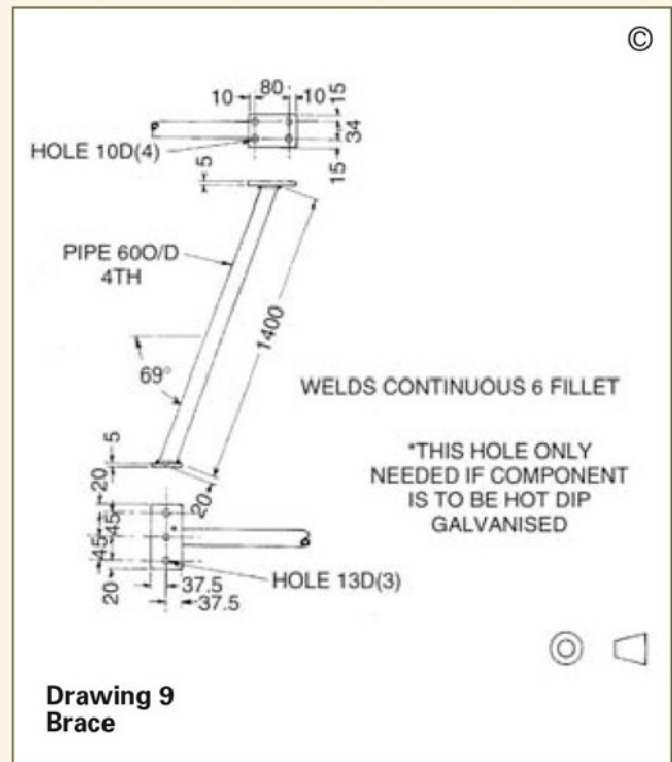
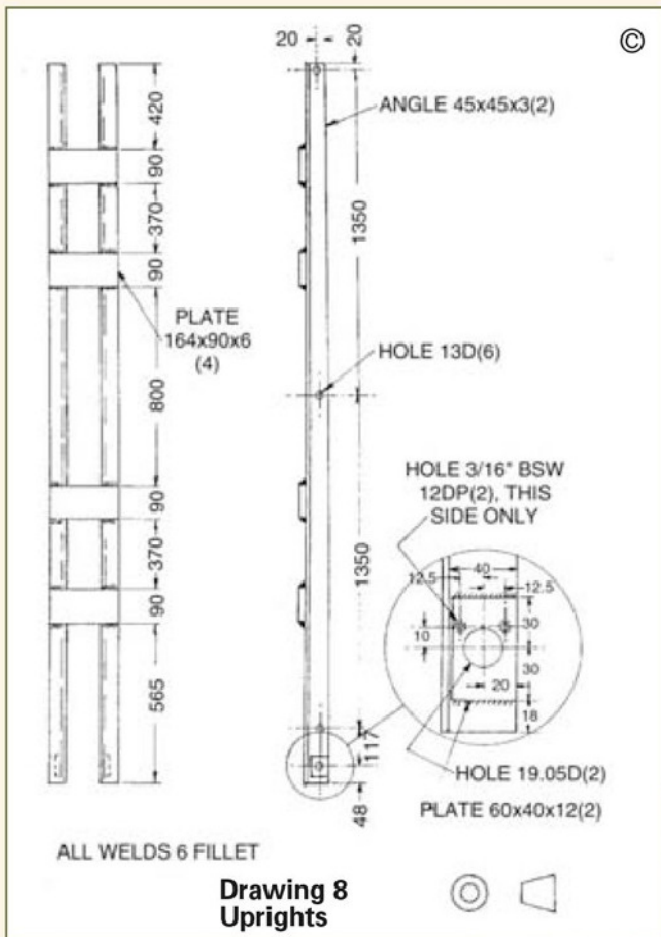
Dimensions of parts and assemblies are given in the drawings 1 to 9, and details are shown also in photos 3, 4, 5 and 6. It might be noted that the commercial cast iron wheels came fitted with grease nipples. They run on fixed axles which are held in place and prevented from turning by a key at one end which is held on to the crane leg by two screws. In addition one wheel in each "A" frame has a "brake" fitted. This comprises a wing screw - made from a wing nut silver soldered to a length of studding. This passes through a tapped hole in the bottom channel and can bear on the tread of the wheel to stop the gantry rolling while the chain block hoist is being operated.

Sequence

In order to facilitate ease of assembly of this crane it is important to make parts in a particular order, and this is described below.

1. Top channels. Use as templates for corresponding holes in beam.
2. Lower plates on braces. Use as templates for holes in mid channels.
3. Upper plates on braces. Use as templates for remaining holes in beam.
4. Bottom channels.
5. Keys. Drill tapping size for ⅜ inch BSW and use as templates on 60 x 40 mm plates for uprights. Then tap these plates and drill out keys to 5 mm diameter.
6. Drill 60 x 40 mm plate axle holes to 12.7 mm diameter to use with ½ inch BSW nut and bolt to position plate on upright for welding.
7. Drill upright angles including axle holes 13 mm diameter.
8. Position 60 x 40 mm plates and weld to angles.
9. Enlarge axle holes to 19.05 mm diameter.
10. Make axles; check fit with uprights and keys.
11. Assemble angles and channels with ⅜ inch BSW nuts and bolts. Fit axles and keys.
12. Weld 164 x 90 plates to angles.
13. Attach beam to uprights with ⅜ inch BSW nuts and bolts.
14. Attach upper and lower brace plates to beam and mid channels respectively with ⅜ and ⅜ inch BSW nuts and bolts.





15. Weld pipe braces to upper and lower plates.
16. The crane can now be dismantled and painted.
17. Final reassembly including fitting the wheels on the axles.

Conclusion and Caution

It occurred to me that this contraption might be of interest to people who build large weighty models to help handling in their workshops, or perhaps for clubs to help loading/unloading at site. In the latter case it could have flanged wheels and run on rails.



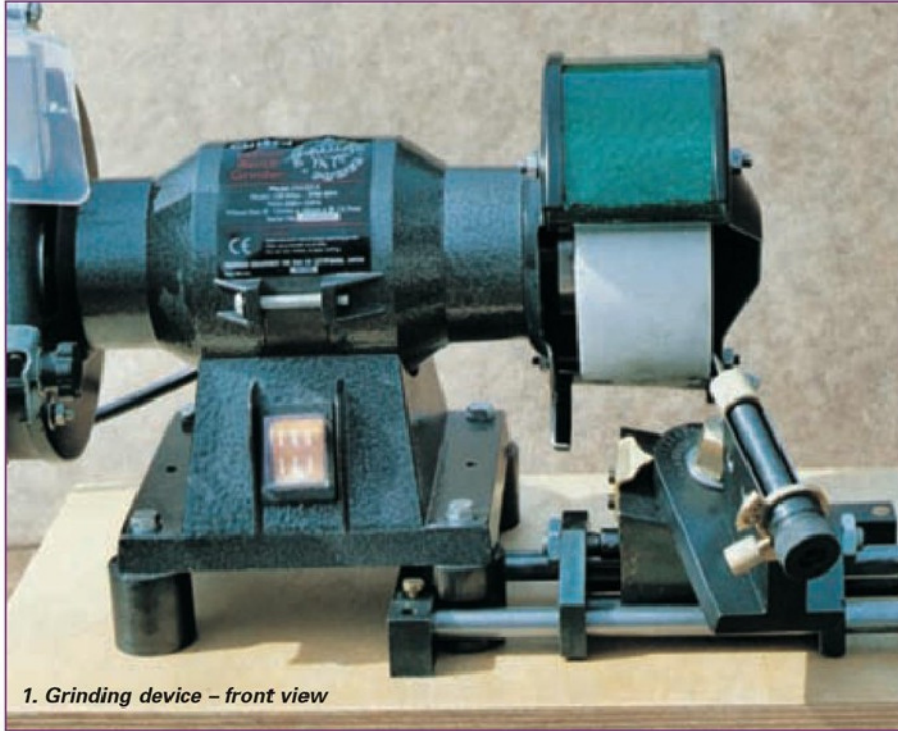
If it is to be used outdoors it would be best hot dip galvanised after fabrication, and painted after the galvanising has weathered for 6 months or so.

A piece of kit such as this, will be

generally classified as "Lifting Equipment", and as such, may be subject to legislation depending on where you are and what you intend doing with it. If in doubt, check.



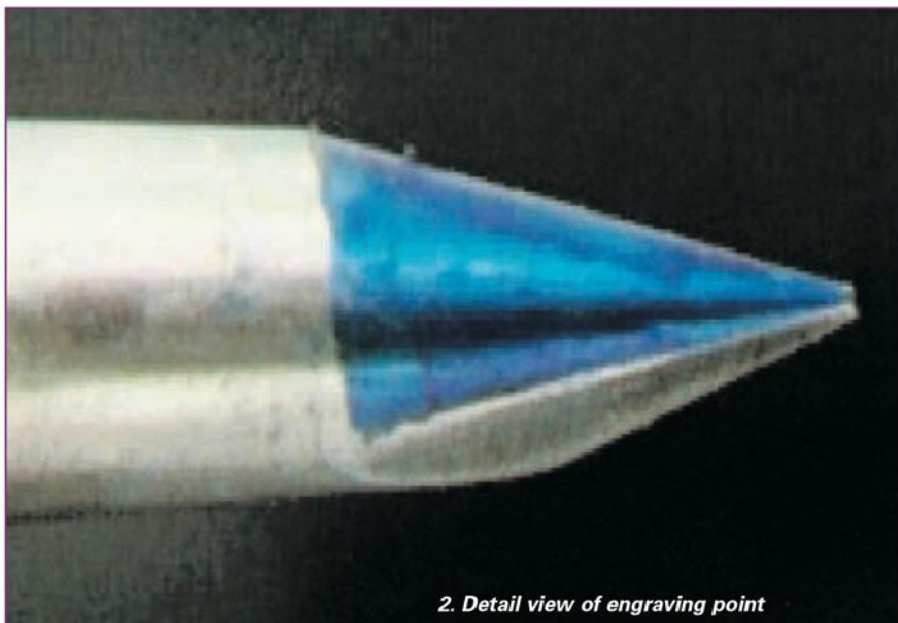
AN ENGRAVER CUTTER GRINDER



1. Grinding device – front view

Background

Having bought a second hand engraving machine it soon became obvious that a cutter grinder was essential. Information was hard to come by, and here is the opportunity to acknowledge the valuable contribution made by a friend, George Dickinson, who was most helpful when designing this cutter grinder. The engraving machine is an elderly Taylor Hobson using the “standard” cutters having a 1 in 14 taper, which is approximately 4° included angle, to the shank.



2. Detail view of engraving point

Doug Ball examines the geometry of engraving cutters, and offers an accessory for sharpening them.

Cutter grinding details

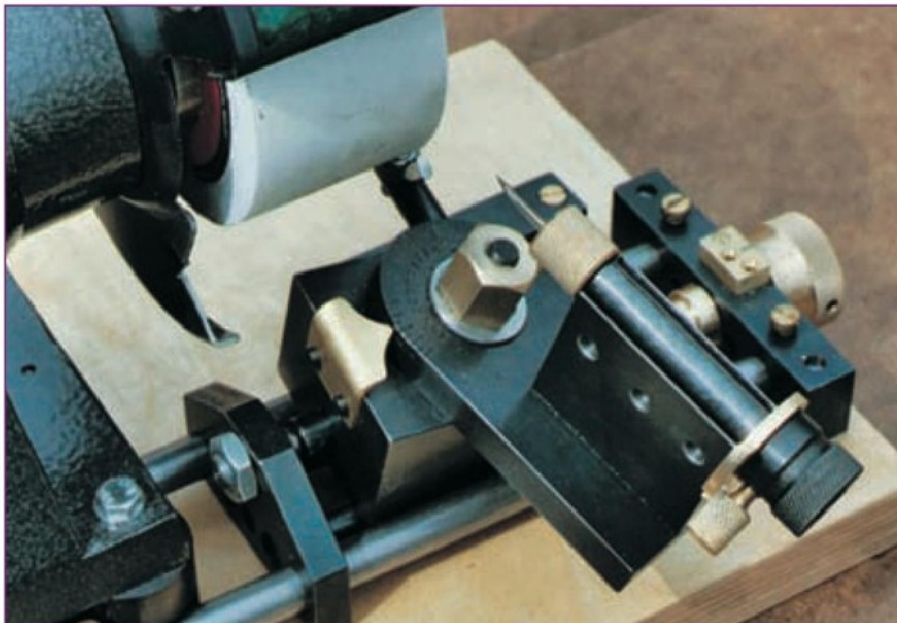
The first hurdle was trying to understand the geometry of engraver cutter grinding, which **Figure 1** will hopefully explain. The recommended “cam angle” is typically 40° - the included grinding angle is typically 40° i.e. the angle on Part 9 is set to 20°. Note that the flat on the cutter end should be small – so small that it is best viewed as a reflected light spot. **Photo 2** shows the back view of a ground cutter: the ground edge flank is steel colour – the ground radius is coloured blue.

The grinding unit

The Heading **Photo No.1**, and **Nos. 3 & 4** show three views of the grinding unit. A local DIY store had a bench grinder with 125w, 2950 rpm motor driving 125mm diameter wheels, selling at around £15. This was bought as the basis for the unit. The bench grinder came with flexible mountings which of course were discarded. Also bought was a 100mm diameter, type 6 (parallel sided cup) 120 grit, grinding wheel – this cost around £10. There are benefits in using a diamond impregnated grinding wheel, necessary if carbide cutters are to be ground, and a

3. End view of grinding device.





4. Angular adjustment and cam arrangements.

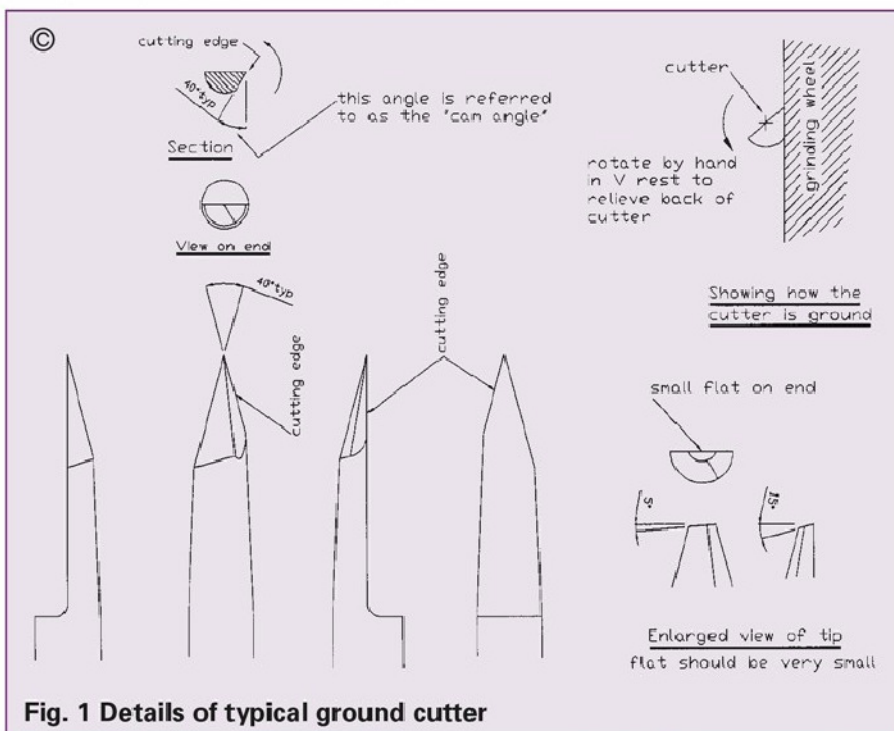


Fig. 1 Details of typical ground cutter

diamond impregnated wheel can be bought for around £40 from Chronos (01727 832793) or Eternal Tools (020 8880 0974). All material was found in the oddments box: materials close to the sizes specified can be used. The unused end of the bench grinder was left intact as this could be useful in future. Grinding wheel, grinding wheel diamond dresser – cost about £2 – and an Arkansas stone were all bought from J&L Industrial Supply (0800 663355).

Please check dimensions before making a part. Drawing errors are not impossible! The drawings are to scale, however the scale varies from sheet-to-sheet.

Construction was not difficult. Probably the most tricky job was setting the top-slide angle to machine the tapered bore in the cutter holder, Pt. 14 on Figure 5. It is vital that the cutters are well located in the taper socket. Having got this right several extra Pt. 14's were made as spares. Also a male taper was made at the same setting from silver steel, the idea being to make a "D" bit for reaming further sockets. Your engraver may use parallel shank tools in which case you are able to avoid machining these tapers.

Three "cams" Pts. 18, 19 & 20 have been drawn. Other "cams" can be made for grinding end mills and slot drills, but this has not been tried.

