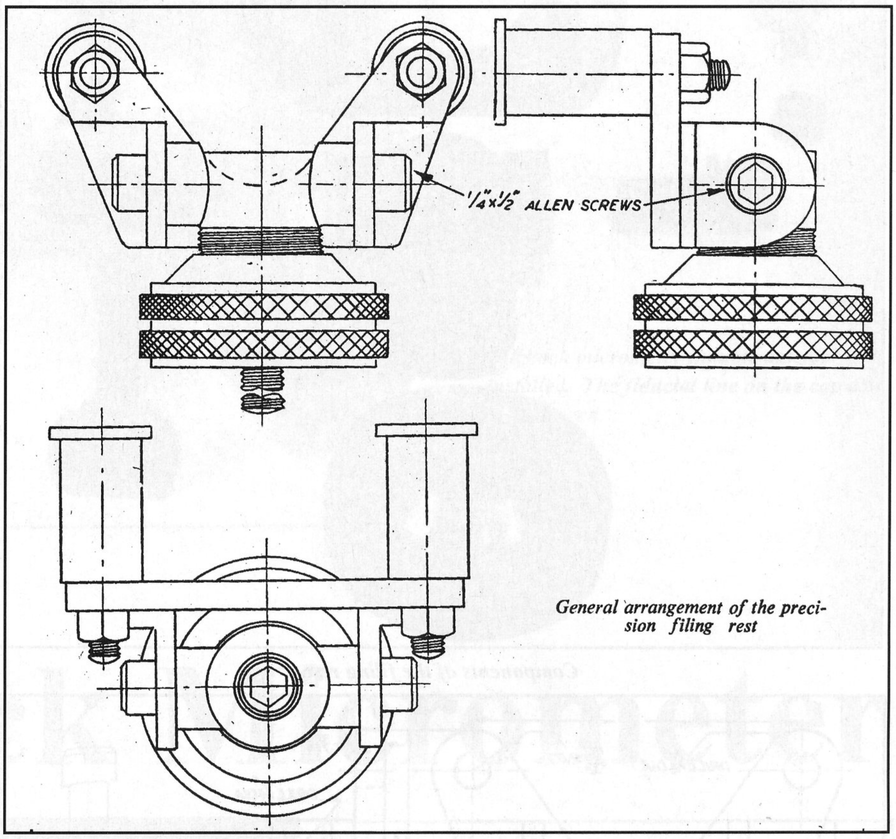
# A simple precision filing rest

by H. E. White, B. Sc.

**Filing Rest**

Here is a hardy annual, described many times over the years. It enables flats to be filed accurately on jobs still in the lathe. You could even form hexagon bolt heads with enough patience ! The current design is chosen because it is fairly simple, fits on the cross slide rather than the lathe bed, is adjustable to form angles to the axis of the machine and is graduated in thous for accurate depthing: it also has a useful capacity of 1 in. bar.

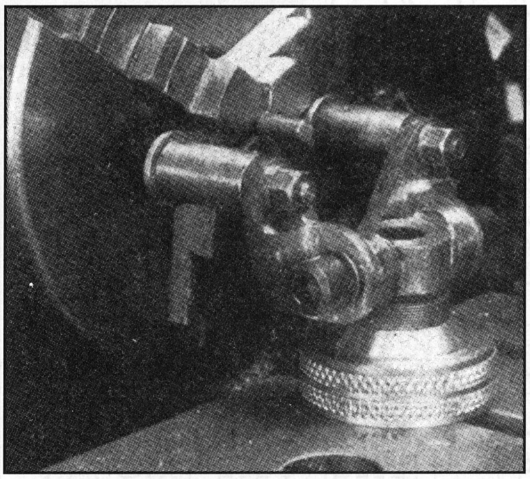



*General arrangement of the precision filing rest*

This filing rest was made in rather a hurry because it was wanted urgently for a particular repetition job; the design may reflect this in some ways, but I hope that the saving in time alone is sufficient justification for it, despite its faults. The main principle of the design is the result of a suggestion by my good friend, Mr. L.H. Sparey, whose ideas on the subject of lathe accessories are always worth listening to. The essential feature is the provision of a supporting post for the actual filing rest assembly, which is of the usual double roller type. This post is capable of fine precision adjustment for height, which is achieved by screwcutting a 40 t.p.i. thread on the post. The height of the rest can be set by means of a screwed base-collar which is indexed so that correct variations of height of 0.001 in. or less can easily be obtained. The attachment was actually designed to fit on the cross-slide of a Myford ML7, but the dimensions given could be modified to suit any ordinary lathe.

