

No.51

MODEL ENGINEERS'

WORKSHOP

THE PRACTICAL HOBBY MAGAZINE

A YORKSHIRE ODYSSEY

Harrogate and
Primrose Valley
reports

RIGHT ANGLE DRIVE

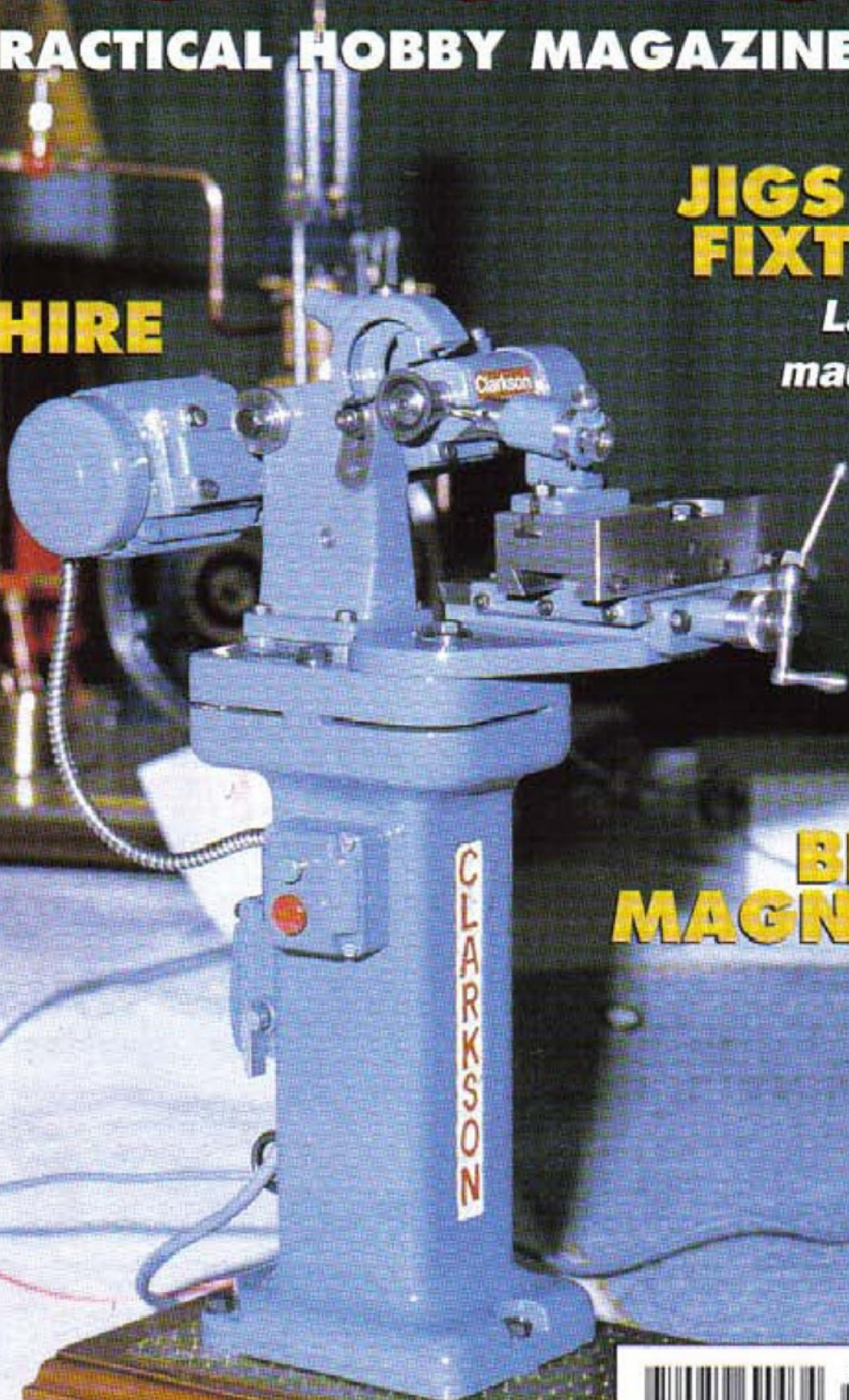
Horizontal
capability
for a
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JIGS AND FIXTURES

Lathework
made easier

BENCH MAGNIFIER

Work
Viewing
Aid



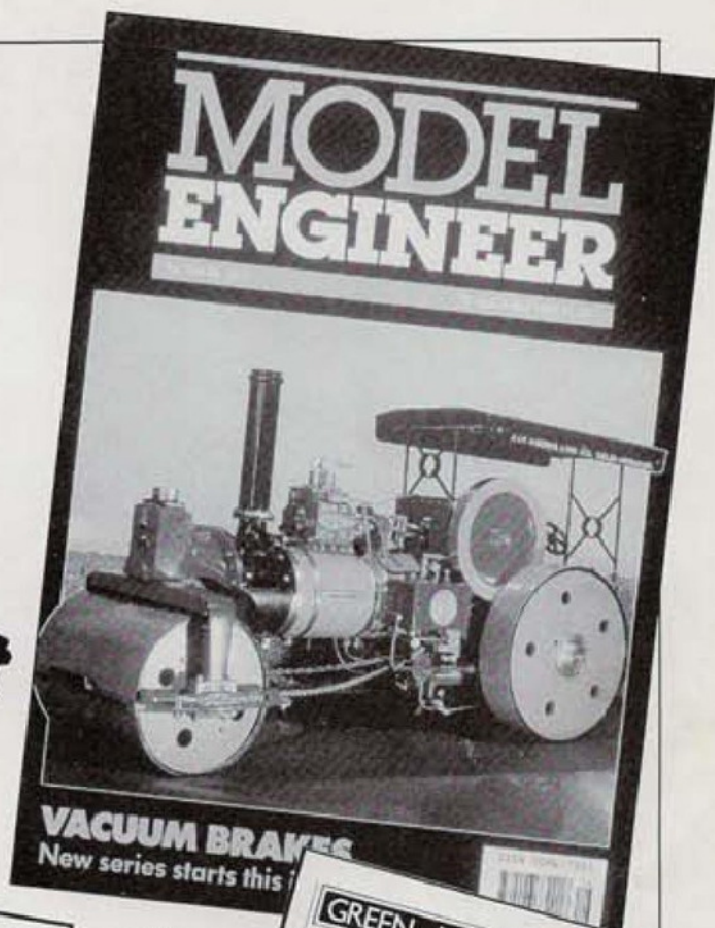
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SOMETHING TO LOOK FORWARD TO...

...every fortnight



There's something to anticipate twice every month in fascinating Model Engineer magazine! Whether your interests lie in live steam locomotive models, traction engines, internal combustion motors or stationary engines, world famous M.E. will inspire, instruct, advise and encourage. Model Engineer is published on the first and third Fridays each month and costs just £1.40 from all good newsagents; alternatively, you may care to ensure your regular copies through an annual subscription - a mere £33.60 for UK readers (overseas rates and airmail details on request).

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Editor: Geoff Sheppard

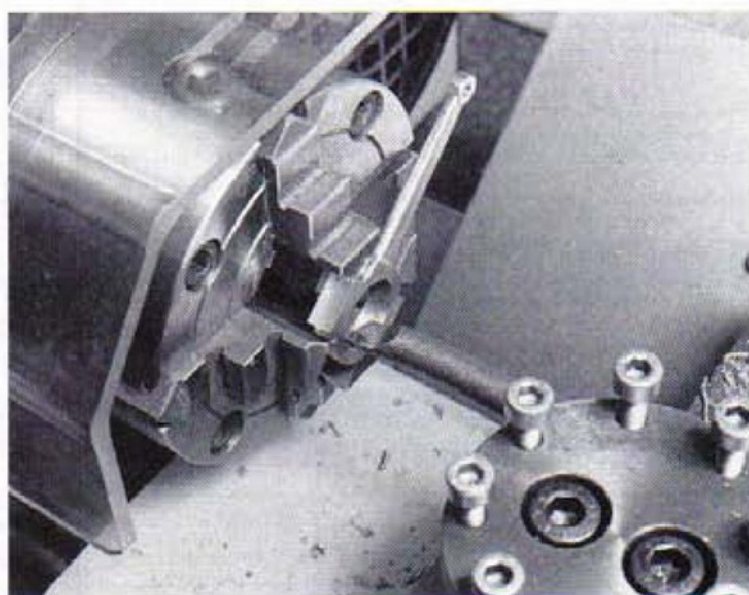
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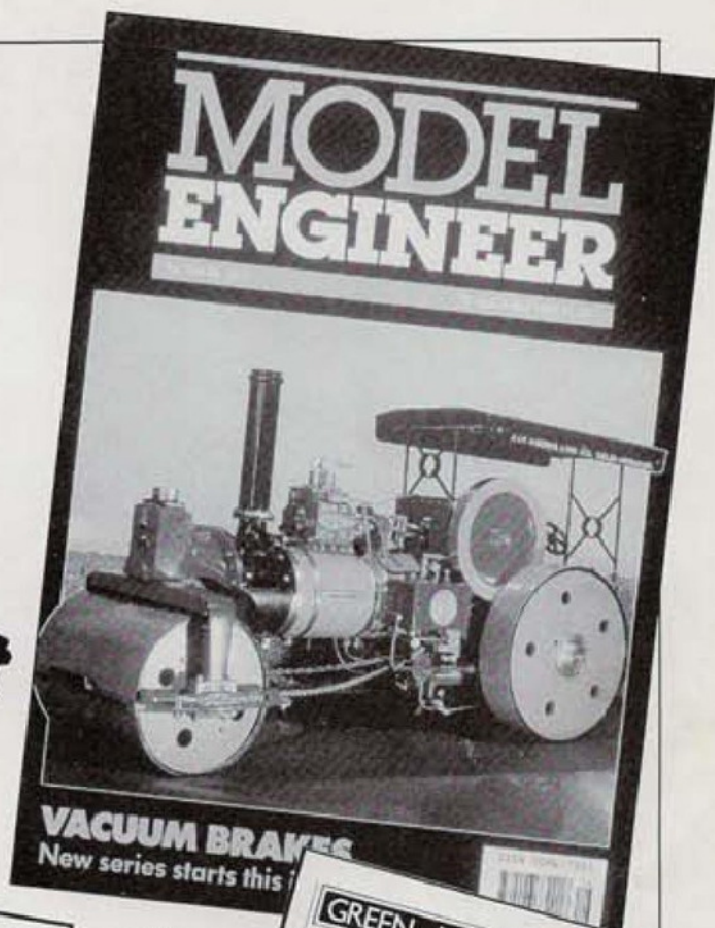
On the cover

Barry Jordan's
miniature Clarkson
tool and cutter
grinder made its first
appearance at the
Harrogate
exhibition.
More pictures on
pages 23 and 24.
(Cover photo by
Mike Chrisp)



The eccentric strap and rod for a small steam engine being bored while held in a four jaw chuck. This and other components for the engine are used to illustrate how simple home-made jigs and fixtures can help to facilitate machining, in an article by Harold Hall, starting on page 28.

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ON THE EDITOR'S BENCH

T. D. WALSHAW DLC
(Eng.), BSc., F.I.Mech.E.,
F.I.Prod.E., M.I.C.E
1912 - 1998

Ivan Law writes:

The passing of Tom Walshaw on 2nd. May brought to an end a very special and influential era in the annals of the model engineering movement. During the last forty years or so, three men stood out and dominated the field of model engineering.

They were G. H. Thomas, Professor D.H. Chaddock and Tom Walshaw, the latter known to many as Tubal Cain, this being his pen name for many of his vast output of articles and books.

Over the years, the annual Model Engineer Exhibition has not only been a gathering of models, it has provided an opportunity for people of like minds to meet. For many years at the exhibition, the three could be seen on the SMEE stand, each with an admiring crowd listening with interest to their words of wisdom.

Although they were busy during exhibition hours, the evenings provided an opportunity for a social gathering, and the three icons would each occupy a corner of the hotel bar and discuss until the early hours various aspects not only of model engineering, but engineering in general. Those of us fortunate enough to call these people our friends would usually join in the gathering, but in the main we played the part of fascinated listeners.

Tom was small in stature but a tower of knowledge, and his input to these late night discussions was considerable. What added spice to the discussions was that Tom and George did not always see eye-to-eye on some topics, and this brought out the best in both men.

Well-known celebrities are often called on for advice from a very wide following and each spent some considerable time satisfying these demands. With the passing of George Thomas and then Dennis Chaddock, much of their 'consulting' passed to Tom, which considerably increased his work load.

When a topic arose which Tom considered important, he always dealt with it at length and in great depth and, where possible, proved his conclusion by fact. He usually duplicated these papers which he circulated to parties whom he thought may be interested and benefit from his findings.

How he managed this level of correspondence and to still write two or three books a year I cannot imagine because he still designed models, prepared the drawings and descriptive articles, built the models and had a new exhibit at almost every M.E. Exhibition. He was the last and certainly the most prolific of the 'great' men, hence my comment about his passing marking the end of an era.

Mr. T. D. Walshaw was born in 1912 into a family whose connection with the iron and steel industry went back several generations.

He studied at what is now Loughborough University, graduating in mechanical engineering and where he obtained a Bachelor of Science degree. He started work in 1934 at the National Gas and Oil Engine Co. Ltd., first in the erection and testing department from which he progressed through the design office until he was eventually put in charge of the Research and Development Department, finally becoming Head of Design. He was responsible for designing several pumping stations, power stations and even a rail-borne power plant. While with this company, he undertook the development of the high compression spark ignition gas engine.

In 1943, at the request of the Ministry, he went back to Loughborough to teach Engineering Design and Thermodynamics and where, after the war ended, he was appointed senior lecturer in Mechanical Engineering. In 1948 he moved to the University of Liverpool, doing similar work but also researching into radio-active isotopes. In 1952 he was appointed Head of Department of Mechanical, Civil and Electrical Engineering at Darlington College of Technology, where he designed a number of advanced pieces of laboratory equipment, some of which are still in production.

His last full-time occupation commenced in 1961 as Head of Mechanical, Production and Civil Engineering at what is now the Lancashire Polytechnic. Here he introduced an unusual course of Industrial Design in which the engineering departments integrated with the School of Art to allow students to follow a disciplined study of engineering with exposure to the art of shape and colour in order to acquire an understanding of aesthetics and proportion. During his time at the Lancashire Poly he was responsible for increasing technical staff from eight to 71!

His interest in model engineering started in 1936; however, this interest lay

in parallel with another one, amateur radio. He built his first transmitter in 1930. Initially, he constructed model railway items in 'HO' size, writing articles in the appropriate magazines of the day. When he changed his small Adept lathe for a 4in. centre lathe and later for one of the first Myford ML7 lathes, he turned to larger scale locomotives and also to a traction engine with which he gained his first Exhibition award in 1949.

Also in 1949 he moved his place of residence to Westmoreland and although he had 2 1/2 acres of land, as he put it "it stood on end" and so his interest in locomotives ceased and he turned his attention to stationary engines, for which he will be mainly remembered.

He started writing for Model Engineer on a regular basis in 1971, and since then he has written over 200 articles, many of them construction serials. In these serials were drawings and descriptions of some 16 stationary engines, mostly drawn from the age of elegance. These designs demonstrate his exceptional sense of proportion, which is an essential for all model engineering designers.

He won many awards at the annual Model Engineer Exhibitions, including one Gold Medal for a very unusual model of the Davey Domestic Motor.

His first book on model engineering topics appeared in 1981 and since then this has been followed by about 16 more, all of which illustrates what a wealth of information he possessed. His Model Engineer's Handbook has become the standard reference manual in most model engineer's workshops.

When I was approached to write this tribute to Tom (he always preferred to be called 'Tom' rather than 'Mr. Walshaw') I knew that I would have trouble, not in finding things to include, but what from his list of attributes to leave out, and this has certainly been the case.

It is often said on the passing of a well-known person that "his like will not be seen again". This phrase is over-used, sometimes to the point of being meaningless, but in Tom's case I can say with all sincerity that it is appropriate. The movement has lost a great mentor, and to a privileged few, a great friend.

The Editor comments:

In recent years, I have been privileged to be able to join those after-Exhibition gatherings, having greeted a few New Years in Tom's company. Since taking over this chair, I have received a number of notes from him, commenting on some aspect of the content of M.E.W., often expanding on some point or, on the odd occasion, pointing out the error of my ways! Always in the latter case, though it was in a most courteous and constructive manner, never critical, for that was the nature of the man.

He was a true lateral thinker. One evening in a Thai restaurant which featured extremely loud background music, he used his knowledge of his own hearing deterioration to estimate the noise level, then to calculate how long it would be before the young waitresses would become deaf! No phenomenon ever avoided Tom's scrutiny for long.

Health and Safety and model engineering

Consternation has arisen in model engineering circles in recent weeks over the impact of the Health and Safety at Work etc. Act on our activities, mainly on the operation of miniature railways. I sense that the worries were generated from some confusion over the applicability of a new Guidance Note for fairground operators, our activities being over-seen by that section of the Health and Safety Executive which also covers amusement parks.

The situation is now being clarified, mainly as a result of sterling work carried out by two members of the Warrington Society, Barry Harrison and John Clifton, whose professional involvement with the HSE enabled them rapidly to make contact with the appropriate people. The HSE are anxious to set the record straight and to develop contacts with the model engineering fraternity, so that there is a clear understanding, on both sides, of how clubs and societies operate and how the Act could impinge on our activities.

As a first step, Barry and John have prepared a paper which has been agreed by Dr. Terry Williams, Head of Entertainment National Interest Group, HSE, Glasgow, entitled 'Health & Safety At Work Act: The Model Engineer's Perspective'. I do not propose to reproduce that paper here as I am aware that many of our readers have no interest in the operation of miniature railways. It is to be published in our sister journal, *Model Engineer*, appearing in two parts, the first being in issue No. 4070, which is due out on 19th June. Anyone interested in the topic should make sure of getting a copy.

The second step is the convening of a Seminar on the whole subject, to take place on Saturday 22nd August 1998 at the Trencherfield Mill, Wigan Pier. Hosted by the Northern Association of Model Engineering Societies, the programme which is now being finalised, is planned to include presentations by the Warrington Society representatives, the Health and Safety Executive and the Railway Inspectorate. The afternoon session will be devoted to open discussion.

Formal invitations have already been sent to the major Federations and Associations and the model engineering press, and individual clubs and societies are invited and encouraged to attend. Space limitations dictate that attendance will have to be limited to one representative per society, entry being by ticket only, allocated on a 'first come, first served' basis. Any organisation wishing to send a representative should write to Warrington & District Model Engineering Society, c/o B. J. Harrison, Alvanley Cottage, Alvanley Road, Helsby, Cheshire WA6 9QD.

Although the current concerns are associated with the operation of miniature railways, there are other areas where the HSWA could impinge

on the activities of our fraternity. Two which immediately spring to mind are the operation of club/society workshops and the carrying out of demonstrations, particularly those involving machinery, at our exhibitions. There is no point in trying to ignore the HSWA and pretend that it doesn't exist. It's there and it isn't going to go away. Better to understand how we could be affected and to make the appropriate provisions before a problem arises. Perhaps this is a second area for discussion once the immediate concerns have been resolved.

'SMEE100' The Centenary Exhibition

More details are now to hand regarding the exhibition to be held to celebrate the centenary of The Society of Model and Experimental Engineers. To be held at Brunel University, Uxbridge, London between 3rd and 6th September, it promises to be an unique event. Supported by another ten or so clubs and societies from around the country and also by the majority of the model engineering trade, it will feature 500 or more outstanding examples of model engineering from across the century. Many of these will be making a rare appearance outside private or closed collections and will include definitive examples of internal

combustion and hot air engines, locomotives and traction engines, clocks and other horological items and a display of an engineering apprentice's work history.

The names of exhibitors reads like a 'Who's Who' of the hobby, including Cherry Hill, Peter Dupen, Alf Case, Ron Jarvis, Gerry Tull and Ron Harris. A display board will show some of the late George Thomas' original workshop items and such renowned items as the late Tom Walshaw's 'Lady Stephanie' stationary engine and the late Bill Carter's 'Earl of Berkeley' locomotive will also be there.

Making a rare outing from The Institution of Mechanical Engineers' headquarters will be the Bradbury Winter silver Rocket, to be joined by another silver model, that of a 1902 James Browne 2-cylinder motor car.

Tickets are now on sale, and for those wishing to attend for an extended

period, accommodation is available on the campus, those staying being given a season pass.

Booking forms can be obtained from Resources Exhibitions Ltd., 2 Forge House, Summerleys Road, Princes Risborough, Bucks HP27 9DT and should be returned by 15 August.

Tools For Self Reliance

Do you have an anvil going spare, or any other tools for that matter? Trevor Jones of Withington, Manchester has asked me to pass on a plea from the charity Tools for Self Reliance for redundant hand tools which could possibly find a new lease of life in developing countries.

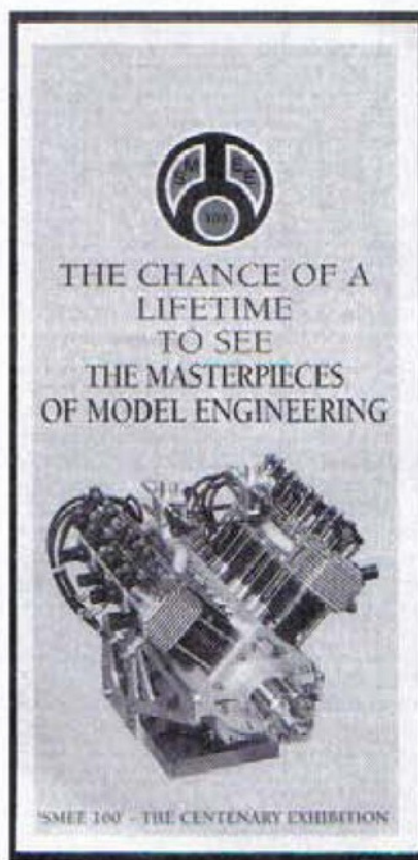
Many people in these countries possess traditional skills that can be passed on to others, but are handicapped by a shortage of simple hand tools. Groups of volunteers in the UK collect unwanted tools, clean and refurbish them and assemble them into kits for despatch to countries in Africa and Central America. Kits for carpenters, joiners, builders, fitters, blacksmiths, tinsmiths and like trades are despatched as needs are identified.

Apparently, the anvil is the single most valuable tool to be supplied, but

the most difficult to obtain. They can be purchased, but even at a discount they cost £100, so every redundant example donated represents a generous gift.

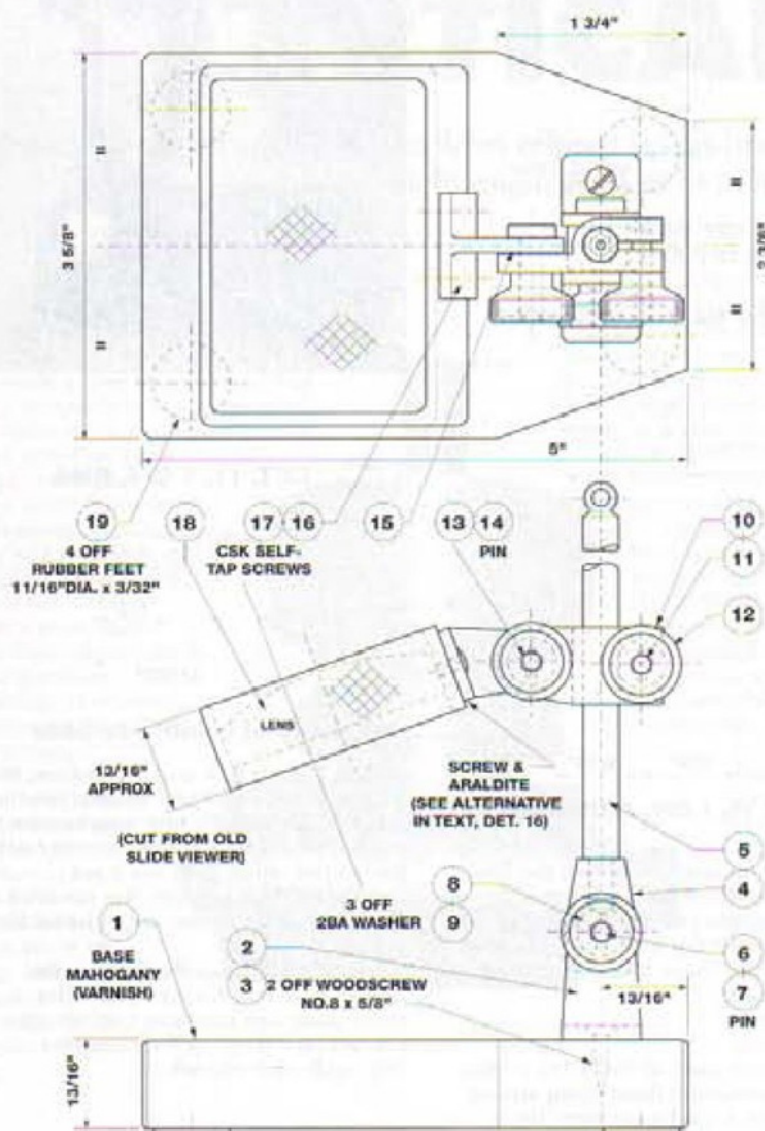
Look in that old chest in the shed and dig out grandfather's rusty tool kit for which you have never found a use, but which you just couldn't bear to throw in the skip. It could bring a real benefit to someone prepared to make an effort to help themselves if only they had some equipment. Even if there is nothing immediately to hand but you feel that you would like to give some assistance, there are groups based around the country, collecting, refurbishing and despatching. The average home workshop is ideally equipped to restore such items.

Tools For Self Reliance is based at Netley Marsh, Southampton SO40 7GY Tel. 01703 869697 Fax. 01703 868544. Trevor is on 0161 445 3734



A BENCH MAGNIFIER

Len Walker adapted the lens from an old slide viewer into a useful workshop instrument. Similar suitable lenses can often be found in local opticians or tool shops. Keep an eye open for one to adapt.



**BENCH MAGNIFIER
GENERAL ARRANGEMENT**

Having thought (for many moons), how useful a decent bench magnifier would be, I was spurred into action when I came across an old slide viewer in a charity shop. At 50p it seemed a bargain!

Bearing it home, I found that it yielded two high quality rectangular glass lenses. It must have been a first class viewer, as the larger lens, (approx. 3in. x 2in.) gave a large distortion free field, a distinct improvement on the 'bullseye' effect produced by round lenses. Careful work with a junior hacksaw separated the larger lens, complete with a moulded frame. I was in business.

I sketched a simple stand, allowing full adjustment in use, and also permitting the device to be folded flat for storage in a

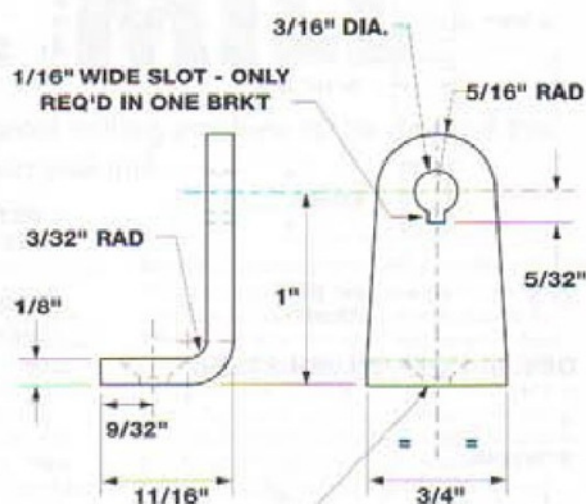
strong cardboard box.

An odd scrap of mahogany, with a lovely golden grain, was used for the base. What a joy to work with decent timber. No wonder Chippendale produced such works of art. After shaping and sanding, finally using 1200 grit paper, three coats of polyurethane varnish were applied, allowing each coat to dry thoroughly. Four rubber feet were cemented to the underside of the base as shown on the G. A. I use old car or van inner tubes for jobs like these. Four taps with a hollow punch and the job's done.

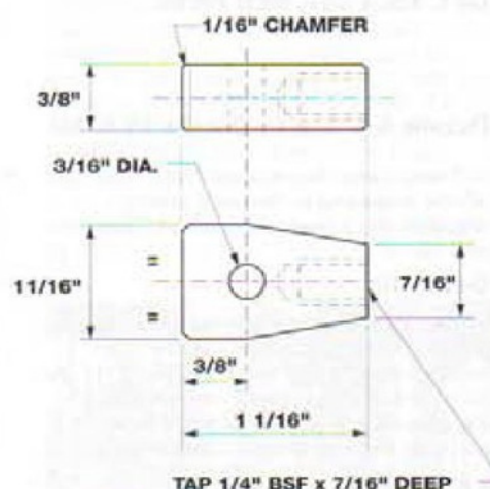
The details are simple to make, requiring little description.

Details 2

A $\frac{3}{32}$ in. radius formed on an odd



**DRILL 11/64" DIA., CSK 5/16" DIA.
DET. 2, 2 OFF, ALUMINIUM**



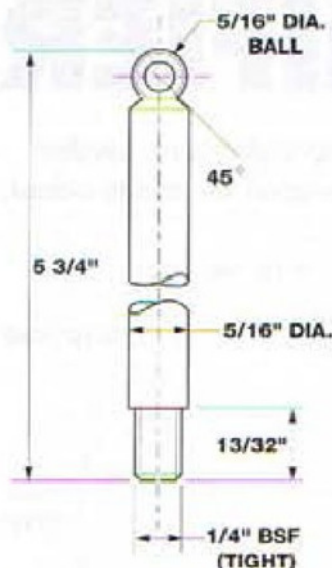
**TAP 1/4" BSF x 7/16" DEEP
DET. 4, 1 OFF BMS**

piece of 1in. x $\frac{1}{2}$ in. bright mild steel will provide a bending block for these two brackets. Drill the $\frac{3}{16}$ in. dia. holes as a 'matched pair'. Only one bracket needs the slot for the anti-rotation pin. Use filing buttons to ensure a neat $\frac{5}{16}$ in. radius.

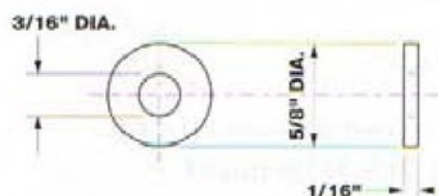
Detail 4

Use $\frac{3}{4}$ in. x $\frac{3}{8}$ in. bright mild steel. Hold in a 4-jaw lathe chuck, face, centre, then drill and tap as shown. Reverse in chuck and face to length. Mark off the position and drill the $\frac{3}{16}$ in. dia. hole. Mark off profile and mill (or file) to shape.

This method will produce a true thread, so that the column (Detail 5) will be vertical on assembly.



DET. 5, 1 OFF, SILVER STEEL



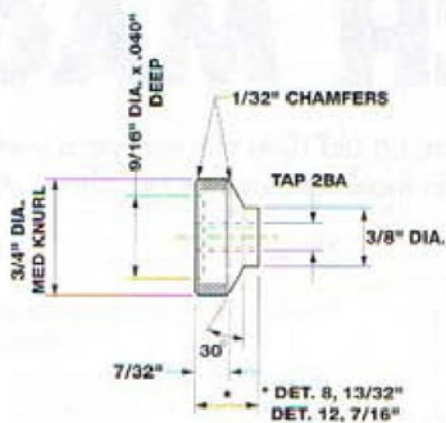
DET. 15, 1 OFF, RED FIBRE

Details 6 & 7 (also Details 13 & 14)

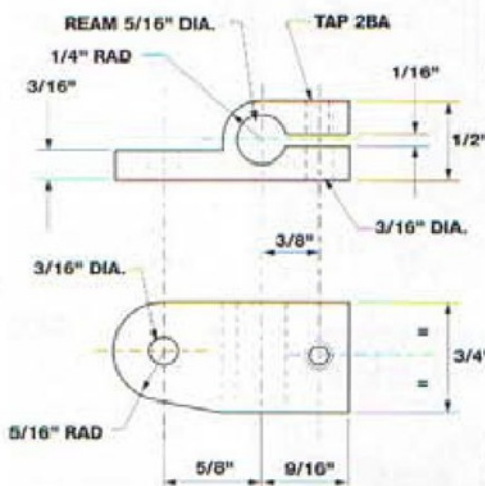
These items incorporate 1/16in. dia. pins which, engaging in Details 2 and 16 respectively, prevent rotation of Details 6 and 13.

Detail 10

Use 3/4in. x 1/2in. aluminium. Clamp the item to the lathe topslide, packed up to centre height to drill and ream the 0.312 dia. hole. This method gives better control of the process and should produce better accuracy than by using a small drilling



**DET. 8, 1 OFF BMS
DET. 12, 2 OFF BMS**



DET. 10, 1 OFF, ALUMINIUM

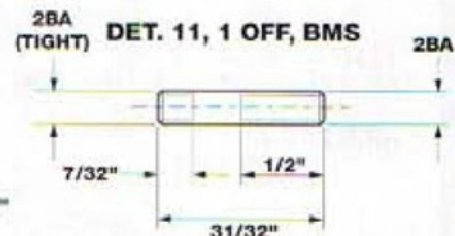
machine. Mill (or neatly hacksaw) the 1/16in. slot then mark off the profile and the position of the other holes. Drill and tap the 2 BA hole and drill the two 3/16in. dia. holes.

Mill or file the 3/16in. thick lug and the profile as shown.

Detail 16

I used an odd piece of 1in. x 1in. x 1/8in. tee section aluminium (been lying around for years!), but it can be cut from 1in. x 1in. stock or even built up from bright mild steel. You pay your money and take your choice.

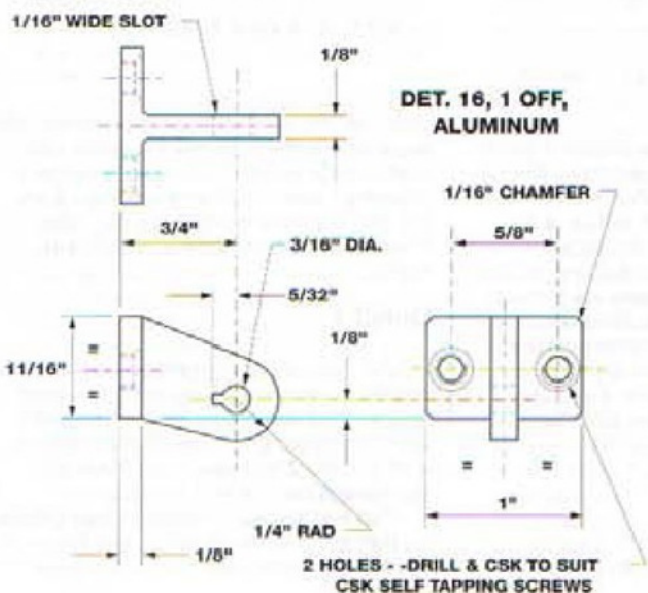
Note: I have shown this bracket screwed and 'Araldited' direct to the plastic frame around the lens. With hindsight (wonderful stuff!), an easier method would be to screw and 'Araldite' the bracket to a plastic 'pad' (say 3/4in. x 1/8in. x 1 1/4in. long), then cement the pad to the frame. This would avoid having to remove the lens, and should provide a stronger attachment.



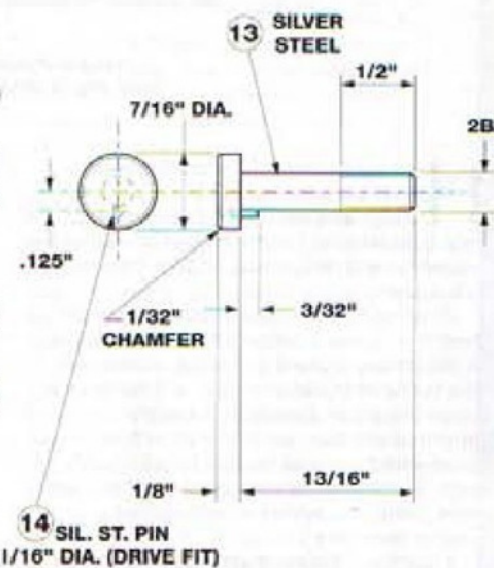
Assembly of column to base

Bolt Details 2, 4 and 5 together. Mark off the position of one woodscrew hole and drill to suit. Fit one woodscrew to the assembly. Move the column to the horizontal, align with the base centreline then transfer the position of the other woodscrew to the base. No sweat.

The finished magnifier looks quite professional and is a joy to use. The rectangular lens seems to brighten up everything offered up for inspection. Yes, - well worth the effort!



DET. 16, 1 OFF, ALUMINIUM



DETS. 13 & 14, 1 OFF EACH

A RIGHT ANGLE DRIVE UNIT FOR A VERTICAL MILL

Peter Rawlinson missed the facilities offered by his horizontal milling machine so he devised this right angle drive to fit to his vertical mill

I have been a modeller for some 45 years, but have only owned a lathe since 1971 when I was able, with the Wife's help, to purchase a new ML7 for a total of £112, complete with a number of accessories. This lathe held me in good stead for some years, milling being done either in the lathe or at work, on rather over size machines (the biggest having a bed some 8m long).

At a time when I was travelling regularly to Croydon on business, I found an auction catalogue for the closing down sale of a local firm. Listed in the catalogue was an old horizontal flat belt drive bench mill, which had a table some 18in. long. As I thought that this would be ideal for me, I duly

made a successful bid and purchased it for £15.00. It was subsequently modified, using a worm box and motor to provide the horizontal drive.

The configuration was quite good, so a vertical head was designed for fitment to the overarm mounting. This combination was used for a number of years, but the machine was very old and eventually a replacement was needed. In the end I purchased a Taiwanese mill/drill.

I missed the horizontal feature of the old mill, and decided that the only way out would be to make an adapter which would take the form of a right angle gearbox fitted with a No.2 Morse taper spindle incorporating a Myford lathe nose. It would have to have a

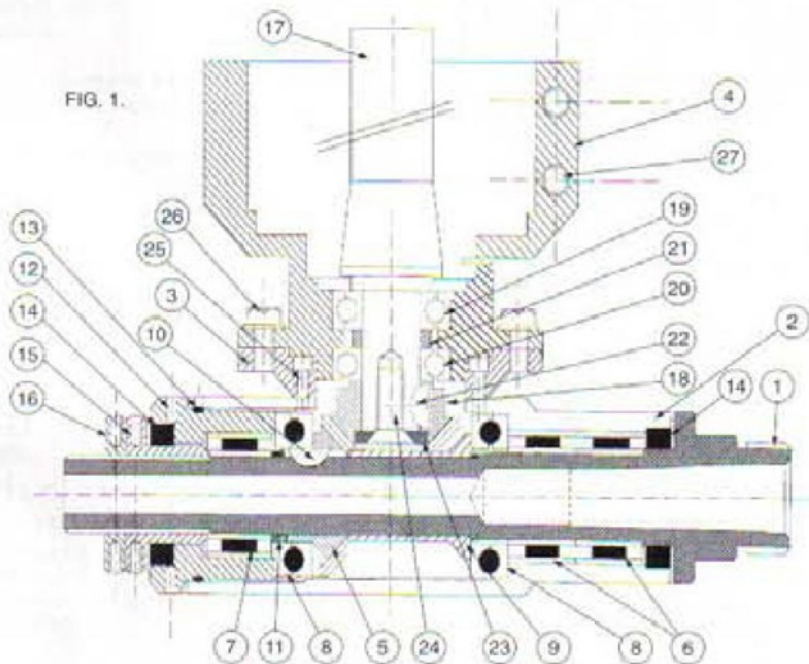
simple mounting to attach it to the mill. This unit was duly designed and made up, and can be seen attached to that mill in **Photo. 1**. It works well, although it does not have the same versatility as the old machine, but I feel that I will never get that back. A simple arbor was used consisting of a plain round pin which fitted up inside the No.3 Morse taper and which had a cross pin to fit into the cross slot in the spindle.

A failing with the majority of mill/drills is that they have a round column. This makes things very awkward when it becomes necessary to use a series of 'centre drill - pilot drill - 1st. drill - 2nd drill - reamer', because the head must be raised to accommodate the different lengths of drill and accessories, and in doing so alignment is lost (except with a lot of hard work). So, 15 years later, the mill was changed for a larger unit which featured a dovetailed knee table, thus eliminating this problem. A new arbor had to be made for the right angle drive as the new mill incorporated an R8 taper (**Photo. 2**). The quill was also 5mm smaller in



2. The 'R 8' arbor version

FIG. 1.