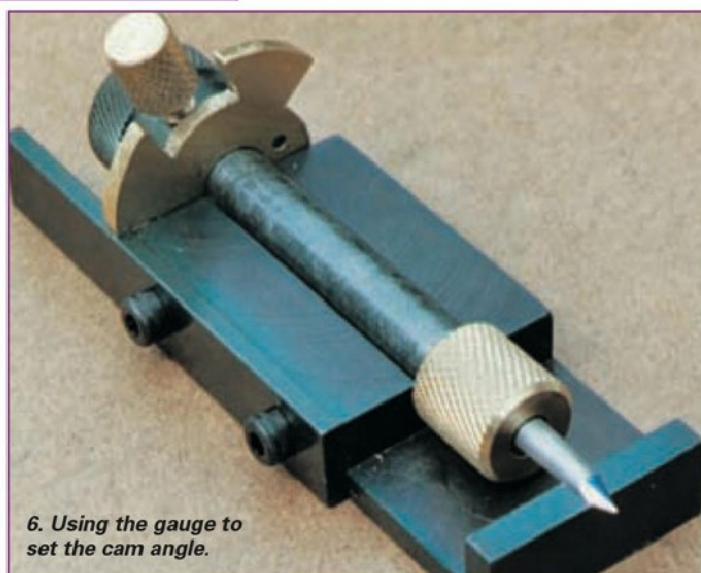
The grinding wheel MUST be guarded. In my case the rolled sheet metal guard provided with the bench grinder was simply copied in a wider form and used between the existing side-plates. It was necessary to cut away some of the side-plates to clear. The guards have not been drawn as your guard as supplied is likely to be different.

Using the grinding unit

As with all grinding activities, safety glasses are a must. Before attempting to grind components, it is necessary to true the wheel. This is done by first mounting the diamond in Pt.12 and attaching this to Pt.13. The diamond is then "rocked" across the face of the grinding wheel minutely advancing the diamond by using the calibrated knob until the face is true: Photo 5 shows wheel truing being done. Be warned that wheel truing generates much abrasive dust. If the grinding wheel



5. Using a diamond to true the wheel.



6. Using the gauge to set the cam angle.

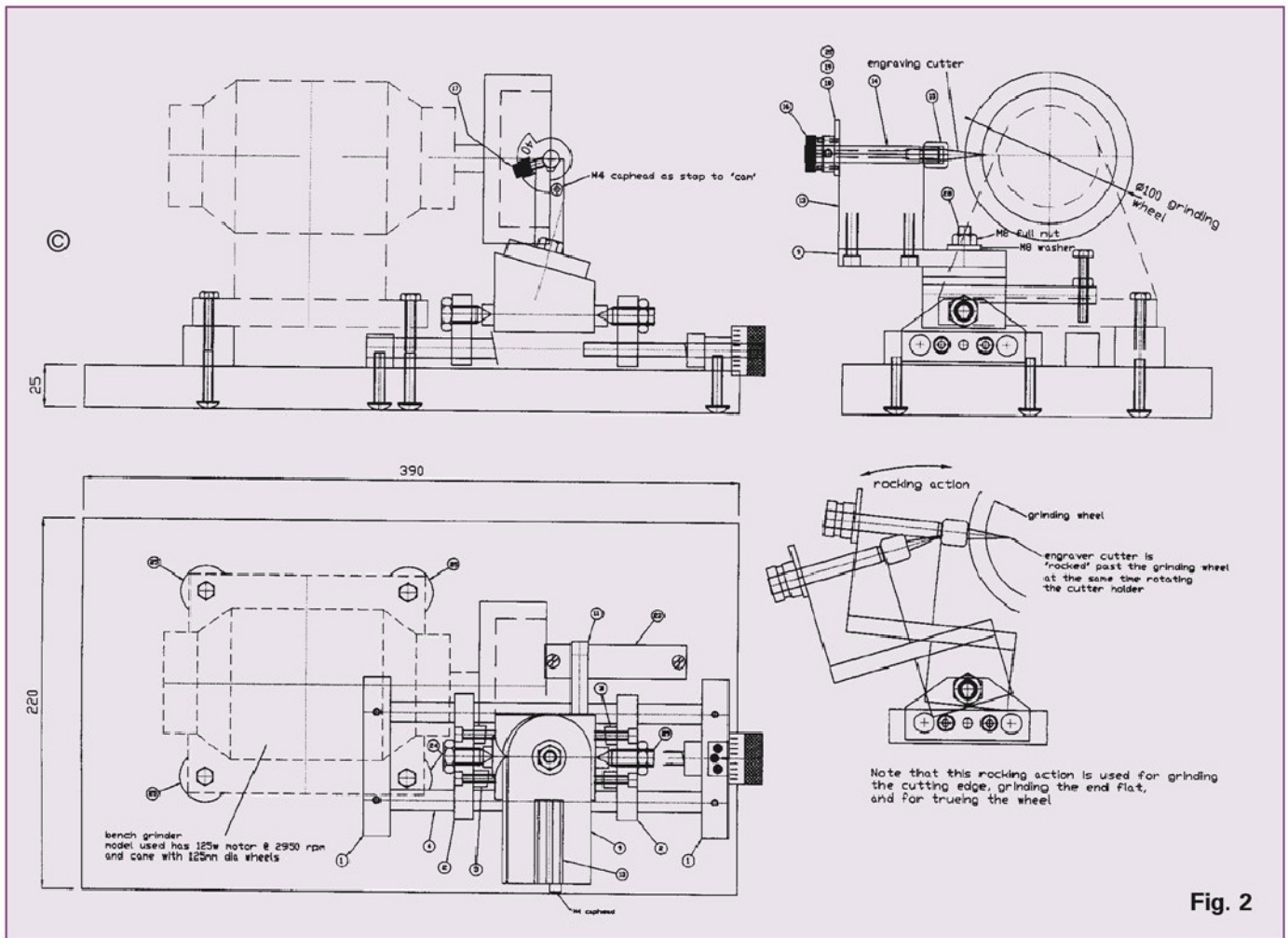


Fig. 2

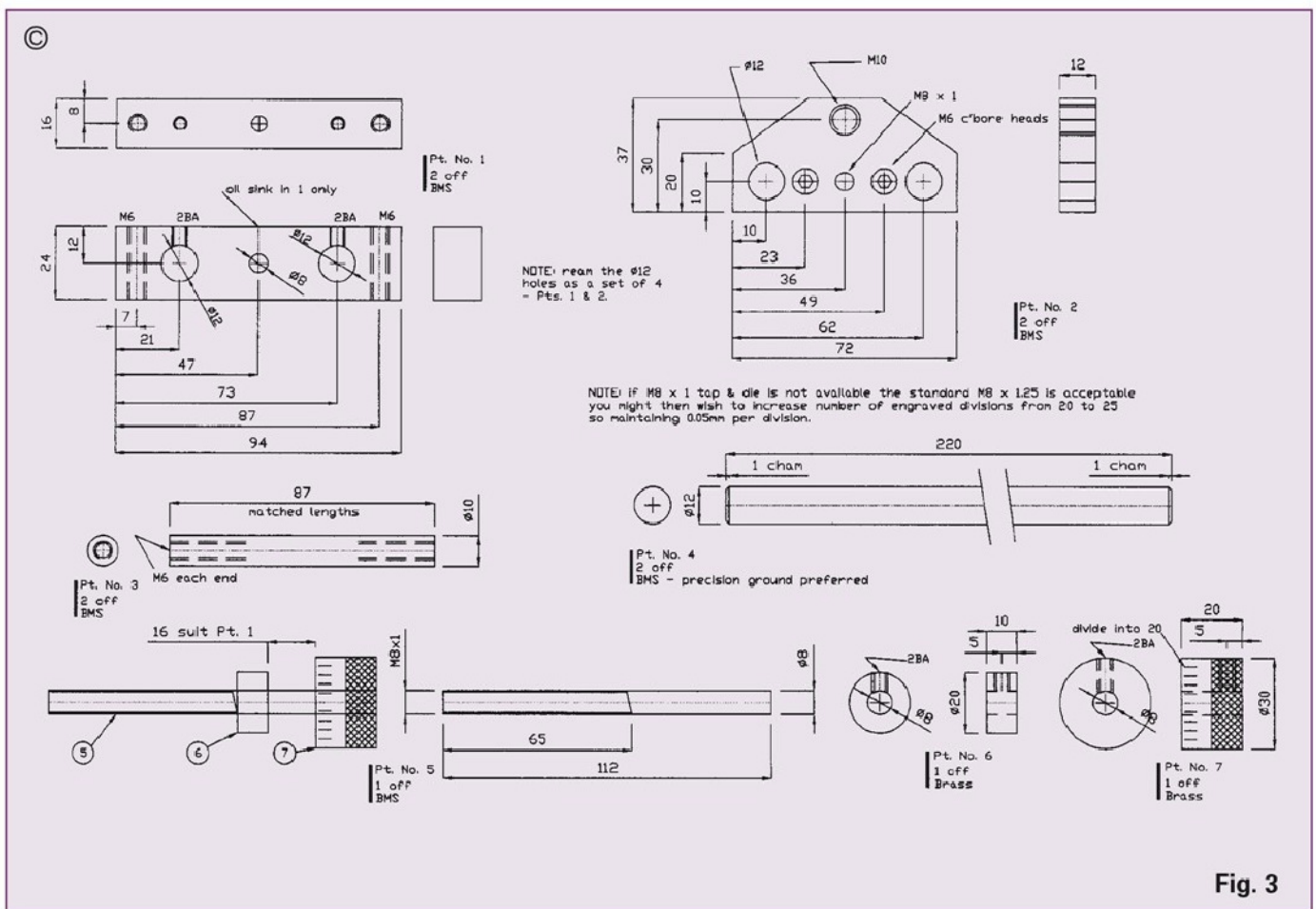
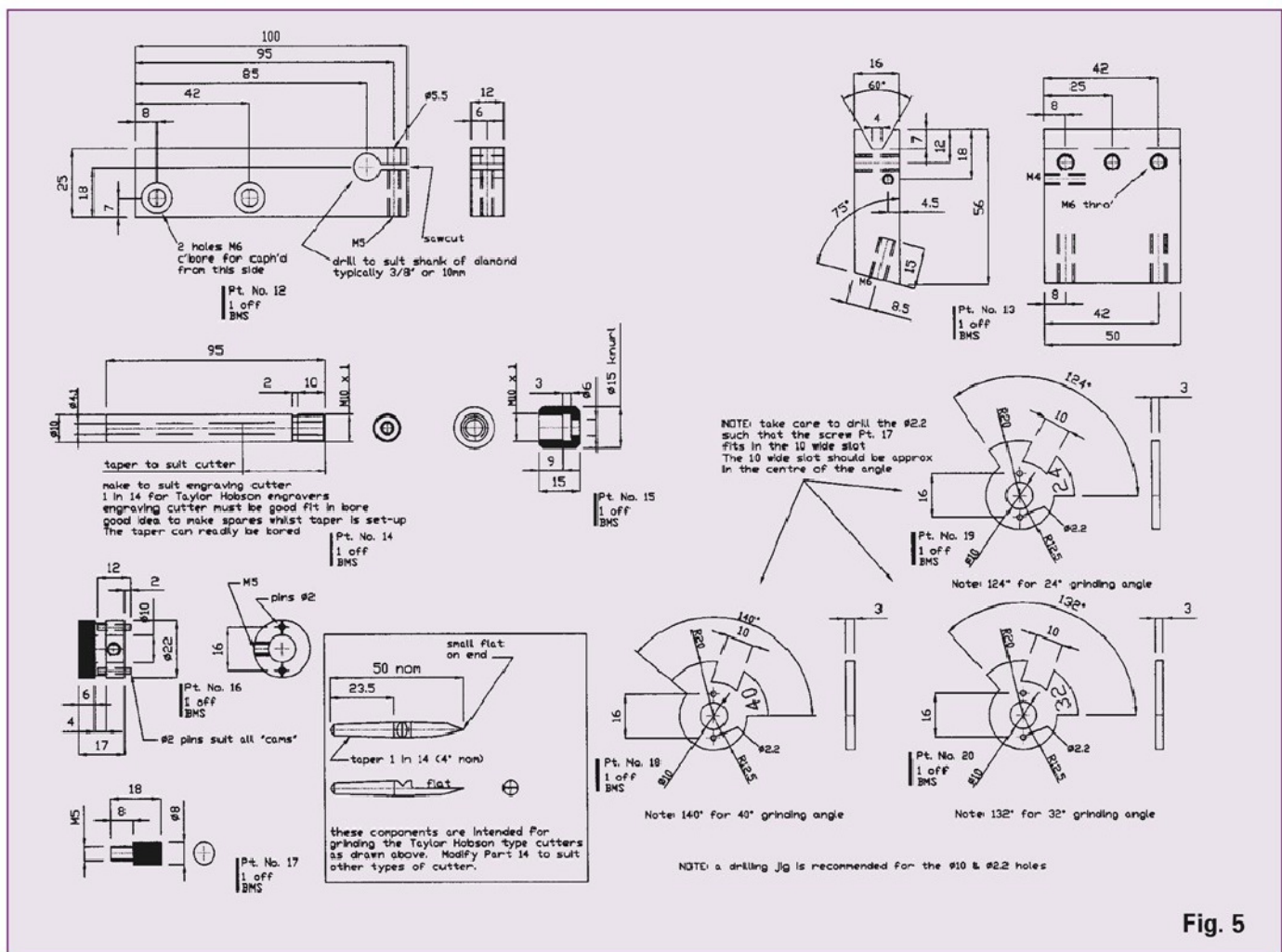
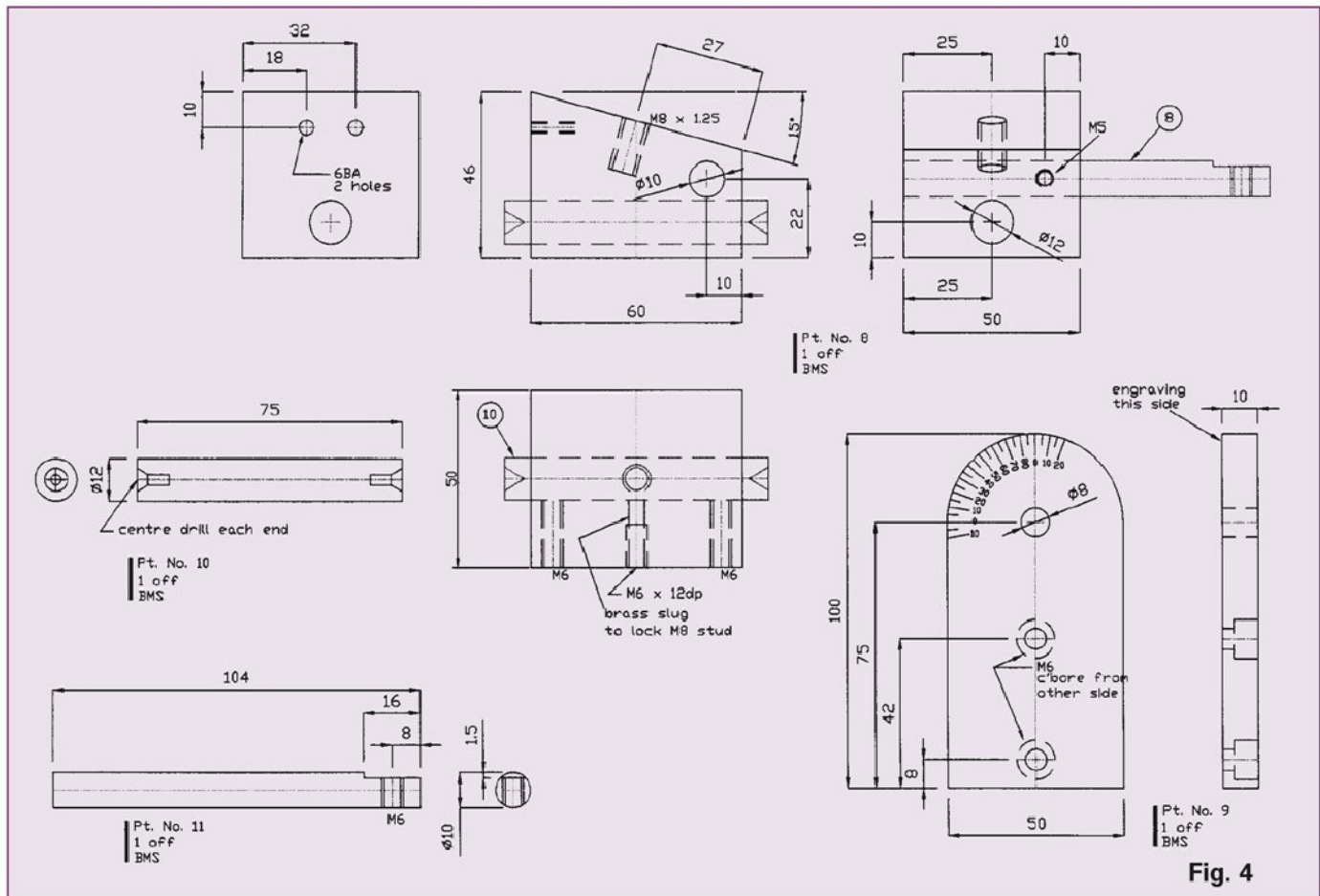