**The Post**

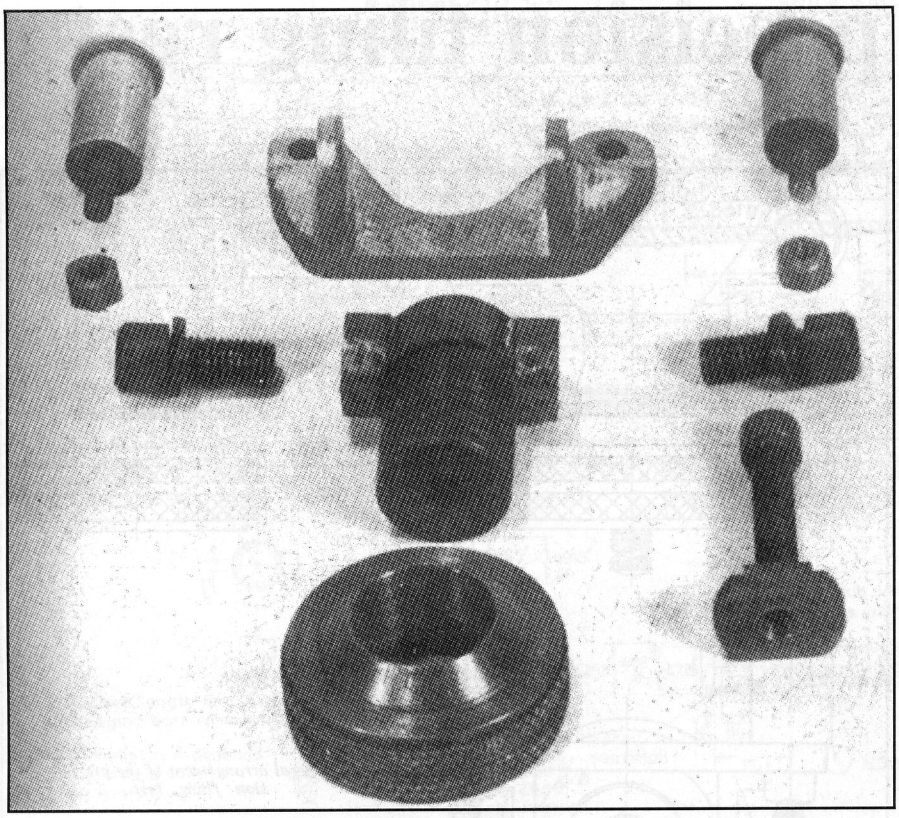
This is made from a short length of $\frac{3}{4}$ in. dia. B.M.S. rod. After its ends have been faced and centre-drilled, it is mounted in the chuck, or between centres, and screwcut 40 t.p.i. for a length of $\frac{3}{4}$ in. The upper end is then cross-drilled $\frac{5}{16}$ in. Two lugs, parted off from a length of $\frac{1}{2}$ in. dia. B.M.S. rod are drilled $\frac{5}{16}$ in., and recessed with a half-round file to fit the post. The two lugs are held in position with a piece of $\frac{5}{16}$ in. steel rod, riveted over at each end, and brazed or silver-soldered on. All that now remains is the drilling. First, mount the post in the chuck, using a wrapping of thin copper or brass sheet to protect the thread, and drill right through with a letter F drill, which will give a clearance hole for a $\frac{1}{4}$ in. bolt. This hole is counterbored $\frac{3}{8}$ in. for a depth of $\frac{1}{4}$ in. If you have no counterbore, or do not wish to set up a boring tool, do this job with an ordinary drill, drilling a little short of the required depth and finishing off the hole with an end-mill, or D-bit. Next, mount one of the lugs in the chuck and cross-drill right through both lugs with a No. 5 drill, tapping size for $\frac{1}{4}$ in. B.S.F. If there is any doubt about the "truth" of the end faces of the lugs, they may be faced off in the lathe by mounting one lug in the chuck and facing off the other, using very light cuts with a freshly sharpened knife tool. Finally tap the cross-holes $\frac{1}{4}$ in. B.S.F.



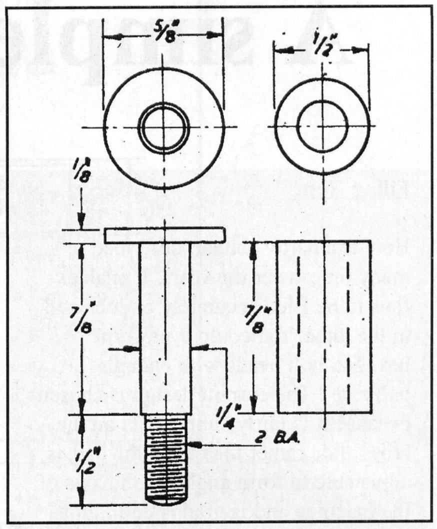
***The filing attachment mounted on the cross-slide of an M.L.7 lathe. Note that the rest has been set at a slight angle to form a tapered square on the rod in the chuck.***