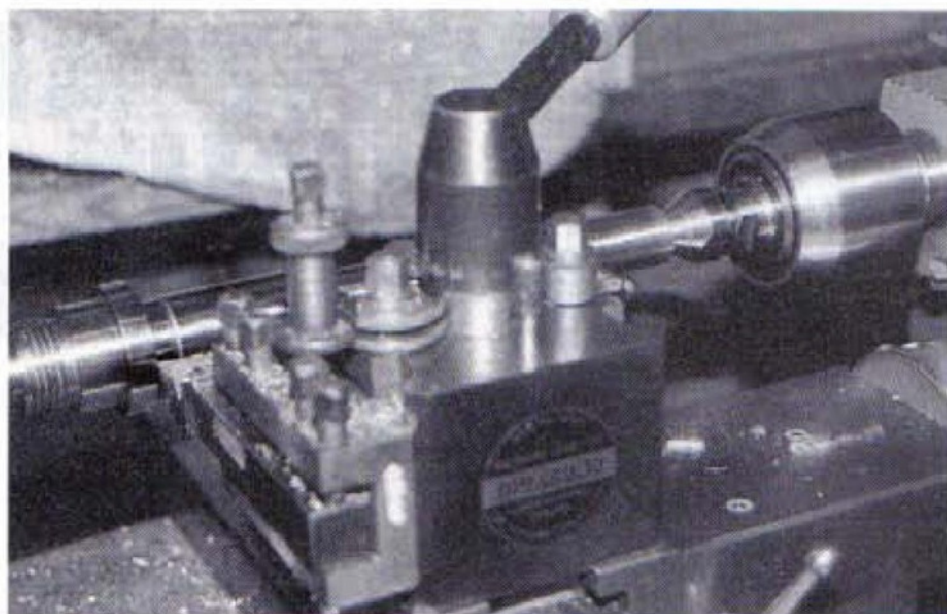
1. Original Right Angle Drive



3. Cutting a rack. The clearance problem can be seen clearly



4. The new gearbox during assembly



5. Machining the main shaft



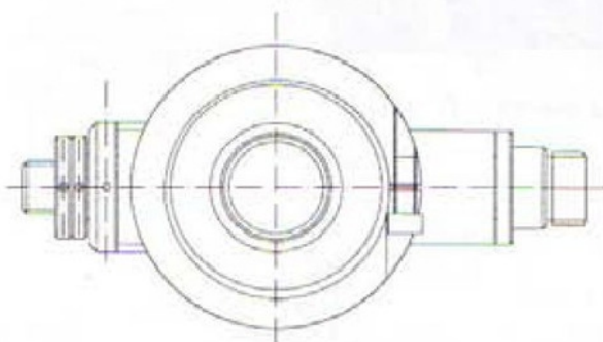
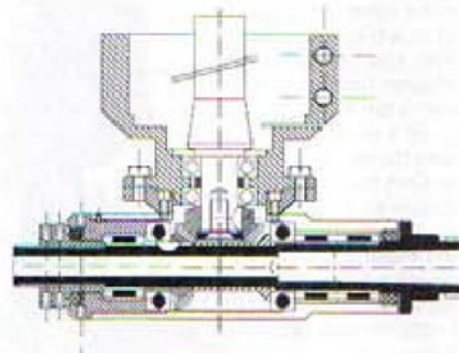
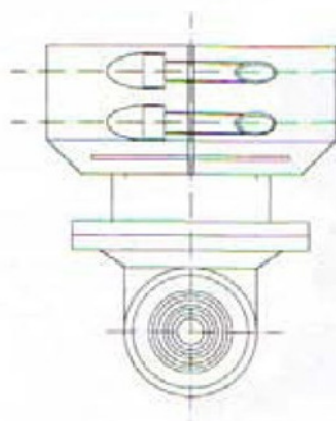
6. Machining the top hole in the shaft housing

diameter, so a sleeve was used to accommodate the variation. The modified unit was used for many years, but last year I wanted to cut a rack for my Band Saw Blade Welder / Spot Welder which was described in Issues 41 and 42.

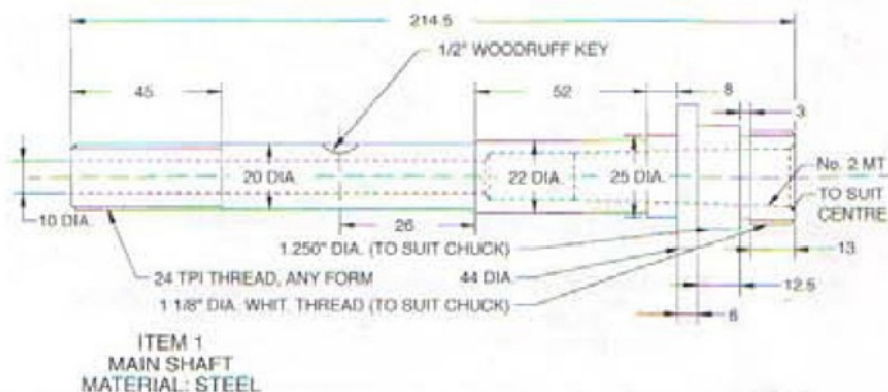
The New Problem (Photo. 3)

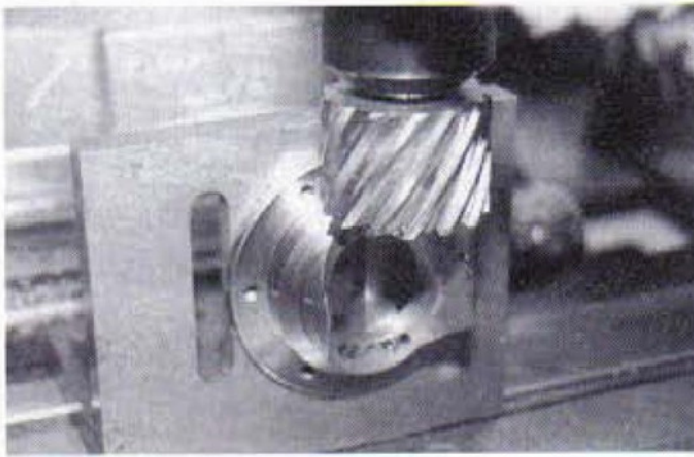
For gear cutting, the normal run of the mill (sorry for the pun) gear cutters are 58mm dia., so there was not sufficient clearance under the base of the drive (which had a diameter of 68mm) to cut the rack. It was therefore decided to re-design the drive to suit, with a maximum outside diameter of the gear box of 50mm and the front section of the nose limited to 44mm, so that other smaller cutters could be used (Photo. 4).

I wanted to maintain the No.2 Morse taper and also the Myford nose, although it is not used very often. This limited the size of bearings which could be used as the Morse taper at this point takes up some 15.3mm dia. and I preferred to leave a wall thickness in the shaft of at least 3mm, which gave me an O.D. of the shaft at this point of 21.3 (say 22)mm. The nearest standard type bearings available have a bore of 25mm dia. and to obtain a reasonable load capacity, then the outside diameter would have to be 47mm. Another solution would be to use taper roller bearings but the minimum outside dia. would still be 44mm, so I next started

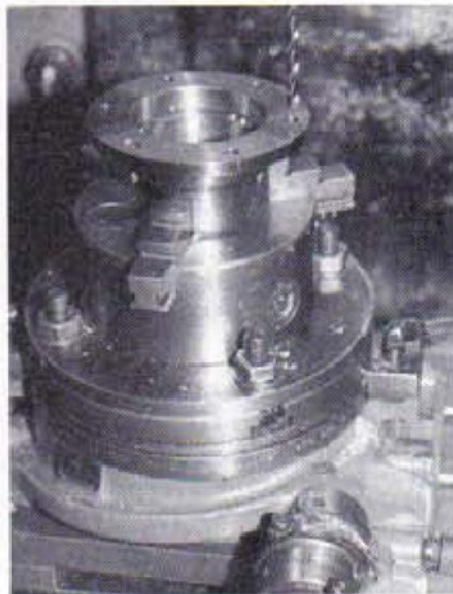
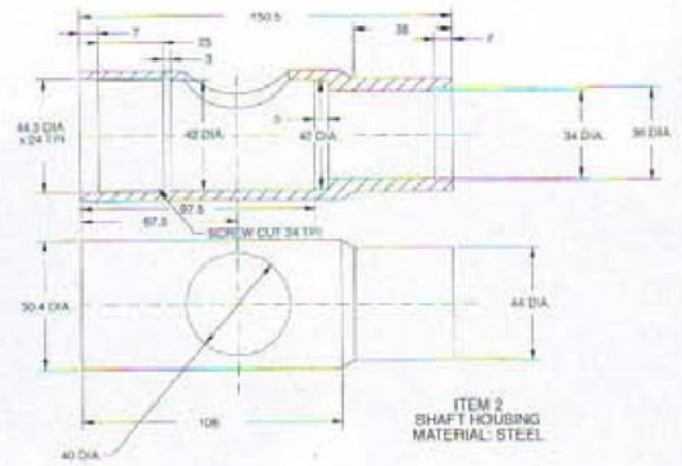


RIGHT ANGLE
DRIVE UNIT
GENERAL ARRANGEMENT





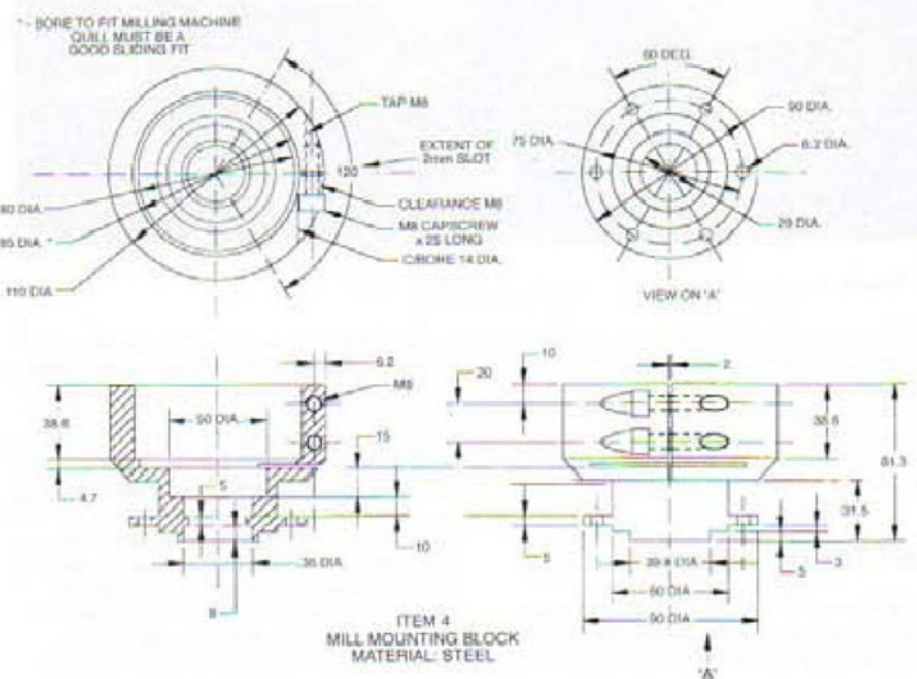
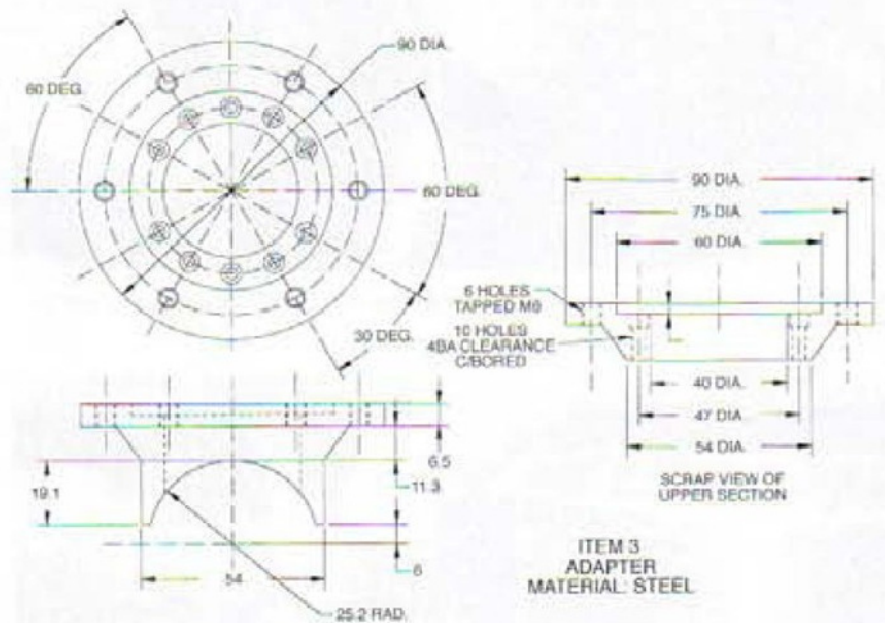
7. Machining the saddle on the adapter



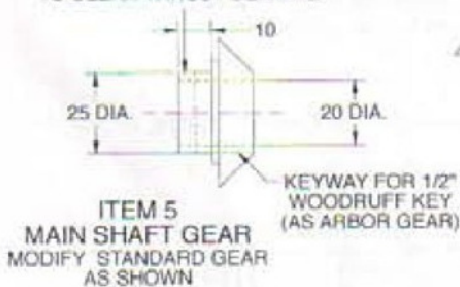
8. Drilling the flange holes

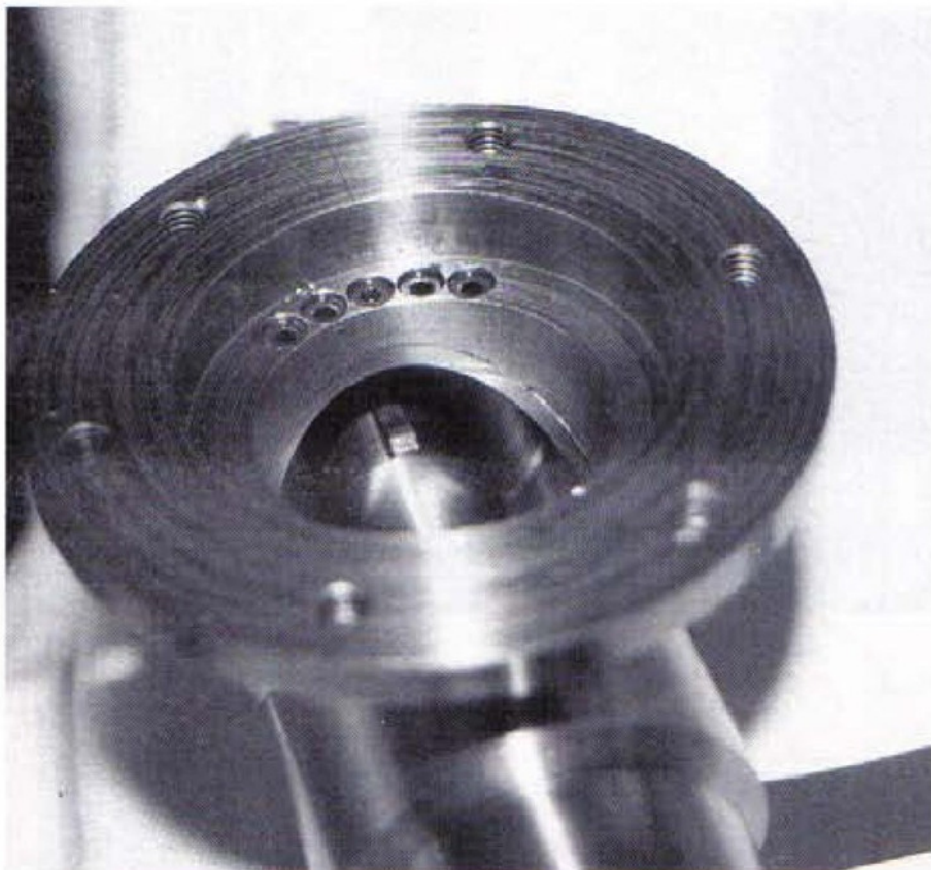
looking at needle roller bearings. These fitted in with the limits that I had set myself and would appear to be able to withstand heavy enough loadings, so I then started to read the manufacturer's information, with the following conclusions:-

1. Basic clearance and tolerances are similar to standard bearings.
2. Load bearing capacity is very similar.

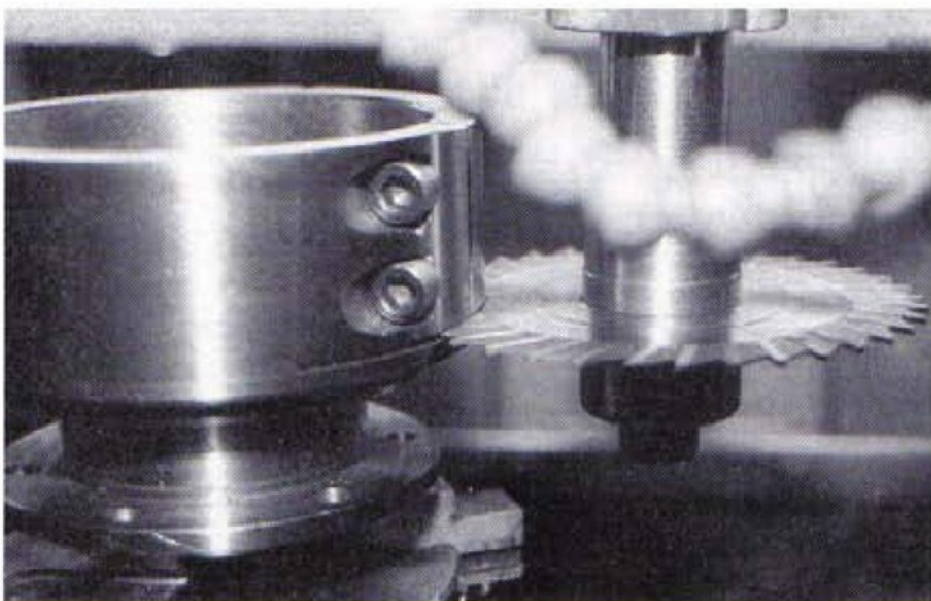


REDUCE DIA. BY 0.2mm FOR 5mm TO CLEAR THRUST BEARING





9. The method of attaching the adapter to the shaft housing. The Woodruff key can be seen in place



10. Slitting the mounting block

3. They are used on similar spindles in industry. Some of the powered spindles seen at machine tool exhibitions are very slim and seem to work well enough.

4. We are building for amateur use only.

Gears and Thrust Bearings

The above convinced me that this type would be satisfactory for my requirements, so the next stage was to select gears and

thrust bearings. Here I was a little misled as my catalogue did not cover all the sizes available, but all worked out in the end.

The gears, shafts and the thrust bearings all have to fit into a housing with a limited inside diameter, this being 43mm maximum. There is a suitable series of thrust bearings available, but I decided on a set having an outside diameter of 42mm, with a bore of 25mm and a thickness of 11mm. The front set was to be located on the outer diameter whereas the rear set would be located at the bore, so the gear

would have to be machined accordingly.

The gears ratio was to be 1:1, and the choice made was for 1.5 module x 26 tooth, having a maximum outside diameter of 41.12mm, which fitted in nicely with the size of the thrust bearings and the bore of the housing. It also had to be born in mind that the gears would have to be bored out to suit the shaft, and that the clearances are quite small.

Arbor Bearings

These are straight forward deep groove ball bearings, the lower having no seals as lubrication is from the oil bath. The top ball race is, however fitted with one seal which is mounted to the outside of the oil bath, this obviating the need to fit a separate seal.

Oil Bath

Although the use of grease would be perfectly adequate at the planned rotational speeds, I decided to employ an oil bath, as little extra work was involved. Top bearings would be splash lubricated and the needle bearings would benefit, as would the gears which are standard unhardened steel. The only extra requirements are one 'O' ring and a little sealant as the front and rear seals would be required anyway.

Oil Seals

These oil seals are standard shaft seals which push into their housings. It is imperative that the shaft on which they run is finished to a smooth polished surface, so that life of the seals is maximised.

'O' Rings

Standard diameter neoprene material can be joined together with instant adhesive or rings can be purchased in standard sizes. The ring dimensions, which are not shown on the drawings, is 1 3/4in. OD. x 0.139in. cross section, and require a groove 3mm deep x 4mm wide. A smear of oil or grease should be used when assembling the components.

Woodruff keys

These are fitted to both the main shaft and the driving arbor. It is felt best that the keyway position in the main shaft be determined and machined after a trial assembly. I assembled the shaft up to and including what I think of as the 'Diablo' spacer (look at the shape), then marked the beginning of the keyway approx. 1.5mm further towards the rear of the shaft.

Machining of Components.

Main Shaft (Item 1)

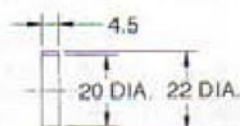
The main shaft is the part requiring the most meticulous machining, and I have my own way of carrying this out. I first hold the billet of steel in the standard 3



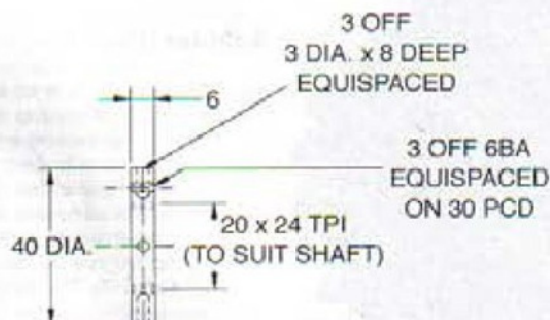
11. Accessories and thrust bearings



ITEM 9
'DIABLO' SPACER
MATERIAL: STEEL



ITEM 11
SPACER
MATERIAL: STEEL



ITEM 16
LOCKING NUT
MATERIAL: STEEL



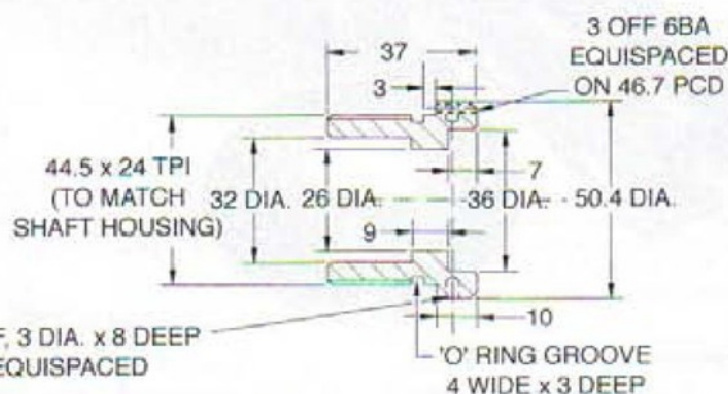
12. Shaft, arbor and gears

Jaw chuck and machine the 'Myford' nose. I then drill, in a series of sizes, for the Morse taper and then bore and finally ream No.2 Morse. This is all machined at the same setting, so all is concentric. I have in my possession a double ended No 2 Morse taper arbor, which is plugged into the head stock and the nose of my new shaft fitted to this. A small centre is then drilled into the end, very carefully to avoid movement of the shaft. This centre is then opened up with a larger centre drill and finally bored with a tiny boring bar, taking

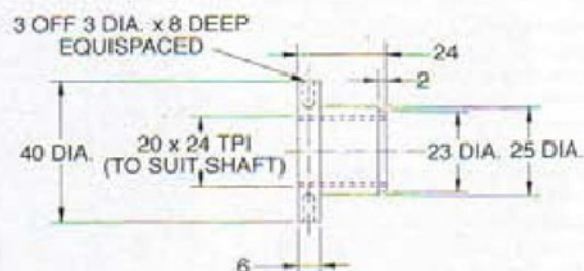
very light cuts. Remember that the work is protruding some 200 to 220 mm. A rotating centre is used to support the end of the shaft so that machining of the outside can be completed, including the screw cutting at the rear (Photo. 5).

Shaft Housing (Item 2)

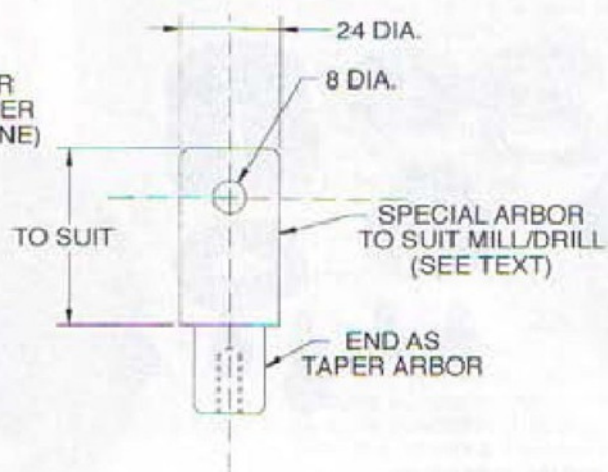
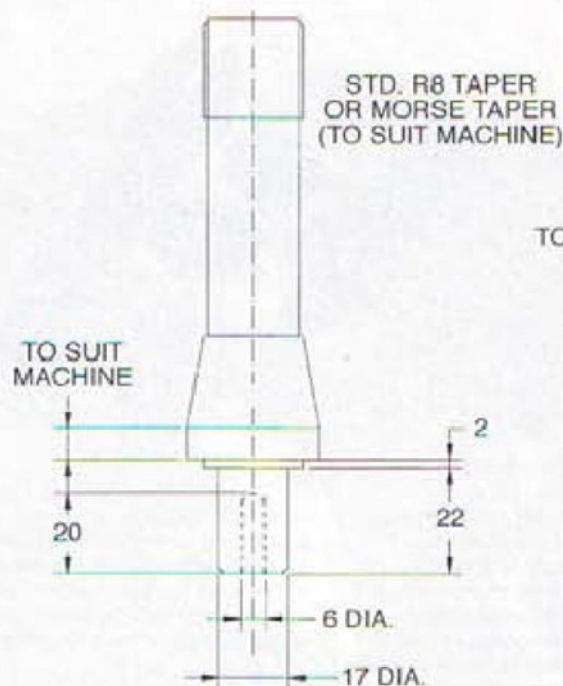
The concentricity of the front seal recess is, within reason, unimportant when compared to the bores inside the housing.



ITEM 12
REAR BEARING HOUSING
MATERIAL: STEEL



ITEM 15
SHAFT NUT
MATERIAL: STEEL



ITEM 17
ARBORS
MATERIAL: STEEL

SPECIAL ARBOR
TO SUIT MILL/DRILL
(SEE TEXT)

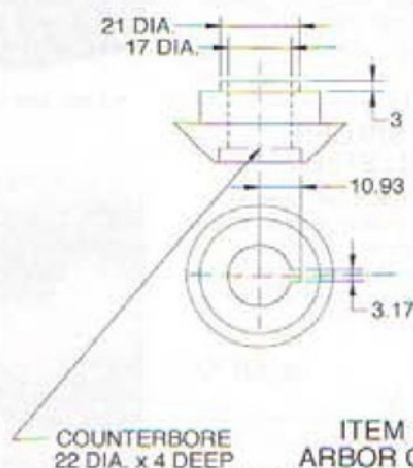


14. Components before assembly

and I therefore concentrate on these by machining them at the same setting. My lathe will hold the 44mm. dia. within the chuck, so this diameter was machined first, then the part reversed. The housing can also be machined on a Myford using a fixed steady.

All machining possible is carried out at the same set-up using the biggest boring bar that can be accommodated, even if it means making a special holder. May I say here that I always cut the inner thread before the outer as the dimensions are more critical. On completion, the part is again reversed and the seal housing machined. This may be a few thou out, but it can be set up in the 4 Jaw independent chuck, and, with a dial gauge on the inner bearing surface, accuracy can be guaranteed.

The housing is then set up in either the



ITEM 18
ARBOR GEAR
MODIFY STANDARD GEAR
AS SHOWN

mill or the lathe and the hole machined in the top, in my case by the use of a 'Rotabroach', but it can also be accomplished by drilling and boring (Photo. 6).

Adapter (Item 3)

This is first fully machined, including all drilling and tapping, then mounted on a solid angle plate using its own mounting holes. This is then clamped to the mill table and either a 'Rotabroach' or a boring head used to give an accurate radius (Photo. 7). The height is also important.

Photo. 8 shows the drilling of the adapter block using a rotary table to guarantee the hole positions. The inner holes are drilled tapping size only.

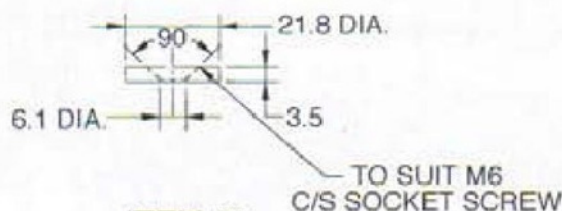


13. The shaft gear, showing the keyway



ITEM 20
SPACER
MATERIAL: STEEL

are no problem, but their surfaces must be parallel so it is best to part these off from a bar length. The shaft nut and locking nut are machined together and parted off; this simplifies the operation as there is only one lot of screw cutting. Again, tapped holes for security screws can be included in the lock nut in case it shows any tendency to slacken off.



ITEM 23
RETAINING PLATE
MATERIAL: STEEL

Fitting Shaft Housing and Adapter together (Photo. 9).

I recommend the following procedure:- First deburr thoroughly and then use a little 'Loctite' to glue the two parts together. Allow to cure, then drill through the tapping size holes, one at each end. Open up the top holes to clearance and tap the shaft housing section. Fit these two bolts and then proceed with all the other fastenings. By using this sequence it will not matter if the bond breaks down during drilling. Separate and deburr. All bolts must be cut to the correct length. They must not protrude into the housing or they will foul the bearings.

Mill Mounting Block (Item 4)

It is impossible to machine this piece from one end. It will therefore be subject to a second operation, and here the unit must be set up accurately to maintain concentricity throughout. **Photo. 10** shows the set-up method for slitting the piece to give the clamping facility. Do ensure that before you make this part, you first check the exact dimensions of your milling machine quill, and bore the block accurately to suit.

Rear Bearing Housing (Item 12)

This is again best machined from a longer length of bar and parted off after completion. This again allows full concentricity to be maintained, with plenty of clearance for trying the threaded parts together before removal from the machine. The 'O' ring groove is situated where the original locking screw was fitted, so I have now drilled the flange axially to take three 6 BA grub screws which bear on the end of the shaft housing.

The rear bearing housing is seen with other smaller components in **Photo. 11**.

Spacers and nuts

The 'Diablo' spacer and the spacer ring

Arbor and Gears

These are shown in **Photo. 12**, together with the main shaft.

Photo. 13 also shows how thin the wall thickness has become above the keyway



16. Initial assembly of shaft housing

In the shaft gear, so careful machining is needed at this point. My keywaying was carried out using a small shaper, but they can be cut, with care, in the lathe.

Assembly. (Photo. 6)

Assembly is quite straightforward, although it may be found necessary to fit shims to obtain correct meshing of the gears. Bearings can be 'Loctited' into place, but please make sure all is correct before carrying this out. Although 'Loctite' can be broken down by heat, plastic cages may not survive.

First, make up the sub-assemblies by fitting the shaft housing and the adapter together (**Photo. 14**). I suggest a 'Loctite' sealant and a thin (notepaper) gasket between the surfaces. Don't cut out the paper. 'Loctite' the housing face and lay the paper over, then put another thin layer of 'Loctite' on the adapter face and fit together. Push the screws through the paper and tighten. Finally trim the excess from the inside and outside. Make sure all adhesive is removed from the inside, so as not to contaminate other parts. The mounting assembly is then put together as in **Photo. 15**. The top bearing is a push fit or again

can be 'Loctited' into place (a push fit is best, the same for all bearings). The bottom bearing requires to be a sliding fit. Next, fit the inner races to the main shaft, then the bearings and the seal to the front of the shaft, followed by the rear seal and the rear needle bearing to their housing.

Mounting the Shaft

Slide the shaft carefully into the housing and place the front thrust bearing into place, followed by the 'Diablo' spacer.

It is then essential to fit the Woodruff key, using a pair of long nose pliers, at the same time sliding the gear into place.

If all is well put the rear thrust bearing on to the gear and finally, the rear bearing housing. This should screw in to leave a narrow gap of 0.5 to 1.0mm between its flange and the body. Screw in the rear shaft nut and again, it should leave a gap of similar proportions. The shaft should rotate freely, with no longitudinal movement what so ever. If there is, strip apart and correct the problem.

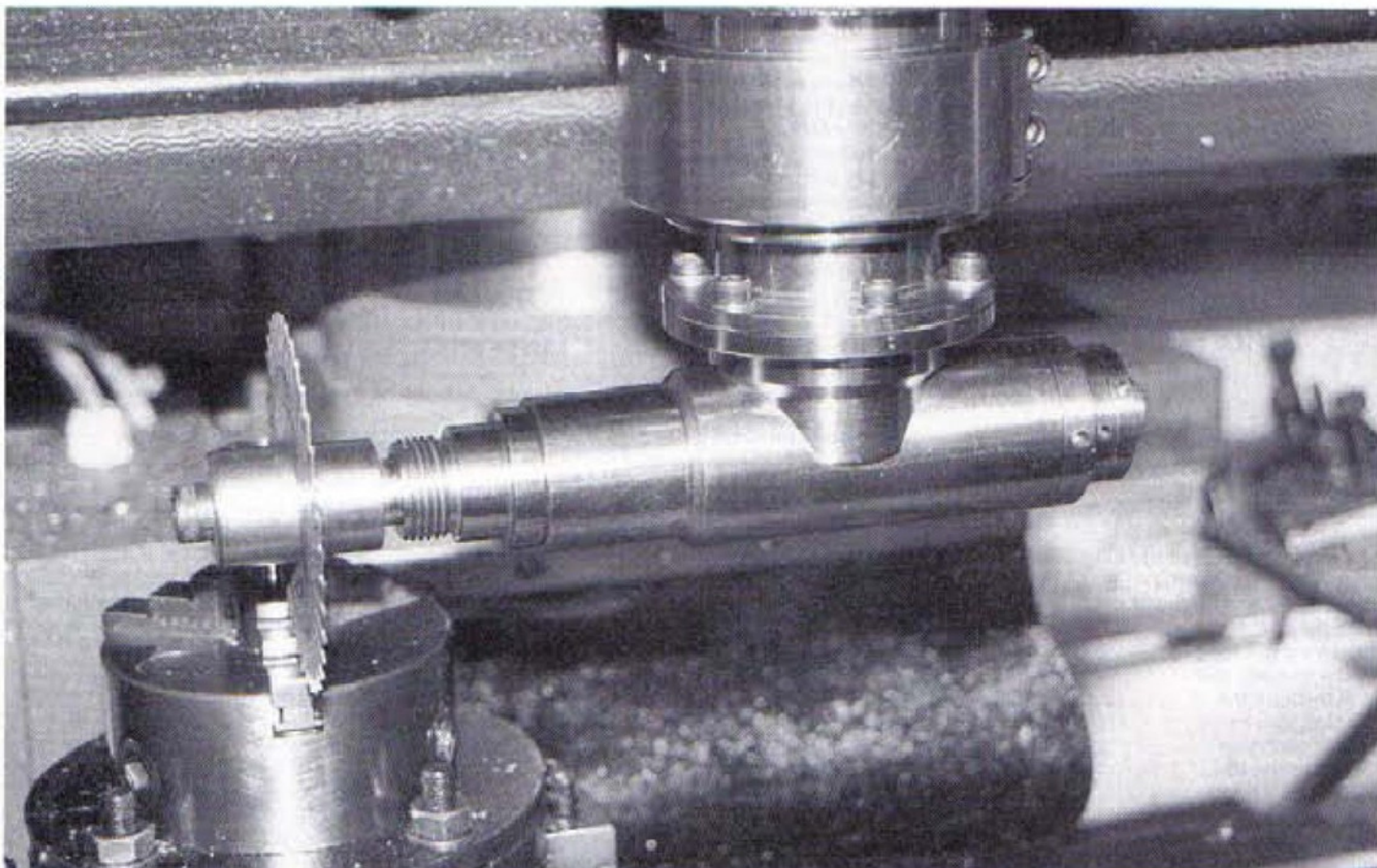
The assembly is seen in **Photo. 16**.

Fitting the Mounting Block

Hold the main shaft housing in the vice and offer up the mount and adapter



15.
Mounting block final assembly



17. The new gearbox being used to slit a collet



STANDARD 1:1 BEVEL GEARS
1.5 MOD. 26 TOOTH, STEEL

assembly. It should drop straight in and the two flanges should close together (see **Photo. 4**). Fit two bolts or toolmakers' clamps and rotate the arbor in both directions. If all feels smooth, then fit a paper washer or sealant between the flanges and bolt up. If however, there is a problem it may be necessary to correct the meshing of the gears:-

1. If the flanges do not touch, fit a loose shim, clamp up and try again, increasing the shim thickness each time until a smooth rotation is achieved.

2. Check the position of the shaft gear and correct if necessary by using a shim between the front thrust bearing and the 'Diablo' spacer. This can be a little time consuming, but well worth while.

3. The problem could be caused by a

combination of the above or, if the gears are 'out' of mesh, then a small amount of metal removal may be required from one or more components to bring them into the correct mesh.

Photo. 17 shows the new unit mounted on the mill, fitted with a saw to slot a collet which is held in a chuck mounted on a rotary table. I find that 90% of its use is with saws or similar cutters.

I hope the article is of some interest and provides food for thought. The unit was made some 18 months ago, and has been used on a variety of jobs with no problems. All photographs have had to be posed, as none were taken at the time of manufacture. This is evident from the sealant which can be seen on the face of the adapter.

Suitable bearings, seals, gears and 'O'

rings are readily available from local bearing suppliers, addresses being listed in Yellow Pages. I obtained mine from the local branch of Olympic Chevin Ltd.