Fig. 3



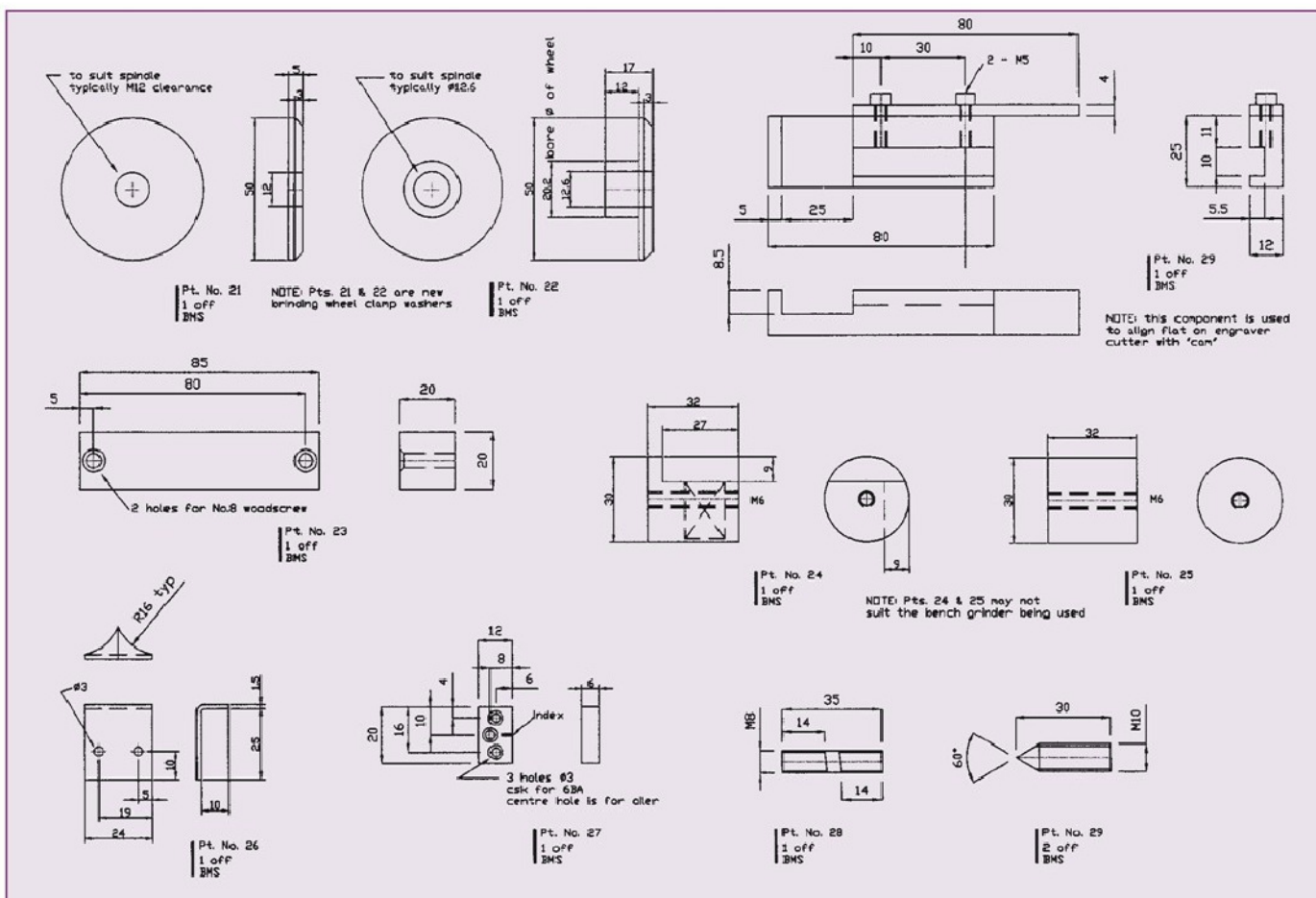


Fig. 6

is far out of balance this can be corrected (so it is said) by adding "Blu-Tac" inside the wheel rim.

Using the unit is more difficult to describe, but having understood Figure 1 and made a grinder the use becomes fairly obvious. The idea is to:

- Mount a cutter in the holder.
- Set the cam angle using the gauge Pt. 29, see photo No. 6.
- Set the cutter half angle, which is usually 15° or 20°, on Pt. 9.
- Adjust the traverse knob until the cutter just contacts the wheel.
- Set the rocking stop to limit inward travel.
- Grind a series of flats on the cutter until the end comes to a point. Grind these flats by rocking the cutter across the grinding wheel.
- Now whilst continuing to rock the cutter also rotate the cutter holder in the "V" support so merging the ground flats together. It will be seen that one flat remains, this flat gives the "cam angle".
- Now rotate Pt. 9 to 95° and grind the smallest of flats on the end of the cutter, again using the rocking action. Photo 7 shows the set-up for grinding this flat.

Having mastered this basic type of grinding other cutting profiles can be ground. An Arkansas stone is recommended for removing burrs from the ground cutters. These cost nearly as much as the bench grinder!

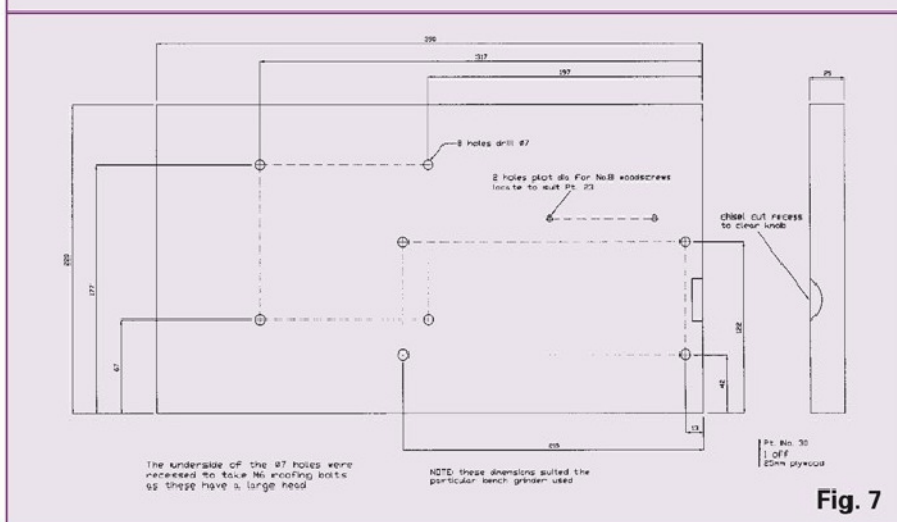
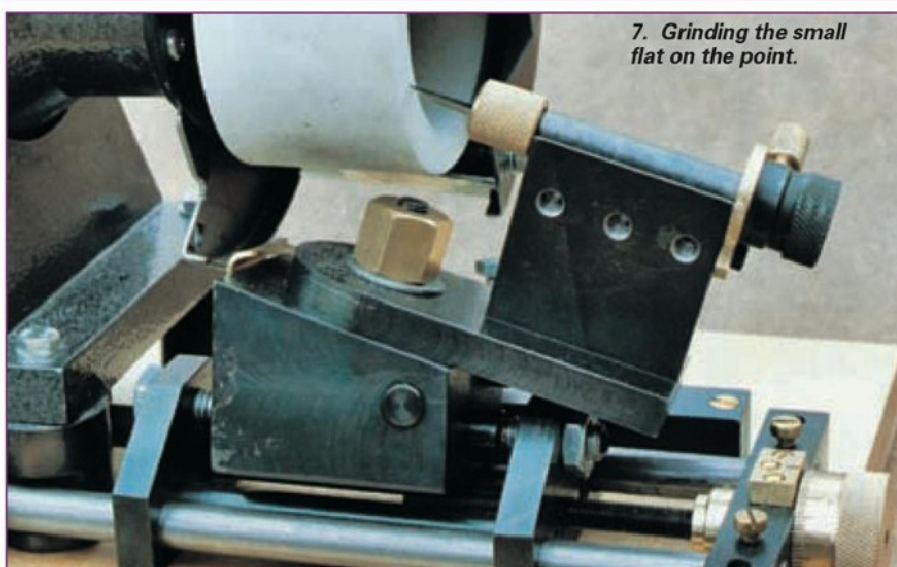


Fig. 7



LINK UP

Would readers wishing to make use of this facility please note that the maximum total value of items accepted for a 'For Sale' entry is £50.
To advertise goods of a greater value, please contact our Classified Advertisement Department. Please indicate clearly if an item is intended for Link Up.

FOR SALE

● For Sale 5inch dia. M.E.S. Rotary Table price £15-00. Buyer collects. Please phone Mr M Marsh 01629 650699 (Derbyshire)

● For Sale Klockner Moeller switches, new and boxed with installation/connection diagrams. Type TO2/1EZ 3 pole on/off and type TO2/8293 4 pole on/off. Both are rated at 3KW at 220v or 4KW at 415v. Complete with fascias /knobs/mountings similar to switches on Bridgeports etc. Also MTE 4N8-8R contactors, 9way either NO or NC may be selected, rated to switch 2HP at 415v but 115v coils. New but I've had them so long their dusty. All at £4-00 each plus postage. Please phone M. Leafe 01924 460 864 (West Yorks)

WANTED

● Wanted to buy or borrow for a short period of time issue No. 77 of Model Engineers' Workshop. All costs will be met. Please contact Mr. C. Williams on 0121 681 4847.

● Wanted supplier information. In his book on heat treatment, Tubal Cain mentions the use of "Anti Scaling Paint" to control the formation of oxide scale on heat treated components. Can any readers advise where this paint can be obtained, asks Mr A. J. Lewis of Camberley. Answers please to the editor so that the information can be both publicised, and forwarded.

● Wanted information. I have recently purchased a second hand metal cutting lathe - a Granville Star. It was manufactured by Burnett and Co. of Hull, England. Are they or successors still in business? Does anyone carry spare parts for this lathe? Does any reader have any E-mail or postal

addresses that would help me in my quest for spare parts and owners manuals for my new lathe. Any help would be much appreciated. Please contact Ron Graham – grahamr@uniserve.com

● Wanted - for ML 2 lathe, (flat bed with dovetails on outside edges, approx 3inch centre height), 1) Fixed steady, 2) Leadscrew and half nuts, (screw 8 tpi x 29 in. overall. Please contact Mr. T Ellis 01900 604 741 (evenings only).

● Wanted – tailstock for 10in. Southbend Lathe, 1940's model. Also tooling, chucks etc. Please phone Ian Shephard on 01237 451 489

● Wanted to Buy or Borrow, Drawing Nos. 6 and 8 or complete set for Rover Engineering - De Winton "Lady Penrhyn" please phone Gordon Tew on 01460 64376

IN OUR NEXT ISSUE

Coming up in Issue No. 88 will be

Cutting Bevel Gears

Brian Perkins talks through some of the trials and tribulations.



Getting Engineering information on the internet.

Mike Haughton offers step by step advice to make new technology easier than a trip to the library.

A Pump Centre

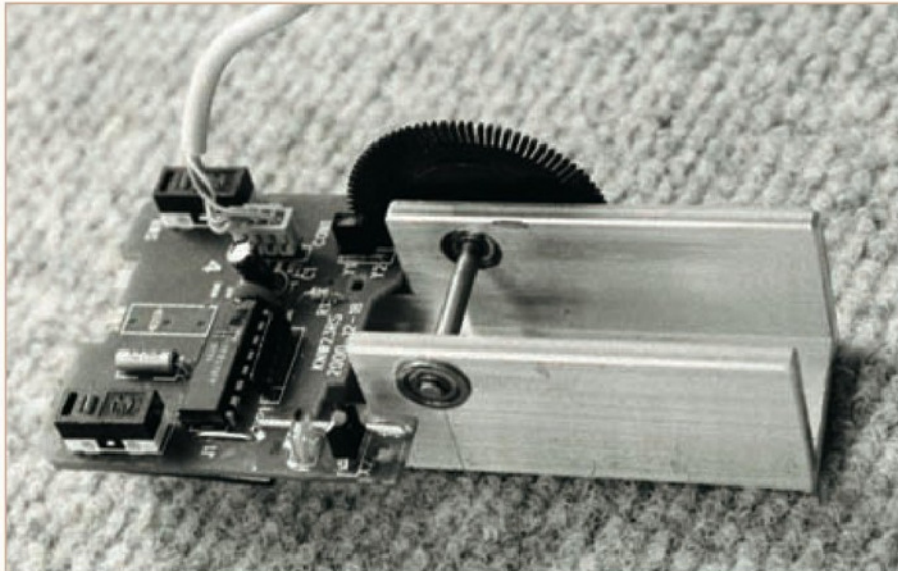
Peter Rawlinson describes a straightforward accessory to ease tapping.



Issue on sale 14th February 2003

(Contents may be subject to change)

ENHANCEMENTS BUDGET



6. PCB carrying the optics shown with the encoder wheel. The mouse PCB will be fixed in the housing, the channel section bearing housing will be spring mounted against the linear rod.

Several approaches can be considered to solve the problem, and within the confines of this brief article, I shall consider frictional, geared (rack and pinion) and helical arrangements.

a) Frictional translator

My Z-axis DRO uses a simple linear version of the mouse ball, a Carp brand Tufnol rod provides a non-slip drive when sprung loaded onto a steel axle running in ball bearings unless it: gets oily, is accelerated too quickly, or is driven into a dead stop, (decelerated too quickly).

The general layout of the design is shown in **Figure 1A**. The translator has to be built carefully with appropriate materials to work reliably. The diameter of the measuring axle is critical. It is at this point we have to start throwing things away. The plastics axle in the standard mouse runs in partial bearings made as part of the light plastics moulding which forms a 'chassis' for the PCB. The design hinges on the significant difference in friction between silicon grease lubricated plastics and the silicon rubber sheath of the ball running on the plastics axle. Anyone who has used this 'ball' type mouse knows that they work well until any kind of dust/grease gets onto the measuring axles. Only in certain locations on a machine tool can this degree of cleanliness be relied upon. It is not practically possible to duplicate the surface frictional characteristics of the mouse ball in rod form.

This design uses the difference between ROLLING and SLIDING friction to ensure

that the exact linear movement of the slide is translated to an equivalent angular movement of the measuring axle, without SLIP.

Photo 6 shows the new steel measuring axle and new slotted wheel now carried in miniature ball races mounted in a sprung loaded carrier. When the linear rod is in position in its bushes the spring steel strip locates the measuring axle firmly against the rod. The engagement of the slotted wheel into the opto source/detector pair is adjusted, and we have our linear encoder.

It follows that in theory one can use any diameter of axle and any number of slots in the disk. However, I estimate that 45 slots is as delicate as a DIY wheel can get, with about 100 slots being maximum for convenient housing. The resolution equation will be based on what you are starting with. On the prototype I opted for a resolution of 0.001 inch. Bearings for the stainless or silver steel axle are available with 1/8 inch and 3mm bores, so as a starting point:

Try 1/8 inch axle:	
RESOLUTION (0.001) =	$\frac{\text{PI} \times 0.125}{\text{SLOTS} \times 4}$
	= 98.175 slots
Try 3mm axle:	
RESOLUTION (0.001) =	$\frac{\text{PI} \times 0.118}{\text{SLOTS} \times 4}$
	= 92.763 SLOTS

Continuing from the previous issue, Richard Bartlett considers design solutions to the "Linear to Angular Translation" question, and the application of Rodent Rules software.

Rounding down to 90 slots to suit an easily available gear means the 3mm axle shaft will need to be REDUCED from the nominal 3mm to compensate. Restating the equation to find the new axle diameter:

$$\text{AXLE DIA.} = \frac{\text{RESOLUTION} \times \text{SLOTS} \times 4}{\text{PI}}$$

$$= 0.11459 \text{ inch}$$

Polishing a little over 3 thou off the 3mm silver steel spindle between the bearings to get the 0.11459 inch diameter is as accurate as possible is the way to go if you require Imperial units, Compumill has 10tpi screws so Imperial is appropriate here.

For a METRIC resolution of 0.02mm using a 90 slot wheel the central measuring section of the axle would be:

$$0.02 = \frac{\text{PI} \times \text{DIAMETER}}{90 \times 4}$$

$$= 2.2918 \text{ mm diameter}$$

The drawing 1A is an inconsistent section through my current prototype showing the essentials, which are:

A diecast box (RS 225-186) holds the bushes through which the rod slides and locates the mounting blocks for the PCB and the flat spring. I chose IGLIDUR moulded plastics bushings to run with Tufnol, these have two integral mounting holes. I expected to have to ream the holes in line as the box sides have a slight draft for mould release. In the event it was not necessary as the bushes were neither round nor size, the Tufnol rod 'running in' quite quickly.

The flat spring is 1 1/2 in. wide spring steel 0.02 in. thick screwed to a 1/2 in. square steel mounting. The free end of the spring carries a 1 x 1 inch x 1/8 in. aluminium channel screwed to the spring. If the channel is tapped M3 for several pairs of holes and the matching holes in the spring are slotted then the encoder wheels can be easily interchanged if necessary. The channel carries two lipped ball races of 3mm bore at a height to give 1/8 inch deflection of the spring when the rod is

TO COMPUMILL - ET DRO

inserted. Measure the height of the axle centre from the bottom of the box under spring pressure.

The PCB sits glued to a wooden mount. The height of this mount will allow the centre of the collimating lens on the LED to be at the same height as the axle. The circuit board material is very weak, and warrants reinforcing with Araldite and stiff wire in the sections that protrude to support the optics.

Prior to final assembly of the PCB into the box, drill any fixing holes in the box to allow mounting to the machine and also file a slot in the top edge to allow the lead to be trapped by the lid on assembly. Make or adapt a push button with spring return to actuate the RIGHT mouse micro switch. Fix this into the lid of the box. Thoroughly clean all swarf from the box and assemble. Finally, test using the DOS mouse driver TEST routine.