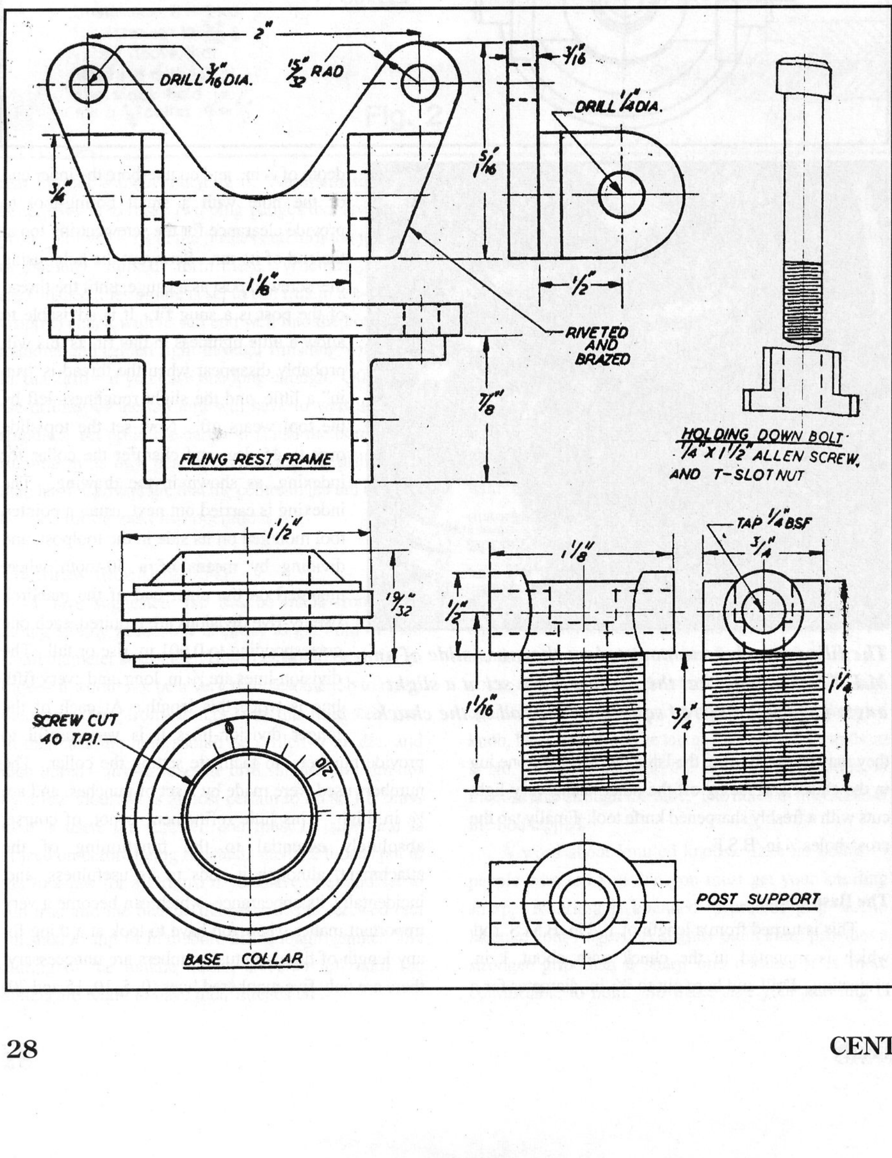
**The Base Collar**

This is turned from a length of 1 $\frac{1}{2}$ in. B.M.S. rod, which is mounted in the chuck with about 1 in. projecting. Drill and bore out to $\frac{23}{32}$ in. diameter for a depth of $\frac{3}{4}$ in., and counterbore the inner end of the hole with a small boring-tool to provide clearance for the screwcutting too at the end of its run. Screwcut the hole, using the screwed post as a gauge, until the thread of the post is a snug fit. It is advisable to allow a little tightness in this fit, as this will probably disappear when the thread is "run in" a little, and the slight roughness left by the tool wears off. Now set the top-slide over to 45 deg. and chamfer the collar for indexing, as shown in the drawing. The indexing is carried out next, using a pointed tool mounted on its side in the toolpost, and dividing by means of a 50-tooth wheel mounted on the outer end of the mandrel. Twenty-five divisions are required, each one corresponding to 0.001 in. rise or fall. The division-lines are $\frac{1}{10}$ in. long, and every fifth line is twice this length. At each of the longer division-lines it is very useful to provide numbers, to facilitate setting the collar. The numbers used were made by a set of punches, and are $\frac{1}{16}$ in. high. This little refinement is not, of course, absolutely essential to the functioning of the attachment, although it adds to its usefulness, and, incidentally, its appearance, which can become a very important matter when you have to look at a thing for any length of time! Actual numbers are unnecessary: there are only five numbered lines (0, 5, 10, 15 and 20)



*Components of the filing rest.*




and a system of punch-dots or chisel marks would be quite satisfactory if number-punches are not available.

Now set up a parting tool and turn a parting slot at a distance of 19/32 in. from the end of the chamfered top of the collar to a depth of about ⅛ in. With the same tool, shoulder down the outer diameter of the collar as shown in the drawing, and turn the medial groove. The knurling is the next job, and this must be done before the collar is finally parted off from the stock, because a very rigid mounting is necessary for the knurling process. When both the ribs have been satisfactorily knurled, part off the collar from the stock and, if necessary, face up the base truly, in case the parting tool has wandered.