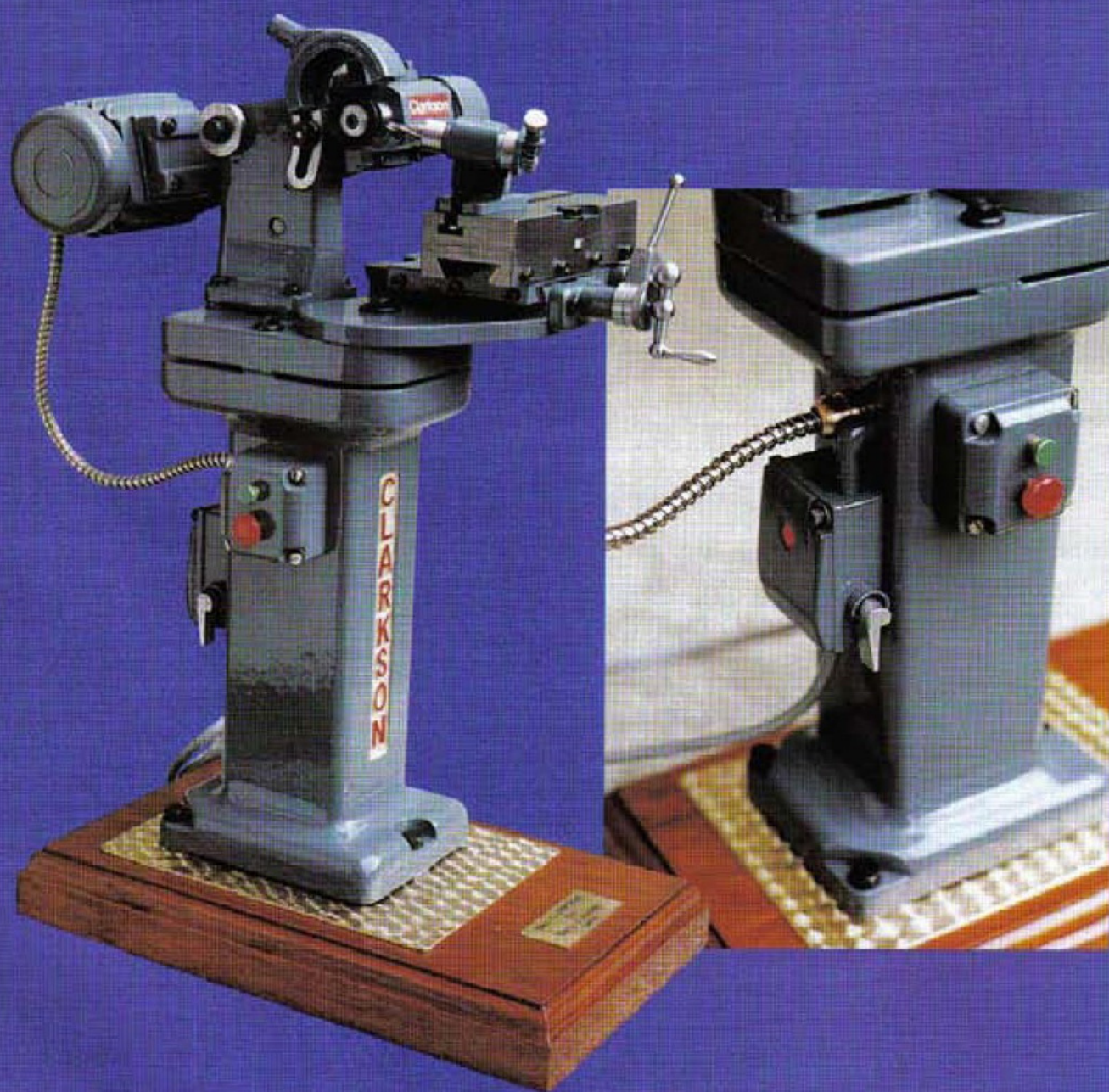
LIST OF PARTS

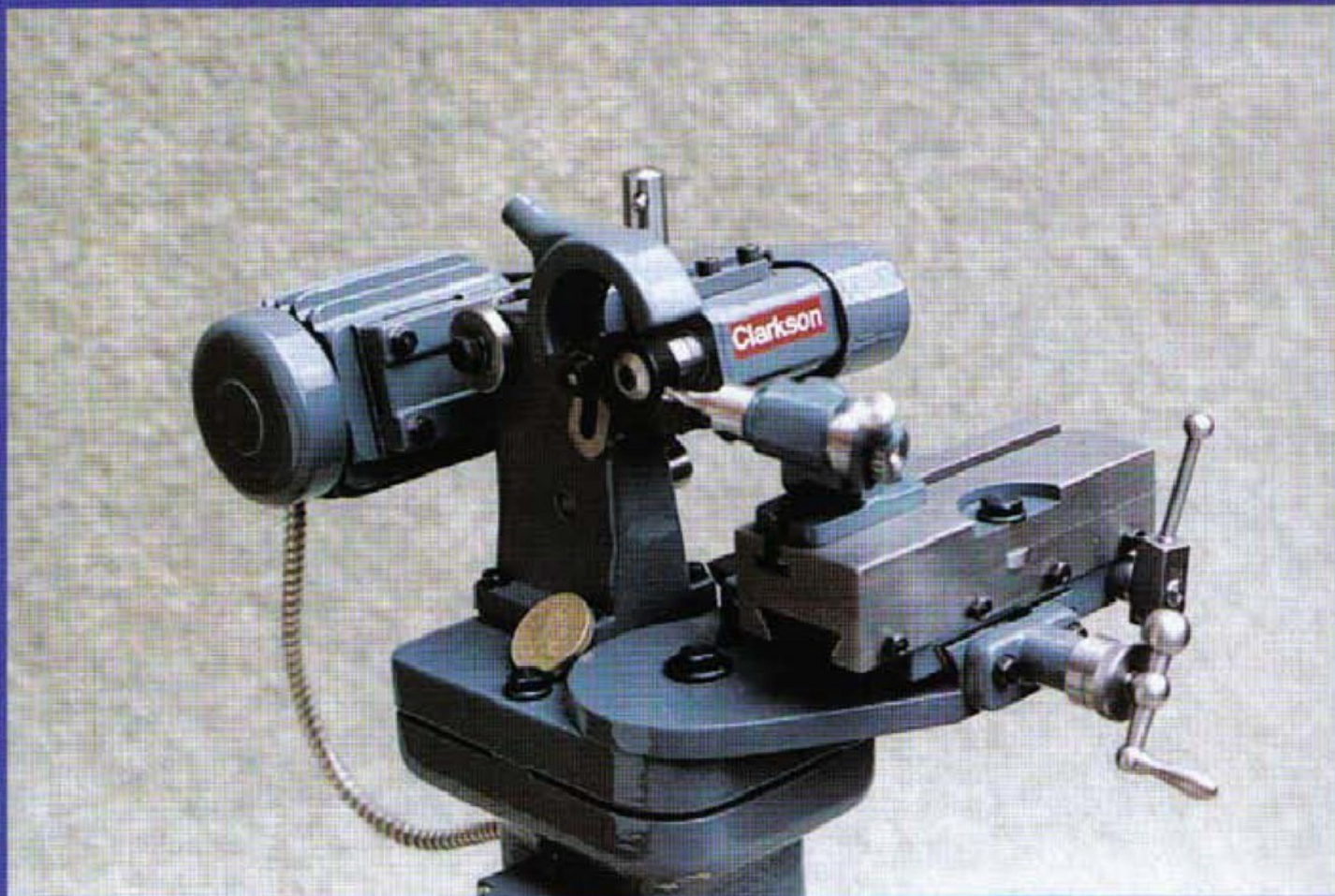
1. Main shaft
2. Shaft housing
3. Adapter
4. Mill mounting block
5. Shaft gear (1:1 ratio bevel gears Devell MB 15 26-5)
6. Needle bearings (Front) with inner ring NKG 22/20 (2 off)
7. Needle bearing (Rear) with inner ring NKG 20/20 (1 off)
8. Thrust bearings 25mm x 42mm x 11mm (2 off)
9. 'Diablo' spacer
10. Woodruff key
11. Spacer
12. Rear bearing housing
13. 'O' ring
14. Seals 25mm x 36mm x 7mm
15. Shaft nut
16. Locking nut
17. Arbor
18. Arbor gear (Pair with item 5)
19. Bearing (with single seal) 6003 - 1RS1 (1 off)
20. Bearing 16003 (1 off)
21. Spacer
22. Woodruff key
23. Retaining plate
24. Retaining screw (M6 countersunk socket)
25. 6 BA cap head screws x 40mm long maximum (10 off)
26. M6 cap head or hex head screws x 20mm long, with washers (6 off)
27. M6 cap head screws x 25mm long (2 off)
28. 6 BA grub screws x 1/4in. long (6 off)

A MINIATURE TOOL AND CUTTER GRINDER

That man Barry Jordan has done it again! After all what use is a 1/5th scale Bridgeport milling machine if its not possible to sharpen the cutters? Here is the solution, a matching Mk. 1 Clarkson tool and cutter grinder which made its debut at the Harrogate exhibition.

The model was completed in about 480 hours, spread over some four months, and runs "as sweetly as a sewing machine", purring over at 5,800 rpm on 12 volts DC. No castings or drawings were used, and the method of manufacture of the 'diamond' wheel is a closely guarded secret. An idea of the size of the machine can be gauged from the pound coin to be seen in one of the photographs.





ACCESSORIES FOR THE SMALLER LATHE

Whatever the size of our workshop machinery, there always seems to be an occasion when we need something slightly larger. J. Neave of Wokingham, Berkshire describes some simple accessories which will allow larger end mills and Morse taper shank drills to be held safely

1. A Simple Collet Fixture

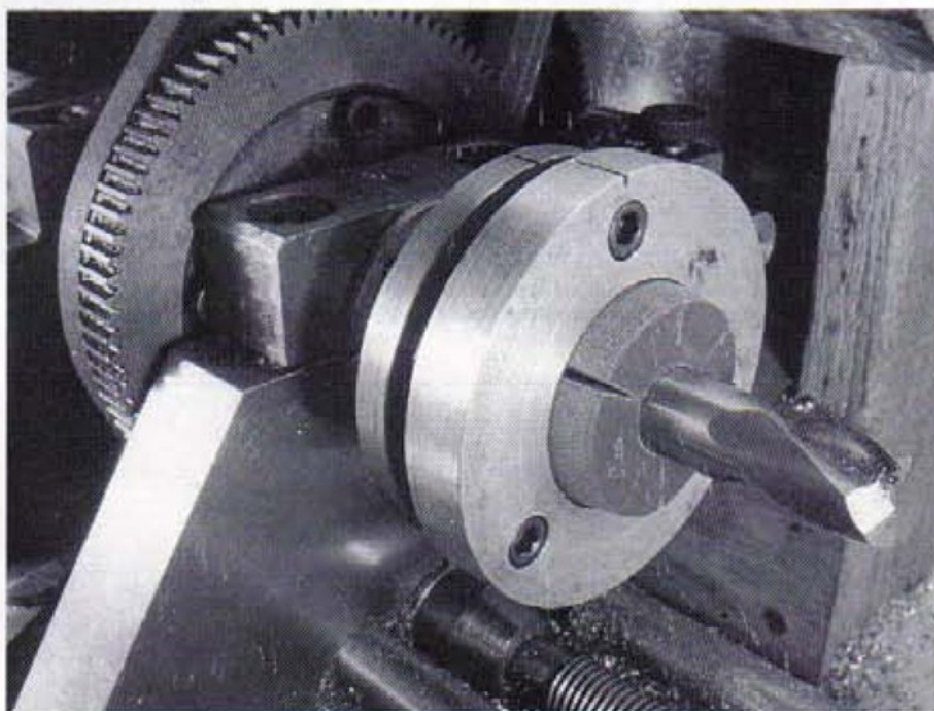
Milling operations on a small lathe are often limited by the restricted diameter of the chuck throat, which prevents the shank of a larger end mill being held safely and securely. The fixture described here was designed to overcome this difficulty by using the collet principle to fully support and grip an end mill shank. The assembly drawing (Figure 1) shows a simple design which is based on the use of an existing catch plate or face plate, without impairing its continued use as such. The fixture is economical to make in time and material. The drawing shows a catch plate being used, but a face plate could equally well be employed in which case there would be no driving pin to be removed or replaced.

Item 1 Catch Plate

Select a suitable existing Catch Plate (a 3in. dia. example is shown) and remove the driving pin. A dividing head should then be used to position and drill the three M6 tapping holes (5.1mm diameter). Tap the holes M6. These hole positions must match those of Item 2, the Clamp Ring.



1. The component parts of the collet fixture. On the left hand side are the segments of the 0.75in. dia. collet, while those on the right are for the 0.50in. dia. version. In the foreground is a collet blank, ready for boring to size and then slitting when required



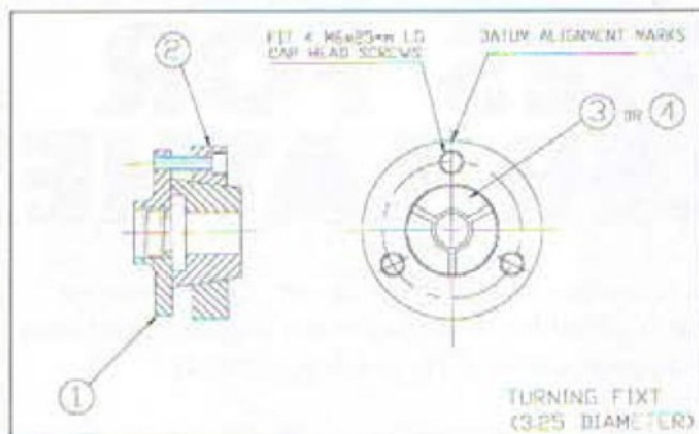
2. The collet fixture set up in the lathe for a milling operation. Note that the witness marks on the components are in alignment

Item 2 Clamp Ring (Material: Aluminium)

Finish machine to outside dimensions. Position, drill and counterbore the three holes to suit M6 cap head screws. These hole positions must match the M6 holes in Item 1, the Catch Plate. Set up Item 1 in the lathe and screw Item 2, the Clamp Ring, to it with suitable parallel packing between them (about 0.25in thick). Bore the centre hole out to 1.76in diameter and an included angle of 15 deg. Witness mark the two items so that they can always be assembled in the same orientation.

Items 3 & 4 Collets 0.75in. & 0.5in. Dia. (Material:- Tufnol, Aluminium or Plastic)

From bar stock, face the end and machine the end recess. Centre drill & drill a 0.375in. dia. hole through; part off to length. Repeat this procedure for the second collet. Fit the first collet on a suitable mandrel and turn the 15 deg. included angle taper. Use Item 2, the Clamp Ring, as a gauge and try to get this between 0.062in. and 0.125in. from the front face of the collet. Repeat this procedure with the second collet. Set up the first collet blank (Item 3) in the lathe

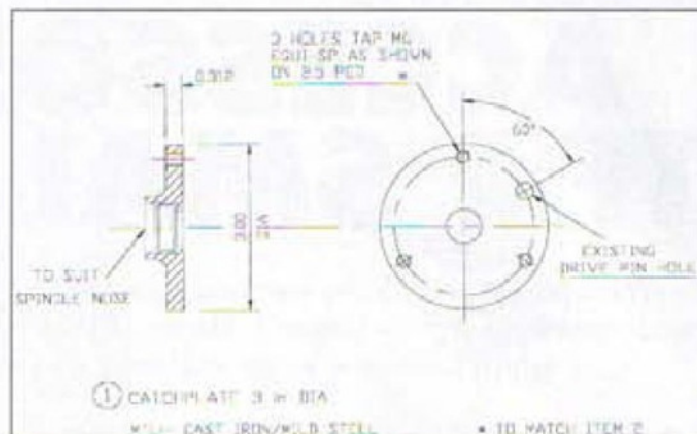


using Items 1 & 2, taking care to line up their witness marks, as shown in the assembly drawing. Drill and ream the centre hole to 0.50in (or required) diameter. Make a witness mark on the collet blank to line up with Items 1 and 2. Repeat this operation with the second collet blank (Item 4), but make the centre bore 0.75in. (or required) diameter. Both

collet blanks can now be slit into three segments using a 0.125in wide cutter.

2. The Morse taper Fixture

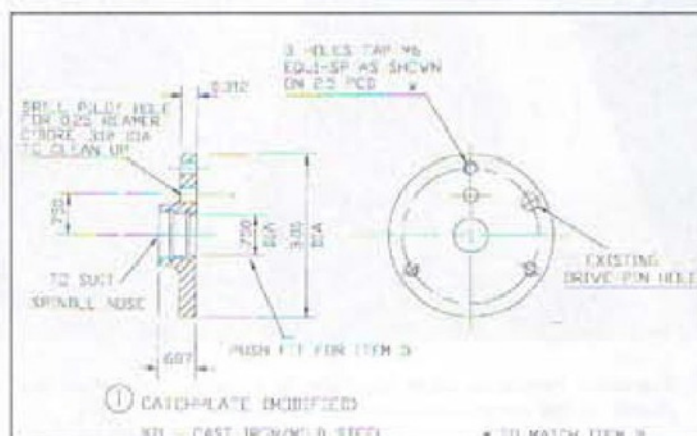
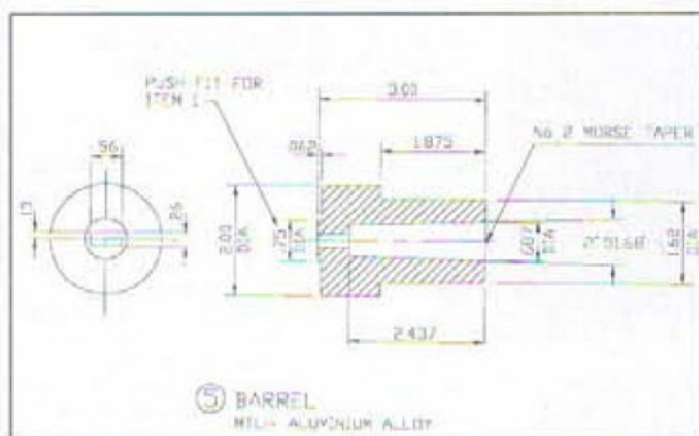
The aim of this fixture (Figure 2) is to enable a large Morse taper shank drill to be used in a small lathe where it does not match the spindle and obviously cannot be

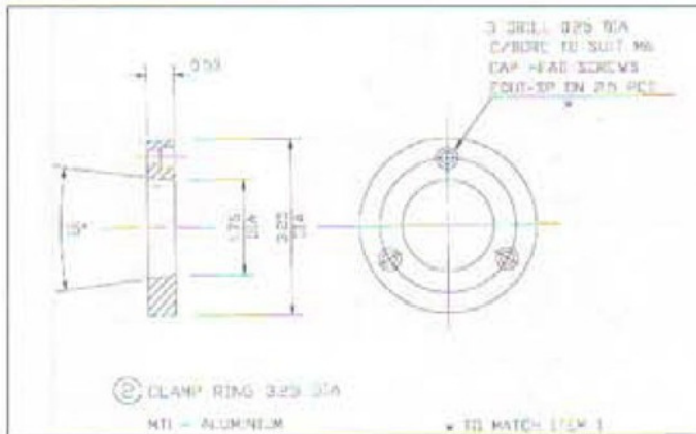


held in a chuck. Some items from the Simple Collet Fixture described above can also be used. They are: Item 1 the Catch Plate, which requires some minor additional machining and Item 2 the Clamp Ring, which remains unchanged. The additional machining required on the Catch Plate will not impair its continued use as such. One completely new piece is



3. The component parts of Morse taper fixture. On the left hand side is the modified catch plate with its driving pin removed. In the centre is the Barrel which has a Morse taper bore. The tang slot can be seen with the locating spigot and driving dowel in position. On the right is the clamp ring

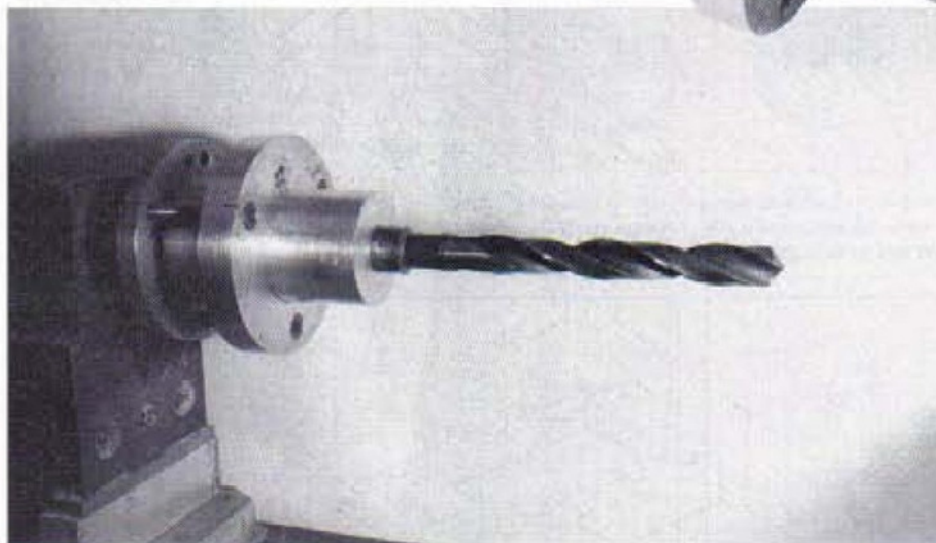




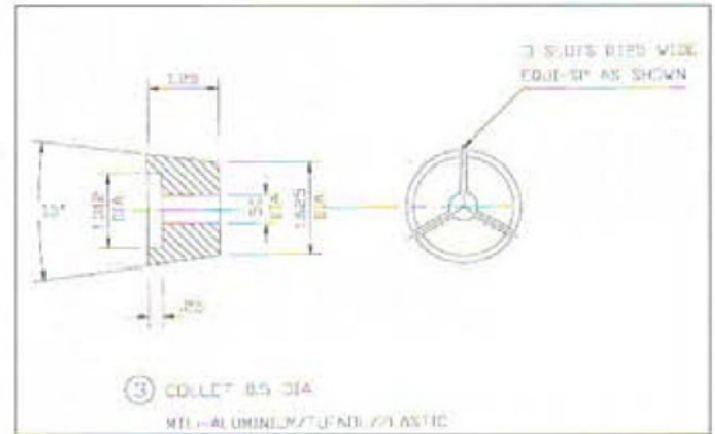
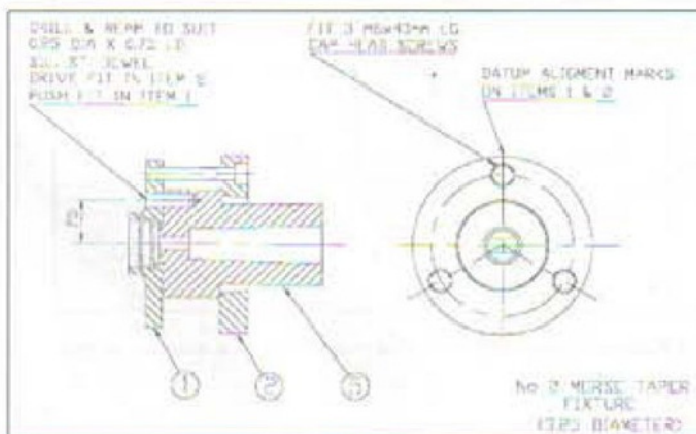
required, Item 5 the Barrel. This is shown with a No 2 Morse taper centre bore. Other suitable internal bores could be used if required.

Item 1a Catch plate

Start by modifying the Catch Plate exactly as described above by removing the driving pin and drilling and tapping the three M6 tapping holes to match those of Item 2, the Clamp Ring. Bore the centre hole out to be a push fit for the spigot on Item 5. If it is already size or larger, adjust the spigot size on Item 5 to match. Drill the pilot hole for the 0.25in. diameter dowel, say 6mm diameter.



4. The completed fixture screwed on to the lathe spindle nose, with a No 2 Morse taper shank drill in position ready for use



Item 2 Clamp Ring

This component is identical to that described previously.

Item 5 Barrel (Material:- Aluminium Alloy)

Machine to overall dimensions. Turn the 0.062in. long spigot to be a push fit in Item 1a. Assemble Item 5 into Item 1a and clamp them together with Item 2, as shown in the G.A. drawing. Spot through from Item 1a into Item 5, ream to size and fit the dowel. The dowel not only keeps the items in the correct orientation during

5. The assembled fixture holding a newly machined barrel in which is shown a Jacobs 5/8in. chuck.

machining and subsequent use, but also takes the load when the completed fixture is being used for drilling operations. Set the assembly up in the lathe and initially machine the centre bore 0.562in. dia. by 2.437in. deep, counter bore 0.625in dia by 1.375in. deep and use a No 2 Morse taper reamer to open out to 0.687in. dia. Remove from the machine and dismantle the fixture. Remove most of the material from the tang slot by drilling and end milling. Finish, if necessary, by hand filing.



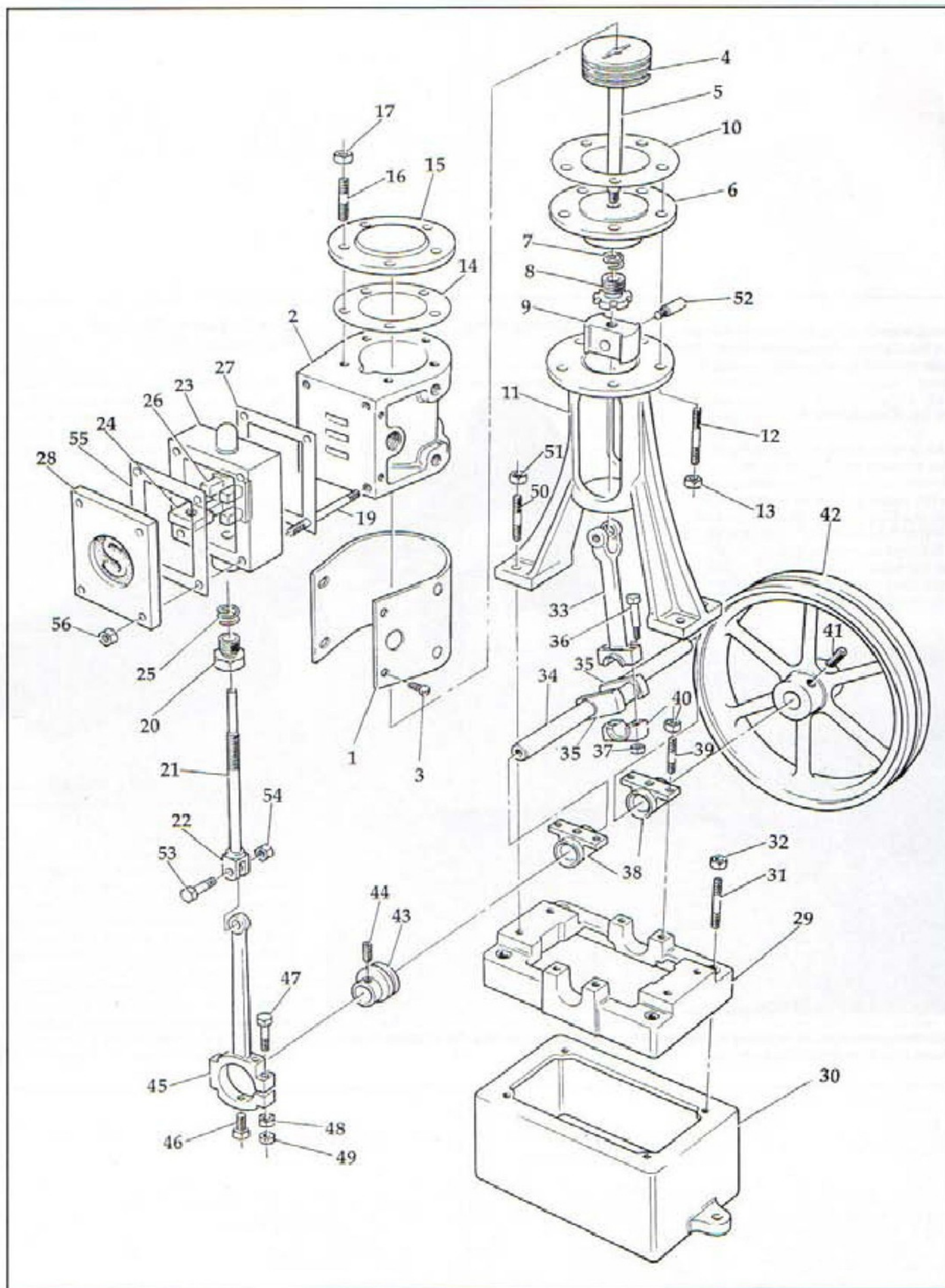


Figure 1: Exploded view of the Stuart 10V engine, published by kind permission of Stuart Models. The machining of a number of the components for this engine is described in Harold Hall's article

JIGS AND FIXTURES AND THE SMALL LATHE

Having completed his series on basic lathe work, Harold Hall shows how additional home-made tooling can assist in the manufacture of components, particularly where castings and forgings are involved. As a vehicle, he uses the kit of parts for a popular small steam engine

Whilst this article relates to the construction of a Stuart 10V steam engine (Fig. 1 and Reference 1) and may be of help to anyone making one, its aims are not to describe this engine in detail. Rather, they are to show what can be done using only a small lathe and to encourage all lathe owners to consider the benefits of making simple fixtures. As a vehicle for this, the Stuart 10V is an excellent subject, having many iron castings and brass pressings which benefit greatly from specialised fixtures being made to aid machining.

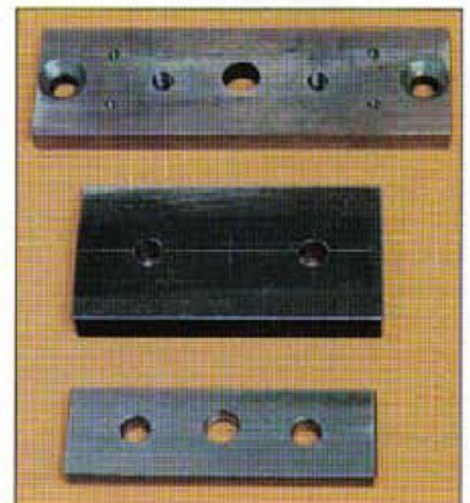
Jigs and fixtures

The urge to make progress can easily deter one from first spending time making a fixture to help with the task in hand. This should be resisted, as the benefits of using fixtures are many, the main ones being summarised as follows:-

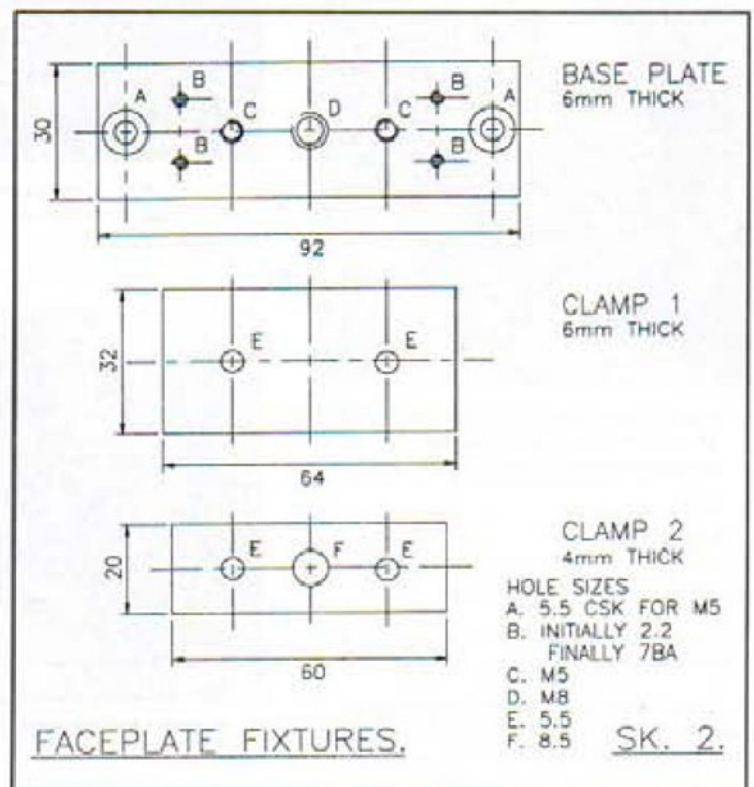
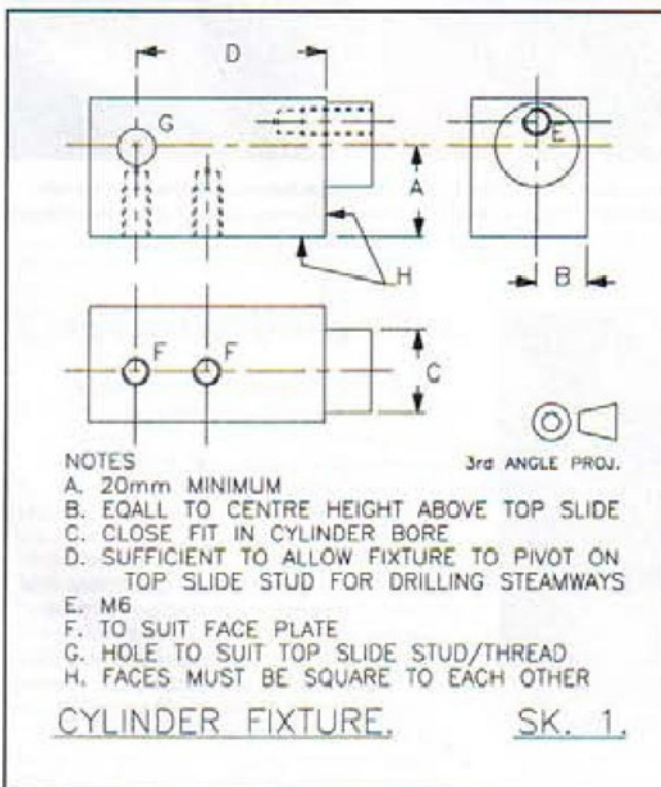
1. Producing a better and more accurate item.

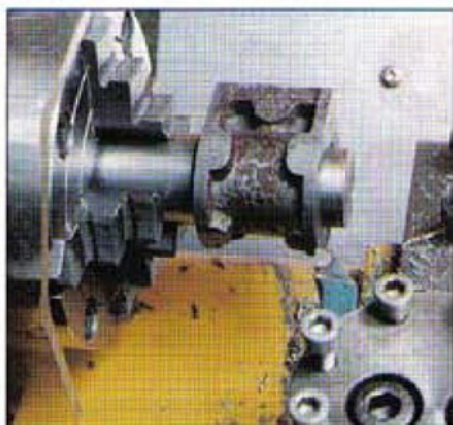


1. Some of the fixtures referred to in the text and seen in use in subsequent photos. (When viewing the photographs used in this article, please do take note of the comments in the text regarding the photographs having to be retaken).

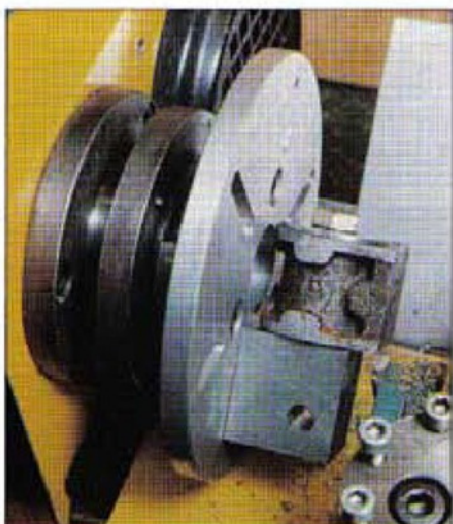


2. The remainder of the fixtures

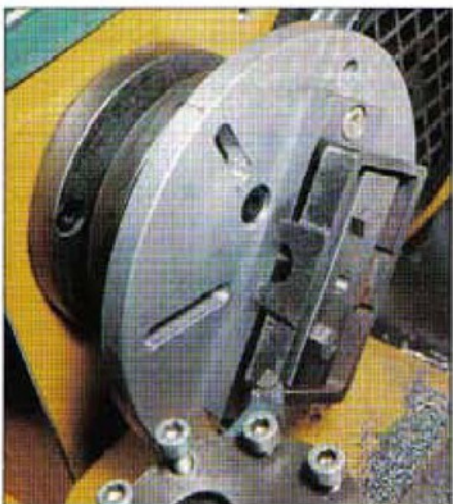




3. Facing the second end of the cylinder.



4. A special fixture being used whilst facing the port face of the cylinder.



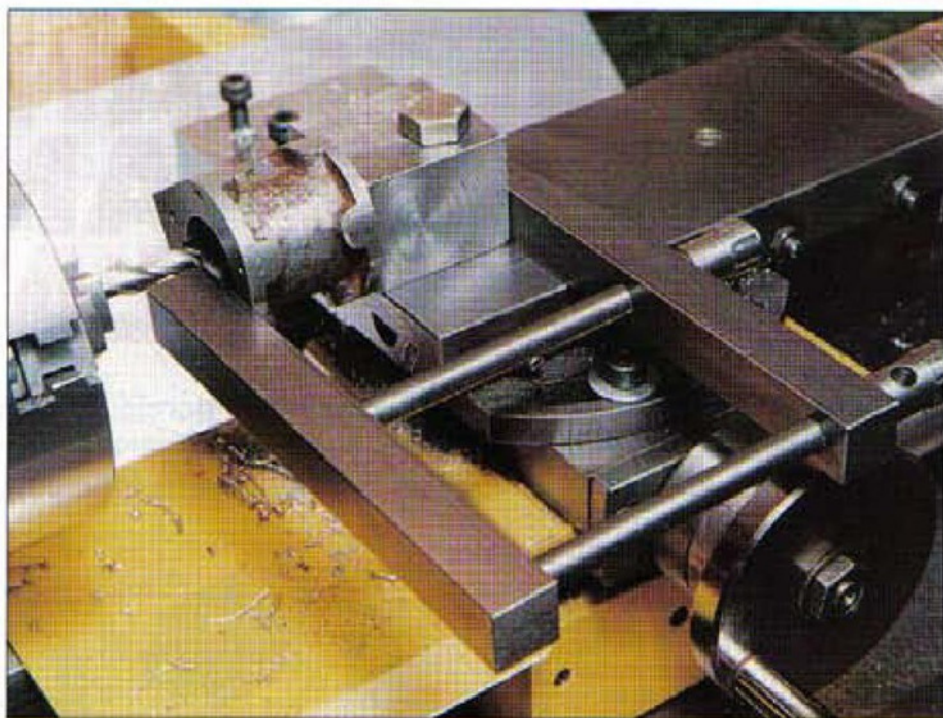
7. Special base plate and clamp 2 (both shown on Sk. 2) being used to hold the soleplate whilst facing its underside.

2. Saving in time.

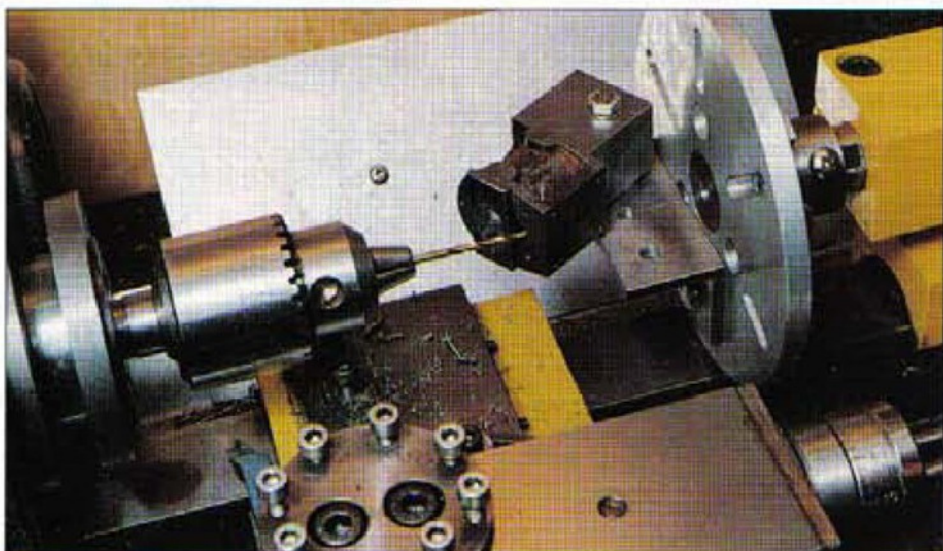
3. Making the manufacturing process easier, and

4. If identical parts are being made, greater consistency.

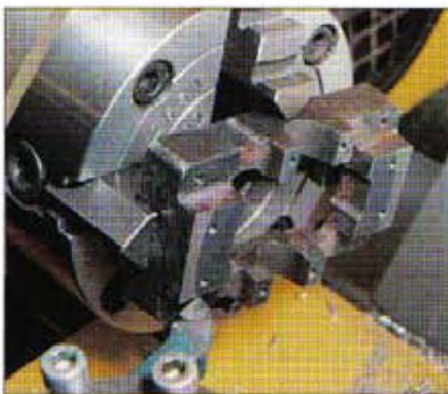
Some of the fixtures, seen in **Photos. 1 and 2**, are used for more than one component, others for a single part.



5. The same fixture as shown in Photo. 4, now being used whilst machining the steam passage recesses.



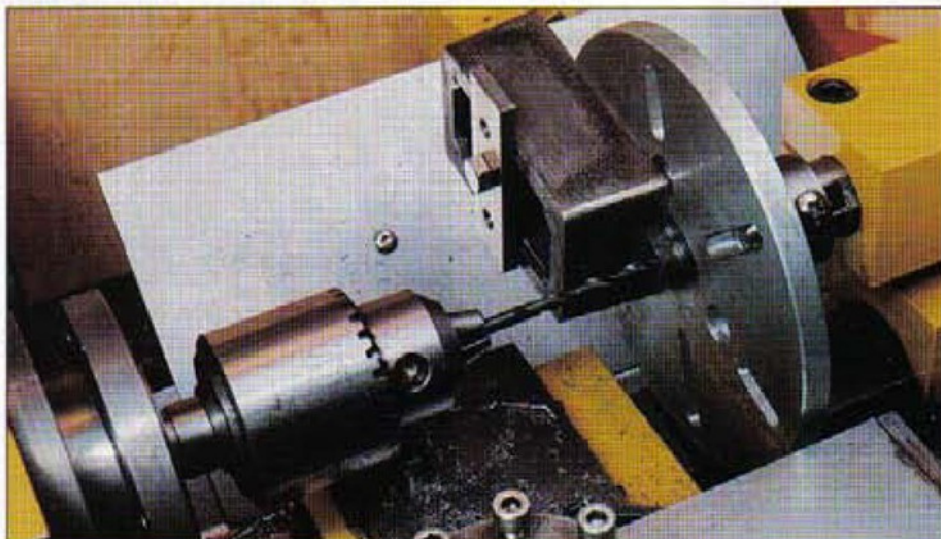
6. Much of the drilling was carried out on the lathe using the faceplate mounted on the tailstock. In this case the fixture is again being used, this time whilst drilling the steam passages.