When made and used carefully these linear encoders using frictional translators are, subject to the provisos mentioned, reliable. When fixed to the table of a mill and intending to use them in ABSOLUTE mode they need an improved translator.

b) Rack and pinion translator

Rack and pinion drive is mechanically very similar to the frictional system described, and an easy conversion from the 10mm Tufnol friction drive rod with 3mm nominal diameter axle can be made using an M6 stainless threaded rod spring-meshed with a 15T pinion of 1mm circular pitch turning a slotted disk of 75 slots to give a resolution of 0.05mm. (a suitable double sided pinion in stainless steel is DSTC1-15 from HPC)

The conversion simply requires the 10mm bushes to be lined with 6mm phosphor bronze bushes and the 15T pinion reamed 3mm to allow Loctiting to a 3mm axle. The spring maintained linear rod to axle centres are close enough to preserve the optical alignment when changing from system to system.

The choice among standard threaded rods to be used as racks will be a compromise between being mechanically robust enough to run the length of the slide without additional support versus having a pitch fine enough to give adequate resolution using a relatively small pinion. In my view an M6 rod will run unsupported from the main anchoring point to the support of the bushes in the reading head.

An M5 rod would need to be fastened to a continuous support beam, an aluminium angle for example, which must alter the design of the reading head to provide an external, single ended pinion.

The accuracy of this very cheap

translator based on the threaded 'rack' will be degraded due to the 60 degree thread not matching the 20 degree pressure angle designed into the pinion. The result will be cyclic errors based on a 1mm pitch. Consequently, when calibrating the rack / pinion choose increments smaller than 1mm, say 0.2mm to observe these non-linearities allowing an informed decision on whether the system is likely to meet your requirements.

Calibration

If the frictional translator is being converted then all is to hand. If the rack/pinion unit is the starting point then a simple set up could be to chuck a length of M6 (or whatever you choose) threaded rod in the lathe. Mount the pinion and slotted disk on a shaft supported in bearings whose housing is held in the toolpost. Adjust the mesh to give NO clearance. Fix the PCB to present the optics to the slotted disk and cover to keep out direct light.

Connect to the PC serial port as COM1 and install the normal DOS mouse driver then run the TEST routine. Channel 'Y' will indicate movement of the DRO on test.

Connect the 'standard' linear device which can be the machine leadscrew or top slide, a DRO or a Dial Test Indicator. Move the saddle/top slide in 0.2mm increments referenced to the standard and note the Y channel readout on the PC for each one.

A test range of a few pitches, say 5, are all that is required to indicate the quality of the translation.

If the accuracy falls short of your expectations then a commercial rack such as: 1mm Circular Pitch cut on a 10mm diameter stainless rod 400mm long can be used (TRC1 from HPC), these are obviously more expensive than threaded rod. Alternatively, for those with an interest in gearing there is the possibility of using the standard 60 degree threaded 'rack' with DIY pinions made to suit the new pressure angle.

Do remember that we can only improve on the cyclic errors which are caused by the non-standard pressure angle of the rack. The pitch of the 'rack' is our linear reference and any errors in this whether cyclic or cumulative are cut in at manufacture. It is reasonable to expect that A4 stainless threaded rod from an engineering supplier will be significantly better in this respect than zinc plated rod from the hardware shop.

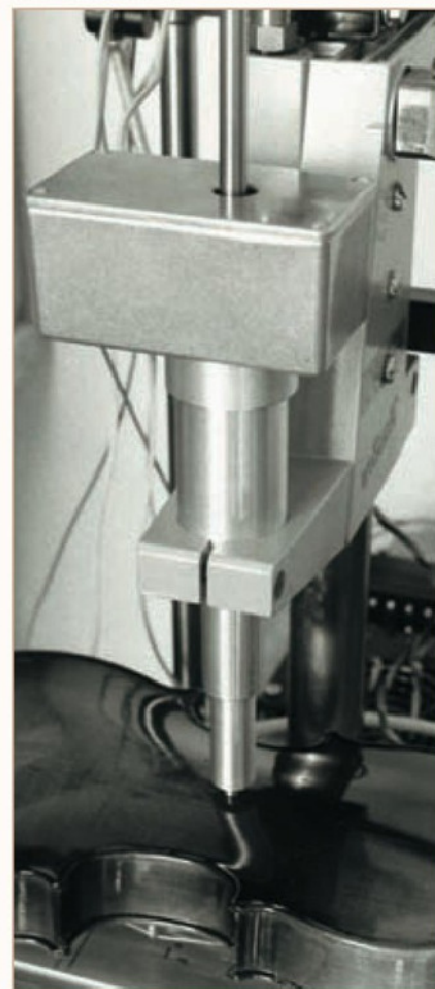
c) Helical translator

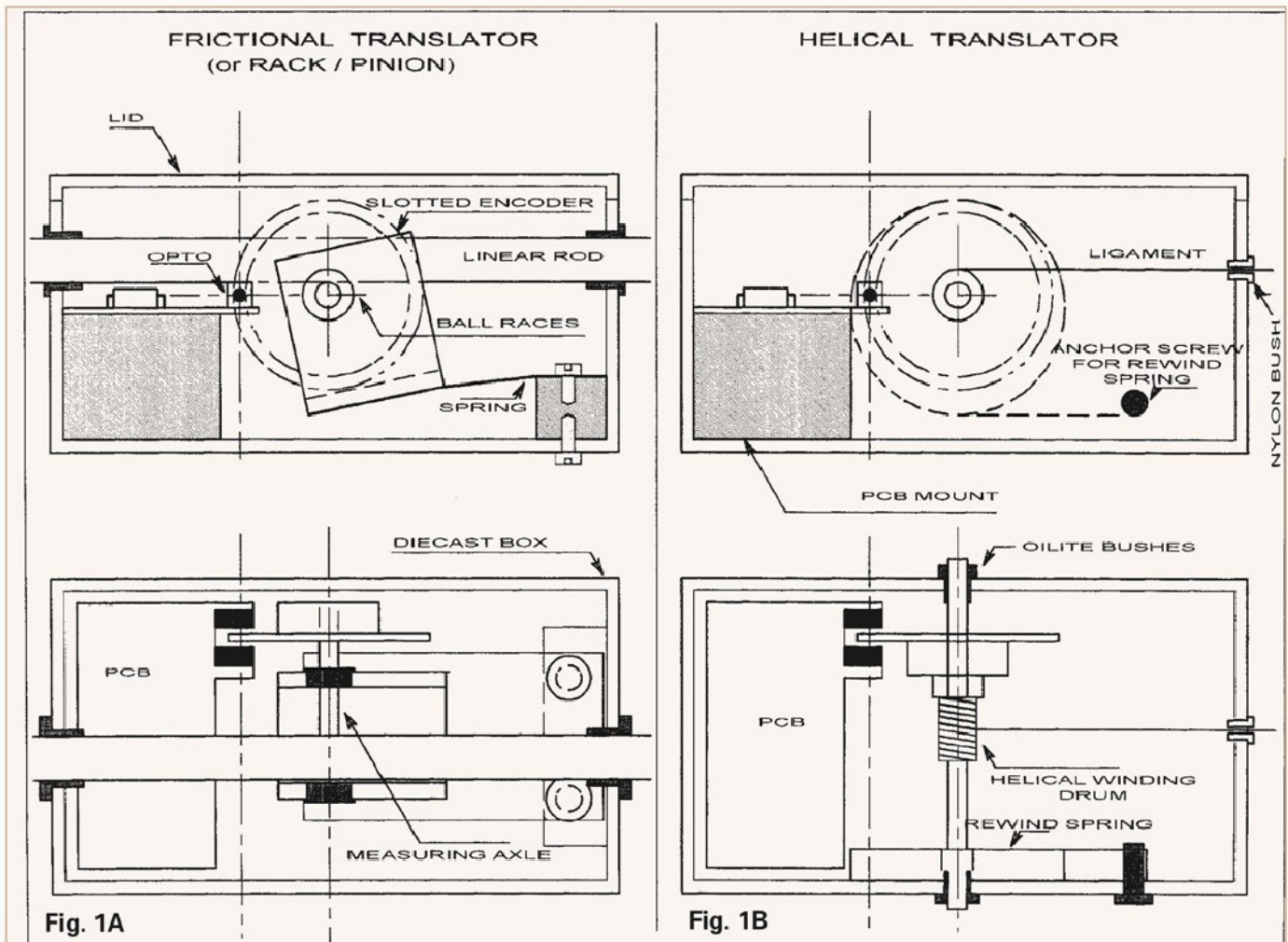
The measuring axle can be turned by a tensile ligament wound around a helical groove cut in the axle and fixed to some point on the machine outside the encoder housing.

This method has the advantage that the translational element is DIY rather than bought and can be calibrated as it is made. The helix has to be under a constant rewind torque strong enough to ensure that the ligament is reloaded precisely into the helical groove at maximum rewind speed. The rewind mechanism can be 'borrowed' as the mainspring from a pocket watch or small clock, the return spring from a 'power' tape rule or made by wrapping piano wire around a bolt in the lathe to produce the spring.

The ligament can be braided phosphor bronze wire as used by clockmakers as an alternative to chain in fusee drives, braided stainless steel as used by anglers to make wire hook traces or Kevlar. Any non-

7. Perpendicular Frictional Translator. An aluminium housing carries well spaced ball-bushings allowing the 10mm diameter stylus to follow the gentle contours of the instrument. The original mouse shell could be used but as this was going into a woodworkers shop a diecast box was chosen.





stretch flexible ligament can be tried and although nylon monofilament fishing line does not meet this 'non-stretch' requirement, when being stretched at all times by the constant rewind torque the length is likely to be constant over the period one job, although large changes of workshop humidity will affect the accuracy unless a 'reset' is performed periodically. Other ligaments which come to mind are polyester whipping twine available from a Yacht chandler and lacing thread (waxed linen or polyester) as used for looming wires in instrument panels, even good quality button thread would probably last for years.

If you already have a BW (trademark) type of DRO which uses this principle of operation then choose a ligament of the same diameter as the BW unit to allow it to be used for calibration during turning.

The helical measurement drum is turned from a free cutting material. Brass, Lead mild steel or Aluminium alloy can be used.

The helical drum is reamed 3mm and Loctited to the axle.

Example: To suit the longest axis of Compumill we need an operational length of 11inches. The DRO must have a range of at least 12inches to avoid being used as a 'dead stop'. Aiming at a resolution of 0.001inch.

Using a 90 slot wheel:

$$0.001 = \frac{\text{effective circumference of helix (C)}}{\text{slots} \times 4}$$

$$\text{i.e. (C)} = 0.36\text{inch}$$

$$\text{effective diameter of helix} = \frac{0.36}{\pi} = 0.11459\text{inch}$$

I think this is too small to be practicable, the radius would seem to be too tight for the springy stainless trace wire. There are three remedies:

1. Increase number of slots.
2. Add a geared lay-shaft (say, 2:1) to allow a helix of larger radius at this resolution.
3. Decrease the resolution.

For a resolution of 0.002inch the effective circumference of the helix is 0.72inch, giving an effective diameter of 0.22918 inch. This is my solution. The pitch of the helix will be 1.2 x dia. of ligament, this will allow easy laying of the ligament into the groove. The tool angle for screwcutting the helical groove will be 90 degrees. This arbitrary choice of angle reproduces the 'bar in a Vee-block' scenario which always gives good location.

$$\text{The number of pitches required} = \frac{12}{0.72\text{inch}} = 17$$

Assume the diameter of the ligament is 0.02inch then minimum length of blank for helix = $17 \times 0.02 \times 1.2 = 0.408\text{inch}$. Adding a few turns to secure the end of the ligament gives 0.5 inch minimum.

(The diameter of 10lb 7-strand nylon covered stainless steel trace wire is 0.02inch)

The turning operation is straight forward, but instead of checking the diameter between cuts, the effective circumference of the helical groove is tested by measuring the length of several pitches of the tensile ligament as they are wound on against a reference linear scale such as the BW or any other DRO, vernier calliper etc.

The linear calibration dimension will be Number of pitches x 0.720 inches

Bolt a temporary index to the headstock of the lathe to register with a mark on the chuck. This will allow an integral number of pitches to be counted when checking for linear winding of the ligament. When deciding on the layout within the housing, keep the distance between the helix and the feed thro' bush in the wall of the housing to a maximum. This will narrow the angle between the winding limits and reduce the non-linearity due to this varying angle. Note, that as the range of the translator increases so do the non-linearities due to winding angle. Mounting the feed thro' bush at an increased distance from the measurement helix will help.

Figure 1B is an inconsistent section showing the essentials, which are:

A die cast box housing the bearings for the axle on which the helical translator and the slotted encoder are mounted. The rewind spring which in this case is an ex- alarm clock spring of the open variety is anchored to the side of the box with the inner end hooked to an arbor on the axle.

The PCB mounted on an insulating mount to make the height of the collimating lens equal to the height of the axle centre line.

Guarding the ligament outside the reading head housing is obviously desirable.

The helical translator will be as good as you make it. Using cheap, easily available materials a linear digital readout using this general arrangement could have a range of one metre with a resolution of 0.05mm for a cost of approx ten pounds (excluding the PC). There are other ways of translating linear to angular motion, the above being the easiest. It is worth restating that: "Any inaccuracies due to mechanical limitations inherent in the translators of these linear encoders are NOT present in the angular encoders which turn the slotted disk directly via an axially coupled shaft within the machine setup."

Testing the units in XYZ configuration

You will need a COM (serial) port fitted into your PC for each device connected up to a maximum of four. Most PCs have one or two serial ports already fitted, to fit additional ports buy them on ISA or PCI

cards whichever suit your motherboard. Add-on cards are available in single, double or quad format. Keep a standard serial mouse for running the software for the first time. The program called 'Rodent Rules' has been written by Allan Good a Compucutter who uses CNC woodworking machines at hobby level. It is available as a free download (3-axis) from the Compucut Users Forum.

The simplest way to access the forum is log on to the Compucut Website at www.compucutters.com, then click the link at top left called Compucutters user forum. The program is in the software section under 'Rodent' and includes a DOS mouse driver.

Install the program onto your hard drive under Win 3.1, 95, 98 or 2000. Connect the rodents and run the program. You will be prompted with an introductory screen then a menu screen allowing the association of COM1 thro' to COM3 with X,Y or Z axis display, an X or Y mouse channel and a scaling factor. Make your selections for the devices you have attached and click OK. The screen now shows all enabled devices, click START and the program continuously monitors up to three serial ports updating the large XYZ displays. There is a short

text manual supplied with the program which covers the details of all other options. Anyone wishing to play with the 'Rodent Rules' but having no internet access for the download can send five pounds to COMPUCUT for the Rodent programs on CD. Address is elsewhere in this magazine.

Final photo 7 is of a linear encoder with frictional translator being used as a high speed digitising head for scanning a violin prior to making a cello sized copy. Such gently undulating yet fairly complex shapes are ideal applications for these frictional devices as they do not involve 'dead stops' or rapid acceleration in the scanned axis, yet are capable of being read several times a second.



Suppliers

HPC Gears 01246268080 for gears, racks and pinions.

RS Components WWW.RS.COM for bushes, bearings, die cast boxes

Farnell Electronics 08701 22 77 22 for A4Tech Serial Mice

CPC Electronics 08701 20 25 30 for A4Tech Serial Mice

Making a very simple linear DRO

(This simple DRO is recommended for anyone unfamiliar with computer terminology, as a familiarisation exercise)

You will need:

An IBM or clone PC of any vintage, your old Commodore or Spectrum will NOT work here. If you are buying a PC for workshop use then a 66Mhz '486 or 166MHz Pentium is a good choice as they are very cheap. The ideal operating system is DOS version 5 or 6 with Windows version 3.1 or 3.11. If you have the CD follow the attached printed instructions to install the DOS mouse driver and the 'Rodent Rules'.

PLUS

A serial mouse of the 'opto-mechanical' type, which means it uses a frictional translator of the 'ball and axles' type. The A4Tech 'fast' mice costing 99pence are ideal. These are fitted with a 9-way socket serial lead. If your computer has a 25-pin COM port then buy an adaptor for 25-pin to 9-pin serial. Plug the serial mouse into the COM1 port in the back of the computer. Check the operation of the mouse by starting the computer and when the C:\ prompt is on the screen type MOUSE then press enter. A message informing you that the mouse driver has loaded will appear on the screen. Now type TEST and press enter. The test routine will echo the X and Y mouse channels to the screen as a pair of co-ordinates. Moving the mouse on a flat surface will show as variations of these co-ordinates. This shows that the mouse unit is functional, and can be remembered as a useful quick test of a mouse PCB. The plane of the flat surface on which the mouse moves is often formed by a grippy layer called a mouse mat. Further reference to the 'mouse mat' simply refers to this lower plane of the mouse housing.

Remove the ball from the base of the mouse, then remove the screw which holds the two halves of the plastics housing together. Remove the top housing and the mechanism is on view. Moving the axles by hand will no longer cause a change of display due to extraneous light falling on the opto detectors. Cover the unit with one hand, then move the axles and the unit will be seen to operate. The X and Y channel axles which lie at ninety degrees to one another give different levels of physical access. I chose the Y channel axle as the operational channel. Rotation of this axle can be made by:

- The linear movement of a rod moving in line with the unit and passing over the PCB. Note, the rod has to be displaced slightly from centre so that it passes over the integrated circuit and clears the other components. OR
- A hole for the rod can be made in the mouse base and upper housing allowing the rod to move perpendicularly to the mouse mat. This is easiest and the housing is provided so we will make the first tests with this configuration, but take care when drilling the large holes in the thin plastics shell.