### The Filing Rest

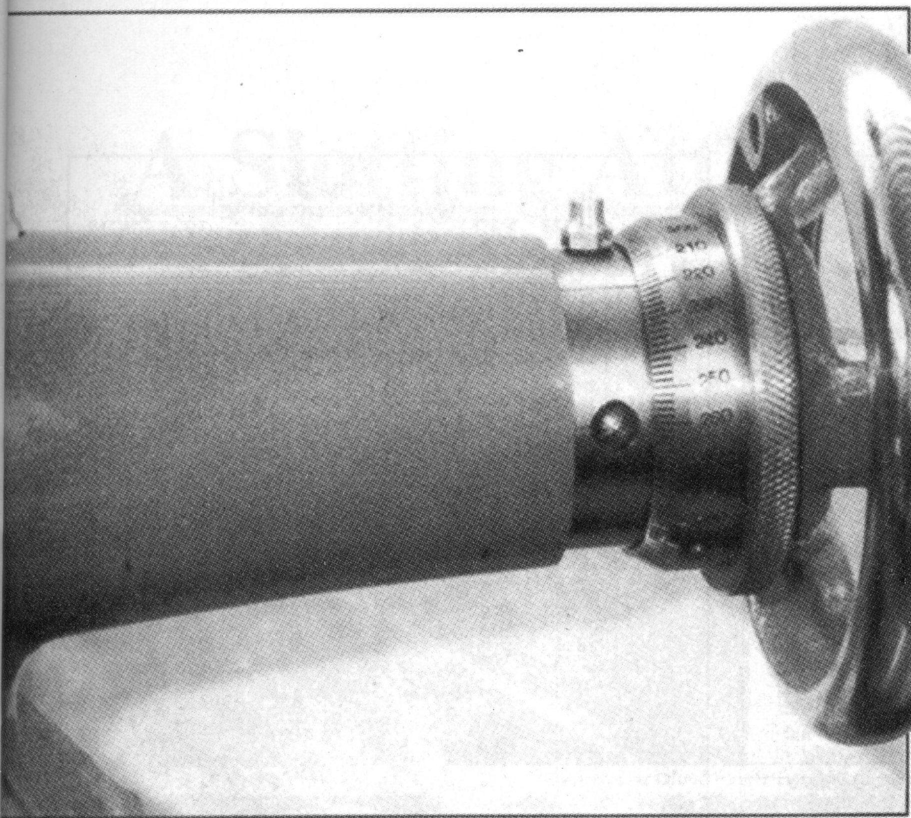
The frame of the rest is cut from a piece of 3/16 in. mild-steel plate to the outline shown in the drawing. Two 3/16 in. holes are drilled to take the roller-pins, and two brackets, cut from ¾ in.x ⅛ in. angle steel are lightly rivited in position and then securely fixed by brazing. As a matter of fact, a spacing jig-piece was bolted between the two brackets before they were riveted and brazed, to ensure that the bolting faces were the exact distance apart, and perfectly parallel at the end of the brazing process, a little precaution which saved time in the end.

The two rollers were parted off from ½ in. dia. silver-steel rod, drilled, reamed, and hardened right out. The pins were turned from ⅜ in. dia. mild-steel rod and case-hardened. The attachment of the filing rest to the post in this manner allows the rollers to be inclined at any desired angle, and provides for the forming of tapered squares or hexagons – a useful point when it is desired to fit a square-holed component tightly to a square shank.

### Attachment to Cross-slide

The post is held to the cross-slide of the lathe with a ¼ in. Allen cap-screw, which at the same time locks the adjusting base collar. A T-slot nut must be filed up from a piece of mild-steel bar, making sure that it is symmetrical, and grips equally on both sides of the T-slot. No dimensions are given for this, as its size will obviously depend upon the size of the T-slots. ●

***Model Engineer*** ***106*** ***222 (1952)***



*Tailstock micrometer thimble assembly installed. The fiducial line on the cap can also be seen.*

# Tailstock Micrometer

**DEREK OXLEY CONTINUES HIS SHORT SERIES WITH A DESIGN FOR A MICROMENTER SCALE FOR THE SUPER 7**

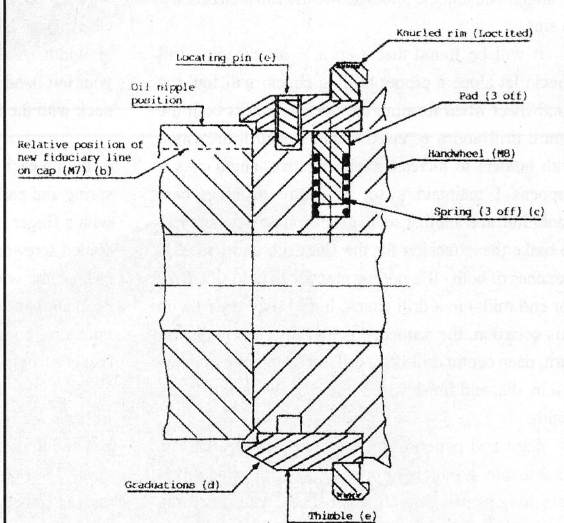

**Tailstock Micrometer**

One of the frustrations of many lathe tailstocks is that one has to judge the depth of feed with reference to an indistinct scale. It has always irked me that the Myford tailstock zero graduation cannot even be reached without ejecting the Morse Taper shank! How potty! But read on: this design is simple to make and install and the thimble is easy set to zero. Pity about the small indistinct printing in the graphic presentation.


*Tailstock barrel advance*

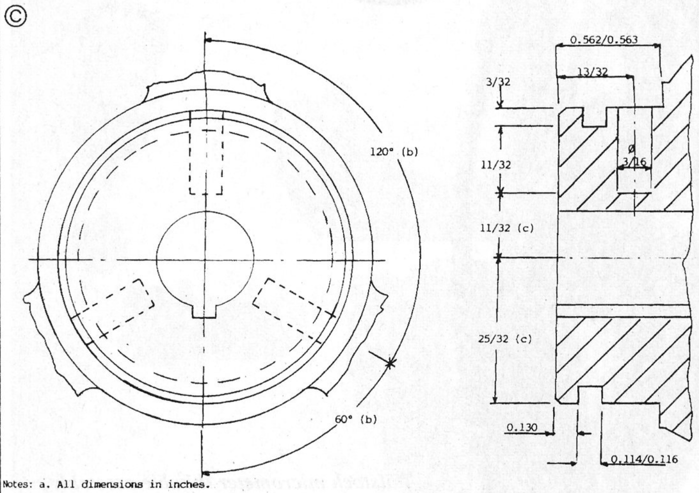
In both model and experimental engineering it is frequently necessary to restrict the depth of drilling or counterboring from the tailstock, in order not to hazard some other feature of the workpiece. On the very old ML7 the tailstock barrel advance was ⅛ in. per handwheel revolution and, by observing marks taped onto the handwheel periphery it was possible to make a reasonable judgement of 1/64 or 0.010 in. increments. The newer models have a faster rate of tailstock barrel advance at 0.300 in. per handwheel revolution from a 10TPI x 3 start thread, which warrants an engineered solution, rather than a makeshift one. True, the tailstock barrel is already graduated in ⅛ in. linear steps, the first 3 or 4 of which are always exposed before the self-eject mechanism has been overcome, and in my view is too coarse to be useful.