8. Machining the upper faces of the soleplate.

Square, parallel and concentric

A major emphasis of this article is the production of accurate components, paying particular attention to surfaces being parallel or square to each other, and circular features being concentric, the aim being problem free assembly. Some may feel I have put too much emphasis on accuracy, but this is always worth aiming for, providing it is not too demanding in additional time. With the knowledge gained, it will be available when a really demanding item is being made. Anyway, the procedures suggested with accuracy in mind should contribute little in terms of added time.



9. Drilling the box bed whilst on the tail stock mounted faceplate.



10. Again using the base plate, this time whilst machining the feet of the standard.

Photographs

Unfortunately, the initial set of photos was lost in transit and had to be taken again, using the finished parts. Sometimes therefore, when showing an operation taking place, the photos also show later stages having been completed. I do hope this does not confuse the situation unduly.

Roughing and finishing

Parts made from cast iron may have hard spots on their surfaces, and to remove these without undue wear on the cutter, the initial cut must be deep enough to get below them. Some set-ups for achieving accuracy are not robust enough to permit heavy cuts, and the part must be rough machined initially by another means. Parts made from materials other than cast iron may be treated similarly, thus avoiding the need for many light cuts which may be necessary if all machining were done in the finishing mode.

Manufacturing sequence

The sequence used through this article is not intended to be the manufacturing order, but the time taken will be reduced if thought is given to the stage at which each task is completed. The aim should be to reduce the number of times chucks, mandrels and fixtures are interchanged. My advice is to produce a simple programme, listing the tool changes required. This will be more than repaid for by the savings in time taken on the project.

Parts are referred to by the names and part numbers used on the latest Stuart drawings.

Cylinder (Item 2)

The cylinder provides an interesting exercise, requiring accuracy, mainly of geometry rather than of linear dimension. The aim is to get the bore and port face parallel, and these at right angles to the end faces.

The first end was rough turned in the four jaw chuck, then reversed to rough and finish turn both the bore and second end, thus making the bore and second end precisely at right angles. A taper mandrel was made (Photo. 1, top left) and the cylinder fitted as in Photo. 3, then the first end finish machined, now making both ends parallel and at right angles to the bore.

The fixture shown top centre, Photo. 1 was made, generally as shown in Sk. 1. This is not fully dimensioned as the size will depend on individual circumstances. A piece of bright mild steel was placed in the four jaw, ensuring that the face eventually to be mounted on the faceplate was at right angles to the chuck face. A small square applied to the chuck face was used to check. The spigot was then turned to fit the cylinder bore. I made an M8 thread central with the spigot, but would now recommend, for reasons explained later, an offset M6 as per the sketch.

With the fixture on the faceplate, the port face was machined as shown in Photo. 4. All the major faces were now machined and correctly positioned relative



11. Machining the bore of the standard, again using the base plate. The top flange was also machined at this stage.



12. Set up for rough machining the flywheel outer diameter, sides and central boss.

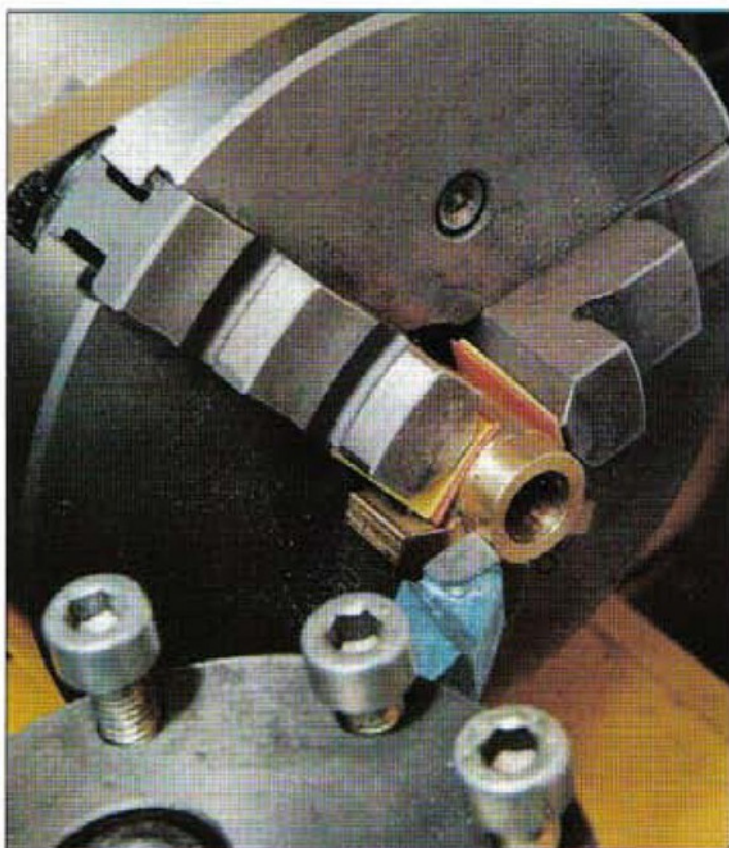


13. Finish machining all machined surfaces of the flywheel whilst mounted on a taper mandrel.

to each other.

The fixture was next used, as in Photo. 5, to machine the recesses for the steam passages. As these are semicircular, the cylinder does not have to be held level. The photo shows how it was angled to machine the recess in the correct position. However, Sk. 1 suggests that the fixture should be made such that the cylinder is held at the lathe centre height, as this would avoid the need for it to be angled down. More importantly it would also be of benefit during the next operation. The offset hole would avoid the need to use the toolmaker's clamp, as a narrow bar with an M6 screw would allow access for the end mill, which the central M8 did not.

Photo. 6 shows the steam ways being



14. Set up for finish machining the bore and first end of the crankshaft bearings.

drilled whilst the fixture with a small angle plate is mounted on the tailstock mounted faceplate. Had the fixture spigot been at centre height, the drilling could have been much more easily carried out, generally as in **Photo. 5**, but with the fixture angled.

Box bed (Item 30), Soleplate (Item 29) and Standard (Item 11)

These make considerable use of the fixtures shown in **Sk. 2** and **Photo. 2**, primarily on the faceplate, but the base plate is also used as a drilling jig.

The top faces of the soleplate were dressed such that it rested on these without rocking. It was then mounted on the base plate and held with clamp 2, as in **Photo. 7**, and the underside finished machined. Two opposing jaws of the four jaw were reversed and the soleplate mounted as in **Photo. 8**, making sure it rested accurately on the steps of the two jaws. The top surface was then finished machined. Care was taken not to over tighten the jaws on the side of the casting as it is rather weak in this direction.

The underside of the box bed was finished machined similarly, but using clamp 1. The two fixings in the box bed were drilled as in **Photo. 9**, and then used to secure it directly to the faceplate for finish machining the top surface, with the faceplate back on the lathe spindle.

The top face of the standard was dressed and mounted on the base plate using a central stud, and the feet finish machined as in **Photo. 10**. The base plate, which at this stage had only tapping size holes, was then used as a drilling jig for the holes in the feet of the standard. For this, a stud was passed through the

standard and the central hole of the base plate and nutted tight, such that the holes would be positioned correctly. The holes were then spotted with a tapping size drill in a small hand drill and then drilled with a clearance hole after having removed the base plate. Before tapping the holes in the base plate it was also used as a spotting template for the holes in the soleplate, this time held in position using clamp 2.

The base plate was then tapped and used to mount the standard as in **Photo. 11**, and the bore of the standard, top flange face and top flange edge finished

machined. The standard was again mounted as in **Photo. 10**, taking care that the flange edge was running reasonably true, and the flange rear finish machined.

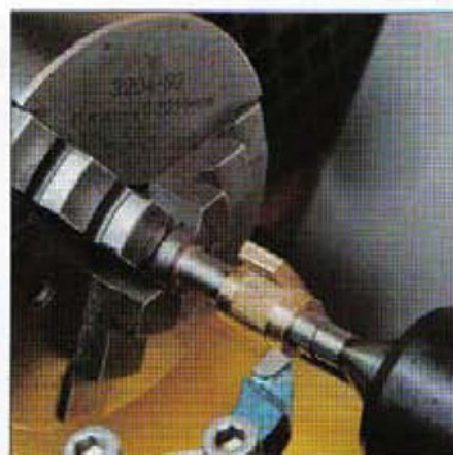
Flywheel (Item 42)

Even if the engine is never to be powered, and I suspect this is frequently the case, making a flywheel that runs true is a worthwhile aim.

The flywheel casting was held in the three jaw chuck on the shorter of the bosses, ensuring that it ran reasonably true. The longer boss was rough machined and the spokes very lightly faced in the area where the spokes meet the boss. It was then reversed and held on the longer boss, the faced portion of the spokes placed against the chuck jaws helping to ensure it was securely held.

This time, the other boss was rough machined with the outer flange of the wheel, both on the outer diameter and on the sides, as shown in **Photo. 12**. The bore was also finish machined at this setting. This bore has a common diameter with those in other parts, all of which are to be mounted at some stage on the same taper mandrel. Because of this, all these bores need to be of precisely the same diameter. Whilst the actual diameter is probably not that crucial, consistency is. These bores were therefore made using the same D-bit.

A taper mandrel was turned (**Photo. 1, top right**) to support the flywheel, and because of its large diameter and weight, the mandrel was supported by the tailstock centre. The flywheel was mounted on the mandrel and all the machined surfaces finished to size, as illustrated in



15. Machining the second end of the crankshaft bearings mounted on the taper mandrel.



16. Using a plain disc faceplate, machined in situ, to face the valve chest cover. Thin film double adhesive being used to hold the cover.

Photo. 13. Because of the inherent accuracy of working in this way, the flywheel can be removed after machining one side and reversed to machine the other.

Crankshaft bearings (Item 38)

These come as a single piece of brass extrusion. This was first cut into two pieces and one piece mounted in the three jaw chuck, as seen in **Photo. 14**. Packing, 0.6mm thick, under the two jaws as shown, brings the part on centre. If you are making one of these engines, it would be worth checking this dimension before proceeding. The part is short, so some care was taken to see that the bearing fitted into the chuck squarely.

The end was then finished turned to diameter and the hole produced to size using the D-bit. It would now be difficult to remove the part, rotate it and return to the chuck and be sure that the bore was running true. The second end was therefore finished machined as illustrated in **Photo. 15**, using the taper mandrel already made. My three jaw is accurate at the diameter of the material from which the mandrel was made, otherwise the four jaw would have had to be used to make the mandrel run true.

Valve chest cover (Item 28)

Holding a thin part for turning is not easy, especially if its faces have to be parallel. After dressing both faces of the

casting, a piece of bright mild steel was placed in the three jaw and its face surfaced so that it ran true. The cover was held on the turned face using thin double adhesive. With this type of adhesive, the surfaces must be free of grease. I also found that using the tailstock barrel to apply some pressure for around a minute improved the grip. Taking only light cuts, the process was completed without any problems. However, when turning the first side, the cover was held using only a dressed surface. Because of this, two thin strips, also held with double adhesive, were butted against the cover for additional support. **Photo. 16** shows the second side being finished.

Valve chest (Item 23)

This was rough machined all over, holding it in the four jaw. Following this, the two main faces were machined using double adhesive in the same manner as for the cover. If the plate has been removed from the lathe it will require facing again. This is a typical example how prior planning can avoid tool changes. With the two faces parallel, the part could be held in the four jaw, as shown in **Photo 17**. The two plain sides were machined first and positioning for this was not critical. However, when turning the second side, the first side had to be in contact with the chuck face to ensure that the two faces were parallel.

The valve chest was then held, exactly as shown in **Photo. 17**, for turning the end face, the boss and drilling and tapping the hole. This time positioning was critical, including the sides of the chest being square to the chuck face. This was tested using a square off the chuck face. The fourth side was also machined in the same way.

For those not conversant with this method of using a four jaw, the following comments will be of help. It should not be used on parts that are gripped only at the end of the jaws, as this will create excessive sideways force on the jaws. Also, first position and grip the part using two adjacent jaws only. Where positioning is critical, this is not that easy, as loosening one jaw will make the part free to move in all directions.

When the part is positioned and held using one pair of jaws, carefully move one of the other jaws to just touch the part. Repeat this process with the fourth jaw, then progressively tighten, first one jaw and then the other, until both are fully tight. By using this approach, placing undue forces on the workpiece will be avoided.

Cylinder covers (Items 6 and 15)

These are made from a single piece of cast iron bar, and both have bosses that register inside the cylinder bore. The lower is the most critical as it has bosses on both sides, one for the cylinder bore, the other to locate in the bore in the standard. These two bosses must be concentric.

With the bar in the chuck, the boss on the top cover was first finished turned, then the cover parted off. When parting off, the tool was first fed to produce a

diameter just larger than that of the dome then withdrawn and moved towards the chuck and parted off fully. This provided a roughly made dome, ready for later finish turning.

The bottom cover was started in a similar manner, finish turning the boss for registering into the cylinder. The hole for the piston rod was also drilled, ensuring that it was concentric with this boss. The cover was parted off, again using the parting off tool to roughly create the other boss.

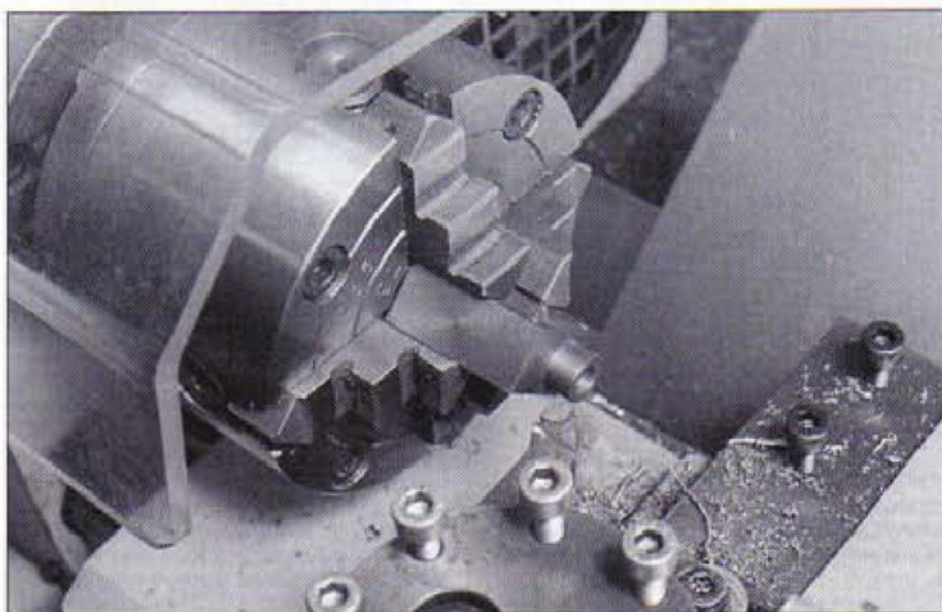
The fixture, **Photo. 1, bottom left**, was now turned, the central bore being a close fit on the cylinder register bosses. Whilst still in the lathe, and therefore still concentric, the bottom cover was placed on the fixture using the thin double adhesive tape, again applying pressure with the tailstock barrel for a firm hold. The part was then finished turned, as can be seen being carried out in **Photo 18**, the hole also being bored for tapping. This process ensured that all faces were

accurately parallel or concentric as is necessary. The dome on the top cover was finished machined in a similar manner.

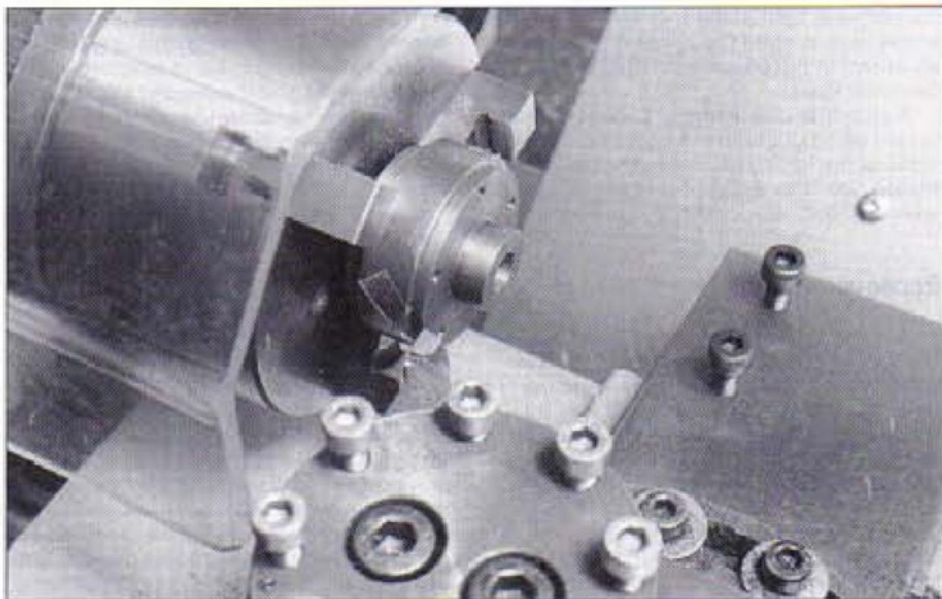
Connecting rod (Item 33)

To fully detail the machining of every component would make the article unacceptably long and inappropriate for a magazine having a much wider appeal than just model engineering. Only limited detail is therefore given on a few of the remaining parts that use purpose made fixtures.

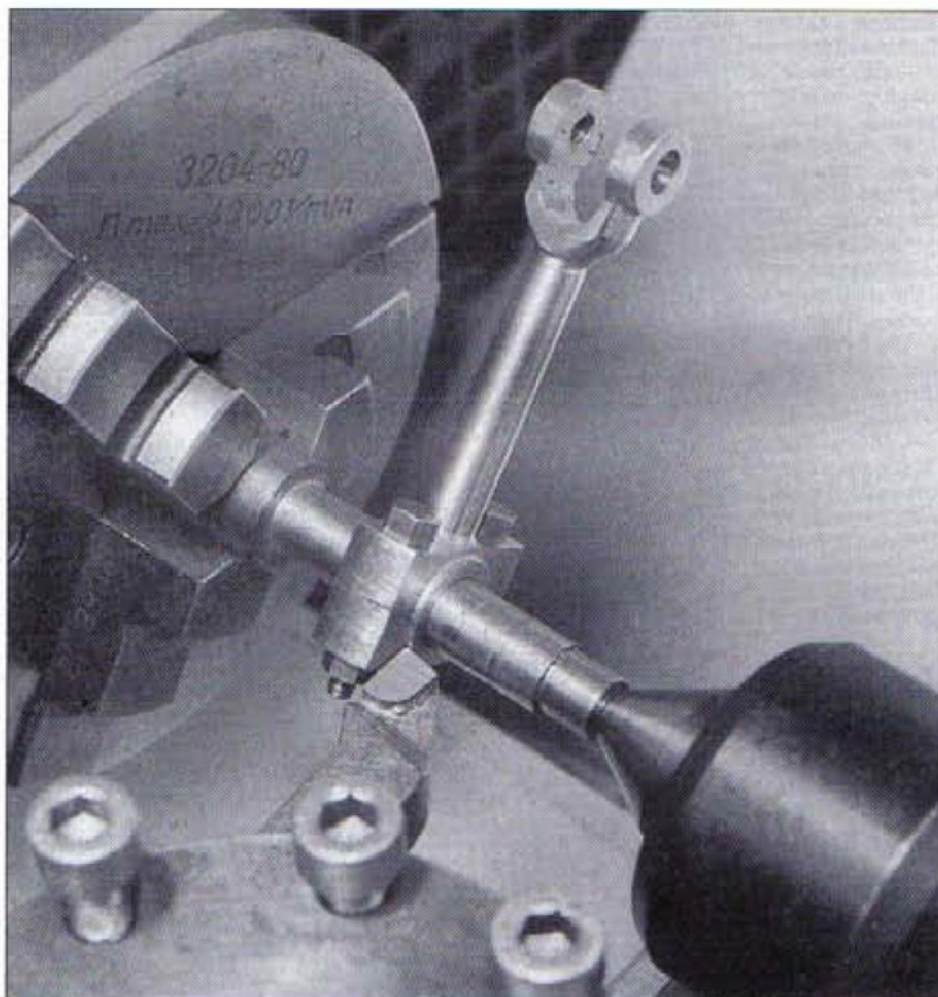
After having slit the big end of the con rod and fitted the parts together, the position for the hole was centre punched on the join line. The base plate was then mounted on the faceplate and with a small area of double adhesive tape, for an initial fixing only, the con rod was positioned on this using the tailstock centre in the centre punch mark. It was then securely held using clamp 2 and the hole drilled and reamed with the D-bit, working through



17. Machining the valve chest.



18. The fixture, bottom left **Photo. 1**, turned and used in situ to machine the second side of the lower cylinder cover. Thin film double adhesive being used to hold the part.



19. The taper mandrel once more being used. In this case machining the con rod big end side faces.

the hole in the centre of the clamp bar. The sides of the big end were machined as shown in **Photo. 19**, using the taper mandrel.

Eccentric strap (Item 45)

The bore of this part was made whilst the part was held in the four jaw. This works well, despite the shape of the end, as shown in the photo published on the Contents Page.

A stub mandrel, **Photo. 1, centre**, was turned as a tight fit in the bore and the sides of the big end faced as shown in **Photo. 20**. This ensured that the faces were parallel.

Eccentric sheave (Item 43)

A piece of bright mild steel was held in the four jaw, the outer diameter turned to fit the bore in the eccentric strap and the retaining groove made. The part was then moved off centre and the bore drilled and reamed using the D bit. The boss was also turned and the sheave parted off, all surfaces being left oversize.

With the taper mandrel in place, the sheave was placed on it and the mandrel supported by the tailstock. The diameter of the boss and the three end faces were finish machined, making the thickness match that of the big end of the eccentric strap.

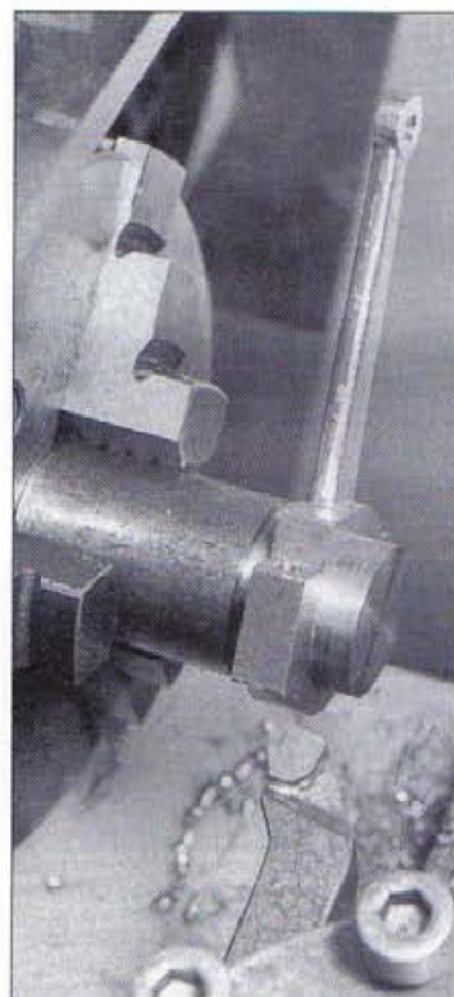
Gland (Item 8)

The gland has six slots around its periphery. After having fully machined the part, less the slots, a piece of hexagon bar was threaded internally to take the gland thread, seen **centre, Photo. 1**. With this mounted on the top slide, suitably packed up to centre height, the slots were made with a small end mill mounted in the headstock chuck. After having completed one slot the hexagon bar was moved round one flat and the second slot made, similarly for the remaining slots. This is an easy way of providing six divisions for simple components, typically hexagon heads for screws.

Drilling

Just one fixture remains, that is the one seen in **Photo. 1, bottom right**. Its purpose was to aid the drilling of the five holes on a PCD in the cylinder and associated parts.

A piece of mild steel was placed in the three jaw and bored out to a depth of around 5mm and to a diameter equal to that of the cylinder bore. An automatic centre punch was held on the top slide and the positions of the five holes marked, the divisions being determined using a 30 tooth gear at the end of the lathe spindle. After parting off, the fixture was drilled with 7BA tapping size holes.



20. Machining the big end faces of the eccentric strap whilst mounted on a taper stub mandrel.

The fixture was then used to drill the two cylinder covers, locating the fixture on the bosses on these. The covers were then used as drilling fixtures for the cylinder and the standard, the holes being either tapped 7BA or opened up to a clearance size.

Other parts were, where applicable, used as drilling jigs for mating parts. Typically, the valve chest being used to drill the cylinder and the valve chest cover.

Remaining parts

It would have been pleasant to have made this article a comprehensive guide to making the 10V in addition to the main aims described at the beginning. This would though, have made it a lengthy series. For those making the engine and looking for more detail, the book 'Building a vertical steam engine from castings' by Andrew Smith and published by Nexus Books, is worth considering, even though it is based on the use of a larger lathe.



References

1. Stuart Models, Braye Road Industrial Estate, Vale, Guernsey, Channel Islands. Tel. 01481 49515 Fax: 01481 47912

AN AUTOSTOP FOR THE MILLING MACHINE SELF-ACT

In our last issue, Stan Wade described the table self-act mechanism which he fitted to his Sharp vertical milling machine. He completes the modification by adding an auto stop system.

After fitting a self feed to the milling machine, the temptation to let the machine do the work was too great, and it was obvious that some sort of an automatic stop was called for if I was to avoid a major slip up at some point in the future. The following is my solution to the problem.

As I had already fitted an adjustable stop to the table, this would stop the feed, but it would put a strain on the mechanism which I did not think would be very good. The answer would have to be a switch in the power feed to the motor.

The obvious arrangement would be to replace the centre fixed table stop with a microswitch which could be brought into action by the adjustable stops at each end of the table. As a stop was required in both directions there would have to be two switches, one for each. If these were wired in series, pressing either would cut off the current to the motor.

Figure 1 shows the layout of the stops, and the switch box. The stop bar is a length of $\frac{3}{8}$ in. dia. steel fastened to the front of the table with two 2BA socket head screws and a spacer at each end. The sliding stops are $\frac{3}{4}$ in. square steel, drilled to fit the bar, then drilled and tapped for clamping screws and slit down to the $\frac{3}{8}$ in. dia. hole to allow for tightening when in position.

If your machine is already with a stop, this could be used, and would simplify the fitting.

Switch Box

Figure 2 is an isometric view of the box itself. The sizes are for the fitting that I



1. The box containing the microswitches acts as the fixed stop

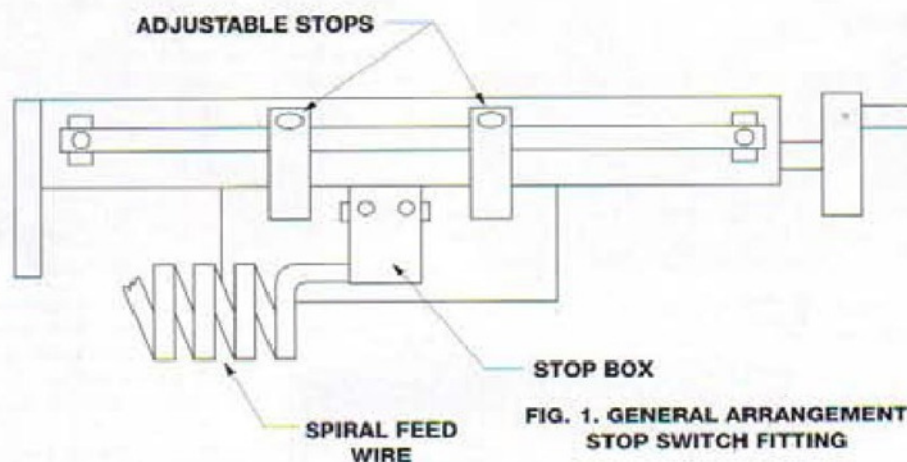


FIG. 1. GENERAL ARRANGEMENT STOP SWITCH FITTING

made, but it all depends on the micro switches that are to be used. Different switches could mean that some measurement would have to be changed. The box (Item 1) was made from a block of aluminium 1.25in. x 1in. x 0.75in., milled out as shown to take the actuating plunger and the two micro switches which are fastened in with 8BA screws.

The idea is for the drive not to switch off at the exact end of the cut, but to cut off just before, thus allowing the last bit to be fed by hand. The switch box itself acts as the fixed stop, just after the plunger is pressed level with the case.

Making The Switch Case

The first operation is to mill the metal to the shape and dimensions shown on the drawing. The $\frac{1}{4}$ in. dia. holes for the plunger and the wire entry are then marked out and drilled, the plunger hole being drilled right through, while the wire

hole is taken down to about three quarters of the depth of the block. These holes remove some of the metal that otherwise would have to be milled out.

The milling can be done at one setting by careful use of the feed screws, and in my case I used a $\frac{1}{8}$ in. slotting cutter for

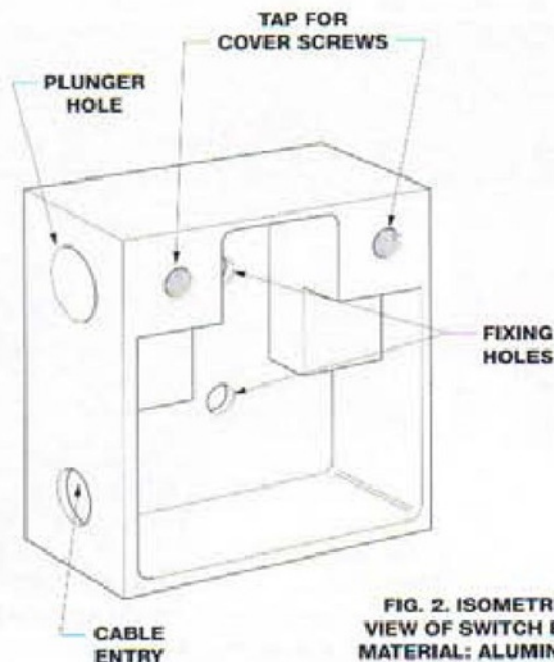


FIG. 2. ISOMETRIC VIEW OF SWITCH BOX MATERIAL: ALUMINIUM

the whole operation, but some may wish to use a larger cutter after going round the outline of the recess with the small one.

Actuating Plunger

Item 2 is made in two pieces from 1/4in. dia. brass rod, drilled and tapped 4BA at one end. A small plate, shaped as shown is sandwiched between the rods (using a short 4BA stud to join them), and presses on the switch arms to cut off the current in each direction. The length of the two rods may have to be adjusted due to variations in the action of the micro switches, but when the switch is operated, there should be about 1/16in. still protruding from the box. Manual operation of the table feed is this then employed until the table stop contacts the wall of the box.

Slots across the ends of the plungers are to allow the use of screwdrivers to tighten the assembly.

Wiring

The main input wires are taken to a

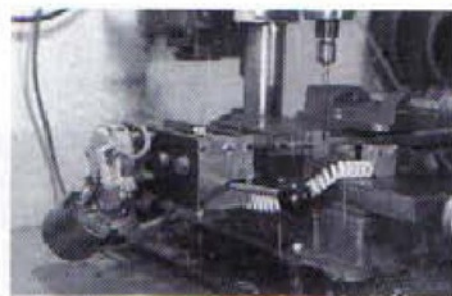
three way terminal block (in my case I used the two outer terminals) which was fixed in a convenient place on the drive unit. I milled a flat on one of the spacers to provide an attachment point.

The rest of the wiring was as shown in **Figure 4**, making use of the centre terminal to connect the push override switch into the circuit. The connection from the reversing switch to the microswitches was via a coiled cable containing two mains wires. Mine was obtained at a club auction, in an electrical junk box, and is ideal for the job.

Both the reversing switch and the override are mounted on the front cover of the drive unit.

The override was added because I found that, when the drive was stopped by the switches and the direction was changed, I had to feed manually for a short distance to allow the microswitch to activate again. The obvious solution was a switch to override the micro's, and a push switch filled the bill nicely.

The centre off reversing switch is used so that, when changing direction, the motor is switched



2. The coiled cable carries the supply to the 12 volt windscreen wiper motor

off first to prevent any back e.m.f. which could cause problems in the control box.

The ends of the coiled lead need to be secured so that there is no pull on the wire itself. I used a plastic tie at each end (the plastic covered wire that is used to tie up plants or Hi Fi cables will do).

Finally, my motto when wiring is "it does not matter where the middle goes as long as the ends go to the right place".

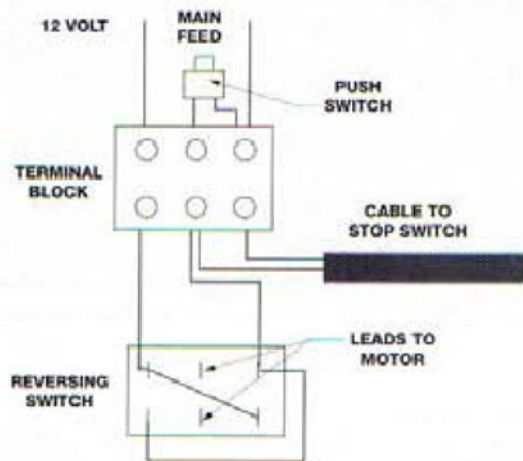


FIG. 4. CIRCUIT DIAGRAM

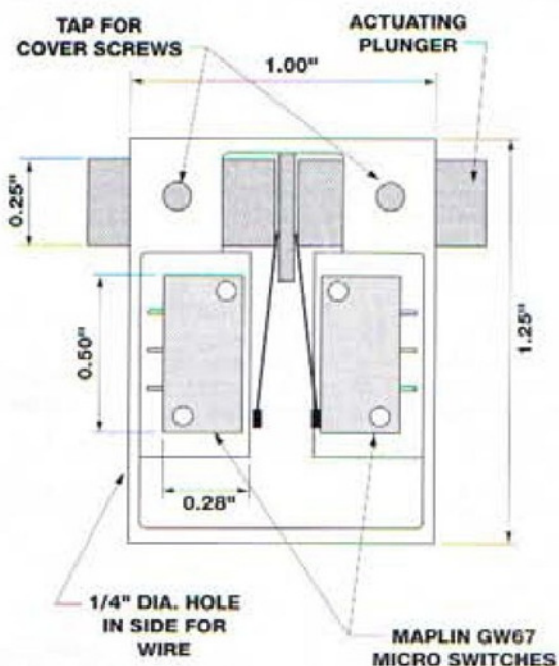
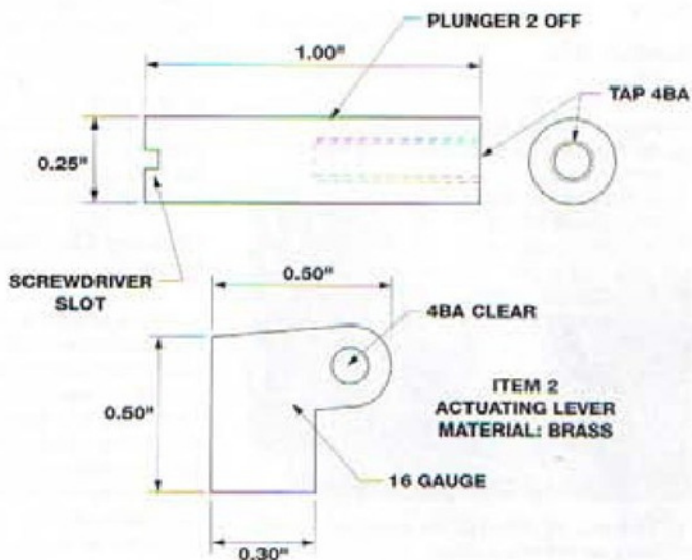
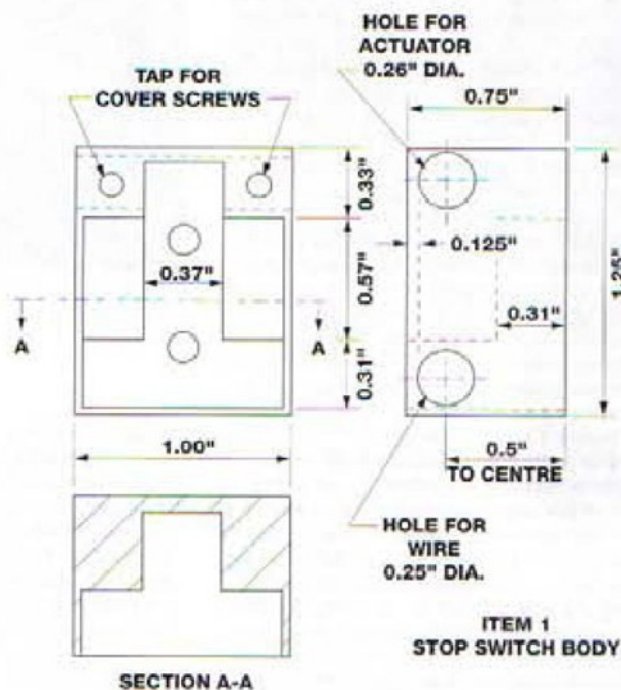


FIG. 3. MOTOR STOP SWITCH



MODELLING BY THE SEA

May Day week brings the annual Model Makers' Festival at the Primrose Valley Holiday Village which is located just south of Filey on the Yorkshire coast. The regular workshop team of Mike Chrisp, Roger and Lee Nicholls and Geoff Sheppard were present to demonstrate a variety of techniques and equipment and also to repair a wide range of items which had come to grief out on the flying fields, car tracks or boating lakes.

Mike's photos illustrate just a few of the interesting scenes.



One of the more unusual repair jobs - fitting a new radio switch to a yacht owned by one of the lady competitors.



Yorkshire modeller John Bamforth is wheelchair bound, but this does not prevent him from driving such models as his 2in. scale 'Minnie' traction engine or his 'Clayton' undertype wagon around the extensive private road system within the Village. This year however, he decided to give the 1in. 'Minnie' an airing.



A Greenwood Tools parting tool made short work of producing some steel discs.



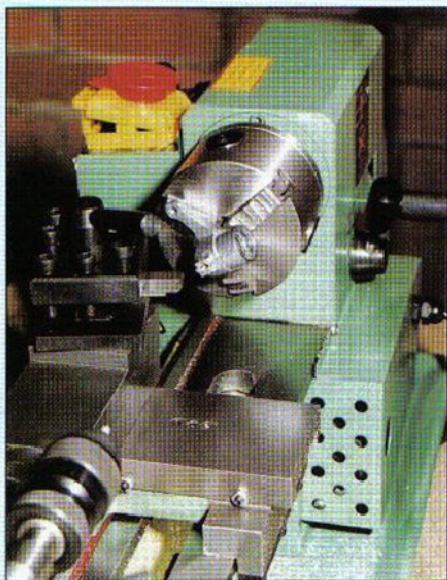
This 'Conquest' lathe, loaned by Chester U.K. Ltd shouldered much of the machining burden during the week. It proved to be a versatile and accurate machine.



Mike Chrisp, Technical Editor of Model Engineer magazine demonstrates lathe tool sharpening on the latest version of the 'Worden' tool and cutter grinder, supplied by local firm Messrs Hemingway of Burstwick, Hull.



The Editor had the opportunity to try the new Autotorch Brazing System, loaned by Bullfinch. It was capable of silver soldering smaller boilers.