Remove the PCB for drilling the housing. The hole is a comfortable clearance on whatever rod material you have for your tryout linear elements, I found Tufnol/silver steel to be the best of the few materials combinations I had available. Refit the mouse upper casing and spot through to mark the position of the hole through which the rod will pass. A 2mm clearance is adequately light-proof.

Decide how/where you are going to test the readout unit, a backstop for the guillotine or side fence for a circular saw

etc. Mount a flat bracket slightly larger than the base of the mouse and perpendicular to the travel of the unit. Remove the mouse PCB and drill fixing holes which will align with tapped holes in the mounting bracket. Elongate these fixing holes to allow adjustment between linear element (the rod) and the Y channel axle. Mount the mouse base, then replace the PCB, then replace the upper housing.

Mount the short rod firmly to the moving part of the mechanism allowing it to pass through the mouse. Adjust the mouse to give a reliable grip between rod and axle.

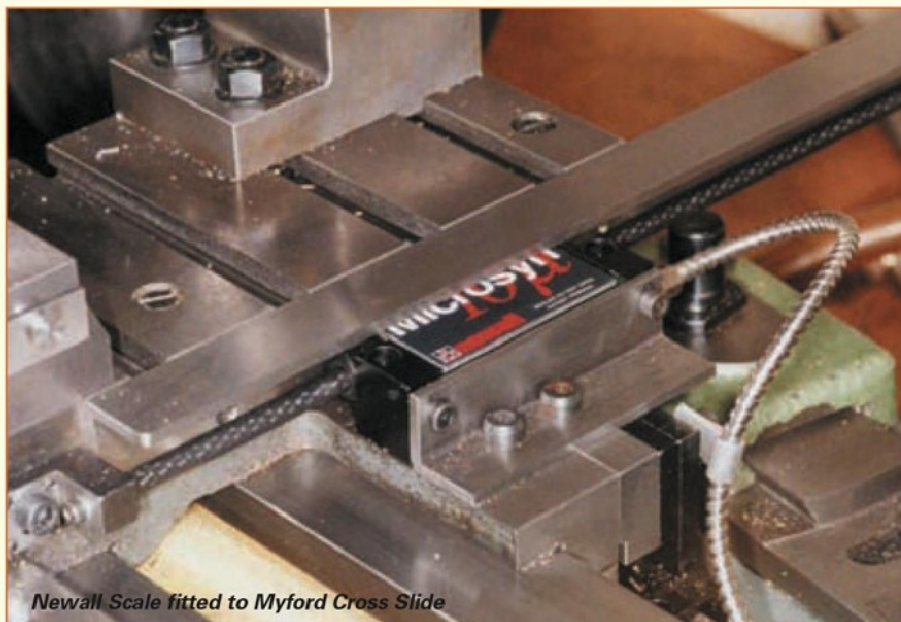
That's it. Watching the display will indicate the level of repeatability for different accelerations and it will be seen that moving sharply to a dead stop with these frictional devices is an absolute 'NO-NO'. Photo (7) shows my version of this type of DRO with an extended housing containing linear bearings, used for digitising on an overhead router.

The display of the mouse test program is not particularly visible when the computer is mounted out of harms way. Exit the TEST program and start Windows by typing WIN then pressing enter. Run the Rodent Rules program and the enlarged display makes the data visible from several metres.

At this stage you have beaten the computing element and any enhancements needed are now likely to be straightforward applications of model engineering workshop practice.

Additionally, these little circuits are very transferable to other uses, the mouse electronics can be rehoused in whatever situation and at whatever resolution your project requires, offering much scope for imaginative instrument making and lots of fun for a pound!!

A TALE OF TWO READ OUTS (3)



Newall Scale fitted to Myford Cross Slide

We come now to the bit about how to fit the Newall DRO to the Myford, but first I need to get the Health Warnings out of the way!

GOVERNMENT HEALTH WARNING #1:
Buying a DRO can seriously damage your wealth!

GOVERNMENT HEALTH WARNING #2:
The dimensions used to design the components were taken from Myford S7B Power Cross Feed Lathe Serial No. SK123955.

As far as is I have been able to check, the components should fit all S7 PCF lathes after that serial number. However, I cannot be sure that they will fit earlier S7 lathes, ML7s, machines without the long cross slide, etc., and cannot vouch for any variations introduced by Myford since they built my machine. So whichever machine you have, you are strongly advised to check the basic dimensions on your own machine prior to manufacturing any components, and then adjust the component dimensions to suit. Some are shown (together with the measurements taken from SK123955) on the cross section drawing of the saddle. Another one to check is the location of the holes in the back of the bed to which the Adaptor Plate mounts – check the lateral spacing between the holes and distance of the holes from top of the bed.

And naturally, you use the designs at your own risk! As far as I'm aware the drawings are correct, but you never know. If anyone spots a mistake I, and others who might wish to use them, would very much

appreciate your comments. The components fit and work on my machine, but as far as yours is concerned.... that's down to you!

I am bound to say that I didn't make the X- and Z-axis brackets and Plate 'B' exactly as per the drawings. After successfully making and installing the original ones, I came up with an easier way of doing things – Thanks, Murphy, you're a ...well, we all know what Murphy is! I would also add that the information is provided to assist an individual model engineer in making his own components for his own use. Newall have my permission to distribute the drawings and notes to their model engineering customers on that basis, so any model engineer purchasing a Newall system for their Myford can request a full size set of drawings. Commercial manufacture is not permitted without prior arrangement, and these notes and the drawings should not be copied or distributed.

The Components

There's little to say about the components, they're nothing more than exercises in marking out, drilling, and a bit of milling or filing, nevertheless a few comments may be of assistance.

Adapter Plate

Some accuracy is needed with regard to the countersunk holes in the Adaptor Plate. These need to be carefully done, since any errors here will mean that the screws won't align with the tapped holes in the bed, and the countersunk heads won't sink properly but will protrude

Barry Harrison concludes by presenting his arrangements for fitting the readout scales to his Myford Super Seven.

somewhat, impeding the seating of the taper turning attachment.

If you want to use the full adaptor plate to simplify scale installation, but don't envisage ever wanting to fit a taper turning attachment, then socket head capscrews can be substituted for the countersunk screws shown on the drawings, and the holes opened up a touch to give you more tolerance to play with. An alternative for this situation would be to use only the end say 250 mm sections of the plate to avoid the need to drill the bed.

Note that the bottom pair of countersunk holes aren't essential as Myford have, at some time or other, dropped these from the lathe altogether. The row of tapped holes at 43.4 mm from the top of the plate are to take the taper turning attachment and could be tapped 6 mm if you prefer.

X- Axis Bracket

In general, the dimensioning is not super critical. Aspects on which comment may be useful areas follows.

The width and location of the 3 mm wide slots at 65.5 mm centres – these take the bolts for the Microsyn head and need to be in the proper position. If you're not too fussy you can make them a bit wider and a bit longer to give yourself an easier ride.

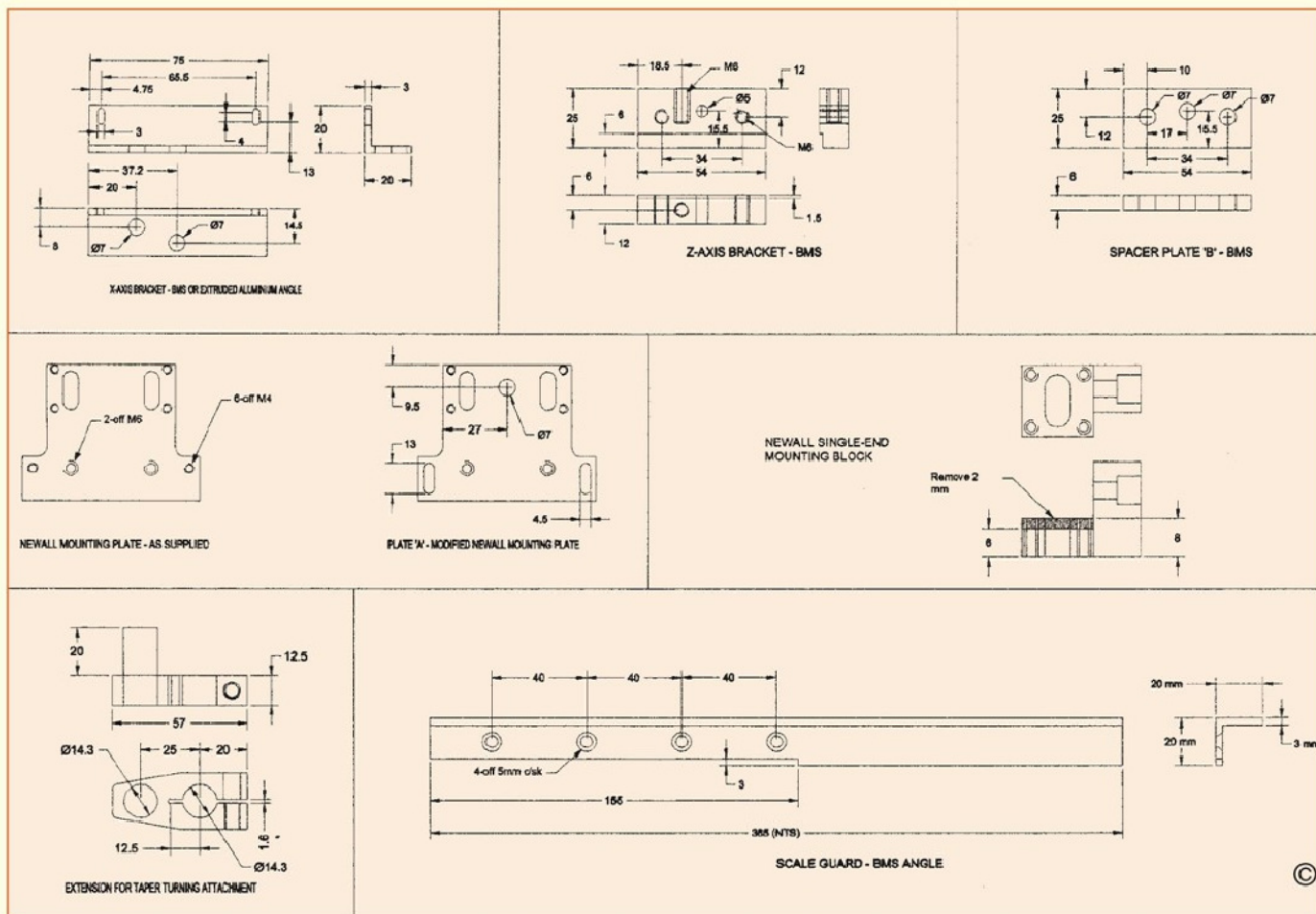
The 7 mm hole next to the web needs to be carefully positioned – too close to the web and you won't get the socket head cap screw in place, too far away and the head will come too close to the cross slide to allow the scale to pass through the head. It also needs to align with the tapped hole in the saddle wing normally used for the coolant stand pipe. Make it bigger if you so desire!

Z-Axis Bracket

The blind tapped M6 hole on the top of the bracket takes the second bolt through the X-axis bracket, as can be seen from Photograph 3 in the first article. Not critical if you've put a more tolerant hole in the X-axis bracket, but make sure that the end of the Z-axis bracket aligns with the end of the saddle wing – purely for appearance's sake!

The recess at the bottom of this component was needed to clear the slightly protruding rear gib strip – if yours doesn't protrude, you don't need the recess.

The M5 hole in the centre of this bracket



might seem to be positioned a little higher up than necessary – it's necessary, it's put there to give you a better chance of not drilling in to one of the gib strip bolt holes. How do I know this?.... silly question!

Plate 'B'

Same comment applies to Plate 'B', also make sure that the holes in Plate 'B' align with those into the side of the Z-axis bracket. The spacing between these holes must align with the slots in:

Plate 'A'

This plate is supplied as part of the mounting kit – apart from the scale supports, it's the only bit of the mounting kit that's actually used, apart from the bolts! The mods required are to drill the central 7 mm hole (needs to be central!!) and put in the slots at the bottom of the plate in place of the original M4 holes.

Single end mounting block

Basically as supplied by Newall, assembly is considerably eased by taking 2 mm from the top surface of the mounting foot.

Scale guard

Now this one does need some care in drilling and countersinking the holes, they must align with the holes in the side of the top slide, and the screws MUST be fully countersunk – there is very little clearance between the guard and the reading head.

The 4 holes in the guard and cross slide may be over the top, two would probably

do. But I guess I'm a dedicated follower of the belt and braces approach.

I drilled the guard and the cross slide separately using the DRO system on the mill, and everything aligned to perfection. If you haven't got the capability to do the same, I'd suggest drilling the guard first and using it as a jig to drill the cross slide, but make sure that the guard is positioned just a touch below the top of the cross slide before you put the drill in. You can use any convenient countersunk screws, I used 2BA slotted screws purely because I had a box full. The cut out at the bottom of the guard provides access to the gib screws.

Cross slide drillings

See the comment above re alignment with the holes in the scale guard. Other than that, not critical. The M5 hole takes the Newall single end mounting bracket, which has got a big slot in it for adjustment.

Extension for taper turning attachment

The use of this should be obvious... I hope so, because there aren't any photographs of it! After going to all that trouble to provide for the TT attachment, and carefully installing and aligning it, I haven't used it since installing the DRO, and so haven't got round to making the extension!

That's about all I can think of to say with regard to the components. So now you've shelled out all that hard earned brass, chopped up some metal and drilled and tapped a lot of holes, time for:

Assembly to the lathe

This bit is presented as bare instructions for assembly of the mounting components, the procedure for aligning the scales and heads is not detailed as that will be available to those who buy the Microsyn system, and of no interest to those who do not.

1. Remove the saddle clamp assembly from the rear saddle wing and discard it.
2. Bolt the X-axis bracket to the saddle wing using the existing $\frac{1}{4}$ " BSF tapped hole (normally used for the coolant stand pipe) and align to the cross slide axis using a DTI – better than ± 0.002 " required over the length of the bracket – tighten securely. A socket head cap screw must be used as there is insufficient clearance for anything else. And no room for a washer!
3. Fix the Z-axis bracket to the X-axis bracket, holding the Z-axis bracket firmly against the rear of the saddle wing and the underside of the X-axis bracket. Tighten securely.
4. Use a 5 mm drill to drill the saddle wing M6 tapping size, using the 5 mm hole in the bracket as a guide bush. Remove the bracket and open out the 5 mm hole to 6.5 mm (clearance for M6).
5. Tap the saddle wing M6 and fit an M6 stud.
6. Re-fit the bracket, fit a temporary nut over the rear M6 stud. Check alignment of the X-axis bracket, make sure the Z-axis bracket is against the saddle wing and the underside of the X-axis bracket, then tighten everything up gradually.

7. Remove the M6 nut, fit the spacer plate and Plate 'A', followed by Plate 'B', the modified Newall mounting plate. Hold Plates 'A' & 'B' against the underside of the X-axis bracket, re-fit the M6 nut to the central stud and use 2- off 6 mm socket head cap screws to hold the 'A' & 'B' plates to the Z-axis bracket. Tighten securely.
8. Install and align the reading heads as per Newall instructions.
9. After making the X-axis scale guard, remove the cross slide and use the guard as a jig to drill the cross slide – ensure that the top of the guard sits below the top of the slide, but by no more than 0.2 mm... more than that, and the reading head may foul the guard. Drill and tap the M5 hole for the scale mounting bracket.
10. Re-fit the cross slide and guard, hopefully the guard will clear the X-axis reading head!
11. Bolt the adaptor plate to the back of the bed using c/sunk screws in ALL the holes, note that later machines are missing the lower row of tapped holes..
12. Fit the Newall support pins to the M6 holes at the extremities of the adaptor plate, then install the rest of the scale support fittings and fit and align the Z-axis scale in accordance with Newall instructions.
13. After modifying the Newall single-ended scale mounting bracket, fit it to the cross slide using the M5 hole in the side of the cross slide.
14. Install and align the X-axis scale in accordance with Newall instructions.
15. Route the cables carefully to ensure that they don't kink and don't hang down in to the tray. Secure the cables

with the supplied clips, as shown in the photographs of Part 1.

16. Connect to the read out, switch on, and follow the Newall instructions for setting things up
17. After fitting and aligning everything, and ensuring that the things are functioning correctly, you can remove the socket head cap screw between the X- and Z-axis brackets, then re-fit it using a Loctite or similar thread retaining compound. Do the same for the cap screws holding the 'A' & 'B' plates to the Z-axis bracket. The whole assembly can then be removed and re-fitted by removing just one cap screw (the one into the top of the saddle wing) and one M6 nut, and everything should stay in alignment.
18. It may be necessary to make a new $\frac{1}{4}$ " BSF hex head bolt with a thin head to replace the rear gib strip bolt nearest to the tailstock.