My solution to this problem was to fit a micrometer thimble to the re-machined boss of the handwheel to be read against a fiducial line cut in the tailstock cap (part 7 of illustration M in Myford handbook S723W) at about 30 deg. from the vertical towards the operator. The sketches show the general



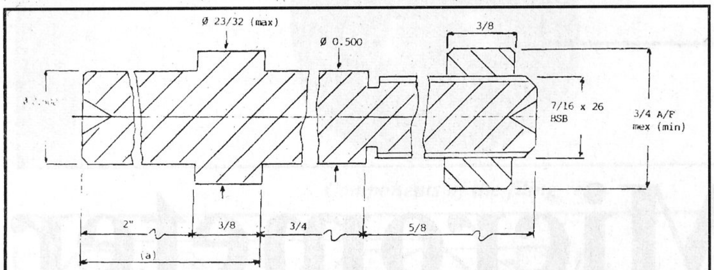

Notes:
a. Drawn and detailed to suit tailstocks on which the visible portion of the cap (M7) is parallel. Thimble to be modified to suit tapered caps.
b. Horizontal fiduciary line cut on cap, approx 30° from vertical and towards operator's line of vision.
c. Springs (3) cut and ends ground from 1/8" nominal i.d. x 24 swg stainless valve spring (Reeves type) to give 7/16" overall free length.
d. Graduated 150 E.S. divisions (0.002" steps). 0.010" and multiples full length of taper, others 1/8" long.
e. Numbered with 1/16" stamps at long graduations from 010 to 290, the 000/300 position not numbered but position occupied by the locating pin - a 6BA x 1/4" hex socketed grubscrew. Numbers in ascending sequence anti-clockwise when viewed from handwheel rim.

TAILSTOCK MICROMETER THIMBLE ASSEMBLY

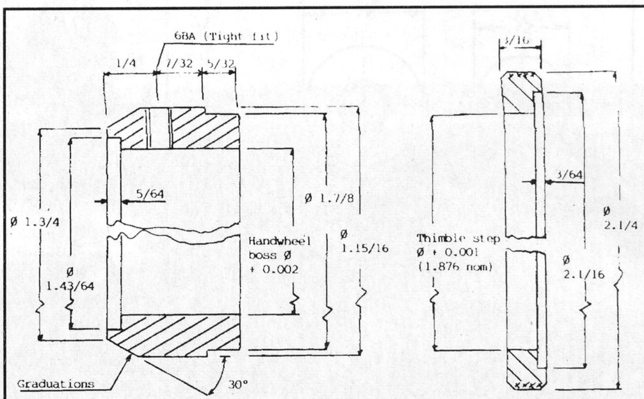



Notes: a. All dimensions in inches.
b. The radial disposition of the three E.S. pockets to be such that one is directly opposite the keyway.
c. If it is found that there is abnormal eccentricity between the factory machined bore and the as supplied handwheel boss, the re-machined boss may need to be reduced slightly below 1.9/16" Ø, and the thimble bore adjusted accordingly.

MODIFICATION OF CI TAILSTOCK HANDWHEEL




Notes: a. As drawn to suit 1/2" Myford collet. Alternatively 2MT, but if that form of mandrel is to be adapted for number stamping by fitting a suitable collar, a tapping for a drawbar would be prudent.
b. Mandrel MS; nut MS or brass

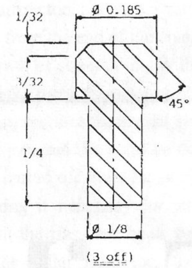



See notes d. and e. on Sketch B (G.A.) and note c. on Sketch B.1 (Handwheel mod).

Loctited to thimble after proof of fit of all parts.

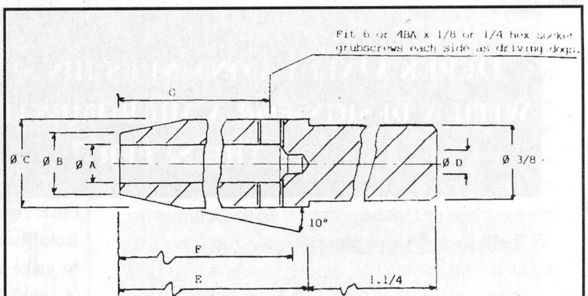
THIMBLE (MS)

KNURLED RIM (MS)



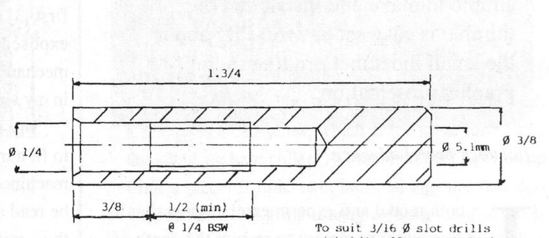

(3 off)

PAD (BRASS/BRONZE)




| | | |
|---|---|---|
| | | For BS.2 |
| Ø A = | Centre drill body size | 3/16 |
| Ø B = | Ø A + 1/8 | 5/16 |
| Ø C = | Ø A + 1/4 | 7/16 |
| Ø D = | Centre drill tip Ø + 1/32 | 3/32 |
| E = | 2/3 overall centre drill length | (say) 1.3/16 |
| F = | Point depth of body sized jobber drill @ E - 0.5A | (say) 1.3/32 |
| G = | E - 1.5A | (say) 29/32 |

CENTRE DRILL EXTENSION (MS)




To suit 3/16 Ø slot drills with 1/4 x 20 screwed shanks.