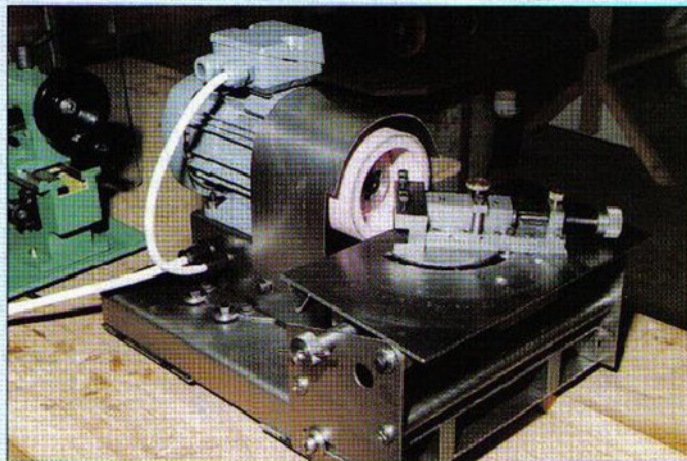
One of the more delicate salvage jobs involved inserting a threaded bush into this model car transmission housing when a replacement component could not be located.



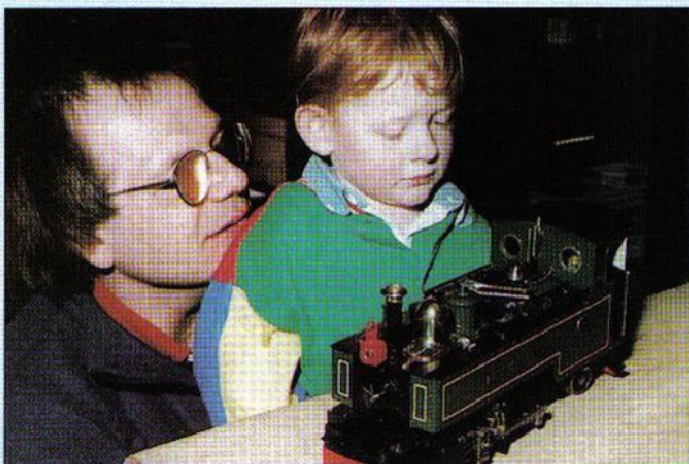
The works of this beautifully machined aircraft gearbox had become deranged, but were restored by the judicious application of a little 'Loctite'. However, the main problem proved to be how to gain access to the 'works', so well did the components fit together.



John Bushell of Harrogate appears to be delighted that he can make Mike's Stirling engine operate from the heat of his hand.



Another view of the 'Worden', which showed itself to be capable of a variety of sharpening tasks. We hope to bring you more information on the construction of one of these machines in future issues.



Three year old Christopher Beech is already a regular at Primrose Valley and a discerning enthusiast, fascinated by all the goings-on in the workshop. Here he is seen with his father, Julian, admiring an exquisite narrow gauge locomotive.



At the other end of the scale is Barry Johnson's 'St. George', a model of Wilson's Farmers' Engine, which covers many miles despite having metal shod wheels.



THE TRIPLE MACHINE

A combination sheet metal working machine has been sold all round the world, but there seems to be little literature available.

Philip Amos gives some information on the adjustment and use of this device.

About 30 years ago there appeared on the market a Taiwanese design of sheetmetal working machine which combined the functions of guillotine, pressbrake and rolls. It was often referred to as the 'Triple Machine'. It was stated to have a capacity of 20 gauge steel sheet (1mm) and came in two models 24in. and 30in. working width. I purchased a 30in. machine and have used all its three functions extensively over the intervening years; it has been a most useful part of my workshop equipment. Unfortunately, it did not come with any instructions for adjustment or use. Likewise there does not seem to be much written in this regard in any of the texts I have consulted. Thus I have been forced back to first principles, trial and error experimentation and drawing on comparison with full size

commercial machine practice to find my way. It seemed that it might be helpful to others to record these matters, so that is the purpose of this article.

General Description

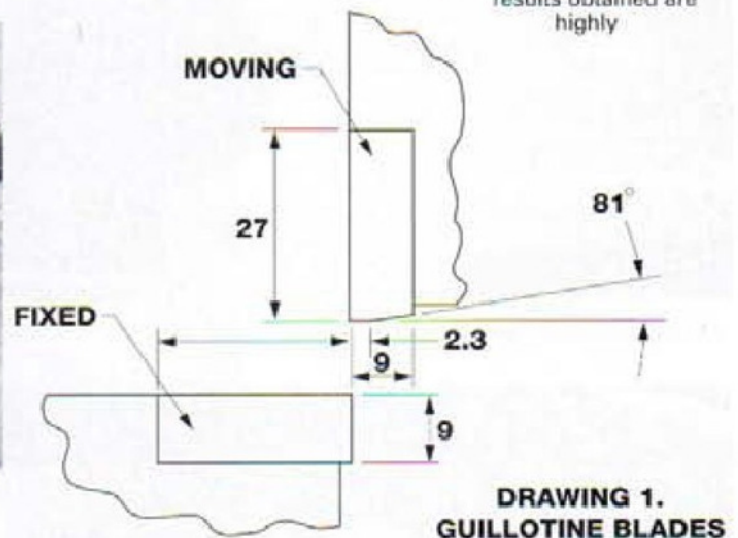
The machine is shown in **Photo. 1**. It is intended to be bolted down to a bench; this is essential for its stability. In my case I welded up a stand of angle steel fitted with wheels so that it could be moved if necessary. The stand also has removable feet projecting front and rear to improve this stability. These are fitted with levelling screws so that the machine table can be set horizontal in both directions. It later had storage shelves fitted as well - see **Photo. 2**. The

machine has a cast iron frame comprising two columns linked by two horizontal beams. At the top there are two rolls geared together at the right hand end. The top roll is removable. There is also a deflecting roll mounted behind the other two.

The lower roll is driven by a handle which can be fitted to either end. Keyed to this roll are two cranks at the lower ends of which is a moving beam, constrained to move vertically. On the upper edge of this beam is a Vee die which engages with fixed Vee ended punches to provide the pressbrake function. On the lower edge of the beam is a guillotine blade which passes a similar blade fixed to a stationary table which is bolted to the machine frame. Thus the whole concept is elegantly simple and the results obtained are highly



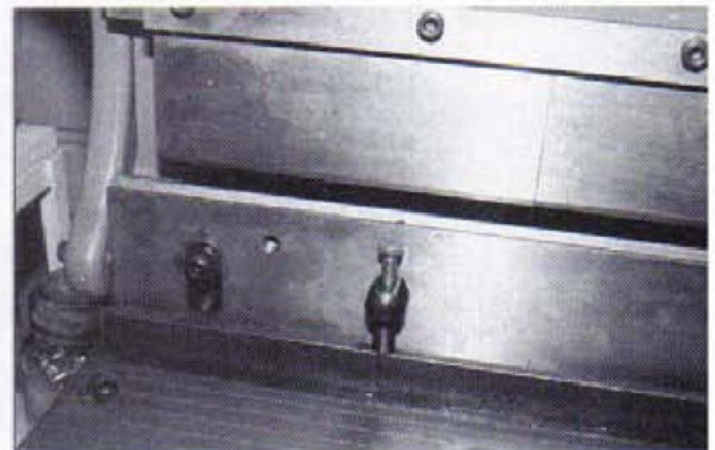
1. Triple machine



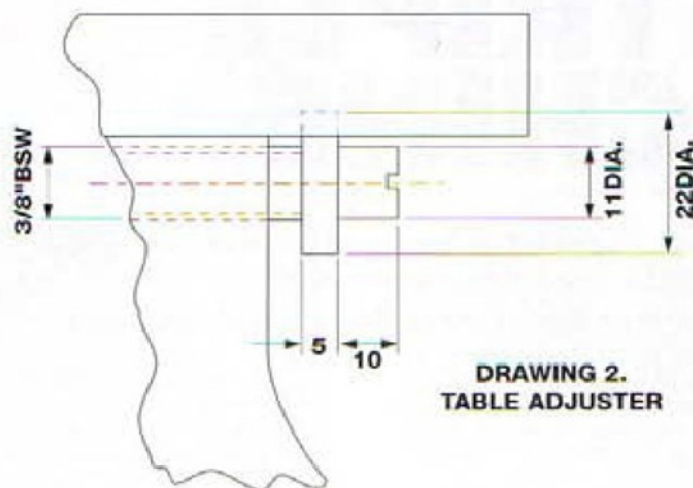
DRAWING 1.
GUILLOTINE BLADES



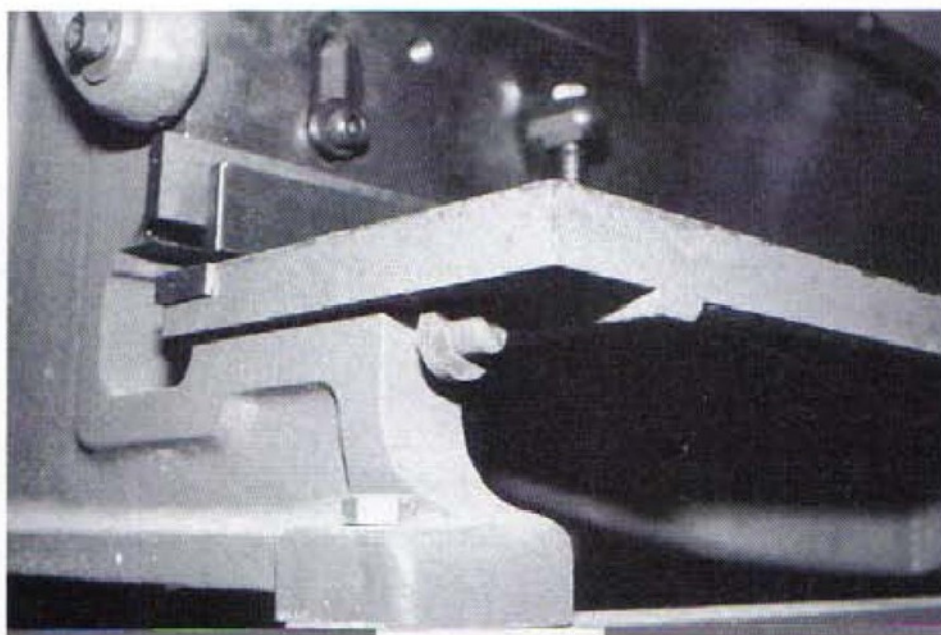
2. Fabricated stand - note levelling screws



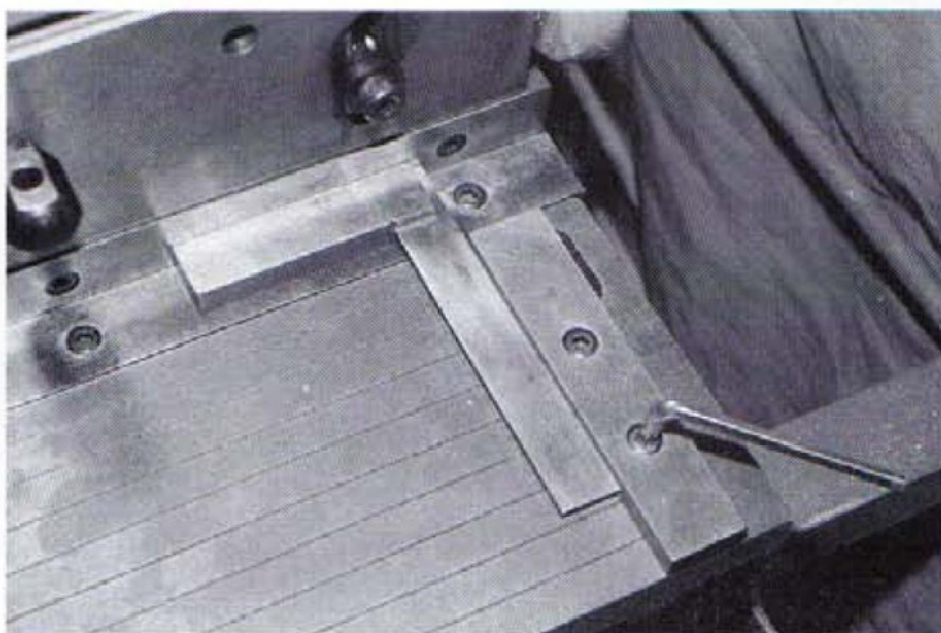
3. Guide washer & screw, pressure pad spring & screw, and table clamping screw



DRAWING 2.
TABLE ADJUSTER



4. Table adjusting screw



5. Setting table fence

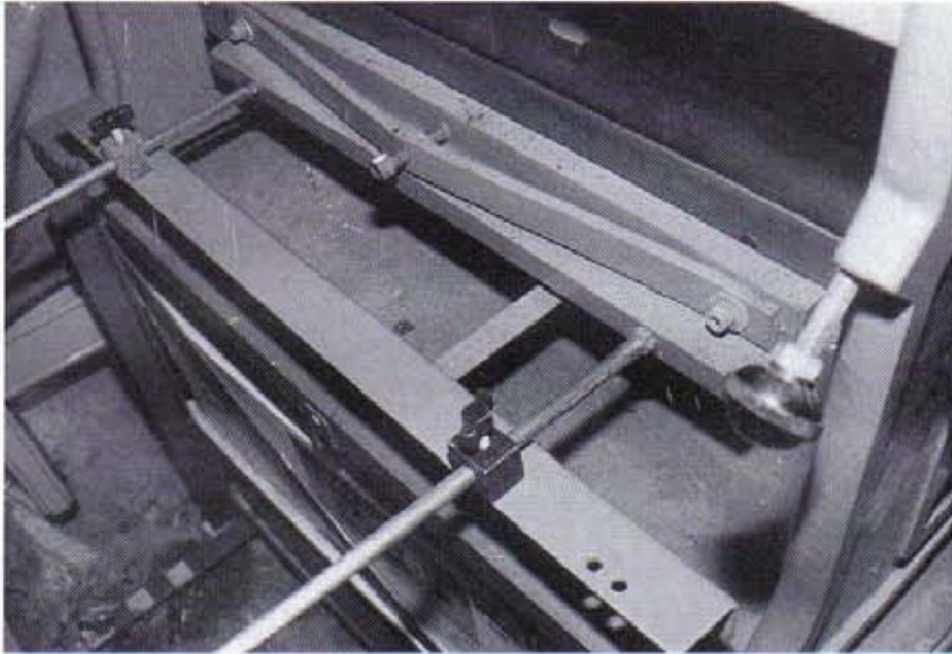
satisfactory.

Guillotine

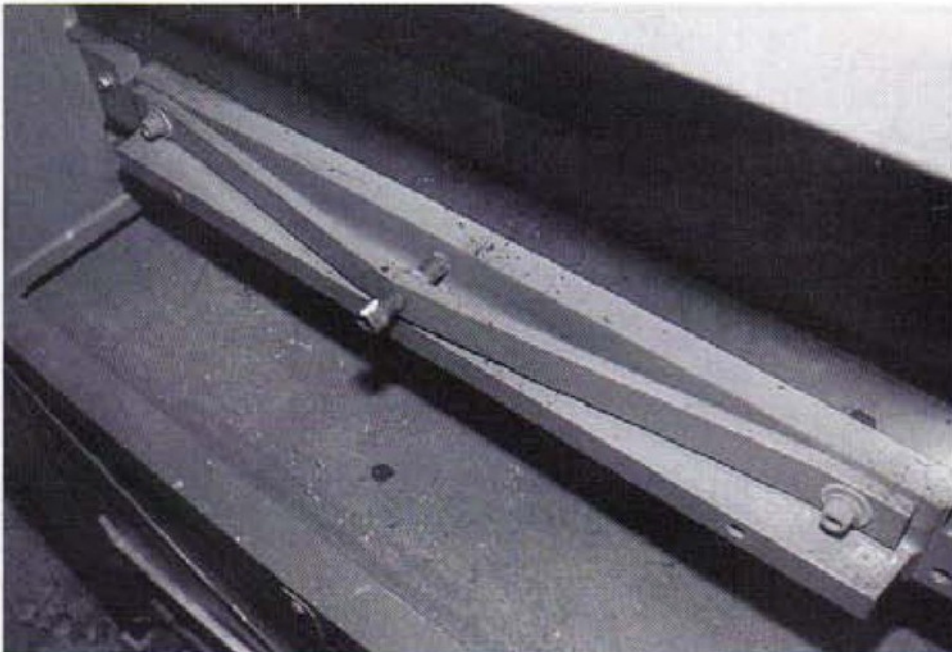
The moving blade, of tool steel, is attached to the bottom of the moving beam with seven socket capscrews $\frac{1}{4}$ in. BSW, and is constrained to vertical movement by large washers $20 \times 9.5 \times 5.2$ mm thick held against its face by two $\frac{5}{16}$ in. BSW capscrews. These pass through slots in the moving beam into the fixed beam behind - see **Photo. 3**. There are washers and locknuts behind the fixed beam. The fixed blade, also of tool steel, is attached to the rear of the horizontal cast iron table, again with seven $\frac{1}{4}$ in. BSW socket capscrews (**See Drawing 1**). Underneath this table at each end there are screws which allow its horizontal position to be adjusted, so that the blade can almost touch the moving blade (**Drawing 2 and Photo. 4**). After setting, the table is clamped in position on the frame with two socket capscrews, $\frac{3}{8}$ in. BSW, one at each end. The moving blade is not horizontal but slopes with 11 mm difference in height over its length of 838 mm i.e. it is angled at 0 deg. 45 min.. Thus it shears the workpiece progressively from right to left. This means that when the moving blade has sheared through a 1 mm workpiece at a particular point and is opposite the stationary blade at that point, then at a point 76 mm to the left it is only just commencing to shear the workpiece. Attached to the front of the moving beam is a full width pressure pad $820 \times 26 \times 9$ mm thick held by two hex. headed screws, $\frac{5}{16}$ in. BSW, on which are springs which are unloaded when the blade is up and compressed just about solid when the blade is down. At this point each spring exerts a force of 10 Kg; this corresponds to a pressure of $2 \times 10 \div (9 \times 820)$ or 0.0027 Kg/mm² over the whole pressure pad. This is really not a very great amount to prevent transverse movement of the workpiece, and it may be found that there is a tendency for the moving blade to carry some of the sheet around the edge of the fixed blade rather than shearing it cleanly. This matter is further addressed below.

In order to cut a sheet at right angles to its side there is provided at the right hand side of the table a short guide fence secured with two $\frac{1}{4}$ in. BSW capscrews. This fence can be adjusted slightly so as to be exactly at right angles to the blade using a try-square and then locked in position - see **Photo. 5**.

To cut sheet to a particular dimension a backgauge can be fitted at the rear of the machine as shown in **Drawing 3A and Photo. 6**. Note that the backgauge is fitted to the stationary part of the machine so that it does not move relative to the workpiece. A steel rule set against the edge of the stationary blade can be used at each end to locate the backgauge where required and it can then be locked in position. In use the sheet is pushed through under the moving blade until it is stopped by the backgauge and held there while the guillotine is operated. However, for one-off jobs it may not be considered worth the time to set up the backgauge. In such case the edges of the workpiece can be marked with a black marker pen and a line scribed where the cut is required. The



6. Setting backgauge for guillotine



7. Stiffening bridge for lower fixed beam

edges with the fixed blade edge. The workpiece is held in this position while the guillotine is operated.

Modern commercial machines have electrical push-button operated backgauges with digital readouts, but this concept is far too expensive for the home workshop. Likewise, in commercial power operated machines there are guards fitted around the front of the blade and pressure pad. Lighting is often provided inside the guard to illuminate the work - I am contemplating fitting something similar to light my machine.

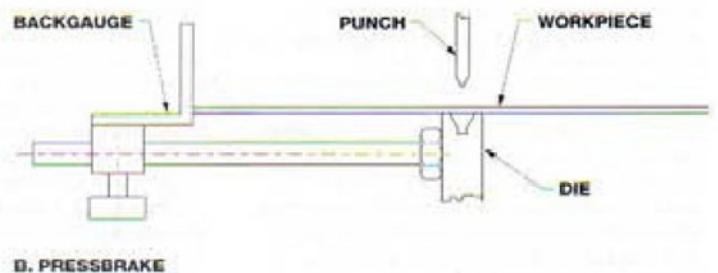
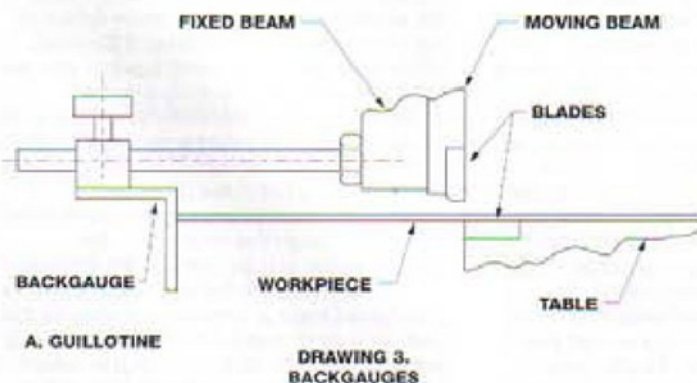
At the rear of the lower fixed beam there is a steel bridge with a $\frac{1}{2}$ in. BSW adjusting capscrew to allow pretensioning of the beam to minimise any tendency to bend away from the work - see Photo. 7. There is no obvious basis to determine how to set this screw so I have left it as received from the factory and it seems to have been satisfactory.

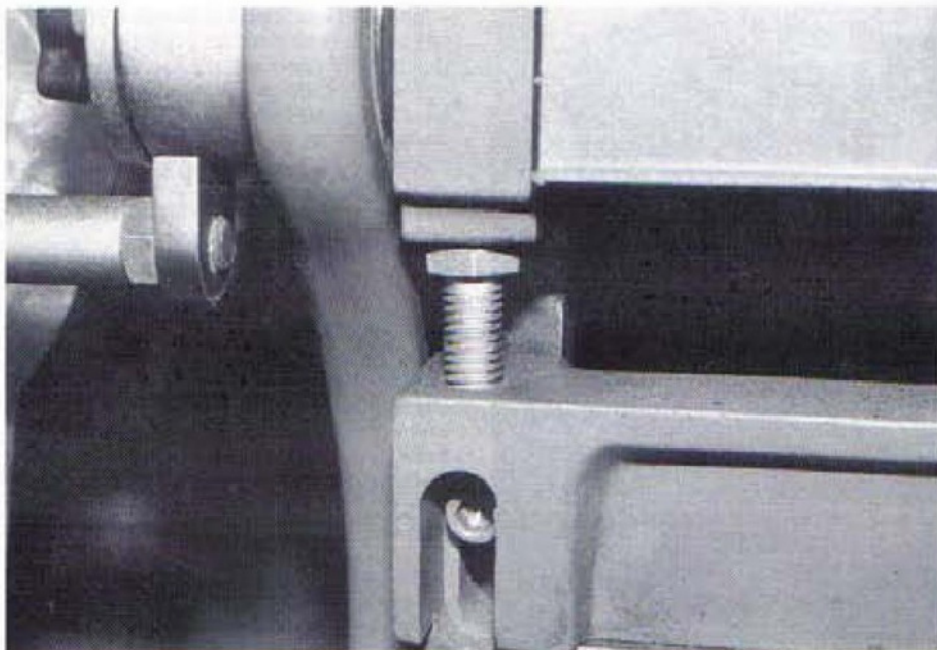
Three matters must be addressed to promote clean cutting by the guillotine. Firstly the blades must be keenly sharp. The blade should be detached and its edge closely inspected with a magnifier. Any burrs should be removed by lapping with a diamond lap - the vertical face of the fixed blade and the horizontal face of the moving blade. After long service these blades will need to be taken to a commercial establishment for resharpening, as this process requires large equipment not available in the home workshop.

Secondly the vertical blade must move freely in the vertical direction, but have absolutely no movement front-to-back horizontally. Thus the two screws and thick washers at each end of the moving beam controlling this movement must be tightened and locked to achieve this condition. Better too tight than too loose, but the beam must be able to still move vertically without excessive effort on the handle.

Thirdly the gap between the fixed and moving blades must be minimal. Their relative positions can be set using the adjusting screws below the horizontal table at each end. The $\frac{3}{8}$ in. BSW clamping screws through the top of the table are slackened off, and the adjusting screws moved appropriately so as to position the fixed blade as nearly as possible to achieve a uniform small gap to the moving blade when the latter is lowered behind it. The straightness of these two blades will now be revealed. In my case, over a blade length of 838mm, the maximum gap as measured with a feeler gauge is 0.15mm when the minimum gap is less than 0.03mm. The two blades should not touch. With this gap my machine cuts cleanly. If this were not

sheet is placed under the moving blade and, by sighting down past the pressure pad, it is possible to align both scribed marks at the





8. Upper fixed beam clamping & adjusting screws

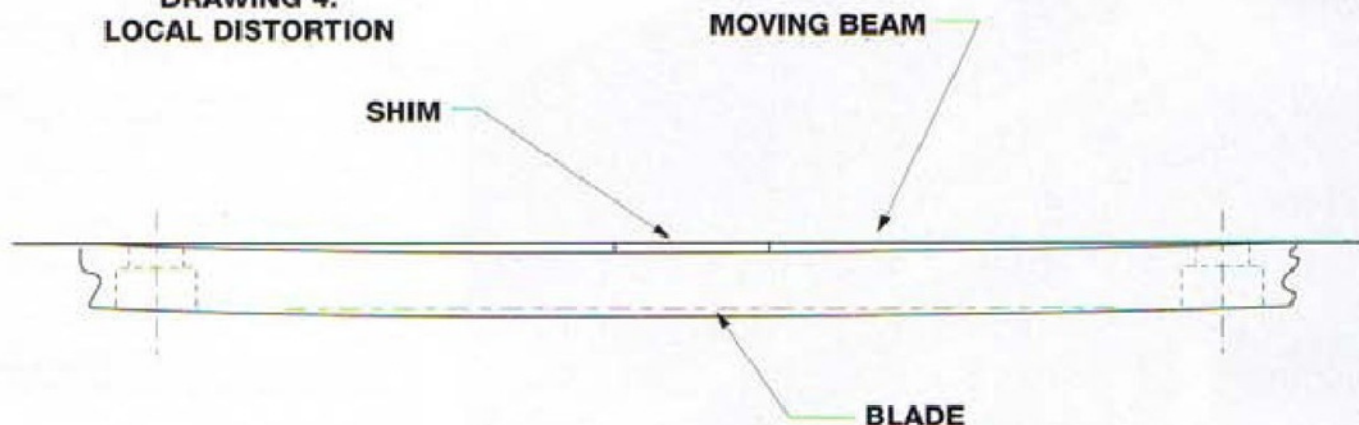
are possible, allowing for some springback. A bit of experimentation may be necessary to get exact 90 deg. bends where required, but some adjustment with a rubber or rawhide mallet can usually produce the final shape desired. In commercial practice, the exact stroke depth required to achieve the desired angle can be found and set for completion of all parts in that production run.

To make a bend, its position is scribed on the workpiece. The die is raised until the workpiece can just fit between the top of the die and the bottom of the punch. The workpiece is then wiggled around until the scribed line just falls along the punch edge, when the die can be raised to the full extent needed to produce the required fold. As will be seen from

Drawing 6 there is a minimum width of flange that can be folded in the machine; the flange must at least run from the centreline of the die to its flat surface and preferably with a bit of overlap.

The backgauge referred to for the guillotine can also be re-positioned for use with the pressbrake function - see **Drawing 3B** and **Photos. 10 & 11**. Note that the backgauge is attached to the

DRAWING 4.
LOCAL DISTORTION



the case I would try to reduce the maximum gap by shims behind parts of the moving blade to locally distort it slightly when it is clamped to the moving beam - see **Drawing 4**.

Pressbrake

The fixed punches of the pressbrake are attached to the top fixed beam of the machine by a common clamping bar held by seven $\frac{5}{16}$ in. BSW socket capscrews. Sometimes it is difficult to make the clamping effective across all punches, but a piece of cellophane adhesive tape run across the top front face of each punch seems to overcome this problem.

The punches must all be at a uniform height above the moving die, and for this purpose there are two adjusting screws at the ends of the upper fixed beam. The clamping capscrews ($\frac{3}{8}$ in. BSW) are slackened off and the $\frac{1}{2}$ in. BSW adjusting screws can be turned by their $\frac{3}{4}$ in. AF hex. section, after which the clamping screws are retightened. On my machine,

the factory setting was correct, so no adjustment has been required - see **Photo. 8**.

The fixed punches have a variety of widths 255, 250, 152, 76, 51 and 25mm. This allows a selection of sufficient punches to produce a width just a little shorter than the required width of the part to be bent, when side bends would interfere with the punches during the operation - see **Photo. 9**. In this way all four edges on a sheet can be folded up. However, if some of the edges are to be folded up and some down, this may not be possible because of physical interference between the job and the tool. Sometimes one edge can be manipulated beyond the end of the die block, but this cannot be guaranteed in every case. Even when there are a number of parallel folds, it may be necessary to effect them in a particular sequence if they are to be achieved without interference problems.

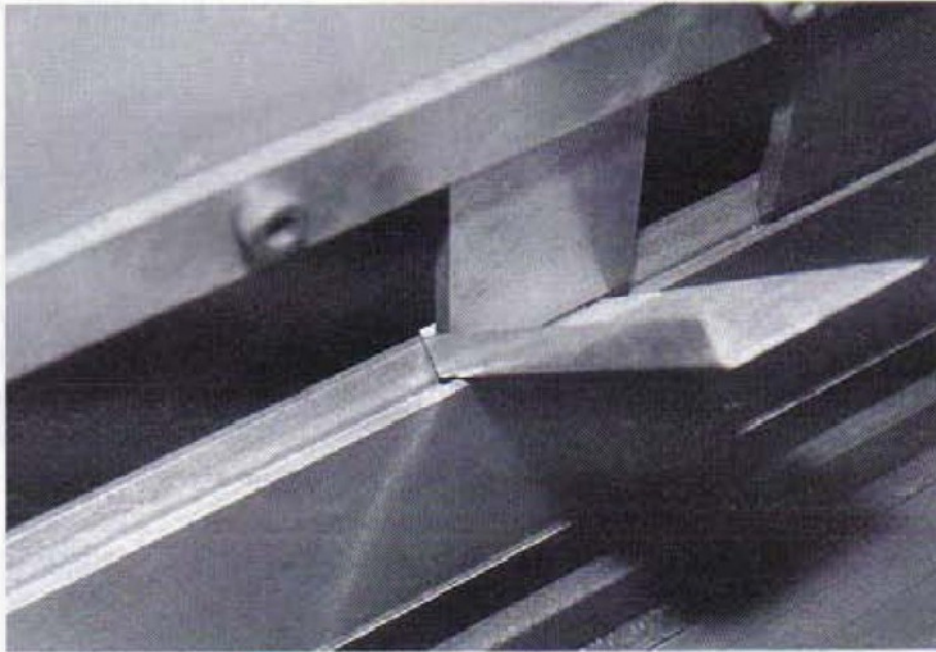
Drawing 5 shows the cross section of punch and die, from which it will be seen that it is possible to make bends beyond 90 deg. In fact, bends up about 115 deg.

moving beam and so does not move relative to the workpiece. Thus it will be seen that the pressbrake is a very handy metalworking device, but it has some inherent practical limitations.

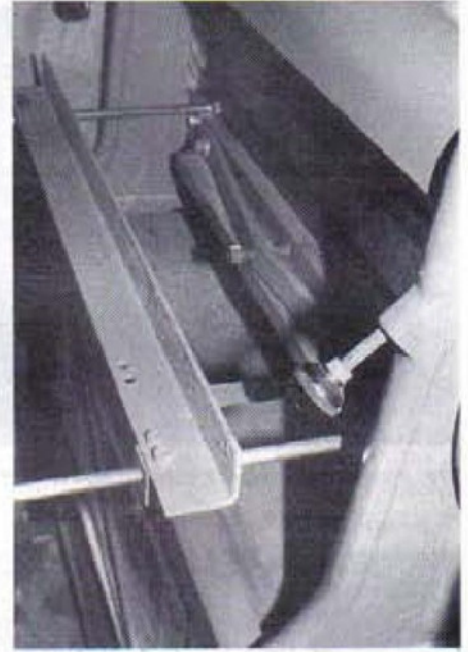
Rolls

The form of rolls in this machine is known in the trade as 'pinch type'. Here the sheetmetal is gripped firmly between the two main rollers (**Photo. 12**) which frictionally drive it forward against another roller (**Photo. 13**), causing it to be deflected and progressively bent into a circular form. The initial length from pinch rolls to deflector roll remains straight after the operation, but if the piece of sheetmetal is now reversed in orientation and put through the rolls again, the straight piece will be curved like the rest.

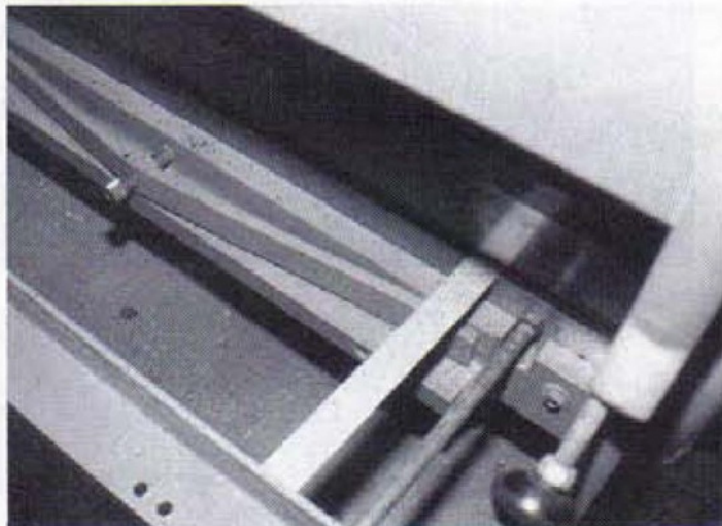
The deflector roll behind the machine is positioned by two screws at 45 deg. to the vertical axis through the two pinch rolls. It is important that both ends of the deflector roll are at the same height, unless one is



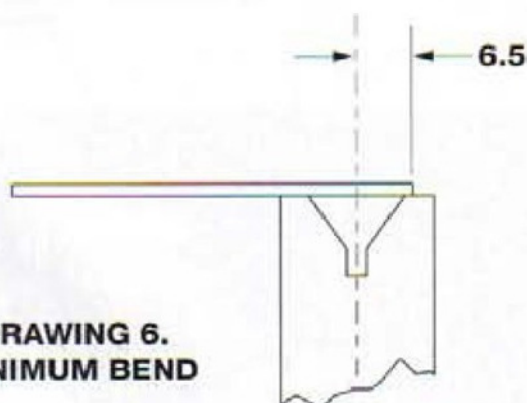
9. Folding edges at right angles to each other



10. Setting backgauge for pressbrake - note deflector roll adjusting screws



11. Setting backgauge for pressbrake

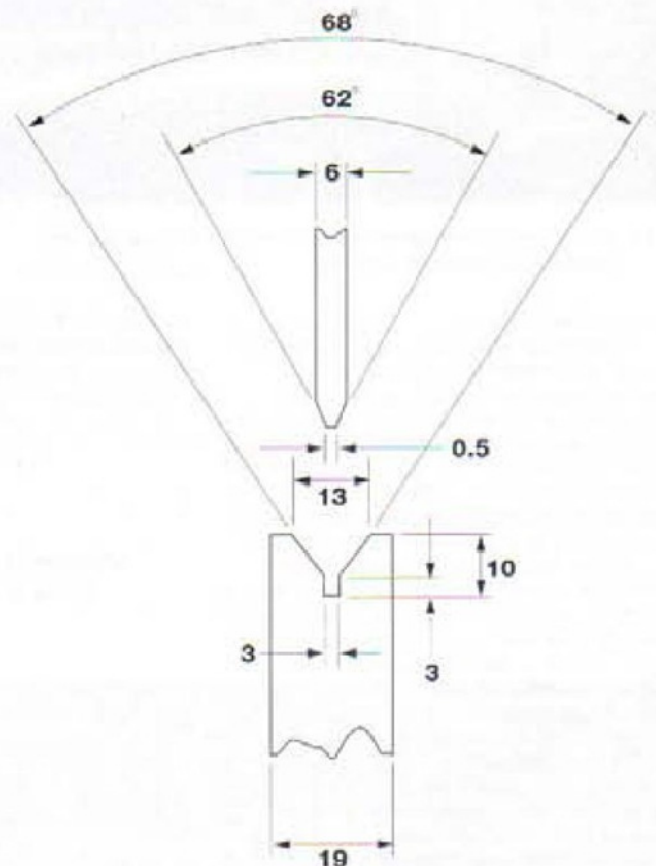


**DRAWING 6.
MINIMUM BEND**

trying to roll conical shapes. I have marked the bakelite knobs on the screws with white dots so that I can keep them in step, at least to about 1/4 turn.

When commencing a job it is inserted between the pinch rolls which are screwed

down in contact with the workpiece so that there is the same gap at both ends. The sheet is checked with a square to ensure that its edge is perpendicular to the rolls. If it is not the piece will be rolled into a helical shape. The deflector roll is set in



**DRAWING 5.
PRESS BRAKE - PUNCHES & DIE**

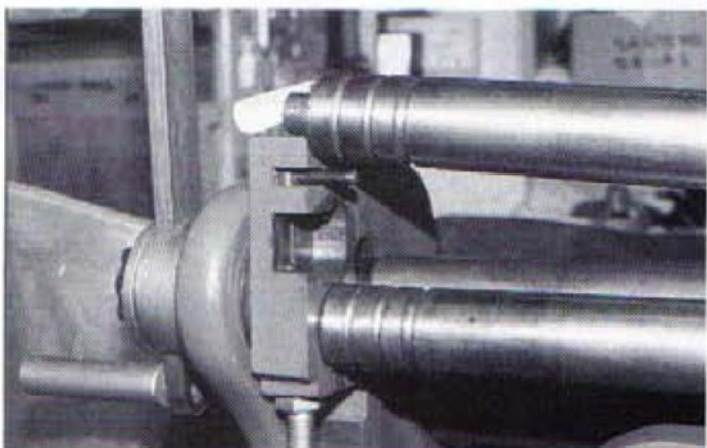
height so that the job will approach it about half way between its diameter and its top edge - see **Drawing 7**. For conical rolling, it will be necessary to set the screws twice for each pass, with the heights reversed when the workpiece is



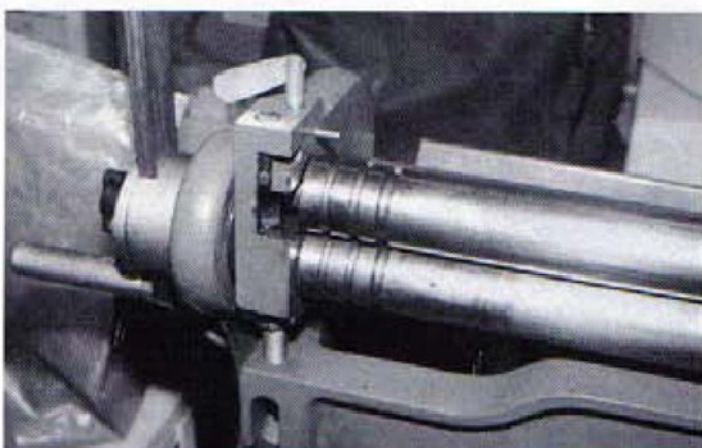
12. Pinch rolls - note tightening screws with flag handles on top



13. Deflector roll. Gearing of pinch rolls can be seen at far end



14. Top pinch roll released from its bearing by rotating the vertical part cylinder retainer



15. Top pinch roll held in place by retainer. Note grooves in rolls

turned end for end.

The rolling process is repeated with progressively increasing height of the deflecting roller. In due course, the curvature becomes such that the ends of the job are too close together to remove it from the top roll. However, that roll can be released as shown in **Photo. 14**. The absolute minimum diameter which can be rolled is that of the roller itself i.e. 38mm.

At the left hand end of the pinch rolls there are several grooves of different sizes (3.9, 4.7 and 6.2mm - probably intended to be $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ in.) to allow curving of wire or rod or sheetmetal with wired edges (**Photo. 15**). Although the machine has a rated capacity of 1mm thick steel, I have successfully curved 3mm thick steel of limited width (50mm) by multiple passes, each causing only slight further curvature. This process was carried out close to one end of the rolls to minimise bending effects on the rolls themselves during the bending operation.