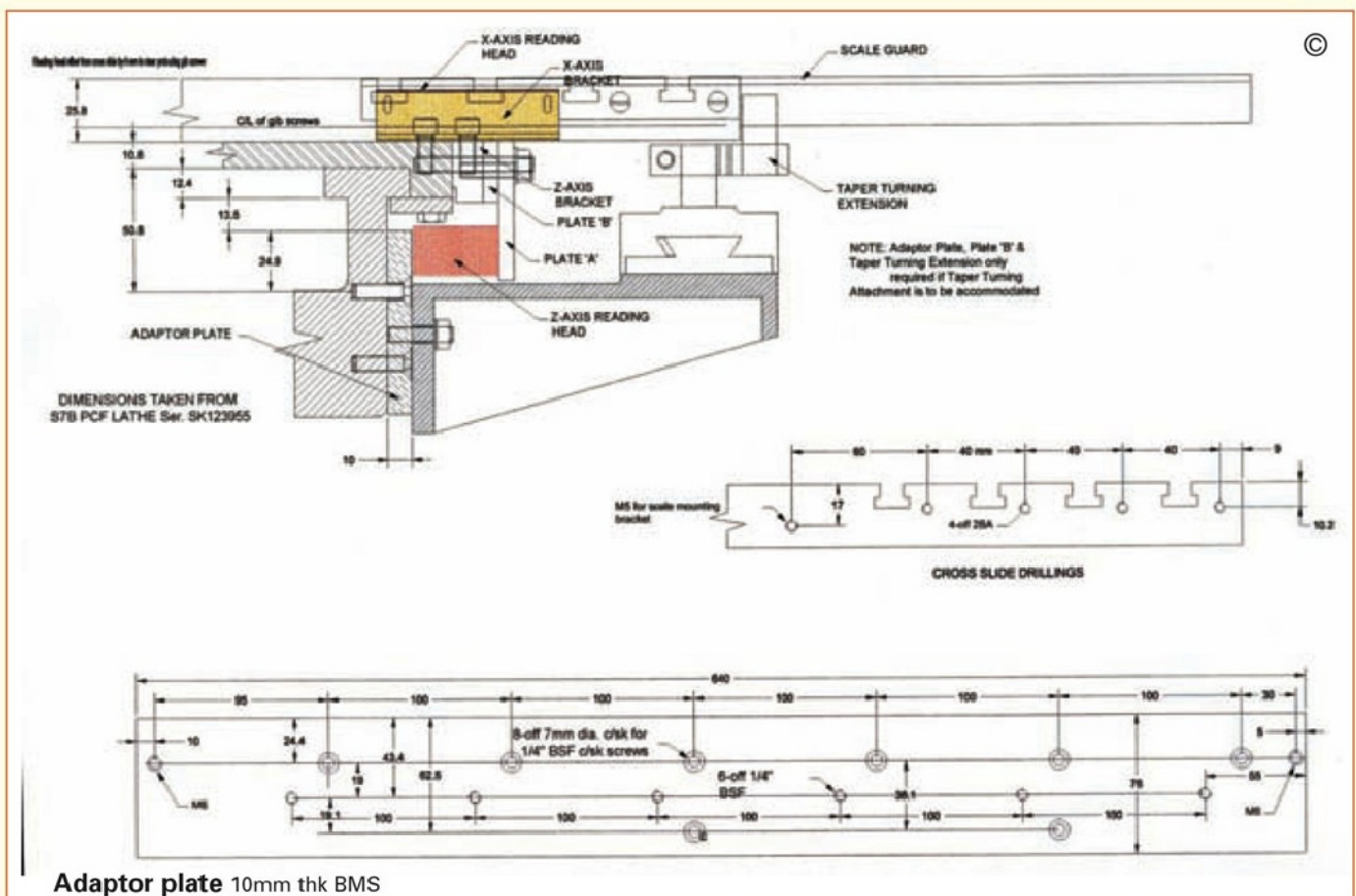
That's it, job done. Time to stop making bits for the lathe and start making bits for the model. Or whatever. Time to start using this magnificent bit of technology, and most importantly, enjoying it's use. It really does make a difference. But remember that it can only help you to produce good work, it can't do it for you, you're still the one on the end of the handle, still the one grinding the tool bit. It won't make you a better model engineer per se. If it comes out wrong, don't blame the DRO, look at what YOU'VE done wrong. And in particular, don't forget that you can switch between radius and diameter readings on a lathe system. And having selected one, don't forget which one you've selected – jobs come out the wrong size if you do, or

holes drilled on the boring table come out in the wrong places. Accurately sized jobs and accurately positioned holes 'tis true, but wrong, noticeably wrong! How do I know this?...Another silly question! Been there, done that, bought the T-shirt... but it didn't fit!

Conclusion

So far as installing the DRO on the lathe is concerned, some may accuse me of over-complication, or of doing things the hard way. Guilty as charged, M'Lud, but I plead mitigation as it was the only way I could come up with of fitting the DRO to the Myford without compromising the use and maintenance of the machine, or risking damage to the DRO during operation. There must be other ways of doing it, perhaps better ways, and if anyone comes up with an alternative I, and I'm sure many others, would be pleased to hear about it.

I hope that these notes have been of benefit to those who intend to install and use a Digital Read Out system, whether it be the Newall Microsyns, or one from another manufacturer. For those who choose other options, I hope that they serve to provide you with some ideas as to how to get round the problems of fitting the things to a relatively small lathe. For those who currently have no intention or desire to use DROs, I hope that my outline of the possible advantages may whet appetites for the future. For those not prepared to set aside significant amounts of hard earned cash for one of these undoubtedly expensive toys, it may well be worth having a close look at some of the lower cost alternatives which will give most of the advantages of DRO facilities.



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.

DIY Waterslide Transfers

Whether your pet project is a model, restored motorcycle or stationary engine, the finishing touches will usually involve decals or transfers, and while commercial suppliers cater well for popular items, the special may be another matter. Jetcal is an inkjet printable decal paper which allows the creation of tailor made designs using PC and inkjet printer.

Design, scan, or digitally photo the image, then print directly on to Jetcal

paper. Immerse in water for one minute then apply to a clean surface by sliding the decal from the white backing paper. As Jetcal is supplied as a white paper, any unprinted areas remain white. However these areas can be rendered transparent by coating the decal with solvent based varnish.

More information can be obtained from the website www.thedecalpaperstore.com or email questions@thedecalpaperstore.com or post to The Decal Paper Store, PO Box 1687, Stoke-on-Trent ST1 3TR

Part Off Par Excellence

Steve Clarke runs Clarke Engineering by day, and relaxes with model engineering out of hours. Wearing his ME hat he was dissatisfied with the high cost of replaceable tip part off tools for the larger (5 – 6½in.) lathe. (Even at sale time the cost of tips blade and block, was approaching £160.00) He now offers a package of 2mm wide tips, blade, and block, sized for toolposts able to take 16mm sq. tools, for a little over half this cost. The tips are professional type with top groove to encourage chip width reduction and improve surface finish.

Having, like Philip Amos, experienced rigidity problems over the years when parting off on front toolposts, I now only ever use a rear toolpost for these duties. So when Steve sent along a kit for a look see, I popped it on the back of a Herbert 6½in machine to try. It's claimed you can actually part material up to 130mm dia, provided the cuts are taken in stages, and the tool overhang stepped out as required. For my purposes, it was convenient to work with some 1½in non free cutting mild steel bar. To give the effect of something larger, and be a bit more brutal to the tool, the blade overhang was increased to about 1½in. which would correspond to parting 3in. dia. bar.

As can be seen from the photo, a little more attention on my part to tool height setting would have improved the residual pip. Nevertheless an excellent finish was maintained from the periphery to within a radius of about 5mm, when presumably the reduced surface speed caused slight degradation. (850 RPM was used with coolant.) A dimensional check showed squareness to be within 0.002in. apart from the pip, even with the excessive overhang. Set correctly for the 1½in bar, it is probable that squareness would be held within a thou. So basically this is an

industrial quality part off system at around half professional price. The quoted price of £89.50 includes VAT and post & packing.

Clarke Engineering can be contacted at: 11 Basey Road, Rackheath Industrial Estate, Norwich, NR13 6PZ, or by phone: 01603 722 023



—And from Enginewise

Under the direction of Paul Prince, Enginewise is a business which specialises in corrosion protection, with particular emphasis on i.c. engines, but relating to tool and machinery storage, and also extending to specialist paint and plating products. For engines which may be used occasionally, or stored long term, the relevant products include oil additives (with vapour phase and contact corrosion inhibitors), dehydration kits, and closure kits. For applications such as tool cabinets, V.C.I. emitters, corrosion control paper, and silica gel sachets are provided.

The products may be of interest to owners of classic vehicles as well as being directly applicable to items of workshop equipment during the winter months.

One photo shows a fully overhauled spare Rolls Royce Merlin engine at the Shuttleworth Collection. Following rigorous tests, Shuttleworth selected V2K oil additive and Enginewise dehydration plugs to preserve the restored engine in its airworthy condition. A second shows a dehydration plug being inserted into a Ural motorcycle engine.

The website www.enginewise.co.uk gives information on test methods, results etc. and specific problems can be discussed on the helpline 01472 347 400. Enginewise are located at 3 Venture Business Park, Gilbey Road, Grimsby, DN31 2UW.



Badger Range: Three Airbrush Kits and a Sandblaster

Badger's three level range, acknowledged as rising to the Rolls-Royce of airbrushes is now complemented by a Mini Abrasive Gun Set. Airbrush sets start with the sub £20.00 model 250-3 external mix kit featuring simple air and paint controls to vary the paint spray pattern.

The Versatile Spray set (350-3) is again an external mix airbrush giving an increased spray volume and handling higher viscosity materials. The supplied "medium fluid assembly" caters for line widths between $\frac{1}{8}$ in. and $\frac{1}{4}$ in. optional accessories extend the capacity from $\frac{1}{8}$ in. to 3 in.

Top of the range is the Precision Airbrush Spray set (Model 200-3) which operates on the internal mix principle, giving a fine spray pattern for professional results.

The Mini Abrasive Gun Set (Designated 260-3) is capable of removing rust or paint from small areas, or of etching glass for decoration or security. Compared to a typical sand blast pot, its diminutive size makes it more convenient for the smaller job. Everything required is included in the kit, and all consumables are available separately. **For more information contact Shesto Ltd. sales@shesto.co.uk**



Air Duster from Kenro

Kenair was originally conceived for use in the photographic and subsequently film and video industries, and avoids the need for expensive or noisy compressors and air lines. Kenro envisage hobby users will include amateur photographers, artists, astronomers, model makers, small gauge train enthusiasts etc. In commercial situations it has also been found useful in connection with cleaning and maintaining personal computers, electronic equipment, audio, and home entertainment systems.

The air dusters are available in three aerosol style sizes, with prices starting at £4.49, from photography retailers, stationery suppliers, and national store chains. For more information call Kenro on 01793 615 836.



New Machine Mart Catalogue

Bigger than ever, Machine Mart's new 308 page trade catalogue gives details of a vast choice of garage equipment, power tools, hand tools, metalworking and woodworking equipment, gardening equipment plus much more, all at competitive prices.

With over 499 superb new products and 537 reduced prices, this new catalogue is a valuable reference for anyone needing tools or equipment at home or at work. For your free catalogue call into any of Machine Mart's 44 superstores nationwide, call the catalogue hotline on 0845 450 1855 or e-mail sales@machinemart.co.uk. You can also order a catalogue by visiting the website at www.machinemart.co.uk

Chronos – New catalogue – new products

The latest 120 page catalogue is now available free to readers, and amongst the new items is the miniature metric tap and die set (see Photo). This is likely to interest those involved in small scale activities. As we move progressively away from the older standard imperial and BA standards, and more towards metric, sets such as this will in time take precedence. Sizes covered are 1.0, 1.1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5 mm. with two taps (taper and bottoming) and a die for each size. Interestingly the dies are not split, and therefore do not need setting to size. Also included in the price (£24.95) are two tap and one die holders, VAT, and UK carriage. By comparison, 12BA is approximately 1.3mm OD, and so this set has two sizes smaller than this.

Copies of the catalogue can be obtained by letter, phone or email: Chronos Ltd. Unit 8, Executive Park, 229/231 Hatfield Road, St Albans, Herts, AL1 4TA, phone 01727 832 793 email: sales@chronos.ltd.uk



TWO DAYS IN THE LIFE OF AN EDITOR



1. First Prize winning Vertical Mill by Philip Arnold

The appeal of either the Midlands Model engineering Exhibition, at Donington, or the Open Week at Myford Ltd. would have provided sufficient reason for the journey south. Taken together, and with an invitation to visit Dick Stephen, the lure was irresistible, and there was no option but get motoring. Accommodation had been booked by Graham Burhouse, who with his wife runs Jean Burhouse, known locally in Dunkeld principally as a specialist supplier to woodworking enthusiasts, but also to the model engineering fraternity as a distributor of Proxon tools and machinery. Graham was exhibiting at the

show, being aided and abetted by our club chairman Philip Newman.

Day One – The Midlands Model Engineering Exhibition

A quick tour revealed a number of interesting workshop equipment items, and photos of some are shown here. A chat with Barry Jordan shed a little light on some of his construction methods, - bolt together rather than complex castings. His productivity enhancing tool carousel was on display causing some discussion. He now feels it needs more tool stations.

Looking around the trade stands, a number of special offers and new products were in evidence. The Chronos offer of a Vertex 6in rotary table at £100-00, was too good to miss.

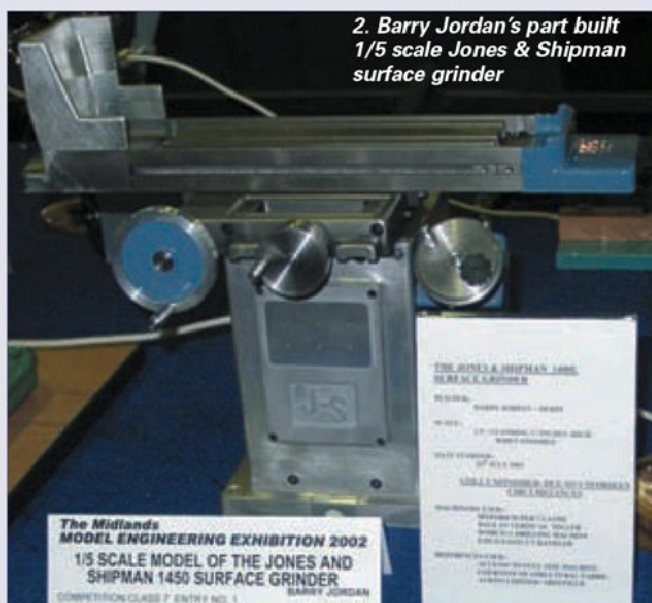
Several accessories are now being marketed to the amateur workshop sector which utilise industrial 5C collets. The collets are a long established standard, available at different prices and levels of precision. It is also possible to buy "Emergency" collets which are supplied unhardened for boring to required size. The Spin Indexer has been available for some time, giving quick dividing to one degree intervals. Two new devices seen on the Warco stand, were precision ground square and hexagonal collet holders, which could allow the collet and workpiece to be held in a three or four jaw chuck, and then transferred to a milling vice. For these items, collet closure could be by either a screwed ring or a quick act handle. For conventional precision turning, a low cost 5C chuck is also available.

Day Two - a morning at Myford

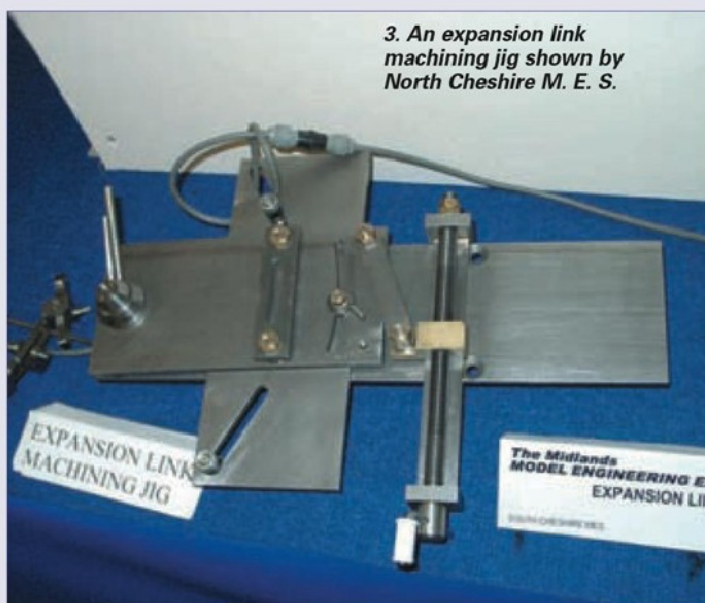
For a number of years, given that the Midlands exhibition is one good reason for amateur engineers to visit the Midlands in October, Myford Ltd. provide a very good second. Arranged to run concurrently, the firm runs an open week, during which the spares counter, and showroom are open and factory tours are available. I had arranged to meet Neil Read, Technical Editor of Model Engineer, and for both of us to visit Myford in the morning, and Dick Stephen later.

It is perhaps not generally appreciated that the company not only manufactures new machines, (Super Seven lathes, mills, and both manual and cnc grinders for industrial use) but also provides a spares support for ML7 onwards, and in turn sells on machines taken as trade ins, many of which are refurbished to exacting standards. Some idea of the mouth watering new machines can be gained from the photo. Second hand tooling bargains were also on hand, and even after many years of Scottish inductration on the art of parsimony, I was still persuaded to part with money.