SLOT DRILL EXTENSION (MS)

arrangement, and the photo shows the finished product in situ.

It will be found that even a ⅜ in. capacity drill chuck, let alone a proper milling chuck, will foul the handwheel when forming the pockets unless both the centre drill and a screwed shank slot drill are fitted with holders to increase their effective length. As it happens I maintain a set of centre drills in bare condition, and another set in extension holders, but had to make the extension for the slot drill, and I include sketches of both. It is not my practice to hold slot drills (or end mills) in a drill chuck, but I broke my rule on this occasion, the sequence being, for each pocket in turn, deep centre drill BS2; drill to 7/16 in. point depth at 11/64 in. dia. and finish with 3/16 in. dia. slot drill to 7/16 in. depth.

Care and patience are required for effecting the final assembly, solely to prevent the springs and pads launching themselves into outer space. After Loctiting the rim to the thimble and fitting the 6BA retaining pin part way into the thimble, the procedure I used (right handed), was as follows.

**a.** Using a solid copper wire (soft iron wire would be fine) of about 22swg, make a single loop around the re-machined boss of the handwheel, just sufficiently tight to be freely movable and secured with not more than two twists, leaving the pair of tails ¾ in. long standing straight out. Slide that loop to a position just to the rear of the pockets, and bend the tails backwards, angled towards the rim.

**b.** Place a rubber/elastic band loosely around your left wrist. Place all the components into a clear plastic bag of about 14 in. length x 9 in. width. A freezer bag does nicely. Enter your left hand into the bag and secure its neck with the rubber/elastic band.

**c.** Taking each pocket in turn, load the spring and pad and, whilst depressing them with a finger of the left hand, use fine bladed screwdriver held in the right hand to push the wire loop to capture the pad head at about half its diameter. A small puncture (but not a large tear) in the plastic bag is acceptable.

**d.** Enter the boss of the handwheel into the rim and thimble assembly and, gently but firmly, press it on until the heads of all the pads have been captured at about half the head diameter. With a suitable pair of pliers in your right hand undo the twists in the wire and move the wire clear of the assembly. Push the rim and thimble fully home.

**e.** Release the neck of the bag from the rubber/elastic band and carefully withdraw the whole assembly from the bag. Screw the 6BA retaining pin fully home, then back it off one complete turn. ●