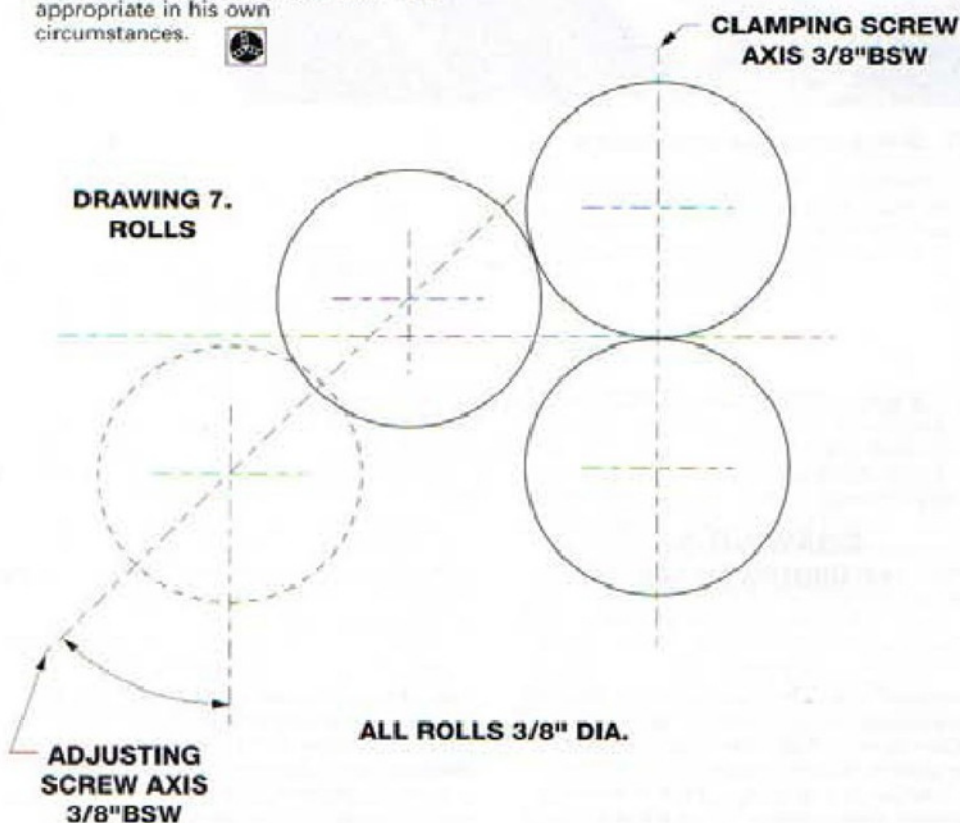
Conclusion

The triple machine is a great acquisition for any home workshop and, with careful operation, can perform a great many useful functions. However, current pricing seems to be quite a lot more than when I bought mine about 20 years ago, so each

worker will have to evaluate for himself whether purchase of such a machine is appropriate in his own circumstances.



DRAWING 7. ROLLS



MORE MODIFICATIONS TO THE HOBBYMAT

In this second article on the modifications he has made to his Hobbymat lathe, E. J. (Mac) Mackenzie describes a major revision of the cross slide and top slide feed arrangements

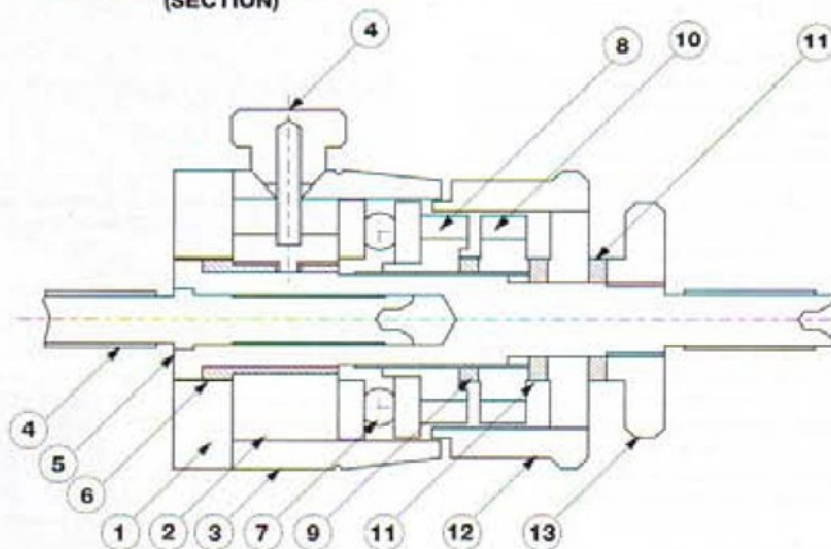
In a previous article on screw-cutting on the Hobbymat (Issue 40, page 52) I mentioned that in order to be able to use the top slide 'set over' method it had been necessary to make and fit what I called 'quadrants' to the cross slide. I also noted that to be able to cut 55 deg. and 47.1/2 deg. BA threads some means of overcoming the obstruction of the top slide by the cross-slide feed wheel became necessary. I indicated that I had elected to redesign the feed arrangements rather than reduce the diameter of the original equipment cross-slide feed wheel and suggested that it would be up to the Editor as to whether I was required to report back on this project. In his wisdom he has acquiesced, so here we go.

Objectives

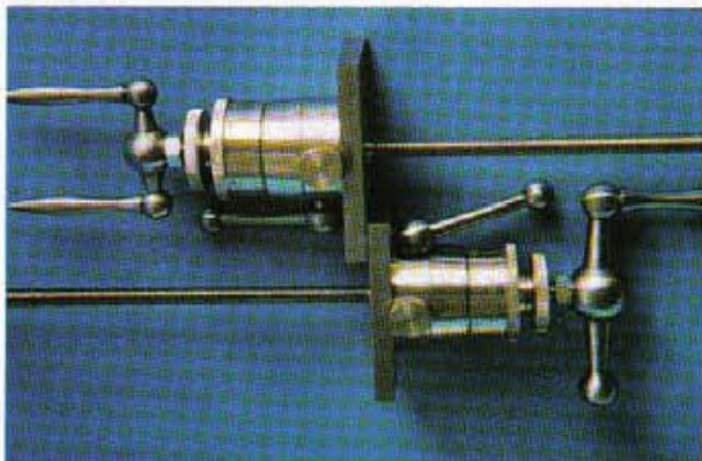
When I was assembling my thoughts on the project five objectives emerged. Having browsed with pleasure through 'The Model Engineer's Workshop Manual' by the late George H. Thomas, I decided that I would follow his example and use a thrust ball bearing in the design. The second feature, from the same source, would be the inclusion of a spindle clamp,

as I have frequently observed movement of the leadscrew or cross slide feed wheels when cutting has been in progress. Thirdly, I considered that positive clamping of the micrometer index collar would be a desirable feature. The fourth objective would be to have index collars graduated in fiftieths of a mm rather than the fortieths of a mm of the original equipment. Finally, I decided that where possible I would employ suitable

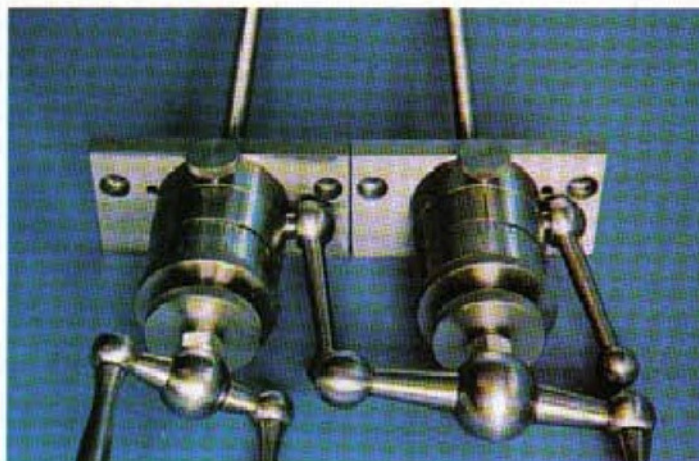
FIG. 1. GENERAL ARRANGEMENT (SECTION)



1. The Mk. 1 system showing the 'set-over' arrangement



2. The Mk.2 feedscrew assemblies



3. Another view of the Mk. 2 system



4. Components of the Mk. 2 system

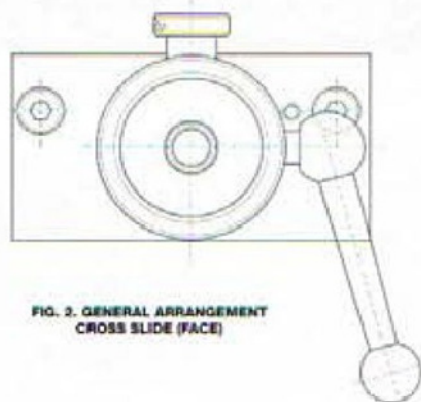


FIG. 2. GENERAL ARRANGEMENT
CROSS SLIDE (FACE)

adhesives with a view to simplifying machining.

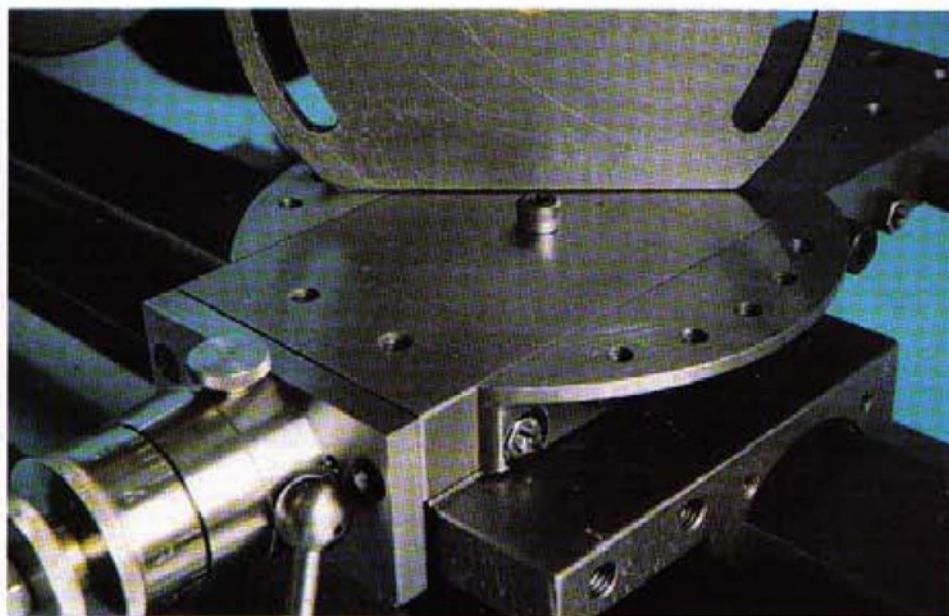
There were many re-thinks (I can't give them the status of re-designs), during the 'make' activities, usually with a domino effect, so that I've ended up with a box of redundant completed and part completed bits which I must throw away some time. When finally completed, the new arrangements functioned well enough but there was one drawback; the increased overall length of the new top slide set-up proved inconvenient (Photo. 1). A Mk. 2 arrangement was called for with the same five objectives but a reduced overall length. The cross slide feed could have remained in its Mk. 1 form but in consideration of aesthetics and inter-changeability of parts it was included in the redesign. Photos. 2 and 3 show the revised assemblies, while Photo. 4 illustrates the component parts.

Minor modifications

As usual, the project spread tentacles to gather in related minor modifications which were generated. I feel that these are worthy of consideration regardless of feed arrangements and have described them below.

a. Top slide swivel. (The handbook names this the saddle base').

I forget the original arrangement for this. I have substituted an 8mm i.d. reamed phosphor bronze bush, 'Loctited' into the drilled-out pivot hole in the cast iron swivel plate. This is complemented by a M5 socket cap screw turned to fit and screwed into the corresponding (now drilled and tapped) location on the cross slide. This modification has provided a more positive feel when rotating the top



5. The top slide swivel modification

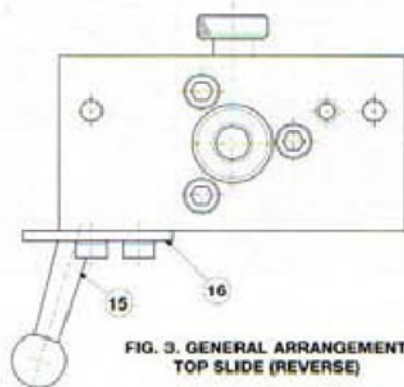


FIG. 3. GENERAL ARRANGEMENT
TOP SLIDE (REVERSE)

slide and adds to the confidence that no unwanted deflection (due to any slight play in the securing arrangement) is likely to occur when carrying out a top slide taper turning operation. (Photo. 5)

b. Gib strip location (1).

To provide a positive stop preventing end play in the gib strip a M3 (in practice a 1/8in. x 40 BSW) socket grub screw has been installed in the slide end plate. This is tightened as required against the hold of the gib strip adjusting screws (see below) until there is no apparent end play in the gib strip. The location of these grub screws as shown on the Item 1 drawing is to suit the gib strip positions on my Hobbymat. If you are considering employing this modification it would be as well to establish the relevant dimensions for your own lathe. When viewed from the front, the grub screw is on the right side of the feed screw on the cross-slide and on the left on the top slide. (Photo. 6)

c. Gib strip location (2)

The original provision for adjustment consisted of M4 slotted grub screws with locknuts and with points at the leading ends. These have been replaced by 18mm lengths of M4 studding 'all-thread', slotted

one end with a 3.2mm dia. x 2mm long turned portion at the gib strip end. Full nuts have been used rather than locknuts to secure them; there is sufficient space and the spanner holds better when adjusting.

To marry the gib strip with the replacement screws it was located in its original longitudinal position with the pointed screws and then clamped to the bevel of the slide. The socket grub screw in the end plate was then nipped up to the gib strip end for insurance. I then adopted the following procedure:- the first pointed screw was removed and the gib strip drilled 3.3mm dia. to the required depth (not right through, though I'm not sure whether it would matter) using the screw hole in the slide as a guide. A replacement adjusting screw and nut were then located and secured.

In practice, I drilled one hole at a time (don't we all), fitting and securing a replacement adjusting screw and nut and checking the end-locating grub screw before drilling for the next replacement, reclamping as necessary.

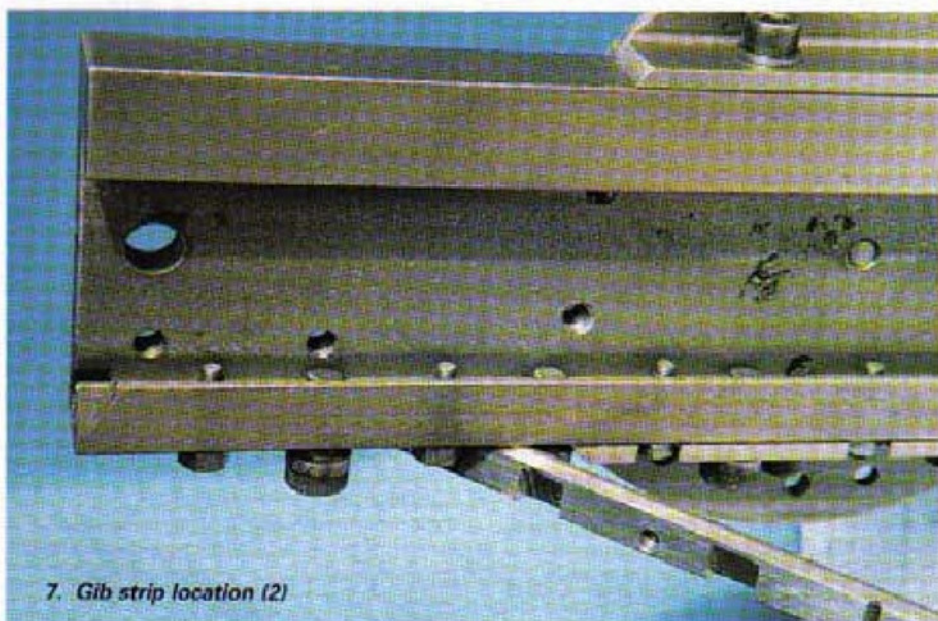
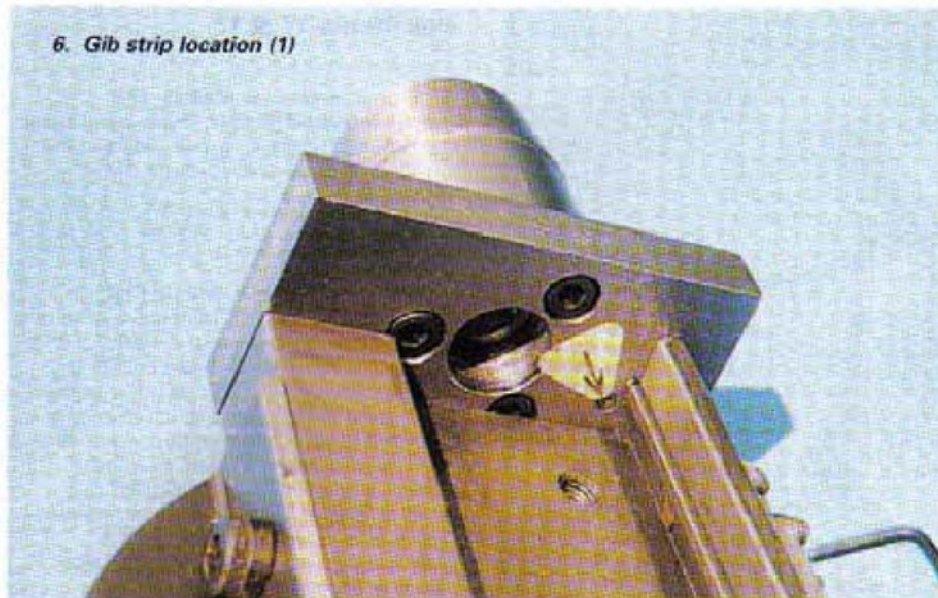
I would point out that the above-described modification is not of my conception. I might have read about it somewhere but I don't remember where. Perhaps that veritable font of engineering knowledge 'Good old Ray' was the source.

The gib strip modifications have resulted in adjustment settings providing a more positive, consistent and lasting fit of the slides on their beds. (Photo 7)

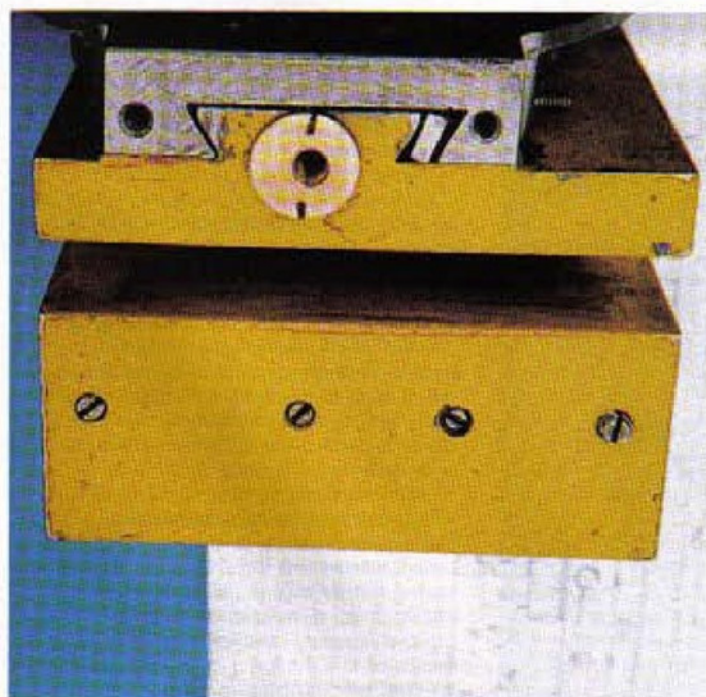
d. Saddle M6 x 1.0 cross slide feed screw hole

By the time I had begun to consider feeding modifications, I had been experiencing an unacceptable level of end play/backlash with the cross slide. I had not been able to correct this by adjustment between the spindle bush and feed wheel. Dismantling revealed that the M6 x 1.0 thread in the cast iron saddle had worn to a point which prevented effective cross feed control. I was not overly surprised as the Hobbymat had seen considerable use over some four and a half years. The best

6. Gib strip location (1)



7. Gib strip location (2)



9. This clearly illustrates the need for the jig drilling procedure

solution appeared to be to drill out the thread in the saddle to a diameter of, say, 10mm and substitute a phosphor bronze plug.

The plug was made 25mm in length which was greater than the thickness of metal in the saddle in that area, with the expectation that a longer useful life would result. It was secured with 'Loctite High Strength Retainer 638' and drilled with the aid of the jig (Item 17) located in the end plate of the fitted (and gib strip-adjusted)

cross slide (Photo. 8). Reference to Photo. 9 showing the off-centre hole in the plug will demonstrate the necessity of locating it accurately relative to the centre of the end plate.

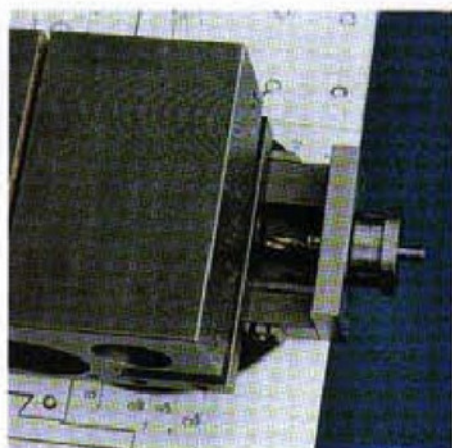
Some six months later, when I had decided on a Mk. 2 system, I was again finding excessive end play/backlash with the cross slide feed. Examination revealed the same problem as before; the thread in the phosphor bronze plug had worn beyond effective use. Substituting a M6 machine screw showed that it was the plug and not the feed screw which was at fault. I must admit to feeling a little dismayed at this. I adopted the hopeful assumption that I had unfortunately come into possession of a short length of drawn phosphor bronze which was of an inferior, soft quality and decided to substitute a plug of mild steel, which I did. At that time I did not have any stainless steel. If a 'next time' does come along, I will probably use stainless steel for the plug and definitely use mild steel for the feed screw (for reasons which will subsequently emerge).

e. Spindle clamp

Because the spindle bush is located immediately in front of the end plate, the handle of any spindle clamp needs to be adjustable for its angle when in the clamped position. The useful $\frac{1}{8}$ in. x $\frac{1}{4}$ in. BSW socket grub screw (M3 would be preferable) provided the solution. (see Fig. 5). The clamp handle doesn't have to be of the ball end type but since it was the choice of an expert and I had the facility for making one, it was my obvious choice (Photo. 10). It doesn't have to be in the location I have used but that seemed to me to be the most natural for a right-handed user.

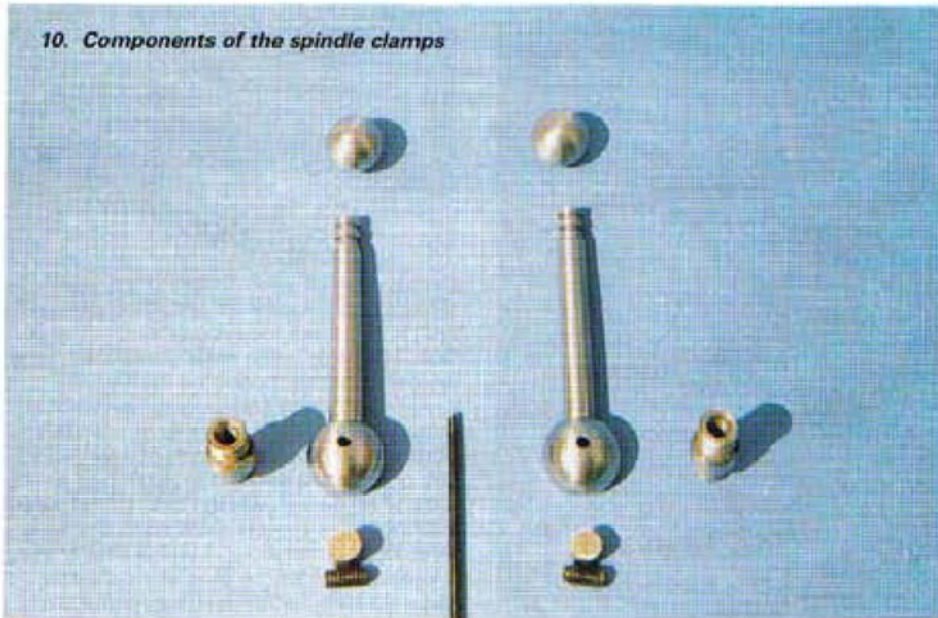
Bearings

I have been fortunate enough to obtain a 'NACHI' bearing catalogue which has proved invaluable to me in the various design tinkering with which I become involved. It may become obvious at some later date that several of my attachments/accessories are designed round a bearing. Understandably, bearing stockists are unlikely to part with such expensive catalogues unless you are likely to become a regular customer. For the occasional one or two off I was afforded



8. Jig drilling the saddle plug

10. Components of the spindle clamps



list price minus 60%. It was suggested that had I approached an outlet other than a bearing stockist, I might well have been required to pay list price plus! Heed the lesson! The thrust ball bearing selected is a standard 51101, o.d. 26mm, thickness 9mm and bore 12mm.

Materials

All the round steel used in the Mk. 2 feed arrangements is 'Ugima' (Ugine-Savoie UK Ltd.) 316 S11 stainless steel, (C 0.30%, Cr 17%, Ni 11% and Mo 2.25%), for no other reason than that I suddenly had access to the occasional off-cut or bar end. The steel producer's recommendations for CNC turning practice with a coated carbide insert are 222 m/min. cutting speed with a 3mm depth of cut! I am just coping with 13 m/min. with a max. 0.35mm depth of cut (HSS tool) and even then over-heating occurs with the swarf showing pale brown. This steel appears to rapidly work-harden when drilling (and

especially when hacksawing) but it gives a very attractive turned finish. A titanium carbide tipped tool produces a superb finish.

Anyone fortunate enough to obtain any of this material should be aware of a less than friendly characteristic. Dealing with the turned swarf requires great care. The heat / work-hardening results in very sharp, continuous coils of spring-like swarf which, if not removed as they form, quickly gather up, wrap around the workpiece and thresh around, creating a very dangerous situation before they inevitably jam, spoil the workpiece and probably the cutting tool. The only preventive method which worked for me was the use of a small swarf hook and riggers gloves, balling-up the swarf as it came away from the tool. This resulted in my watching the swarf rather than the cutting tool. I would suggest that safe turning practice may only be carried out by employing a cutting tool equipped with a chip breaker, something which I have not yet got around to organising.

Jigs. Items 17 & 18.

In the interests of accuracy and simplifying construction, I have used silver steel round for the jig guide rods as I did not have any precision ground BMS. (Photo. 11)

Adhesives

Reference to the Workshop Practice Series 'Adhesives and Sealants' by the late David Lammas provided the addresses for Ciba Polymers (Araldite) and Loctite UK Limited. There are of course other brand names and I would very much like to try them out but the two mentioned above were the first which sprang to mind. A letter to each outlining my project requirements resulted in both companies responding rapidly and with all the technical information necessary to deal with any of my foreseeable adhesive applications. Usefulness apart, I found the information of great interest and I am grateful to them both. With my new knowledge I now foresee using adhesives in many situations with the added confidence resulting from successful experience.

For 'slip fitting', i.e. for parts not using an interference fit and which may require dismantling, Loctite recommend 'High Strength Retainer 638' or 'Bearing Fit 641'. Since I already had both (obtained at a Midlands Model Engineering Exhibition) no purchase was necessary. A slight problem is the apparent scarcity of retail outlets in my area, I don't know of one.

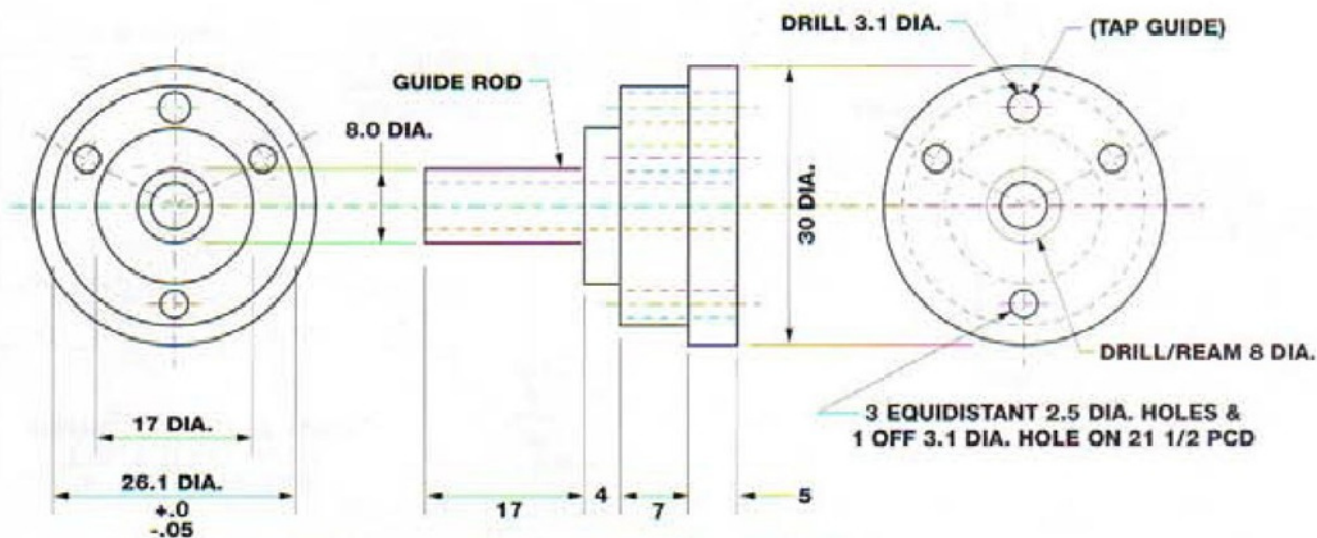
For more permanent fastenings there are 'Araldite' types for a comprehensive range of situations and materials and a chart provided indicates the results to be expected with each type and each material. I would like to be able to experiment with some of these but the literature provided seems to indicate that they are available only in industrial size quantities/packs. This hasn't presented a problem as some local informed opinion suggested that the Professional Pack carried by tool stockists and DIY outlets has all the necessary properties; "they form extremely strong durable bonds with most materials". Since I already possessed a pack of this, once again, no purchase was required.

A point of interest is that for both 'Araldite' and 'Loctite' products, optimum bond strength is obtained when the bond thickness lies between 0.05 and 0.15mm. This immediately suggested to me selecting 0.10mm as the preferred standard for general use. However, as 'Loctite' is an anaerobic adhesive - they harden when in contact with metal and when air is excluded from close-fitting parts - it might be considered that the lower region of the tolerance would be preferable for 'Loctite'.

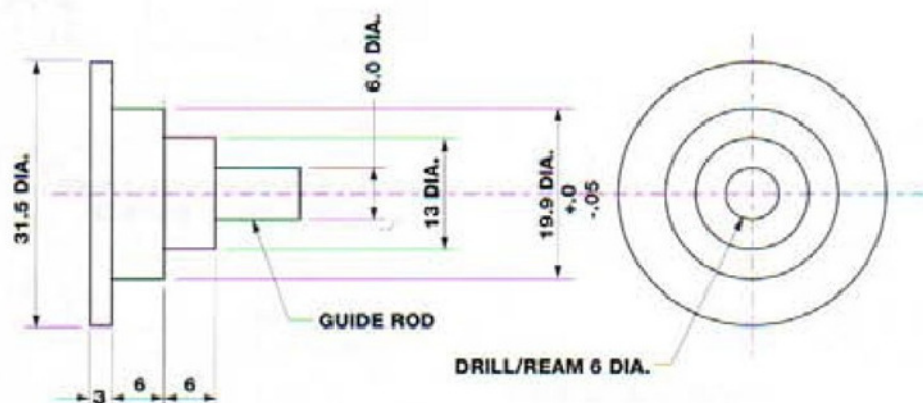
Another point of interest - "though with many two part epoxy resins strong joints can be obtained by curing at room temperatures (for 2 to 24 hours), higher curing temperatures - even a few degrees above room temperature - will raise the bond strength". I think I may have been aware of this. I have a 'two wine jar size' 20 Watt heating pad on which I have always placed any 'Araldited' components



11. Some of the Mk. 2 components seen with the assembly jigs



ITEM 17 ADHESIVE AND DRILLING JIG FOR SPINDLE BUSH AND LINER, BEARING HOUSING, END PLATE AND SADDLE FEED SCREW HOLE
1 1/4" MILD STEEL, 8 DIA. x 33mm (APPROX) PREC. GROUND MILD STEEL OR SILVER STEEL



ITEM 18 ADHESIVE JIG FOR INDEX COLLAR
1 1/4" MILD STEEL
6 DIA. x 25mm (APPROX) PREC. GROUND
MILD STEEL OR SILVER STEEL

for a minimum of 24 hours. In the winter it sits in the tray beneath my Myford lathe when the workshop (shed) is not in use and as the only source of heat, together with Myford's nylon lathe cover has successfully prevented rust on the lathe.

Abrading or preferably, chemically etching, is a desirable surface treatment before joining with 'Araldite'. In the applications described here, where there is no great requirement for maximum structural strength, my experience suggests that this may be conveniently omitted. I had considered painting the relevant surfaces with battery fluid which I then realised would have been pointless given the acid-resistant properties of the 316 S11 stainless steel that I was using. It's worth bearing in mind for any future projects where mild steel is the material employed. (I think 'Ed.' might have something to say about Health and Safety here). *Watch these pages - tests are in progress.*

Most of the boring required has been carried out using a 'Penco' boring bar with

a 'Sumitomo' titanium carbide insert; it's great for metal removal on the stainless steel but produces a superior surface finish which might have some effect on the 'Araldite' bond strength. (This supposition needs to be tested/proved and I can't afford to expend the necessary time). The final borings therefore were carried out employing a HSS tool.

The chosen path of using adhesive construction where possible has definitely achieved a simplification of machining. The extra time required to make the simple jiggling arrangements has been more than compensated for by the speeding up of the boring operations and the peace of mind resulting from not having to bore up to a hidden face. I definitely recommend it.

When joining the feed screw and spindle with 'Araldite', a narrow and shallow groove or flat, milled or sawn along the rear end of the screw will provide an escape for any air or adhesive trapped in the hollow of the spindle.

Machining and assembly notes

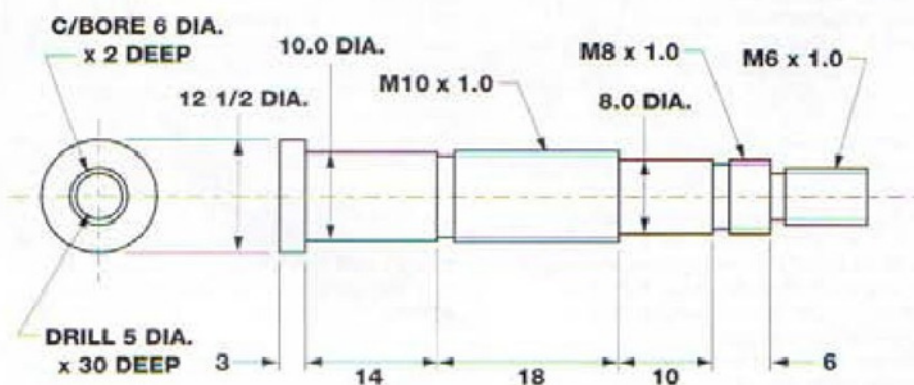
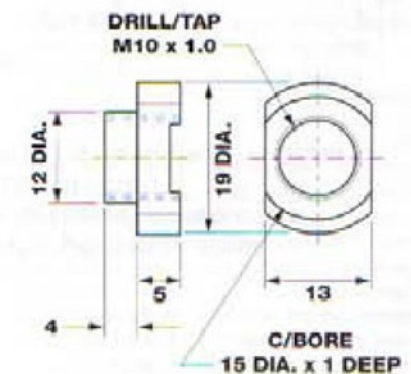
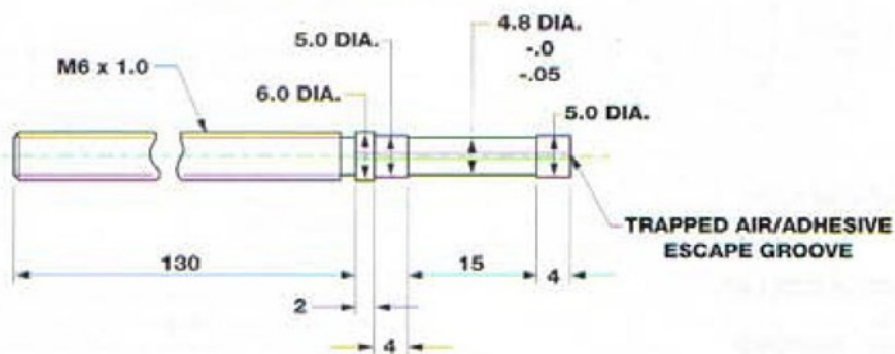
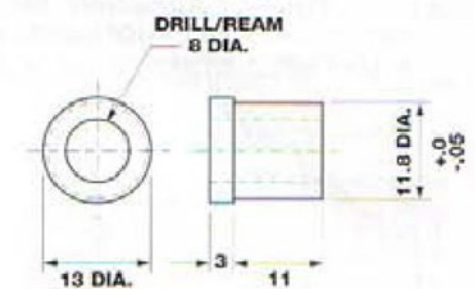
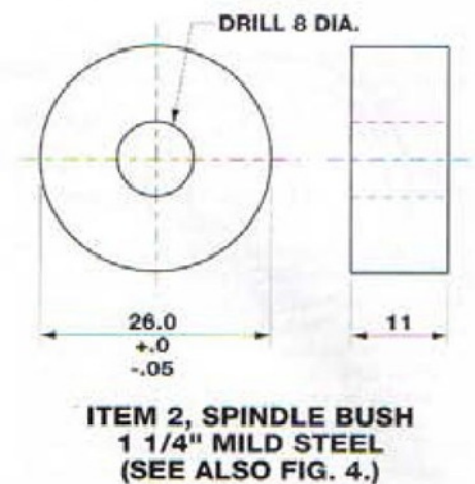
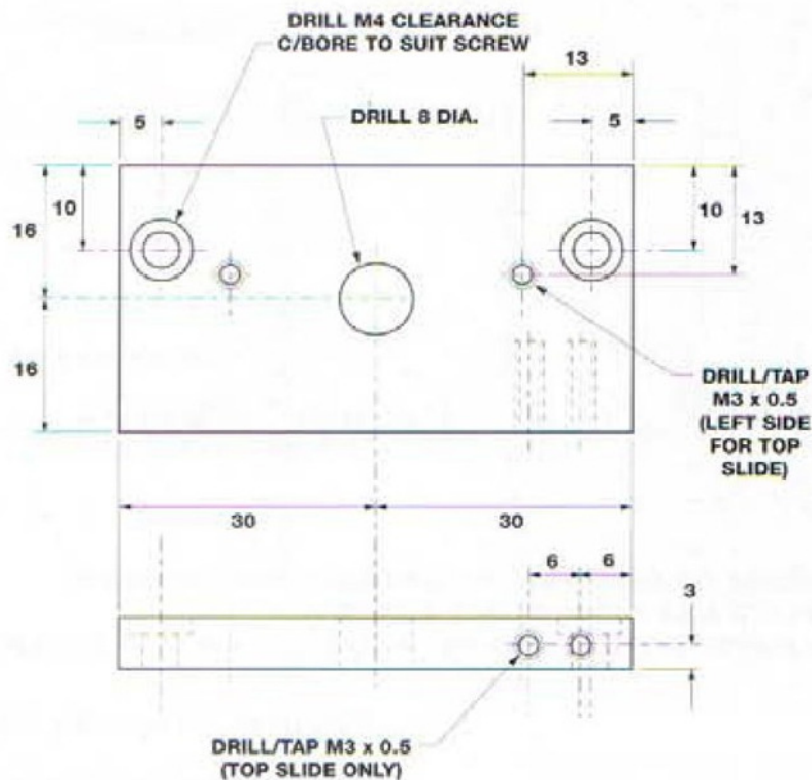
- (i) Item 7, Thrust ball bearing 51101, 26mm dia. x 9mm, bore 12mm.
- Item 9, P.B. Washer, 13mm dia. x 2mm thick, 10mm i.d.
- Item 11, P.B. washer, 13mm dia. x 2mm thick, 8mm i.d.