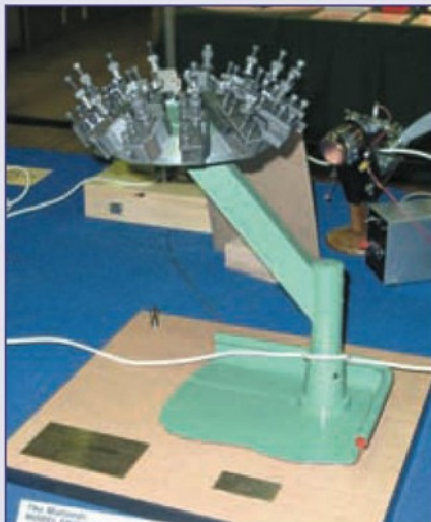
The factory tour which this year was limited due to building alterations, provided an object lesson into why a new Super Seven is not cheap, and how the reputation for quality has been earned. Taking the saddle assembly as an example, the ground saddle has its dovetails hand scraped to match a master. The cross slide is then scraped to fit the saddle thus forming a matched assembly, the scraped finish giving a combination of excellent fit with oil retention. One of the photos shows the master angle and two scraper types used. A similar approach is adopted for the headstock bearing. It is



2. Barry Jordan's part built 1/5 scale Jones & Shipman surface grinder



3. An expansion link machining jig shown by North Cheshire M. E. S.



4. The toolholder carousel by Barry Jordan



5. Model Engineering Heaven? A line of new Super Seven lathes.



6. A saddle at the scraping stage.



7. Two scrapers and master angle used for saddle and cross slide.

known that when the bronze bearing bush is fitted to the casting, a minute amount of distortion will result. To eliminate this, the bush is hand scraped to match its designated spindle. It was also explained that lathe bed castings are aged and then pass through the various machining operations which are sequenced and spaced timewise to avoid distortion.

Although not part of the Myford organisation, Abbco operate from one of their buildings. They are specialist tool

regrinders, supporting local engineering companies, and have a very comprehensive selection of tool and cutter grinders, and drill grinders. To completely regrind a $\frac{3}{8}$ inch endmill (end and flutes) would cost rather less than £4.00, making it substantially cheaper than replacement. Following the recent discussion involving Ray McMahon, the opportunity was taken to ask about the angle of dish on the end teeth. Interestingly, the answer was that

originally one degree was more or less the standard, however nowadays two degrees is common, and three or four not unknown. Abbco are at Wilmot Lane, Chilwell Rd, Beeston, Nottingham NG9 1ER phone/fax 0115 922 6060.

Later in the afternoon we arrived at Dick Stephen's workshop for a high speed tutorial on his latest CNC upgrades. He has agreed to write up the changes and we look forward to seeing the details in print soon.

8. Hand scraping a headstock bearing.



9. A batch of headstocks, awaiting the next assembly stage.



SCRIBE A LINE

Large scale quick fix Mr H Dawson of Dereham writes

Another bit of useless information has come to my mind. Some fifty-five years ago, I was employed at a colliery in the north east. The air compressor, a two stage double acting machine made by "Walkers" (Wigan), developed leaks around the cylinder cover joints, showing initially as little bubbles and which if left untreated would have got worse. Complete dismantling would have been a major operation.

But the leaks were sealed without stopping the compressor, by a man who hailed from Sunderland. He made up steel shoes lined with lead to bed down over the different leaky areas. The shoes were fitted with an "Injector" – a two inch AF hex bar, and strapped down with wire scaffold cords. The injector was loaded with a rubber compound, which was then forced into the leak by a three quarter whit bolt screwed into the end. The compound was left for a time to vulcanise, then the shoe and injector removed, cleaned, and then bedded on to the next leak. Thus all the leaks were sealed without stopping the compressor.

Confusion to the enemy – or ourselves John Brittain writes:

On checking the drawings contained in my article 'Dividing in the Super Seven' I notice that several alterations have been made to the dimensions layout, with a number of 'rules' being broken as a result. According to B.S. 308, where possible, all horizontal dimensions should be shown with the measurement ABOVE the dimension line and all vertical ones above the line when viewed by turning to the left. Whilst I accept that a certain latitude may be desirable in these matters when planning layout, sooner or later confusion will be introduced if the above rules are not observed..

By way of illustration, may I be permitted to tell the following tale:

During my National Service time the Army, I found that I was quite a fair hand with a Lee Enfield rifle and was therefore somewhat dismayed to find that, on one occasion, whilst firing at a range of six hundred yards I had managed to miss the target altogether. Checking the setting of the sights was the obvious answer but nothing appeared to be amiss. The next day was crucial since we were firing to gain our 'third star' and therefore a pay rise, so, in desperation, I pondered the

problem anew. One final check on the sights revealed the truth. Up to five hundred yards, the graduations were engraved ABOVE the numbers but, presumably because the scale was not linear, the number six hundred was engraved BELOW the graduation line. I had therefore inadvertently set my sights at SEVEN hundred yards. My subsequent score of four bulls and an inner ensured that I gained my third star and a pay rise of three and sixpence (18 p). Poor "Dimensioning" almost cost me that princely sum!

Still in business

Mr John Burrridge of Oxford writes:

After reading the article in MEW issue No 84 on the machining of a vertical swivelling slide, for which the castings were obtained from a Mr Ward about fifteen years ago, I can advise that Mr John Ward can still provide castings and finished components for many accessories. He also supplies replacement parts for many lathes and milling machines no longer made, parts such as long tee slotted cross slides, boring tables, plane and swivelling vertical slides, face plates, chuck back plates, lead screws, cross and compound feed screws and the acme nuts to go with them. In addition he also makes many gears in DP and Mod types in various pressure angles, together with a number of vices, rotary tables and angle plates.

He can make one offs at reasonable prices either from part supplied to be copied or from drawings.

The machines that he mostly makes for are Boxford, Raglan, Southbend, Atlas, and Halifax but can do things for many more. Ring him for a price list!

His Address is 27 Trent Row, Foulridge, Nr Colne, Lancashire, BB8 7QF
Tel No 01282-869262

Gas Firing

Mr D. W. Peddie of Woking writes:

In Issue No.85 Mr T H Burt from Rochford asked for advice on gas firing model boilers.

The best thing he can do in my view is to get in touch with Bruce Davey at Bruce Engineering, Hollow Tree, Penny Lane, off Walton Bridge Road, Shepperton, Middlesex, TW17 8NF; Tel. 01932 245529; Fax 01932 226738.

He will not only be able to give Mr Burt all the advice and guidance he will want, but also provide the systems, gear and equipment he will need.

Galling Avoidance Mr Gerhart Wagerer of Toronto, writes:

I bought issue 84 of MEW because of the informative article on the pros and cons of stainless steel. One technique I have seen used to avoid galling of screw threads is to silver plate the fastener or use a thin silverfoil between the threads.

Screwcutting stop and spline technique

Mr B. Campbell of Perth, Australia, writes:

Suggestion For An Article

I have been a reader of the Model Engineers Workshop magazine since the first issue and have enjoyed reading the various articles. I have made some of the items discussed for use in my own workshop.

One project that I have never seen is one about modifying a small lathe to give automatic stopping of the leadscrew though a dog clutch as Martin Cleeve described in his book "Screwcutting In The Lathe".

I am sure that others must have modified their lathes in a similar fashion and maybe one of them could be asked to prepare an article giving details of dimensions, how the headstock was drilled etc (preferably for a Myford lathe).

Also on the same subject of auto stopping the leadscrew I have noticed that the Round Bed Drummond lathe has what appears to be an adjustable auto stop but I have never read of any discussion as to how well it worked, whether it is only a feed stop or if it can be used for screwcutting. Maybe this is food for another article.

Cutting Keyways And Splines

As I was writing I thought that other readers might be interested in a method of cutting long key ways and splines which I have not seen described. I devised this method while working in a workshop having only a lathe. I have also used the method for tap fluting.

My method is to centre one end of the work and reduce the diameter for a short length on the other end, then put a live centre in the lathe spindle and grip the reduced end in a drill chuck in the tailstock. Finally, using overhead gear or other means driving a milling spindle on the

saddle, the lathe may be started, and the leadscrew or auto feed engaged to give a uniform and effortless feed. The live centre then allows the main spindle to rotate while the workpiece is held stationary by the tailstock drill chuck.

For splines or multiple key ways a short length of square, hexagon or other shaped metal can be attached to any clear part of the job and, after loosening the drill chuck, the job can be rotated using a level or try square against each flat in turn to achieve the number of divisions required. Interestingly, the square or hexagon does not need to be concentric with the shaft and this means that one plate can be used with many different sizes of shafts. A travelling steady may also be used to give a uniform depth of cut.

Peter Rawlinson described an auto stop modification for a Taiwanese lathe in issue 74. If any reader wishes to contribute an article on modifying a Myford then please get in touch.— Editor.

Caveat Factotum

Mr M. Kingham of Sunbury on Thames writes:

I have been an appreciative reader of MEW for many years now, and one of the aspects I value is the publication of 'down to earth' practical tips to help survive a day in the workshop'. Although I have my own workshop - which is now more of a repository for things which will undoubtedly be useful sometime in the future, I am currently engaged in beating 'nine bells' out of the machine tools in a local evening institute. During the daylight hours these machine tools are engaged in inculcating the delicate and precise skills of sensitive engineering techniques in young persons, thirsting for careers in engineering, - or so it is thought.

As a consequence it is essential that we unsuspecting 'oldies' of the night shift check every conceivable aspect of the machines before use, which can absorb a considerable amount of our limited time at the institute. The tip that I offer here may already be known, but I have never seen it in print so it may be of some use "out there".

The problem is that of a milling machine vice that has mischievously been set, and bolted down, ever so slightly out of square with the machine ways. My technique to thwart this little prank is to select a machined angle plate, large enough to allow one web to be gripped in the machine vice and the other web to overhang the inside table edge, projecting horizontally towards the milling machine's column. Now just slacken the fixing bolts so that the vice can be just slid on the milling machine table and advance the table so that the edge of the projecting web abuts against the flat machined surface of the column and then gently settle the vice with the plate fully contacting the column, tighten the fixing bolts and hey presto! The vice jaws should now be parallel to the column and with luck, perpendicular to the horizontal axis of the machine. To set the vice jaws parallel to the horizontal axis, merely hold one web of the angle plate, this time with the aris vertical, and repeat the performance.

This I find to be much quicker and easier than fighting the 'evening institute' dial gauge and its stand with the unsecurable knuckle joints. Why are they always missing the spring washer? And why are the spigots are always loose in the clamping boss? ...which always leaves a little 'rock' no matter how murderously tight the clamping screw is applied.

Hoping that this quick and dirty solution will find some acceptance, even in the best regulated workshops. Of course the purists with impeccable measuring gear will no doubt wish to just check this procedure to the odd millionth or so, and no doubt find it wanting. But when faced with an evening session of short duration and a need to achieve something in that time, this may help save a few precious minutes.

I include a few other tips for users of communal machines. The daytime scholars love to set the all the emergency OFF pushbuttons, and to leave the lathes set on the highest speeds, the suds pump tap fully open and pointing skywards, so after having operated all the various switches and contactors, 'sussed out' the emergency stop, finally switching the machine on, we are presented with a terrifying acceleration of the spindle and chuck, whilst spraying the ceiling with cutting oil. In addition to the vice problem mentioned above, the milling machine spindle rotations may be left in the wrong direction for the cutters. There is nothing more tempting than to find a machine with a suitable cutter, the vice already in position, just ready to go! Beware.

Harold Hall writes:

Reading (issue 85 page 50) Raymond McMahon's follow up to his cutter grinder series, I was interested in his comments regarding sharpening end mills / slot drills

with their cutting edges at 90 degrees to their axis. As I see the situation, all values inherent in manufacture, be they electrical or mechanical, have permitted levels of deviation (tolerance). In mechanical engineering these will be predominantly values of length, diameter and angle. The smaller the tolerance, the more difficult and costly the manufacture. For this reason, even the most precise item has a permitted tolerance.

You may ask, where is this getting us with respect to the cutting edges on an end mill. Well, if an angle of 90 degrees is the nominal value, some deviation will be permitted that may produce either hollow, to use Raymond's terminology, or mound end form. I prefer the terms concave and convex.

If the cutter becomes convex then the cutter will be called upon to take extremely fine shaving type cuts on its end cutting edges. Whilst this may just be possible whilst the cutter still has razor sharp edges it will not be possible once this edge has been lost, which will soon happen, and the resulting finish will suffer badly. Even with the cutting edges exactly at 90 degrees a similar situation will surely result if the machine spindle is not exactly 90 degrees to the table movement, (another permitted deviation)

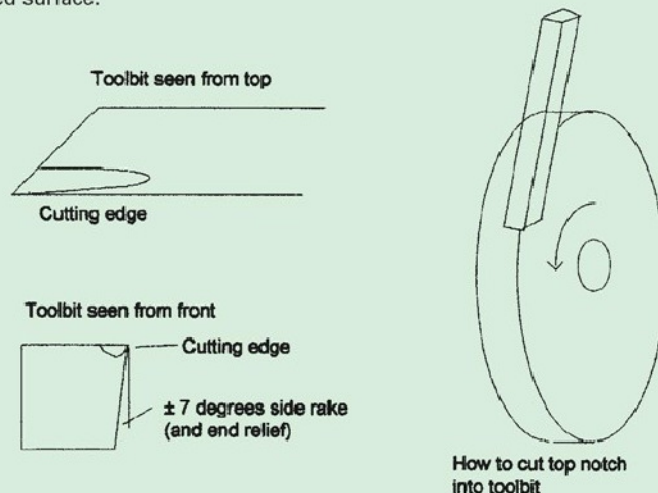
For these reasons my impression is that the end cutting edges should be ground slightly concave, say by 1 degree, to avoid these situations developing. Checking my end mills / slot drills, all practically new but from various manufacturers, shows that they all have concave ends. A dovetail cutter is similarly ground. Being an electrical engineer my experience of mechanics in industry is limited so I cannot be adamant, perhaps some more experienced reader can either confirm or contradict my understanding of the situation. However, in the home workshop where precision cannot easily match that

Tool and cutter grinding

Mr W Vogelbein of Kempton Park, South Africa, writes:

In issue 83, Ted Wale mentioned difficulties turning a large disc defect free. I had the same problem using the rules for grinding toolbits set out in the South Bend Works little booklet "How to Run Your Lathe". The following was suggested to me by a Master Toolmaker and it worked like a dream.

Its key feature is a small notch cut into the top side of the tool bit, next to the cutting edge. Side rake and end relief are about 7 degrees, as usual, all other angles are arbitrary. A small rounded nose is allowed and does improve the smoothness of the turned surface.



of industry, surely end mills and the like should be ground concave.

Explosive remedy

Mr Paul C. Dickie writes:

In Scribe a Line - Issue 85 there is a letter from Mr H. Dawson. In his final paragraph, he stated that as a form of first aid in one workplace, "burns were treated with picric

acid". At first I found this incredible given that 2,4,6 trinitrophenol, the systematic name for picric acid, is also known as Lyddite, and it was under that name that it was used in artillery shells in the Great War as a contact explosive. However, further research in "Explosives" by John Read, published by Penguin in 1942 showed that indeed picric acid was used as an explosive, a dye, and as a remedy for burns.

Perhaps other readers have memories of "Dastardly concoctions" used for medical or other purposes. For more information on picric acid, the following web sites may be of interest:

<http://tinyurl.com/lyda>

<http://tinyurl.com/lydc>

<http://tinyurl.com/lydd>

Belt changing aid

Philip Amos writes:

In MEW issue 85 Mike Houghton describes his acquisition of a new lathe and comments on its features. In particular he mentions his struggle with belt changing. My Taiwanese lathe is an earlier model of generally similar design which I purchased in 1983. It shares some features and I experienced similar inhibition at belt changing in the early days. However I made a "belt changing strap" from woven cotton webbing 25 mm wide and 1.5 mm thick by sewing the ends into loops see photo 1. Each end loop is 120 mm long; there is a 40 mm sewn length and about 100 mm in the middle - total material length about 750 mm.

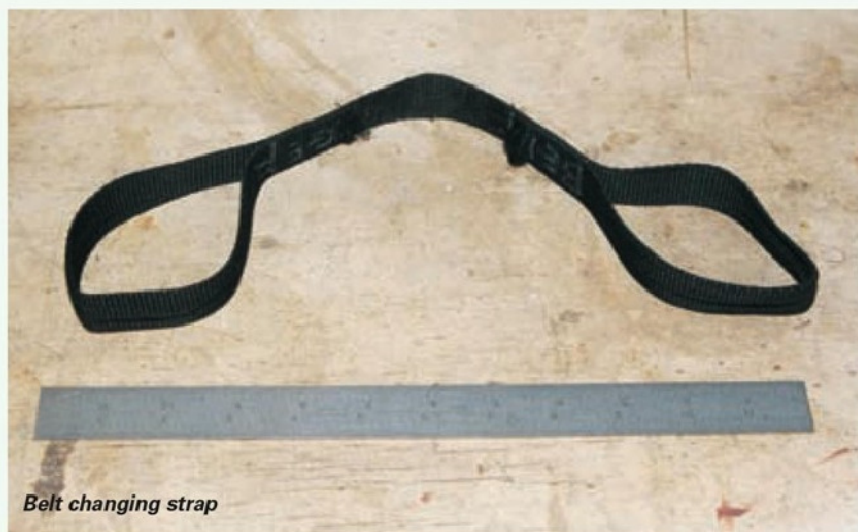
In use the belt tension is reduced by means of the lever (behind the chuck), then the strap is threaded around the lower (rear) part of the belt and both end loops are placed over the left hand. See photo 2. This hand can now exert sideways pull on the belt while the right hand rotates the upper pulley (and belt) over towards the rear. This feeds the strap (and belt) forwards around the lower pulley, and in fact off that pulley on to its adjacent smaller one. The strap is removed and the belt is fed on to the larger upper pulley while still turning with the right hand. The full belt tension is then restored with the lever. This whole procedure takes only seconds to complete.