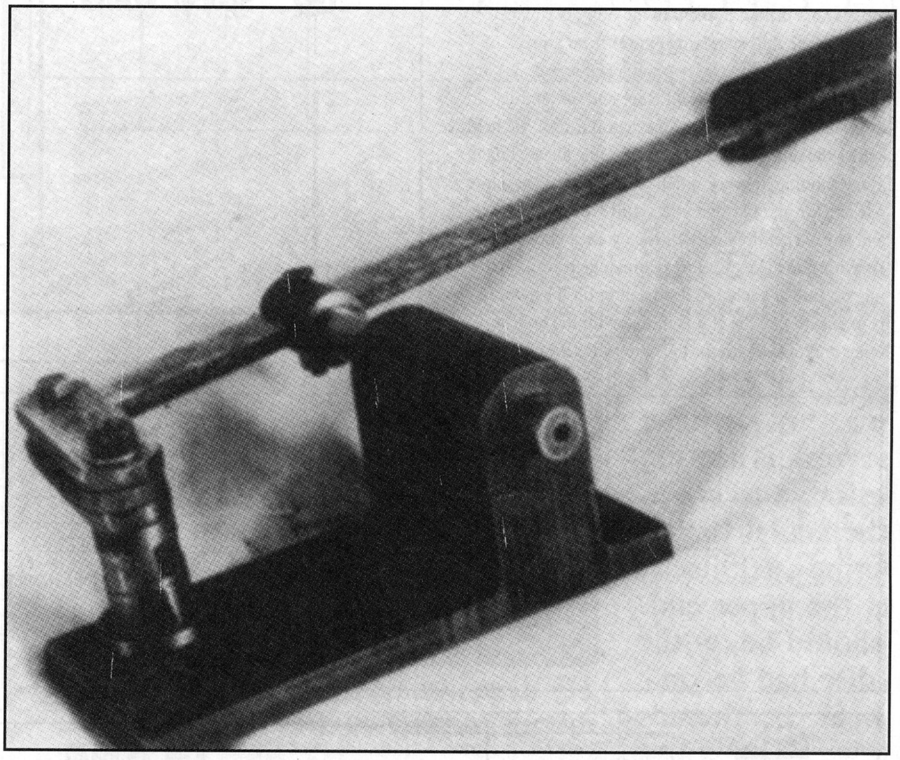
***Model Engineer* *172* *168 (1994)***

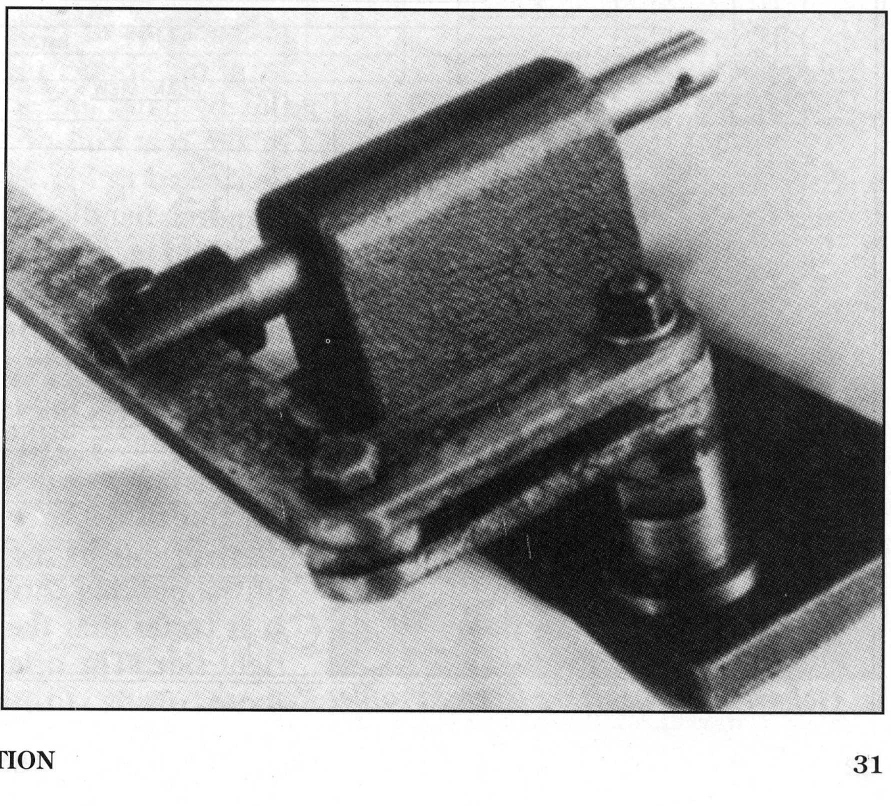
# A Slotting Attachment for use on the Lathe

by R. J. Cochrane

***Slotting Attachment***

It is certainly a great time saver to be able to slot the odd keyway or spline in the lathe. Of the other notable designs published over the years, those by Rose (1968) and Radford (1969) are worthy of mention for their elegance, but they are rejected in favour of the current design, which is completely basic and simple. It needs no castings and the only refinement which I would recommend is two studs or a tenon projecting beneath the base, to engage the tee slots of the cross slide so as to align the tool accurately with the lathe axis. The reader is also referred to another excellent variation of this design by F. P Robinson, published in Model Engineers Workshop in August 1991.