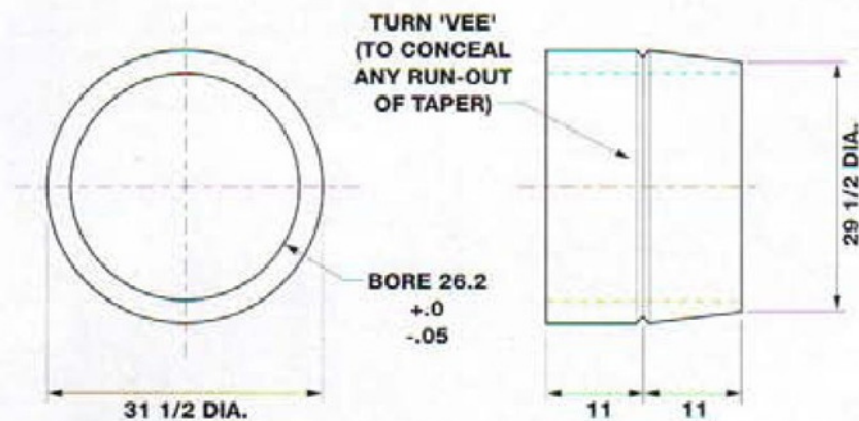
(ii) The drawings of the jigs, Items 17 and 18, incorporate changes resulting from experience in the use of the originals, not least of which has been the substitution of M3 for M4 screws for securing the end plate and spindle bush. Adhesive creep safety zones have also been increased where practicable.

(iii) In place of the ISO threads on the feed screw spindle, Item 5, some might prefer to substitute Model Engineer $\frac{3}{8}$ in., $\frac{5}{16}$ in. and $\frac{1}{4}$ in. threads. I used these of 40 tpi but suspect that 26 tpi would be more suitable.

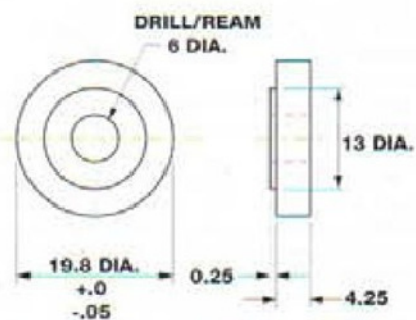
(iv) The bearing housing workpiece was faced both ends to length, drilled/bored through 20mm dia. then mounted on a taper stub mandrel secured in the three jaw chuck and located with a running centre at the tailstock end. It was then turned to 31 $\frac{1}{2}$ mm dia. and the 'vee' to conceal taper run-out was cut. The top slide was then swivelled clock-wise 5 $\frac{1}{4}$ degrees which afforded clearance from the running centre and gave the required taper of 1mm in 11mm. The taper on the bearing housing was then cut (Photo. 12). The fiducial line was cut at the same setting. The final boring to suit the bearing (the jig was employed as a bore gauge) was carried out in the three jaw chuck. (Photos 13 and 14).

(v) The micrometer index collar workpiece was faced both ends to length and drilled and bored out to 20mm dia. It was then mounted on a taper stub mandrel and turned as per detail drawing Item 12, but leaving sufficient material on the diameter to allow a final skim to true

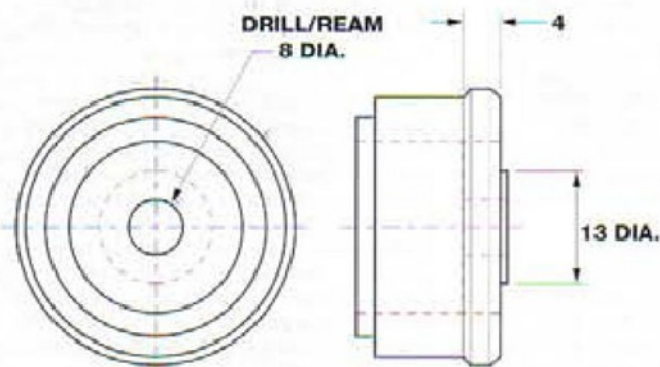




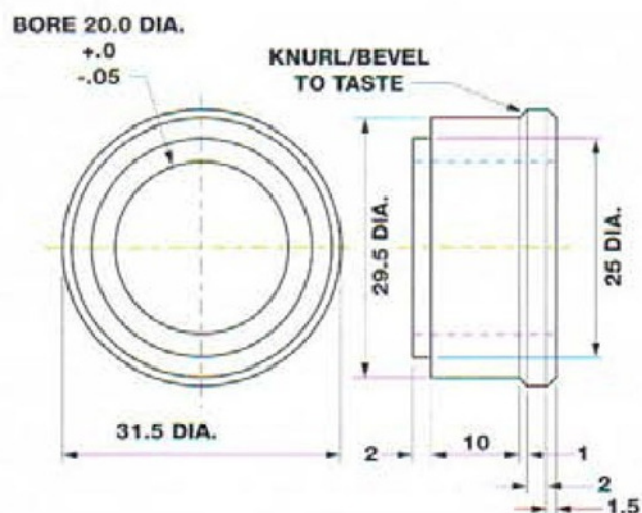
ITEM 3, BEARING HOUSING
1 1/4" MILD STEEL
(SEE ALSO FIG. 4.)



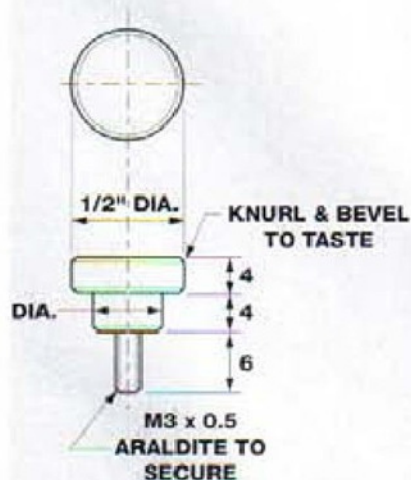
ITEM 12B, INDEX COLLAR BUSH
1" MILD STEEL



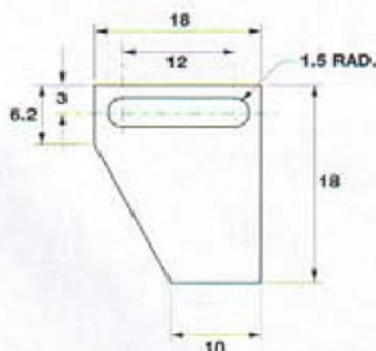
**ITEM 12, MICROMETER INDEX COLLAR
ASSEMBLY (COMPRISES ITEMS 12A & 12B,
SEE TEXT)**



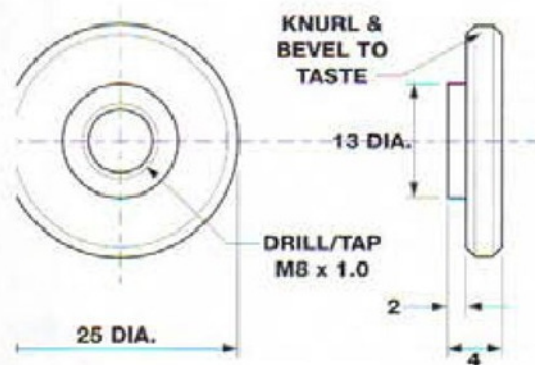
ITEM 12A, MICROMETER INDEX COLLAR
1 1/4" MILD STEEL



ITEM 14, LUBE HOLE PLUG
1/2" MILD STEEL



ITEM 16, SPINDLE CLAMP REST
3/32" BRIGHT MILD FLAT



ITEM 13, INDEX COLLAR CLAMP NUT
1" MILD STEEL

up before graduating.

(vi) Knurling the index collar was carried out using the three jaw chuck. (Photo. 15)

(vii) The top slide was set to feed parallel with the lathe axis.

(viii) The index collar was remounted, flange first, on the taper mandrel which was then secured in the three jaw chuck. The collar was then given a final skim to give parallelism before graduating. I used a titanium carbide tipped tool and the resulting finish on the stainless steel was such that any further surface treatment was postponed until after the dreaded number stamping. (Photo. 16)

(ix) Indexing for graduating was carried out using a detent locating in the 50T gear on the rear of the lathe mandrel. The precaution to prevent backlash incorporated the method of a cord secured to and wrapped around the chuck with a weight suspended at the other end.

(x) The 50 deg. included angle cutting tool was fixed at centre height and set with the cross slide to give a depth of cut which I found pleasing to my eye (graduation appearance is a matter for individual taste and you will doubtless have your own ideas about this). The graduations were cut using the top slide feed. The graduation lengths selected were 3.3mm for the fiftieths of a mm and 5.5mm for the one tenths. Once again, length of graduations is a matter for individual taste.

(xi) The nibs raised at the ends of the graduations were snapped off with a piece of hard brass.

(xii) After number stamping, the raised areas on the index collar (mounted on the taper stub mandrel in the three jaw chuck) were removed with a very worn smooth Swiss file and 'wet and dry' with plenty of 'wet'. Inevitably, some adhesive will get onto this surface when the collar is 'Araldited' with its bush. It can then be mounted on a 6 or 8mm taper stub mandrel to undergo whatever final cosmetic attention it requires. (A brass wire brush works on the knurling).

(xiii) Screw cutting the M6 x 1.0 stainless steel feedscrew gave me a hard time. Although a travelling steady was employed, I could only use a light cut, given the nature of the material and that I was using a small HSS tool. The elasticity of the stainless steel resulted in a 'pushing' rather than a shearing action on the material (I would liken it to a bow wave and similar to what partially results during a knurling operation). This resulted in a build-up of material either side of the thread 'vee'. I am not ashamed to say that I was obliged to resort to the use of an M6 die to finish the thread. Mild steel will be the favoured material in future screw cutting projects.

(xiv) To avoid a very exasperating situation and considerable waste of time, before securing the bearing housing/spindle bush to the end plate with the three M3 screws, (a) position in the

end plate the M4 screw (for securing to the slide) adjacent to the spindle clamp position and (b), insert the spindle clamp assembly into the bearing housing/spindle bush and screw in to meet the spindle.

(xv) If socket cap screws have been selected for securing the end plate to the slide, a ball-ended hexagon key will most likely be needed.

(xvi) Backlash adjustment will require two 13AF spanners. The stamped sheet steel one supplied with the lathe is best suited to the adjuster, with any type used for the locknut.

(xvii) Thrust ball race 51101. The race with the greater o.d. and the larger bore is the one to be inserted first into the bearing housing. Apply 'Loctite Bearing Fit 641' to the outer circumference of the race. The race with the lesser o.d. and the smaller bore can be assembled onto the backlash adjuster with an application of the same 'Loctite'.

Bearing housing and Index collar Assemblies - Some suggestions

I am aware that 'Operation Schedule' type descriptions are not favoured by many of us, but feel that in order to help avoid some of the pitfalls I experienced, a description of some of the procedures I adopted (second time round) might be useful to the less experienced. I am referring to the jig adhesive and drilling activities only. So, with apologies to those who will have already planned probably better methods of their own:-

1. Position the guide rod so that it protrudes from the non-flange end of the jig, Item 17. Locate the bearing housing, Item 3., tapered end first, onto the jig and up to the jig flange. Apply 'Araldite' to the circumference of the spindle bush, Item 2., locate the bush on the guide rod and position inside the rear of the bearing housing, rotating the mating parts in order to obtain proper

'wetting' of the surfaces to be joined. Push the bush fully home. To prevent any adhesive creep between the jig and the bearing housing, place the assembly, jig uppermost, on a thin card/paper-covered flat surface. Allow to cure for 24 hours.

2. The rear face of the bearing housing/spindle bush can now be cleaned up with a light skim.

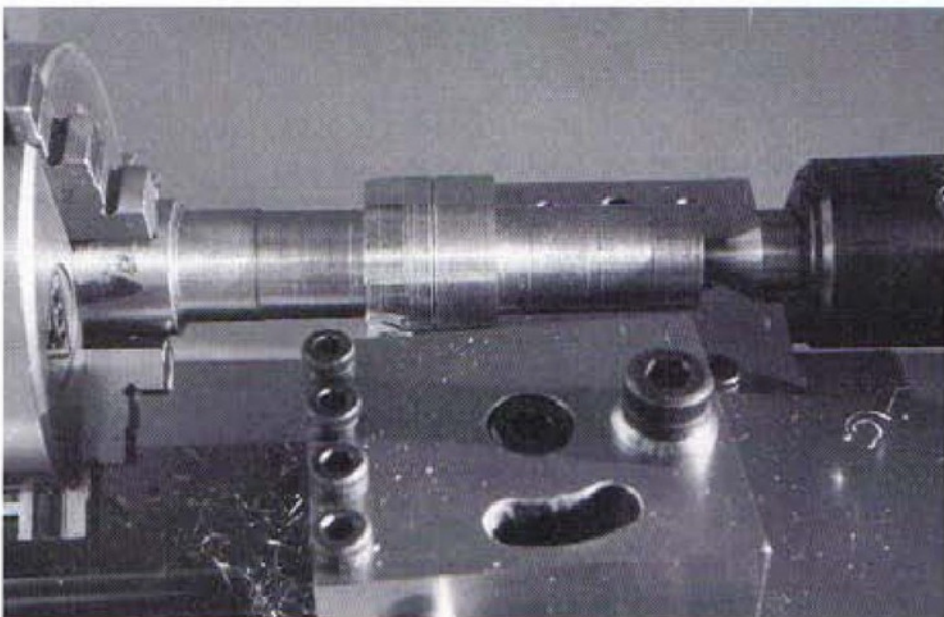
3. Position the guide rod so that it protrudes from the non-flange end of the jig and locate the jig inside the bearing housing with the guide rod protruding from the rear face of the spindle bush. Assemble the end plate, Item 1., front face first, on to the guide rod and against the rear face of the bearing housing/spindle bush.

4. Align the assembly so that the fiducial line on the bearing housing is in line with the top centre of the end plate. Rotate the jig until its three 2.5mm holes are in the correct relationship to the selected positions of the spindle clamp and lubrication screw holes.

5. Clamp the assembly, leaving two 2.5mm holes in the jig accessible for drilling and drill 2.5mm dia. through the jig, spindle bush and end plate.

6. (I dare say many will have a more professional and positive method for all this but it worked well enough for me). Maintain the relative positions of the assembled parts by locating a 2.5mm dia. drill or rod through one of the previously drilled holes in the jig, spindle bush and end plate. Secure the assembly with a second clamp in a location which permits drilling of the third 2.5mm hole when the first clamp is released. Release the first clamp and drill the third hole.

7. Dismantle the assembly, open out the 2.5mm holes in the end plate to M3 clearance size and counter-bore in the rear face to suit the M3 screws selected.



12. Turning the taper on the bearing housing



13. Boring the bearing housing with a High Speed tool

8. Re-assemble the jig and bearing housing and tap the three holes in the spindle bush M3 x 0.5 through the jig tap guide. On the detail drawing of the jig, Item 17., I have suggested a 3.1mm hole for the tapping guide but it might be worth establishing your own selected tap diameter.

9. Open out the 8mm dia. hole in the bearing housing/spindle bush to 12mm dia.

10. Drill the 3mm dia. lubrication hole along the axis of the spindle bush, ensuring that it is directly beneath the fiducial line/selected lubrication screw hole location (see Fig 4.).

11. Position the guide rod so that it protrudes from the non-flange end of the jig. Locate the bearing housing/spindle bush, tapered end first, on to the jig and up to the jig flange. Apply 'Loctite High Strength Retainer 638' to the outside of the phosphor bronze spindle bush liner, Item 6. Locate the liner, non-flange end first, on to the guide rod and position inside the spindle bush, rotating the mating parts in order to obtain proper 'wetting' of the surfaces to be joined. Push the liner fully home up to its flange. Maximum breakaway strength with a 0.05mm bond gap is reached in 12 to 24 hrs, and with a 0.15mm bond gap in 48 hrs.

12. Open out and ream the 8mm dia. hole in the spindle bush liner to 10mm dia. (If you wish to be certain that the bush liner stays put during the above drilling/reaming operation you may have to use 'Araldite' rather than 'Loctite' to secure it. Alternatively, you can drill/ream the liner in isolation and secure it in the spindle bush with 'Loctite' using the jig with a stepped-up 10mm dia. portion on the guide rod.

13. The bearing housing/spindle bush can now be drilled and tapped for

lubrication and spindle clamp holes (see Fig. 19.). The lubrication hole should break into and through the axial hole mentioned in 10 above.

14. Open out the 8mm hole for the feed screw in the end plate to 13 to 14mm dia. (I found it convenient to drill the saddle plug with the aid of the jig before carrying out this operation).

15. (Graduating and number stamping had been carried out prior to the following). Assemble the index collar jig, Item 18., with the 6mm dia. guide rod protruding some 10mm from the non-flange end. Locate the non flange end in the non-flange end of the index collar, Item 12. Apply 'Araldite' to the circumference of the index collar bush, Item 12A. Locate the bush on the protruding guide rod with the 13mm dia. x 1/4mm raised face first and position inside the flanged end of the index collar, rotating the mating parts in

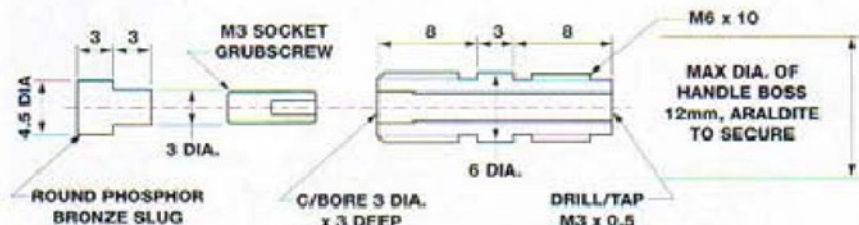


FIG. 5. SPINDLE CLAMP CONSTRUCTION (SECTION) SCREWED PORTION 1/4" MILD STEEL

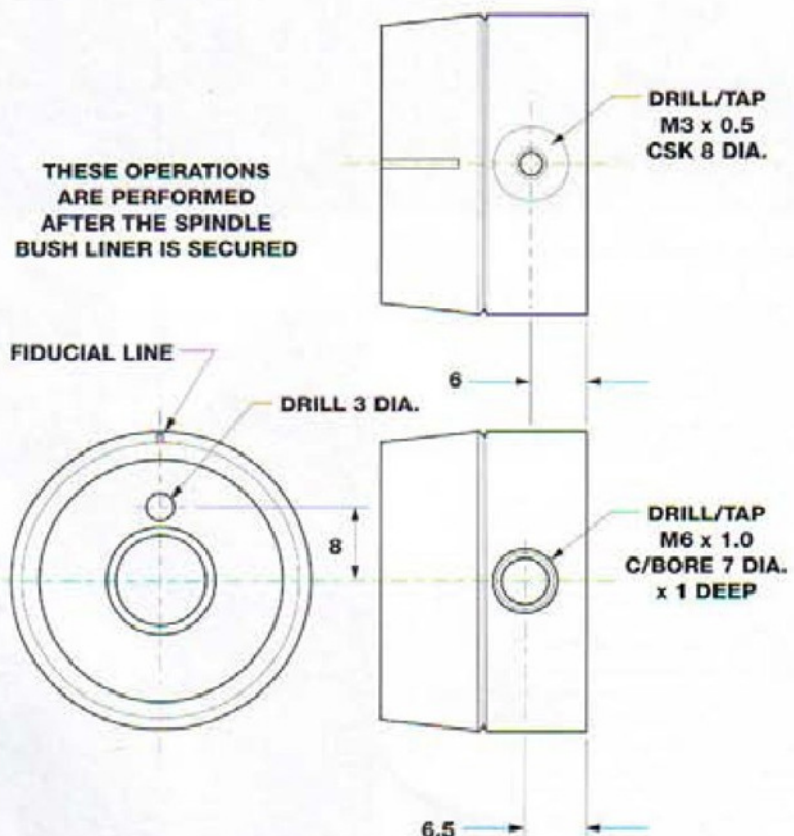


FIG. 4. LUBRICATION AND SPINDLE CLAMP HOLE LOCATIONS IN ASSY OF ITEMS 2 AND 3

order to obtain proper 'wetting' of the surfaces to be joined.

16. Place the assembly, jig uppermost, on a thin card/paper covered flat surface, pushing up the guide rod and ensuring that the index collar flange and bush are in contact with the flat surface. There should be a 2mm gap between the jig flange and the open end of the index collar; this is to permit a little leverage to assist dismantling should it be necessary. Allow to cure for 24 hours.

17. The flanged end of the index collar can now be cleaned up and turned to the dimensions shown on detail drawing, Item 12b.

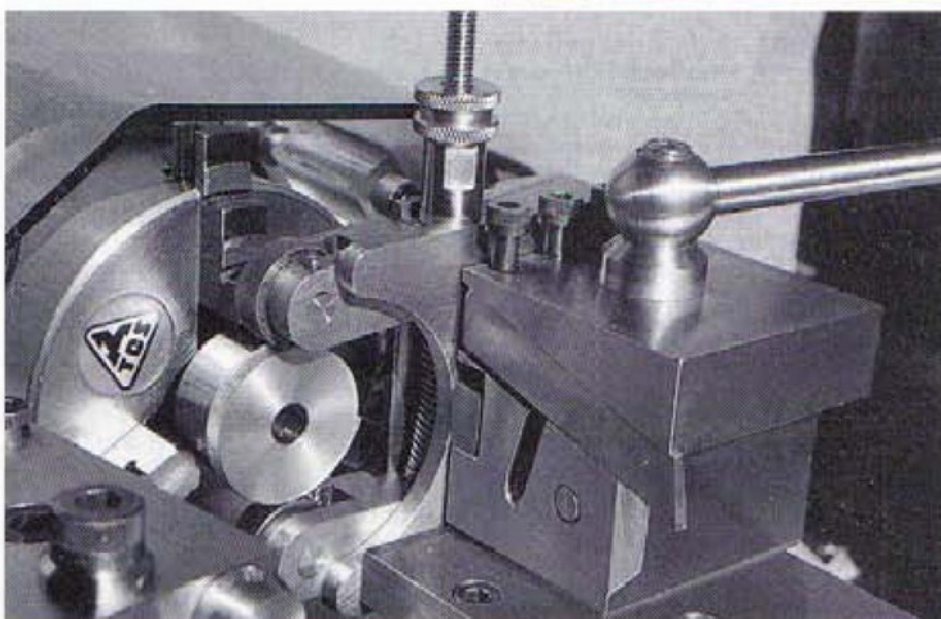
18. Drill and ream to open out the 6mm hole in the index collar bush to 8mm dia.

Conclusion

All the features described in



14. Gauging the bore with the jig



15. Knurling the index collar

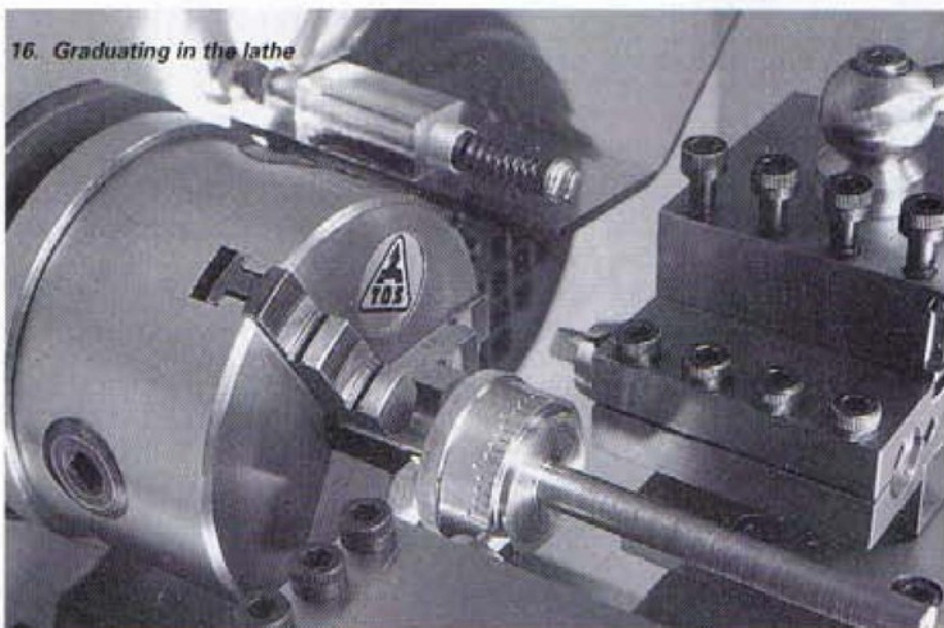
'Objectives' above have been achieved with satisfactory results. The most outstanding improvement has resulted from the positive gib strip location combined with a thrust ball bearing. Feeding is so smooth and positive I'm looking for top slide taper turning projects to indulge myself!

The Mk 1 arrangement permitted adjustment of the gap between the index collar and bearing housing. This flexibility has been sacrificed in the Mk 2 version in the search for reduced overall length.

The design could still retain its current features and be shortened further by reducing the 4 1/2mm dimensions of the backlash adjuster and locknut (and therefore the bearing housing). The micrometer index collar and the phosphor bronze washers could also be marginally reduced. If more usual methods are used to prevent unwanted rotation of the index collar a further reduction in length could be obtained. I'm not going down any of those paths; my original requirements have been met to my satisfaction, I'll be

content with Mk 2.

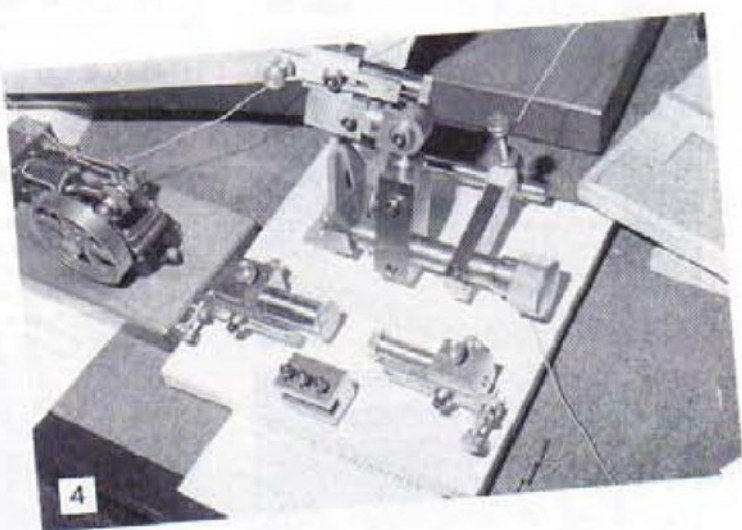
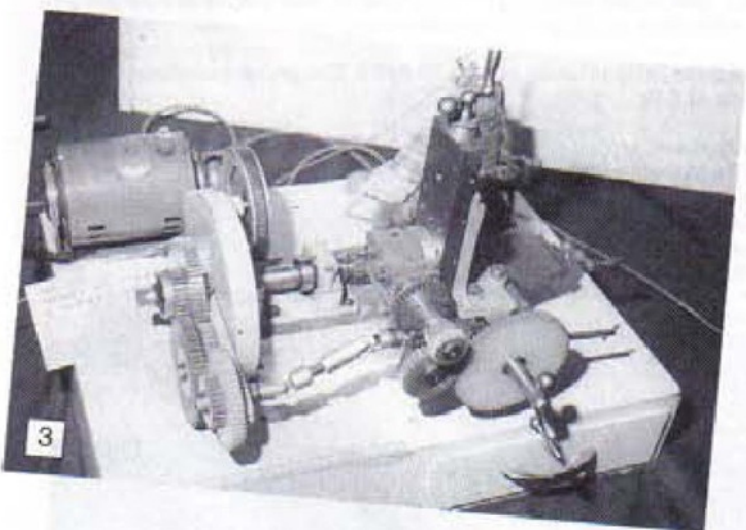
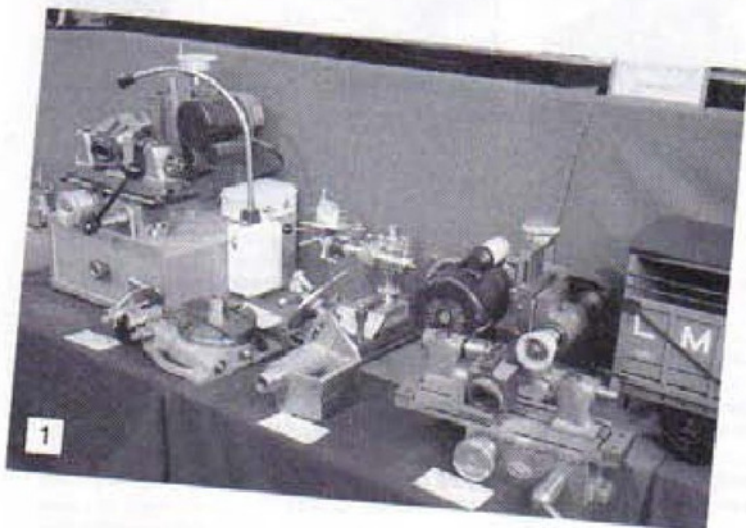
For the experimenters and improvers amongst us there is still plenty of scope and I would be interested to see if there are any small lathe users out there who might be prepared to share their ideas with us. It is to be regretted that the Hobbymat is no longer available, it is at least the equal of contemporary small lathes, many of which do not possess its well rounded attributes. No doubt current Hobbymat owners will continue to enjoy their possession, secure in the knowledge that it lends itself to enhancement features normally associated only with larger lathes, due to its solid basic construction. The basic design enables maintenance using basic engineering skills, something I appreciate when so much of today's hardware appears to be the epitome of the Planned Obsolescence or Throw-away design culture. Anyone considering trading in a Hobbymat should think carefully. I hope I will be forgiven for riding my Hobbyhorse. (I wonder if Fred Dibnah has a vacancy for a tea boy?).



16. Graduating in the lathe

THE HARROGATE EXHIBITION

April brought the fifth National Model Engineering Exhibition, held at the Great Yorkshire Showground, Harrogate. Considered by many to be the outstanding regular exhibition of model engineering, it is well supported by local societies, the trade and the public. Here we show just a few of the items of workshop equipment to be seen on the competition and club stands.



1.. Two 'Stent' tool and cutter grinders and a variety of dividing equipment were to be seen on the York City and District Society stand

2. Bob Pardey of the City of Sunderland Model Engineering Society presented this display of gear cutting tooling, including an 'Eureka' form relieving tool. Another 'Eureka' was to be seen in the competition section, having been entered by A. Hopwood of Boroughbridge

3. Members of Spenborough Model Engineers were seeking more information on this gear hobbing machine. Built by the late Leonard Scott, it appears to be based on the Jacobs design

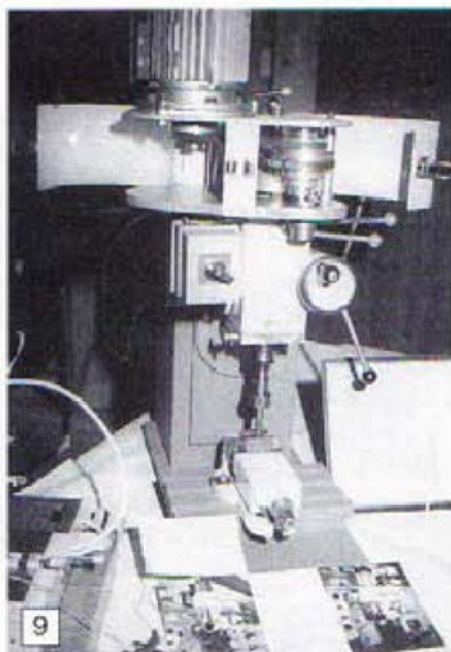
4. Jim Batchlor of the Leeds Society exhibited these tool sharpening attachments.

5. P.J.H. Bowler of Swinton, Lancs. entered a tool and cutter grinder based on an American design.





6



9



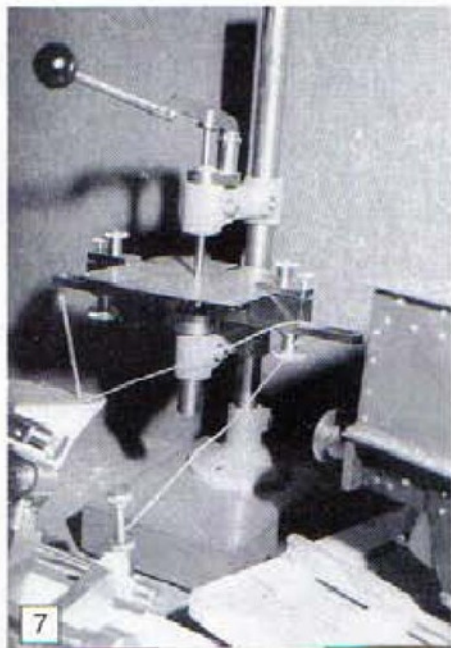
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11



12



7



8

6. This neat lever press is the work of D. Forster of the Cleveland Association of Model Engineers.

7. Jim Batchlor modified the George Thomas staking tool to create a clock bushing tool.

8. Bernard Rosen of Lincoln and District M.E.S. adapted Bill Morris's Universal Parallel Clamp (M.E.W. Issue 48) into this tapping fixture.

9. P. J. H. Bowler also exhibited his Mk. 1 Senior Mill to which he had added the Mark Figs design of Motorised Milling Head described in Issue 34 of M.E.W.

10. The Tyneside S.M.E.E. stand featured a number of items to the designs of George Thomas, including this headstock dividing attachment.

11. The winning team. All the prize winners pose with Mike. The group includes a number of contributors to M.E.W.

12. More on the Tyneside stand, including a rotary table with workholding attachments and an example of G.H.T's Versatile Dividing Head

13. A delighted Barry Jordan receives his 'Best in Show' award from Mike Chrisp, Technical Editor of Model Engineer. Barry entered a group of miniature machines which included his Bridgeport and the Clarkson tool and cutter grinder shown elsewhere in this issue. Exhibition Manager Lou Rex and his team show their appreciation in the background.



13

AN AIR COMPRESSOR FOR THE GARAGE OR WORKSHOP

John Noakes of Aldershot gradually collected all the items necessary to build this useful air compressor system. He describes the various components and gives hints on assembly and testing

I have, for some time, wanted a source of compressed air for use in the workshop and for those other jobs such as inflating the odd car tyre and feeding a draw string down a pipe now and again. Have you ever tried to poke a length of string down a hose pipe? Just in case you are wondering why anyone would want to do such a thing, a hose can provide protection from dampness and the ingress of water for a wire or cable. Make a plug which loosely fits the pipe you want to feed the string down and attach one end of the string to the plug. Feed the string into the end of the pipe and remembering to hold onto the other end of the string, direct a jet of compressed air down the pipe. With a bit of luck (and a fair wind) the string will emerge from the other end of the pipe and you can then use the string to pull the wire or what have you through the pipe. Don't forget to pull second length of string through with the wire so that you don't have to go through the whole business again!

now was an air receiver and I could then get on with the assembly of the various bits and pieces into a working system. A problem was that both of the air compressors were a bit on the small side, and I was reluctant to put time and effort in to the project if the end result would be incapable of providing a useful air supply.

About six months ago a local petrol station closed down and the site was cleared except for an Air Box - a money in the slot tyre inflater. Quite why this had been left behind, I don't know, but on making enquiries of the Site Agent, it turned out that the Air Box was not wanted and if I dismantled it and took it away, I could have it for free. Not being sure what was inside an Air Box, a good look around seemed to show that it was self contained and had not been connected to another air supply. The only connections to the box were a mains cable and an air hose. This seemed to suggest

that there would be an air compressor inside the box, but I had to wait until I got it home before I could be sure of my good fortune. As the Air Box took money in exchange for compressed air, it was constructed to withstand attempts by people to break it open to get at the money.

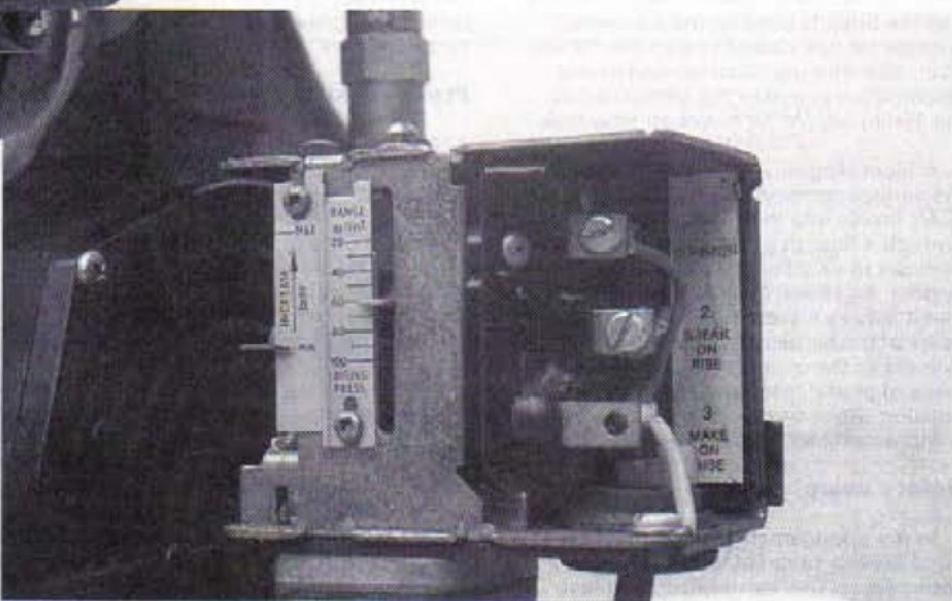
There was no key available to open the box, so as you can imagine, it was only with great difficulty that I eventually managed to get it apart. This was done by drilling out all the spot welds that I could find and then with the careful use of a crow bar so as not to damage what was inside, the box was dismantled to reveal an air compressor, a length of air hose and one ten pence coin. The compressor is an oil-less type and has a $\frac{1}{2}$ horsepower motor driving a piston compressor giving about 2 cubic feet per minute of free air discharge and having an output pressure of about 100 psi.

Now I no longer had an excuse for not getting on with the project and so the hunt for an air receiver started. A good source of a suitable pressure vessel is a commercial vehicle scrap yard. The air tank from a lorry is capable of operating at a high enough pressure for my purposes and usually has a variety of bushes and mounting brackets which go a long way towards making the assembly of the air compressor an easier task. Having scanned the classified telephone directories, I paid a visit to Bennetts Commercials at Wokingham, where I was offered a selection of tanks from which I chose one with four brackets and, as it turned out, too many threaded bushes.



1. The completed air compressor

To construct an air supply, various items are needed, such as of course, a pump and an air receiver. However, with the addition of a few extra components like a safety valve and a pressure switch to control the pump motor, the air compressor can be made to operate automatically. I have been on the lookout for the various bits and pieces needed to make myself a compressor and, over several years, have collected two small air compressors, a pressure switch, a pressure regulator and various connectors, filters and assorted gubbins which might be useful in connection with this project. All I needed



2. The pressure switch with cover removed showing the output pressure and hysteresis adjustments

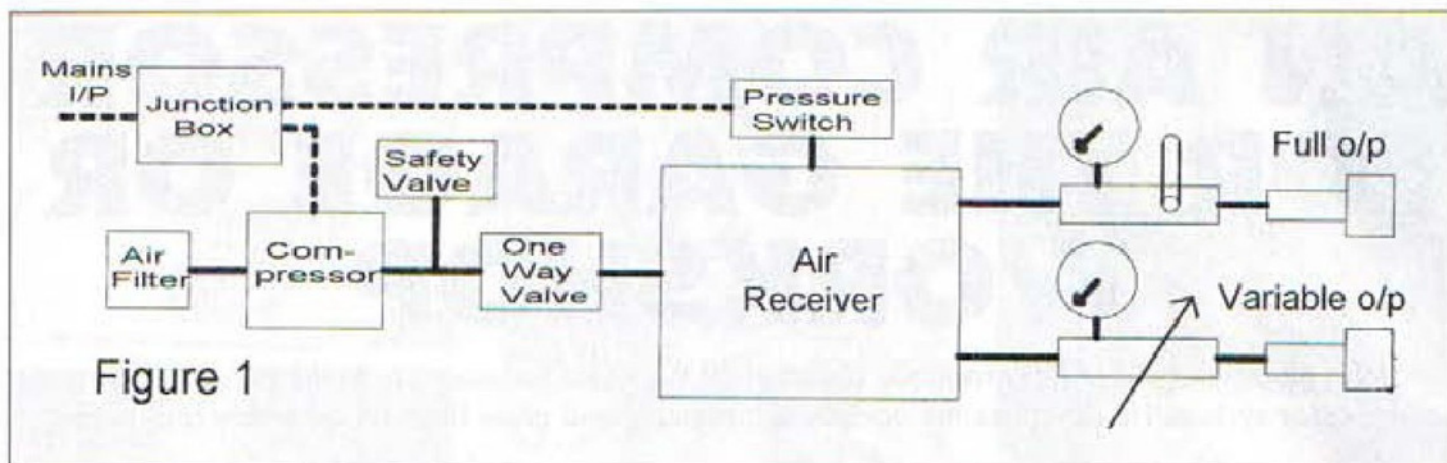


Figure 1

Fitted to one end of the tank was a drain valve which is essential for removing the condensate which collects in the air receiver when in use. The best thing about buying a tank this way is that it cost me just £12. One thing that you must be careful about is that the tank is in a sound condition. Compressed air can be very dangerous and it is up to you to make sure that your activities are safe.