To move the belt the other way the strap is not needed. After reducing belt tension the belt can readily be fed from the upper large pulley to its smaller neighbour. Following this the belt can be fairly easily induced to climb on the larger lower pulley. The full tension is then restored with the lever.

For the 3 stepped intermediate pulleys, once the belt tension is reduced (same lever) the belt can easily be moved provided one always first moves the end which goes from a larger pulley to a smaller one.

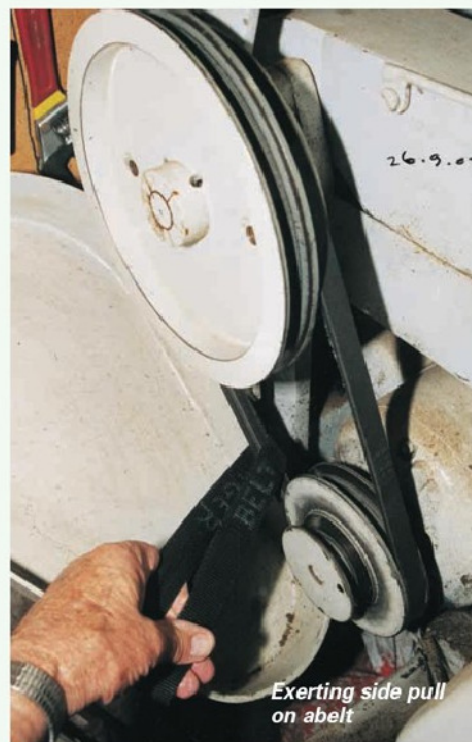
I have had good service from my lathe, but there are some points which might be helpful for prospective purchasers to consider.

1. My machine is a long bed (36" between centres) - in my view the longer the better within reason. However it is not a gap bed and I have found this a limitation on some occasions.
2. It has a screw on chuck - a camlock arrangement is safer and also allows reverse turning.



Belt changing strap

3. Tailstock is 2 MT - if 3 MT would provide more positive retention of drill chuck when using large drills.
4. Calibration is metric only - I favour this rather than dual (inch/metric) calibration which I feel can easily lead to error.
5. It has an 8 tpi leadscrew. This allows the use of a threading dial when cutting imperial threads; and with a 127 tooth change gear exact metric threading. Of course you can't use the threading dial for metric - but then you can't use it with a metric lead screw anyway.
6. To achieve some metric threads you need a change wheel with teeth a multiple of 7 (not provided in my original outfit). I therefore fly cut a 35 tooth gear which works fine.
7. On drill/mills the vertical feed rack and pinion are based on circular pitch (inch or metric) which yields an exact linear movement for a given rotation; but on my lathe the saddle drive rack is module pitch. Furthermore one revolution of the saddle handwheel moves the saddle 14.5 mm (almost); it is calibrated 145 divisions but that is not really convenient. Also because of Pi there is progressive error as one traverses along the bed. There is no room to fit a calibrated handwheel on the end of the leadscrew, so this error just has to be known, accepted or allowed for.
8. As extras I purchased a vertical slide (called a milling attachment), a taper turning attachment and a suds pump. The former is rather large and clumsy but does the job; the taper turning arrangement works well; and the suds pump is satisfactory.



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.:1ft. scale and over.
- B2 Working steam locomotives under 1in.:1ft. 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 1ft. scale) and under.
- B6 Kitbuilt model locomotives gauge 1 (10mm 1ft. scale) and under.
- B7 Scratchbuilt rolling stock, gauge 1 (10mm 1ft. scale) and under.
- B8 Kitbuilt rolling stock, gauge 1 (10mm 1ft. scale) and under.
- B9 Passenger or goods rolling stock, 1in.:1ft. scale and over.
- B10 Passenger or goods rolling stock, under 1in.:1ft. 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, 8in 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.

Model Horse Drawn Vehicle Section

- G1 Carriages and 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 medal.

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 Highbury Nexus Special Interests Ltd.
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 Highbury Nexus Special Interests Ltd, in his/her possession until required for renovation and display at the following Model Engineer Exhibition.
4. Any item 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 Highbury 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. Highbury Nexus Special Interests Ltd. may at their sole discretion vary the conditions of entry without notice.

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 Highbury Nexus Special Interests Ltd.
5. A junior shall mean a person under 18 years of age on 31 December in the year of entry.
6. Past Gold and Silver medal award winners at any of the exhibitions promoted by Highbury 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 Highbury Nexus Special Interests Ltd. will not be eligible for re-entry into the competition unless it has been substantially altered in any way.

7. Highbury 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.

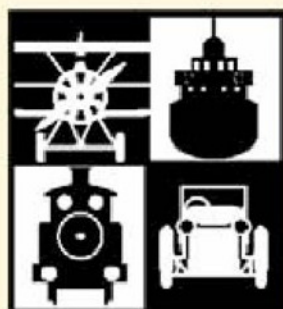
9. The judges' decision is final. All awards are at the discretion of the judges and no correspondence regarding the awards will be entered into.
10. Exhibitors must present their model receipt for all models collected at the end of the exhibition and sign as retrieved.
11. The signed release for each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

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.

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

CLOSING DATE 16TH DECEMBER 2002



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? Yes/No Do you purchase or subscribe to a Highbury Nexus magazine? Yes/No

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) £

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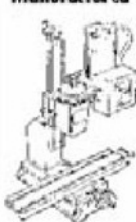
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H1	1/4 x 1/4 x 1/16 - 5/16 x 5/16 x 1/16	
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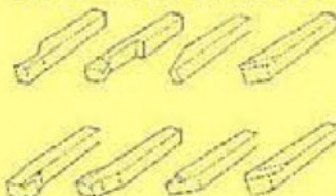
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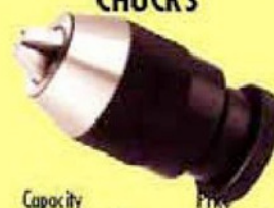
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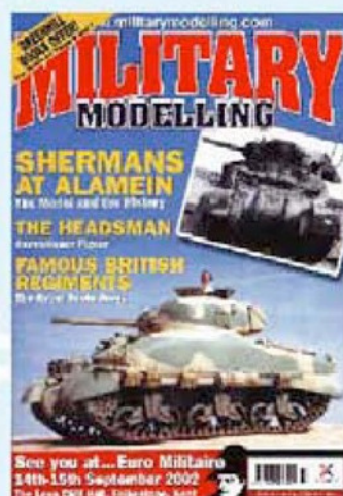
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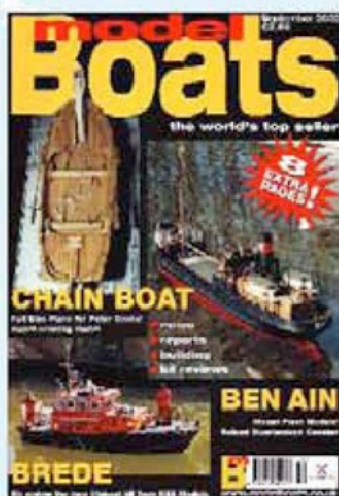
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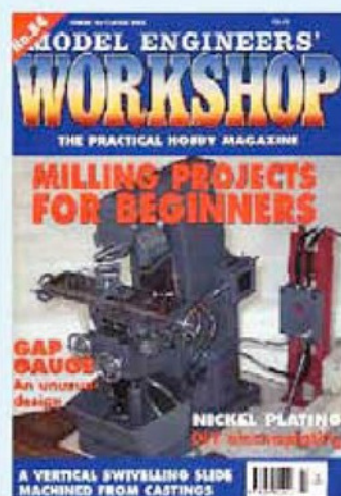
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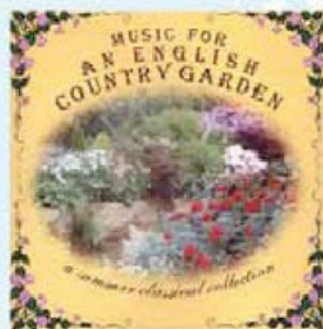
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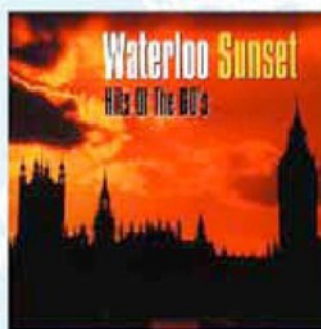
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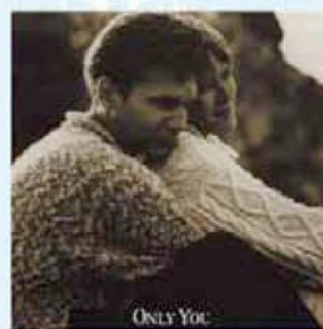
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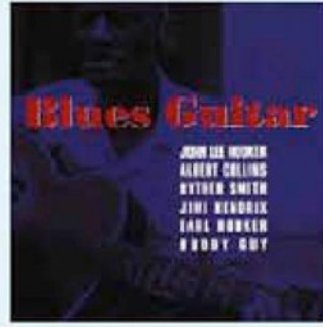
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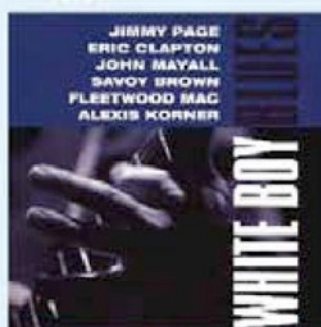
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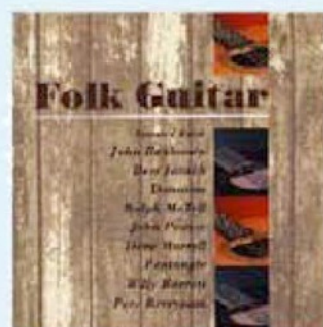
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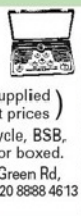
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The proprietor - Richard Brown - is himself an accomplished engineer with his own separate workshop containing a variety of machine tools and fabrication equipment. Like many of his customers much of his own time is spent on projects requiring the skill to turn, mill, weld and fabricate.

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Metal priced per 300mm/11.8" length, larger sizes are priced by the 150mm, 75mm and 25mm.

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3/4"	Rnd	£1.34	£3.35	£1.97	£5.04	1/6" x 1"	£0.46	1/8" x 5/8"	£0.31	3/16" x 5/8"	£0.44	1/4" x 5/8"	£0.61
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1/4"	Hex	£0.28	£0.46	£1.00	£1.38			1/8" x 1"	£0.53	3/16" x 1"	£0.65	1/4" x 1"	£0.94
1/2"	Hex	£0.68	£1.58	£1.50	£2.60								
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1/4"	Sqre	£0.28	£0.79	£0.50	£1.55	cap head 1/4"BSFx1/2" 30p 1/4"BSFx3/4" 30p 1/4"BSFx1" 32p							
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3/4"	Sqre	£1.77	£5.12	£2.65	£5.86	grub/set M3x3mm 8p M4x4mm 7p M5x5mm 8p M6x6mm 8p							
1.0"	Sqre	£3.18	£10.31	£4.95	£8.32								

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- SWING OVER BED: 229MM
- SWING OVER CROSS SLIDE: 133MM
- DISTANCE BETWEEN CENTERS: 500MM
- SPINDLE BORE: 19MM
- TAPER IN SPINDLE NOSE: MT3
- MOTOR: 1/4HP
- 6 SPEED: 100-1800RPM
- NET WEIGHT: 100KG

STANDARD EQUIPMENT:

- 4" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 7" 4-JAW CHUCK WITH REVERSIBLE JAWS
- STEADY REST • FOLLOW REST
- MT2 DEAD CENTRE
- MT3 DEAD CENTRE
- 4-WAY TOOL POST
- FACE PLATE
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£699

Price includes VAT & Delivery*

Model B-Super

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 500MM
- MILL DRILL SPINDLE TAPER: 19MM
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 60-1300RPM
- SWING OVER CROSS SLIDE: 160MM
- SPINDLE TAPER: MT3

- DRAW BAR: M12
- CROSS SLIDE TRAVEL: 180MM
- MOTOR: 1/4HP
- NET WEIGHT: 155KG

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



£725

Price includes VAT & Delivery*

Centurion

- SWING OVER BED: 420MM
- DISTANCE BETWEEN CENTERS: 520MM
- MILL DRILL SPINDLE TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 80MM
- 7 SPEEDS 160-1360RPM
- SWING OVER SADDLE: 160MM
- SPINDLE TAPER: MT3

- DRAW BAR: M12
- CROSS SLIDE TRAVEL: 200MM
- MOTOR: 2 x 1/4HP
- NET WEIGHT: 230KG

STANDARD EQUIPMENT

- 4" 3-JAW CHUCK
- 2 DEAD CENTERS
- 1/2 DRILL CHUCK
- CHANGE GEARS
- MT3 CHUCK ARBOR



£1100

Price includes VAT & Delivery*

Champion Mill

- DRILLING CAPACITY: 20mm • END MILL CAPACITY: 25mm
- FACE MILL CAPACITY: 63mm • TABLE SIZE: 150x630mm
- NUMBER OF SPEEDS: 4 • SPEED RANGE: 400-1640RPM
- SPINDLE TAPER: MT3 • TILTING HEAD: 90° Left & Right
- MOTOR: 1/4HP

From

£585

Price includes VAT & Delivery*



Eagle 25 Mill/Drill

- MILL/DRILL CAPACITY: 25MM
- TABLE SIZE: 190 x 585MM
- FINE FEED
- NUMBER OF SPEEDS: 12
- SPEED RANGE: 100-2150RPM
- SPINDLE TAPER: MT3

- SPINDLE TRAVEL: 100MM
- MOTOR: 1HP

Price

£699

Price includes VAT & Delivery*



STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- T3 TILTING VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

Eagle 30 Mill/Drill

- MILL/DRILL CAPACITY: 32MM
- TABLE SIZE: 210 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 10
- SPEED RANGE: 80-2300RPM
- SPINDLE TAPER: MT3
- SPINDLE TRAVEL: 130MM
- TILTING HEAD

- MOTOR: 1HP
- HIGH/LOW GEARBOX

Price

£899

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STANDARD ACCESSORIES

- 1-13MM DRILL CHUCK & MT3 DRILL CHUCK ARBOR
- EAGLE FACE MILL CUTTER
- V100 MACHINE VICE
- M12 DRAWBAR
- NVR SWITCH GEAR
- INTERLOCKED CHUCK GUARD
- MANUAL AND PARTS LIST

626 Turret Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE: 152 x 740MM
- FINE FEED
- NUMBER OF SPEEDS: 9
- SPEED RANGE: 190-2100RPM
- SPINDLE TAPER: MT3 OR R8
- TILTING HEAD
- MOTOR: 1 1/2HP

Price

£1340

Price includes VAT & Delivery*

STANDARD ACCESSORIES

- ONE SHOT LUBRICATION
- HALOGEN WORK LIGHT
- MACHINE STAND
- DRAWBAR
- MANUAL AND PARTS LIST



Craftsman Gap Bed Lathe

- SWING OVER BED: 300MM
- SWING OVER GAP: 450MM
- SWING OVER SADDLE: 170MM
- DISTANCE BETWEEN CENTERS: 570MM
- SPINDLE BORE: 36MM
- SPINDLE NOSE TAPER: MT5
- CROSS SLIDE TRAVEL: 150MM
- COMPOUND TRAVEL: 89MM
- TAILSTOCK BARREL TAPER: MT3
- TAILSTOCK BARREL TRAVEL: 92MM
- RANGE OF SPEEDS: 50-1250RPM
- MOTOR: 1 1/2 HP
- NET WEIGHT: 398KG

STANDARD EQUIPMENT:

- 6" 3-JAW CHUCK WITH 2 SETS OF JAWS
- 8" 4-JAW CHUCK
- STEADY REST
- FOLLOW REST
- STAND
- FACE PLATE
- SPLASH GUARD
- THREADING DIAL
- 4-WAY TURRET TOOL POST
- 3MT DEAD CENTERS
- T-SLOTTED CROSS SLIDE
- HALOGEN WORK LIGHT

£1550

Price includes VAT & Delivery*



Super LUX Mill

- MILLING CAPACITY: 25MM
- DRILLING CAPACITY: 32MM
- TABLE SIZE: 240 x 800MM
- FINE FEED
- NUMBER OF SPEEDS: 6
- SPEED RANGE: 95-1600RPM
- SPINDLE TAPER: MT3
- TILTING HEAD
- MOTOR: 1 1/2HP

Price

£1500

Price includes VAT & Delivery*

STANDARD FEATURES

- POWERED HEAD ELEVATION
- CAST IRON STAND
- ANGLE TILTING HEAD
- MANUAL AND PARTS LIST