Compressed air is often quoted as being at a pressure of so many bar. One bar is very nearly the same as atmospheric pressure which is approximately 14.7 lb./sq.in. I want my system to be able to operate up to 75 psi which is 5 bar. In order to provide an adequate safety margin, the test pressure should be 10 bar, that is 150 psi. The air tank which I obtained has a working pressure of 8 bar and I have it on good authority from my local plumbing supplier that 15mm copper pipe and the associated fittings are able to withstand a working pressure of 8 bar. Assuming the test pressure of the tank and the pipework is at least one and a half times the working pressure, that is $8 \times 1.5 = 12$ bar, the tank and pipework are perfectly safe to use at a working pressure of 5 bar. Of course the system must be tested at a suitable test pressure and I have used 10 bar which gives me a 100% safety margin. As a general case, it seems that the threads used on the pipework suitable for this kind of project are $\frac{1}{4}$ and $\frac{1}{2}$ in. BSP. The use of compression and soldered joints makes the fabrication of the 15mm copper pipework an easy task.

A block diagram of the arrangement of the various components is shown in Figure 1. Air drawn into the compressor is taken through a filter to prevent any unwanted particles of swarf or spiders entering the system. An added benefit of this filter is that it acts as a silencer by reducing the noise of the air being drawn into the cylinder of the compressor. The filter is a piece of plastic foam sponge inside a housing which screws directly into the compressor inlet port.

Safety valve

In my arrangement, the safety valve is fitted directly to the output side of the compressor. This valve must be able to pass the full output of the compressor. One that is too small will not provide a safe arrangement because of the pressure

drop between the input and the output of the safety valve. Due to this pressure drop across the valve, the pressure in the air receiver will be the sum of the lifting pressure and the pressure drop, resulting in a higher pressure in the air receiver. The air receiver pressure will also be proportional to the flow rate of the compressor.

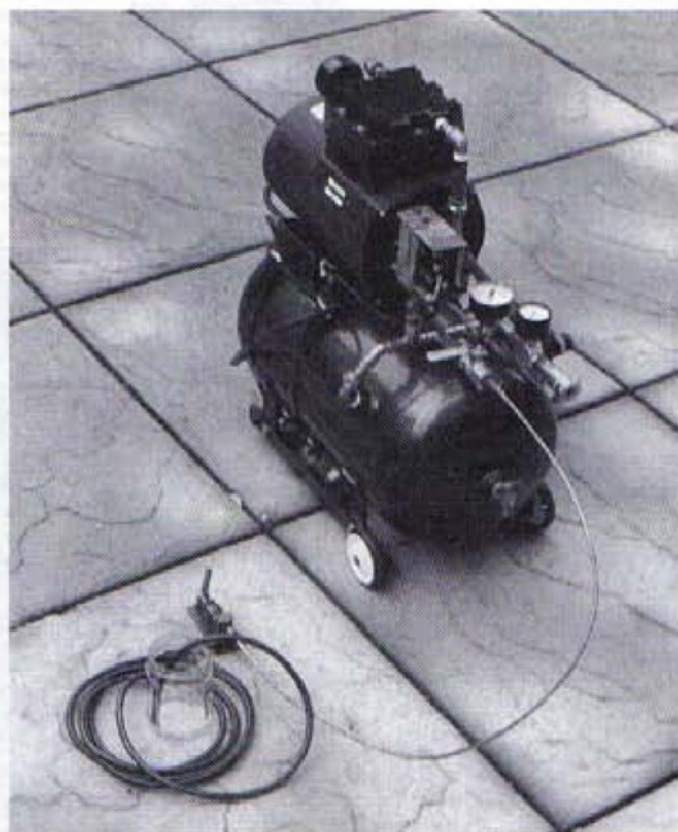
One way valve

When the compressor is switched on, it will have to start against the back pressure which is present in the air receiver. Initially, of course the back pressure will be zero, but when the compressor is recharging the receiver, the back pressure can be up to 5 bar. Because this situation will increase the starting load on the compressor motor, a one way valve is usually inserted between the compressor and the air receiver. This has the benefit of allowing the high pressure air in the pipework on the compressor side of the valve to leak away when the compressor is not running. When the compressor starts, the pipework between the compressor and the one way valve acts like an empty air receiver, so providing an easier start.

Pressure switch

A pressure switch is required to control the pressure of the air stored in the receiver. This usually takes the form of a diaphragm which deflects by an amount proportional to the difference between the pressures on each side. The diaphragm movement is used to operate a type of microswitch mechanism. The actual position of the microswitch mechanism is adjustable so that the switch will operate at the desired pressure. When the pressure is

low, the switch contacts are 'made' and so the compressor can pump up the pressure in the air receiver. As the pressure rises, the diaphragm deflects more and more until the switch operates and switches off the supply to the motor. In addition to the pressure setting, there is another adjustment which controls how much hysteresis there is in the operation of the pressure switch, causing the motor to switch on and off at slightly different pressures. If these pressure values are too close, the compressor will cycle on and off at frequent intervals. By separating them, the compressor will run less often but of course the stored pressure will vary to a degree. Something like a 10 to 15% variation is probably quite acceptable for general use. **Photo. 2** shows the pressure switch with the cover removed. The two pointers which indicate the switching pressure and the switching differential can be seen.



3. The set-up for hydraulic testing. The small boiler feed pump proved to be quite suitable

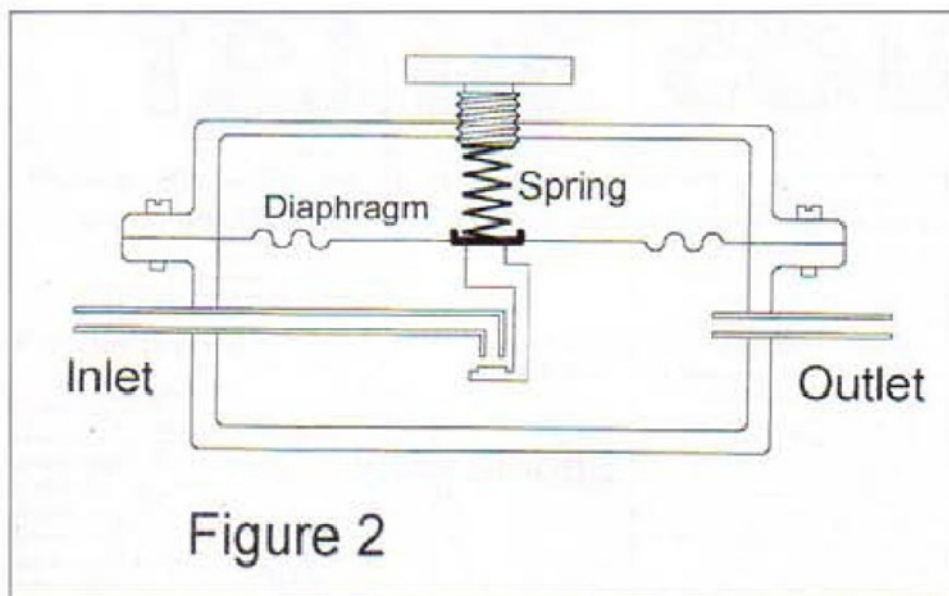


Figure 2

Pressure regulator

Because equipment such as a spray gun requires a regulated supply of air, I have two outputs from the air receiver. One output is at the pressure set by the pressure switch and the other output is through a pressure regulator. This regulated output is very useful if you are running an engine on compressed air as it allows you to adjust the pressure to an appropriate value. The operation of this type of regulator is again by means of a diaphragm (Figure 2). The combination of a diaphragm and a spring is used to control a valve such that the output pressure remains constant with varying flow rates through the pressure regulator. This type of regulator is quite common, being the type used to control the pressure of gas fed to cookers from cylinders of butane. The output pressure can be varied between 0 and 75 psi. by altering the compression of the spring which bears on the diaphragm, the more the compression, the higher the output pressure. The output which is taken directly from the air receiver has a valve to turn the air on and off, but as the regulated output can be reduced to zero, a second valve is not needed.

Gauges

It would be possible to rely upon the calibrations of the pressure switch and the pressure regulator to set the two air pressures, but it is more informative (and perhaps more impressive) if two pressure gauges are fitted, one to indicate the pressure in the air receiver and the other the outlet pressure of the regulator. Suitable gauges can be obtained from tool suppliers who stock compressed air equipment. The gauges fitted to the generally available air compressors are made with a plastic body and need not be too expensive. The accuracy of these gauges is quite good enough for their designed purpose.

Assembly

The assembly of the various components on to the air receiver depends on the form of the brackets and threaded

bushes and their positions on the air receiver. Photo. 1 shows a general view of the assembled unit. A frame made from angle iron is fitted to the four brackets which had been used to mount the air receiver to the chassis of the lorry. To make movement of the compressor easier, wheels are fitted to an axle which passes through the sides of the angle iron at one end of the frame. A fixed leg is fitted at the other end. A saddle (Figure 3), which provides the mounting platform for the compressor, is secured to the air receiver by four tensioned straps anchored to the angle iron frame. The tension is applied to each strap by means of adjusting nuts on short lengths of M6 threaded rod attached to the ends of the straps. The threaded rods pass through holes in the angle iron frame and the nuts are screwed on from the underside, applying sufficient tension to hold the saddle in place. Strips of packing, such as cycle inner tube, are used between the straps and the air receiver to protect the paintwork. Because there were spare bushes on the air receiver, these had to be closed with blanking plugs. Three different sizes of bush were fitted to my receiver, 1/8, 1/4 and 1/2in. BSP. Plugs for

the unused bushes are available from plumbers merchants. Conveniently, the 1/2in. size has the same thread as is used for 15mm compression fittings. In order to obtain a good air tight seal, each threaded connector and plug was wrapped with PTFE tape before assembly. The compression fittings were used dry, but a jointing compound could be used if required. Hose connections to both the full output and the regulated output are made using quick release connectors. These connectors are very convenient to use as the hose adapter is just pushed into the end of the air outlet and then is captive and air tight. To release the hose, a sleeve is pushed back and the hose is released. When the hose is removed, the air outlet is automatically sealed. It is quite difficult to remove the hose from the full pressure output without first isolating the output by means of a valve such as a 15mm lever handled ball valve. This is another plumbing item.

Electrics

To simplify the wiring, a junction box was used to make the connections between the mains supply, the pressure switch and the pump motor (Figure 4). A mains isolating switch could be used if necessary, but as the mains feed to my compressor is taken from a switched 13 amp socket I did not fit one. It is important to ensure that there is sound earth continuity between all the metalwork of the air compressor. If there is any doubt, then earth bonding straps must be used. A 1/2 horsepower motor is rated at just under 400 watts. From this it may seem that a 2 amp fuse would be adequate. However the starting current of the motor is more than 2 amps, probably at least twice and possibly a bit more. I have fitted a 10 amp fuse in the supply to the motor and have had no problems.

Pressure testing

Because compressed air can be dangerous if not correctly managed, testing of the assembled air compressor is the most important part of the whole

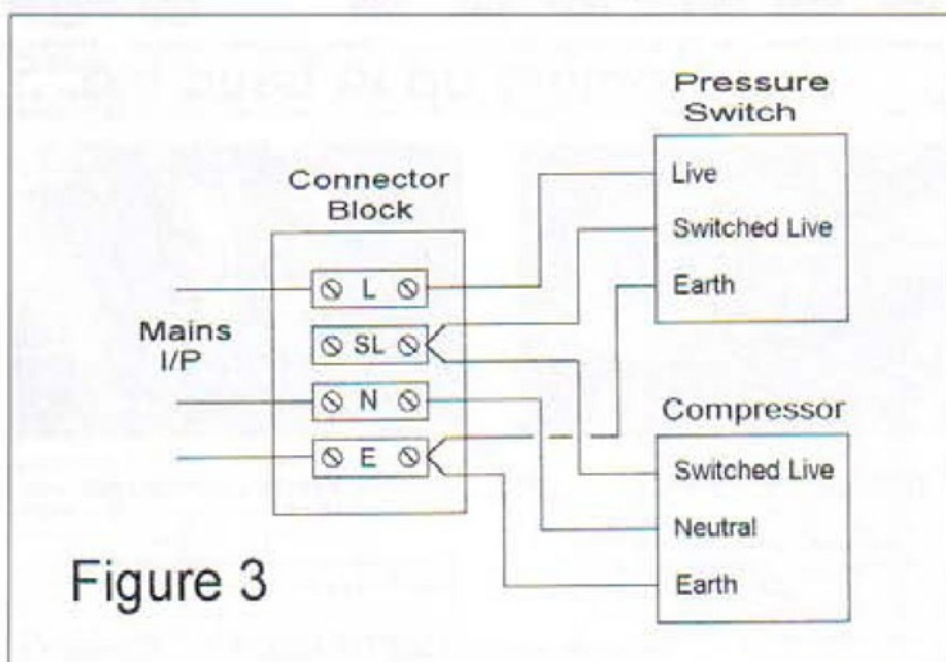


Figure 3

project. The testing of an air compressor is much like the cold testing of a boiler. I used a hydraulic test to determine the safety of the system. Shortly after I had carried out the test, an article by Stan Bray was published in *Model Engineer* (Vol. 179, No. 4049, page 258) describing how to carry out an hydraulic test on a boiler. We both used the same system in that a boiler hand feed pump was used to raise the pressure to the test level required.

Photo. 3 shows the arrangement I used. A hydraulic test entails filling the system with water and then pumping in more water to increase the internal pressure to the level required for the test. The use of water prevents an explosion should there be a failure of the system. What might happen is that you could get quite wet. The less air that remains in the system after filling it with water, the better. It is, of course, the energy stored in the compressed air that propels any water that escapes. Before filling the air receiver and pipework with water, the connection between the compressor outlet and the outlet pipe was disconnected and the end of the pipe plugged. The reason for this was that I did not want to risk water feeding through the one way valve into the compressor. As it happened, I need not have worried, because the valve did not allow water to leak past its seal. A boiler feed pump was attached to the full pressure output connection using small bore copper pipe, and the pump inlet was fed with water from a reservoir using a length of flexible pipe. The air receiver pressure gauge was used to indicate the test situation. Though the gauge may be accurate only to within about 10%, it was

new and it is the one which is used to indicate the state of the system, so it seemed appropriate to use it for the test. Pumping water into the air tank with the boiler feed pump was quite easy, and the gauge began to rise straight away. Not having carried out a test like this before, the tension built up faster than the pressure, until a small leak was spotted at around 5 bar. Having cured the leak by tightening a threaded union, pumping continued right up to 10 bar, 150 psi. At this point the drain tap was seen to be weeping. The tap was original equipment when the air tank was in use on the lorry. On dismantling the tap, it turned out to have a conical seat which had been scored in some way. A good seal was obtained by grinding in the faces using a metal polish and on refitting to the air tank, all was well.

The end result of my activities in hunting out the various bits and pieces, has resulted in a very useful air compressor for quite a nominal cost.

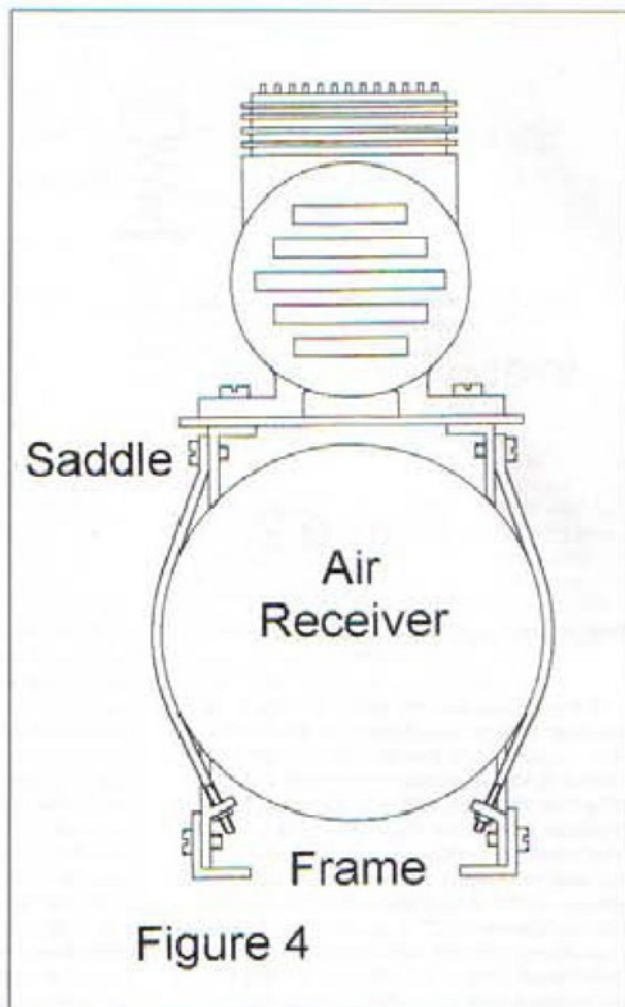


Figure 4

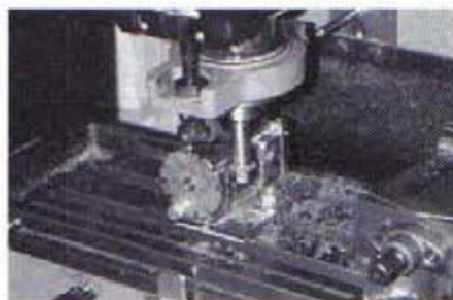
IN OUR NEXT ISSUE

Coming up in Issue No. 52 will be



THE QUICK STEP MILL

John Payne's award winning powered auxiliary milling spindle for the lathe



A CLOCK PINION LEAF MILLING ATTACHMENT

A useful clock making accessory is described by Doug. Ball



WORKSHOP PHOTOGRAPHY

Bob Loader gives some hints and tips on getting successful pictures

Issue on sale 4TH SEPTEMBER 1998 (Contents may be changed)

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

Picador revival

The name Picador has long been a familiar one to home workshop enthusiasts. Their pulleys, plumber blocks and shafts have featured in many machinery drive set-ups and for many years they have listed a drill grinding jig of the type described by Philip Amos in his article in Issue 50.

Although they have continued to be stocked by a number of our advertisers, their products have not been widely advertised in recent years, so we were interested to see that the Company occupied a trade stand at the recent National Model Engineering Exhibition held at Harrogate. It transpires that the business has now passed into the hands of its management, who are actively working to re-establish Picador to its traditional place, with a particular emphasis on the model engineering and home workshop world.

The 64 page 1997/98 illustrated catalogue lists all the familiar items and includes a technical section giving useful advice on selection and application of the equipment.

Picador hope to be present at IMEX 98 which is to be held in Doncaster towards the end of July.

For details of your local stockist or other information, contact Suzanne on 01724 281305.

**Picador, Foxhills Industrial Estate,
Scunthorpe DN15 8QJ. Tel. 01724
281305 Fax. 01724 282123**



Clarke introduce new drill press range

The Clarke Metalworker range of drill presses has been upgraded to offer what the makers claim to be full professional quality performance, suitable for mechanical engineering and industrial workshops.

Both bench and floor mounted options are available, the larger floor standing models incorporating extra large column support castings. These larger units may also have a wet/ 'T' slot work table and an integral work light. With up to 16 speeds, these presses incorporate full rack and pinion table height adjustment, a depth gauge, a chuck guard and a 0 to 90 deg. tilting table.

Safety features include a high visibility No Volt release switch and a cut out which operates when the belt guard is lifted.

List prices start at £59.95, and optional extras include table clamps, a 52 piece 'T' nut set, column mounted tool table and a mortising attachment.



**Clarke International, Hemnall
Street, Epping, Essex CM16 4LG
Tel. 01992 565300 Fax. 01992
561562 E-mail.
sales@clarkeint.com Website
http://www.clarkeint.com**

Power tool accessories from Minicraft

In addition to their own power tool range, Minicraft offer a range of accessories suitable for use with other makes of 12 volt mini tools and 230 volt mini tools with variable speeds. They suggest that these items are ideal accessories for Dremel, Black & Decker, Proxxon and Ryobi mini power tools as well as, of course, their own brand.

The range is exhaustive, covering drilling, grinding, polishing, engraving, cleaning and sharpening. Router bits, diamond tipped engraving bits and diamond saw wheels augment the more usual items such as drill

bits, wire brushes and abrasive discs.

**For a free catalogue and list of
stockists call Minicraft on 07000
646427238**

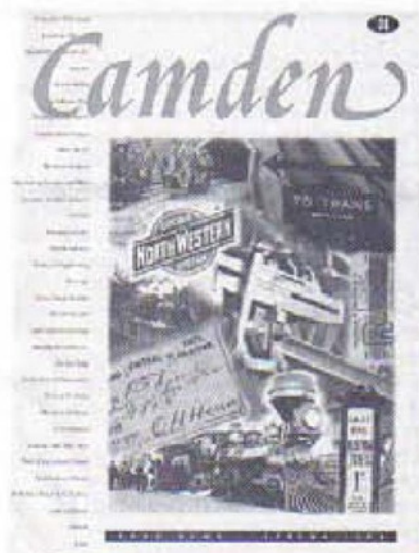


Camden Spring catalogue

Camden's Book News is always a good read in itself. Packed with information on books, magazines and videos on a wide range of transport and technical subjects, it features publications from many countries. The range covers the up to date (a section on gas turbines, large and small) and the not so new (the history of engineering and industrial archaeology).

Of particular interest to readers of M.E.W. may be text books on processes more akin to those practised in our home workshops than those associated with modern industrial techniques. One to catch the eye is a compendium of South Bend Lathe Booklets, containing eight 'How to' booklets from the 1930s. Another is a 1942 publication on Shop Theory, being a collection of instructors' notes from the Henry Ford Trade School.

For those wishing to keep up to date on how proprietor Adam Harris is coping with the machinations of the 'Camden Girls',



the back cover contains Episode 7 of 'Tales of Country Life'. Get your copy now!

**Camden Miniature Steam Services,
Barrow Farm, Rode, nr. Bath BA3
6PS Tel. 01373 830151 Fax.
01373 830516**

Devcon Adhesives for the New Millennium

One of the most significant advances in engineering over recent years must be the



development of the new ranges of adhesives which are capable of supplementing and even supplanting traditional joining methods in a variety of applications.

A new brochure from Devcon illustrates the versatility of these new materials, depicting applications which could not even have been imagined not that many years back. The secret of achieving success in this field is the selection of the correct adhesive for the task, and this publication covers six families of this type of material.



A companion brochure covers repair and maintenance products which also may find application in our sphere of activity.

**Devcon UK, Brunel Close, Park
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Wellingborough, Northants NN8
6QX Tel. 01933 675299 Fax.
01933 675765**

Lathe Bed and Saddle reconditioning by Myford

Most Myford lathe owners are aware that the manufacturers offer a bed and saddle reconditioning service for their products. The machine setting times involved make it uneconomical for Myford to undertake regrinds on a one-off basis, so they have given advance notice of the dates on which they propose to operate the service. Anyone wishing to avail themselves of the service must ensure that the parts concerned are forwarded to the factory, in a clean condition, before one of the designated dates, which occur approximately every two months. The components will then be ready for despatch/collect 21 working days from the date shown.

Remaining dates scheduled in 1998 are 7th September and 2nd November.

**Myford Ltd., Wilmot Lane, Chilwell
Road, Beeston, Nottingham NG9
1ER Tel. 0115 9254222
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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.

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- R8 arbor, tapped 7/16in. UNF to take form cutters (useful for such things as beam engine entablatures, awkward profiles etc.). New and unused, still greased. £17
Andrew Curl, 15 Boxed Close, Luton, Beds. LU4 9HN. Tel. 01582 490818 (after 7.00 p.m.)
- M.E.W. copies: Winter 90/91 (No. 3), Nos. 13, 17, 23, 29. All in clean condition, offered at face price + postage or swap for issues listed in my Wanted ad.
Paul Townsend.
- Brand new copy of Machinery's Handbook, latest, 25th Edition. Standard size hardback version, normally retails around £65. Unwanted gift £40.
Tel. Kevin on 0181 399 3079
- Hydraulic oil pumps, 4 1/2in. long x 4 1/2in. dia. 8in. overall with pulley. Offers
Cast iron legs (only) for Myford 'M' lathe. Offers.
Tel. Gains, 01427 880471

WANTED

- Small milling table (any make) or castings for same.
Tel or Fax. Norman on 0181 924 9745 (Essex)
- M.E.W. back numbers: Autumn 91 (No. 2), Nos. 4 to 12 inclusive, Nos. 15, 16, 19, 21, 28, 29, 31, 32. Any fair price payable or exchange for any of the spare copies listed For Sale.
Paul Townsend, 20 Claremont Road, Redland, Bristol BS6 7EU Tel. & Fax. 0117 9423549
- Information, technical and sales literature on Sharp Mk. 2 milling machine manufactured by Town Bent Engineering c.1987 onwards. also comments on users' experience of machine for model engineering.
Tel. John 01252 613395 (Fleet, Hants)
- I have recently purchased a 5in. Little John lathe and would like any information on a source of spare parts as the original makers, Raglan of Nottingham appear to have gone out of business.
Peer Brennan, 'Pijabah', Kelly Road, Fitzgerald Mount, N.S.W. 2799, Australia
- M.E.W. Autumn 1990 and August/September 1991. Good price paid.
Tel. Derek 01243 863082 (Bognor Regis). Daytime best.
- Photocopy of operator's manual and/or literature for Rivett 608 lathe with quick change gearbox and for SIP model 3C jig borer. I will

pay all copying and postage expenses.
George Ware, Post Office Box 529, Clinton, LA 70722, U.S.A. Tel. 504-629-4724 Fax. 504-683-3121

- Maintenance/instruction manual for Kerrys 8 Speed Superdrill made by Kerrys Engineering Co. Ltd.
Derek Price, 28 Hermitage Way, Stourport on Severn, Worcs DY13 0DA Tel. 01299 823059
- Fixed and travelling steadies (or drawings for suitable items) for Little John 5 1/2in. lathe.
Tel. Mr. Thomas 01386 47455
- Information/manuals etc. for elderly floor-standing tool and cutter grinder, with attachments, with the name 'Frikla' cast on door in base. Also carries a brass plate with "William Urquhart, M/C Tool Manufacturer, London". Perhaps later (from Kelly's Trade Directory) Urquhart Machine Tools, Kingston upon Thames, Surrey.
- Willing to buy material or have on loan to copy (return within days). Costs reimbursed. Information can be sent/phoned/faxed direct.
Edward A Turner, 74 Beech Lane, Stretton, Burton on Trent, Staffs DE13 0DU Tel./Fax. 01283 568547
- Information/literature to buy, borrow or copy as arranged on the Myford ML2 lathe that would allow a stalled restoration project to continue. Any help and advice most appreciated.
Tel. Trevor on 0161 445 3734 (Manchester)

SCRIBE A LINE

Taper turning problem

From John Summers, Lochgilphead, Argyll

Can any of your readers help me with the following problem?

I am attempting to make, on my 6in. x 24in. Churchill Cub lathe, a long slender taper reamer for finishing the bore on a woodwind musical instrument.

To make the reamer, which tapers from approximately $\frac{1}{2}$ in. to $\frac{3}{16}$ in. diameter, and has a minimum cutting edge length of $13\frac{1}{2}$ in., I placed a $\frac{5}{8}$ in. dia. x 17in. tool steel bar between centres, and used a knife edge cutting tool with small depth of cut and small feed to keep the radial force to a minimum, but as I reduced the diameter of the work it started to wobble.

I have a fixed steady, but movement of the tool post carriage limits the use of this facility. I would make a travelling steady, but the tapered workpiece precludes the use of this support.

These tapers were produced on instruments over a hundred years ago, and I received a quotation from a well known reamer maker, so I know that this part can be made, but is it possible to make it on a centre lathe?

Metric pitches on the Super 7

From George Swallow, Dorking, Surrey

As one who was just about to buy the Myford metric conversion kit, I was interested to read the letter From John Peters (S.A.L. Issue 50) about using the 34T gear as a partial solution. Now that I have one, I would be even more interested to hear how he put it on.

I have not had my Super 7 long enough to know which bits come apart easily, but the leeway on my gear quadrant seems insufficient to accommodate anything much larger than the 24T gear already on the shaft.

Could John Peters tell us how it is done?

Vee blocks - What did they really cost?

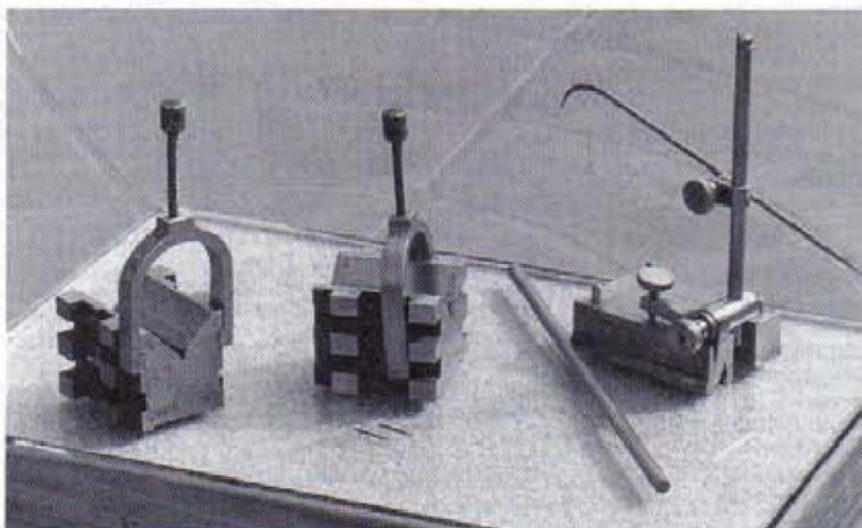
From Gerry Mann, Gawler, South Australia

I have read your magazine with

interest, and have noticed over the past months, illustrations of vee blocks and surface gauges - in particular, those of Harold Hall.

Enclosed is a photograph of some items I made as an apprentice in 1949 (I stamped my name and the date on each piece). The foreman found them, almost finished on my bench and asked what material they were from. I forget now, but it was some hard-to-get material. He didn't answer, but went pale, then flushed and stalked off! Anyway, I finished them and haven't used the vee blocks from that day to this. The clamps fit into the slots, so the blocks may be laid on either side, as a pair.

The surface gauge is 60mm long, the blocks 45mm, all the pieces being through-hardened and ground on external faces. The small items in front are 17 BA taps - no prizes to anyone



who has guessed!

Like Bob Loader, I was an instrument maker, but in the horological field. I came to Australia in 1966, and have been, in turn, a toolroom turner, an instrument fitter on gyro compasses, a fitter on the 'Ikara' missile system, a winery fitter (and foreman), an assistant planner and a Q.A. technical assistant, until I retired through ill health in '86.

I enjoy reading the letters in Scribe A Line, so I hope that this may be of interest to your readers.

It is all done by magnets

From Dennis Fielder, Cambridge

Re, the letter from Geoff Pace of Harlow in Scribe A Line, Issue 50, would you please forward the enclosed material referring to the 'Levitron'. This is currently available from The Nature Company in the U.S.A.

(The literature refers to 'The

Amazing Anti-Gravity Top' which "is able to levitate in mid-air by harnessing the lifting power produced by two opposed permanent magnets and is stabilised in space by the gyroscopic effect spinning produces." Unfortunately, no address is given for The Nature Company. Can anyone help?)

'Classic' workshop equipment designs

From Richard Atkins, Wanganui, New Zealand

Your Editorial (Mar. 98) refers to the next 'classic' design. In 1980 I was advised by the late George Thomas that he was preparing an article for

'M.E.' on a Lathe Tool Grinding Device. His comment was "I shall not describe the one that I have made, but a complete re-design which has been considered for some time, but is still in need of a flash of inspiration".

Ill health intervened and I wonder if George left any notes and if anyone is taking up where George left off, or could do so in this instance?

Such a device would, I am sure, fill the 'classic' design concept.

Halifax lathes - Readers respond to G. R. Neill's enquiry

From 'Monolith'

I read with interest your appeal for information concerning your Halifax lathe, and as the vital statistics seem to match up, I am fairly confident that I can give some information. The Halifax lathe, like the Sphere and Acorn machines, was a copy of the American 'Atlas' lathe, the design of which I believe dates from the mid 1930s.

A couple of years ago, just prior to the discovery and purchase of my first 'M' type, I bought, for restoration, an example of the Atlas locally, its chief attraction lying in the power cross feed, but sold it shortly after the 'M' arrived.

The good news is that many Sphere, Halifax, Acorn and Atlas parts are interchangeable, and better still is that Acorn Tools (1936) Ltd. (of shaper

fame among other things) were still in business two years ago, and probably still are, offering a limited range of new and second-hand spares for these machines. I let all the relevant information go with the machine when it was sold, so I cannot give you the address off the top of my head, but it would not be too hard for me to obtain, as I am still in touch with the current owner.

To come to the motor and countershaft assembly on your machine, it is very similar to the Myford 'M' type set-up and that of a great many other small machines, but was offered originally in either a horizontal or vertical configuration as per the 'M' type and Myford Seven respectively. The only difference was the belt guard shape, but unlike the contemporary Drummond 'M', was only ever offered as a self-contained bench lathe.

From David Halfpenny, Derby

Mr. Neill's lathe was built by The Acorn tool Company, many of its parts being American-made spares for the popular Atlas 10in. swing lathe. During the Second World War, the United States of America provided large quantities of machine tools to the United Kingdom under the Lease Lend programme. With them came enough spare parts to keep them going for years. Following the war, many of the surplus spares were used to build new machine tools, supplemented by British-made copies of any bits missing from the 'kits'. The Halifax is one of several such machines.

Acorn can still supply spares and a manual for your lathe. Telephone Mr. Kurn on 01 784 434 226 or write to The Acorn Machine Tool Company (1936) Ltd., The Causeway, Egham, Surrey, asking for an exploded view and parts price list. The manual is for a similar, but later, version of the Atlas. It describes how to use the lathe, as well as how to service it. Mine cost £18 in February 1998.

(The above two letters are just a sample of a number received, all offering advice and information. Thanks to all who responded.)

Tools from M.E.W. designs - and a plea for help

From Josef Schaller, Washington, U.S.A.

Being one who enjoys making and using small clamping devices, Mr. Len Walker's small instrument vice presented in Issue 47 of M.E.W. caught my eye. After a couple of hours sawing, filing and drilling, another useful tool emerged.

Also, in Issue 44, Mr. Eric Ball presented plans for an adjustable filing rest. With a couple of modifications, I was able to make one to fit my South Bend 9in. lathe. As my lathe has a vee way to contend with, and having no means of milling a vee groove in metal,

I substituted a piece of oak for the base. I used 1/4in. thick aluminium for all the flat parts plus a couple of pieces of 1/8in. thick aluminium for the side clamps. HRS was used for all the turned pieces. It is a very nice tool, which I will use often.

In Issue 45 of M.E.W., a headstock dividing attachment was presented. How nice to have one to go with the filing attachment. However, gearing and that sort of thing is way over my head. My South Bend has a 76 tooth bull wheel on the back gear train. I need some big time help with this problem. Any and all help will be appreciated. Thank you.

The poor man's vee block

From Anthony Walton, Tulse Hill, London

The Vee-block is primarily there to centre round stock, but round stock can be centred quite simply on channel section. Even commercial channel, before fettling, is really highly accurate. Such considerations instantly bring to mind the highly accurate channel at the top of every tee slot.

Centring and cross drilling

This immediately suggests a quick method of accurate cross drilling. First get a piece of round stock of the largest diameter that your drill chuck will take, as we want maximum rigidity. Turn down the end until it is the exact depth and exact width of the relevant tee-slot on the x-y table underneath your drill/mill. Chuck this stock and shift the x-y table until the turned end will just fit in the relevant tee-slot. The chuck is now dead overhead the middle of this slot. Lay your round stock on the slot and drill away - the hole will be central. If you have no bush, start off with a stub drill or better still a centre drill, so that there is no wander.

Adjust the stops on your drill/mill feed and you won't spoil your x-y table by drilling into it. There will be plenty of room for break-through underneath any round stock that will sit on top of the slot.

More thinking about this scheme of things leads to a method of cross drilling square stock centrally. This time, let the end of your setting device be turned to the exact width of the square stock you want to cross drill. All that is now required is that this spigot shall be grasped in a sliding fit by your vice jaws as the appropriate axis of the x-y table is traversed. Clamp up. Now any square stock held in the jaws of your vice will be dead central under your chuck.

Help needed with parting off problem

Parting off (in effect) with a fairly narrow lathe tool in order to sever a large stellite point from an 8 Jarno taper stock, a sudden dig in caused a bang and stoppage (though fortunately

I could switch off the motor before damage was caused). But the dig in seemed inexplicable. Examination showed a circular groove as per usual, but with a blip at one point of the bottom. I can understand that, once the blip was there, it would have the effect it did, but how did it get to be there? How did this blip, in its younger days, manage to be over-ridden by the lathe tool, so that it could live to grow up to be a lathe stopper? Can anyone tell me what I was doing wrong?

'Metalock' repairs - another reader's experiences

From Nick Clarke, Wirral, Merseyside

I have just been reading Issue 49 of M.E.W. and would like to comment on Mr. Bartram's letter in 'Scribe a Line'. He mentions 'Mechanical Stitching' as a way of repairing cast iron.

My late father, Mr. Eric Clarke spent most of his working life with the Metalock Company, the logo on the side of their van saying "Cold Repairs To Cracked and Fractured Castings". I will attempt to explain this process for the benefit of your readers, as I spent many a day in the school holidays, at work with 'Dad'.

Cracked castings are, as Mr. Bartram says, literally 'stitched' together with specially formed material. First of all, at intervals along the crack, rows of holes, spaced with a jig, were drilled across the fracture at approximately 90 de. These were opened up to form a slot into which the annealed material was forced, using compressed air tools, to lock the two sides of the fracture together.

Next, holes were drilled and tapped to take studs which were screwed in then broken off flush with the surface of the casting. This was repeated until the entire length of the crack was filled with studs, pulling it together. Plenty of green Hermitage was used in the operation, and finally the whole repair was ground flush.

Larger repairs were carried out using 'master locks'. Pieces of new casting could be grafted on to a job if the damage was too much to stitch together.

These repairs could (and still do) stand the high pressures and stresses found in many industrial processes. I spent many a day down in ships' engine rooms, in oil refineries, soap factories, breweries, in fact anywhere there is machinery. I have seen photos of 'Metallic' repairs to the cast iron columns in railway stations, underground gas mains, and diesel railway engine cylinder heads - the list is endless.

Regrettably, I did not follow my father into the industry, serving my time as a joiner instead, although I have always retained an interest in engineering. I took up our hobby about four years ago and currently run a Boxford AUD, building a 4in. scale portable engine to John Haining's 'Orcop Yeoman' design.

Perhaps some of your readers may have worked with my father in the past as he worked for 'Metalock' for over 30 years.