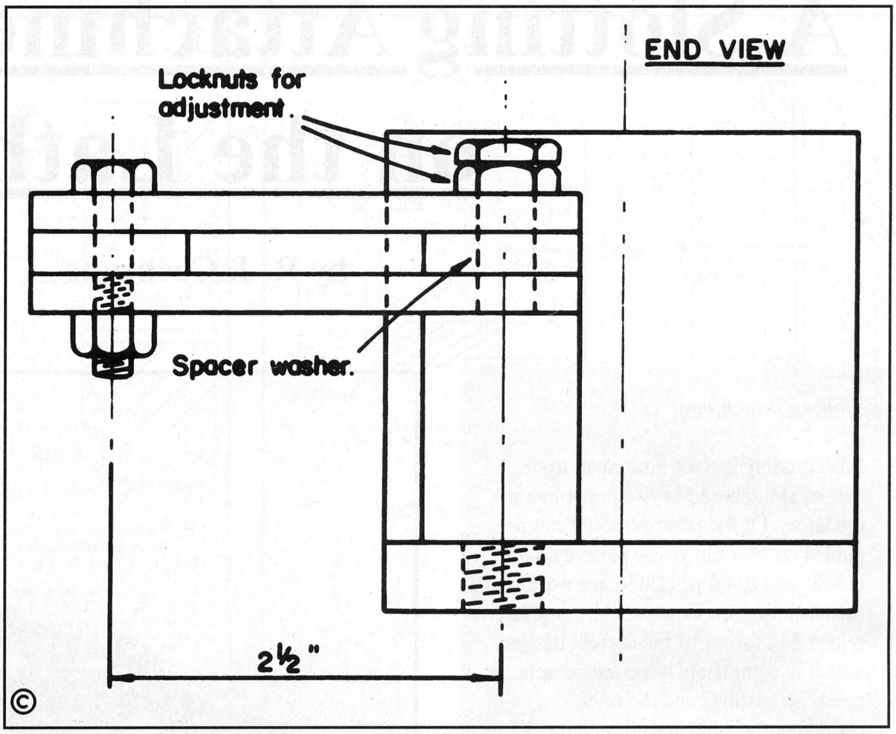


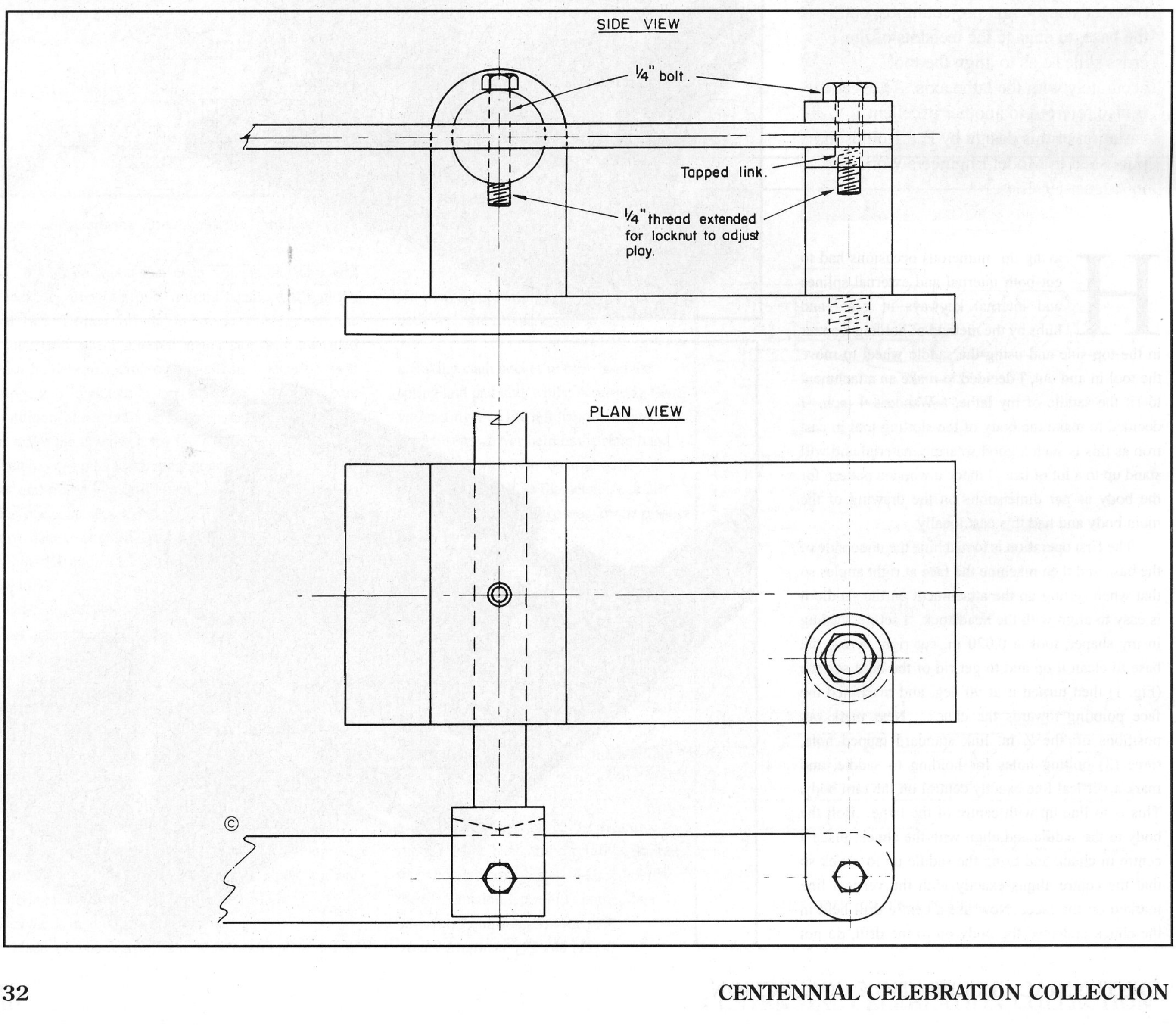


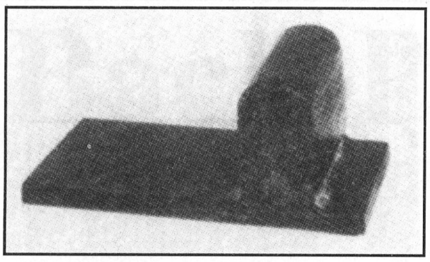
Having on numerous occasions had to cut both internal and external splines and internal keyways in gears and hubs by the method of holding a cutter in the top side and using the saddle wheel to move the tool in and out, I decided to make an attachment to fit the saddle of my lathe, a Wandess 4 inch. I decided to make the body of the slotting tool in cast iron as this is such a good wearing material and will stand up to a lot of use. I made a wooden pattern for the body as per dimensions on the drawing of the main body and had this cast locally.

The first operation is to machine the underside of the base and then machine the face at right angles so that when setting up the attachment on the saddle it is easy to align with the headstock. I set my casting in my shaper, took a 0.020 in. cut right across the base to clean it up and to get rid of the hard surface (Fig. 1) then turned it at 90 deg. and machined the face pointing towards the chuck. Next mark out positions of: the ½ in. link standard tapped hole, three (3) bolting holes for holding to saddle, and mark a vertical line exactly central on the ram body. This is to line up with centre of the lathe. Bolt the body to the saddle and align with the chuck, place a centre in chuck and bring the saddle up to chuck so that the centre aligns exactly with the vertical line marked on the face. Now use a centre drill held in the chuck and feed the body on to the drill, do not forget to check the vernier reading on the cross slide so that you can always set the slotting tool on the saddle accurately. Now continue drilling, gradually increasing the size of drills until you finish up with a ⅝ in. drill. If you have a ⅝ in. reamer then this can be used with the appropiate drill to make a very good finish. As drilling like this in the lathe puts a heavy strain on the saddle mechanism, I brought the tailstock up and fed the body onto the drills with the effect of turning the saddle wheel and tailstock together, this allows the pressure to be obtained without any strain on the saddle feed. Once this hole is drilled, the hole for the link standard tapped and the oil hole drilled in the top, the body is finished.

Turn the link standard (Fig. 2) from a piece of 1 in. dia. mild steel. The two rams (Figs. 3 & 3a) are turned from 1 in. dia. mild steel and are similar on the main dimensions but one has the tool bit held across the ram and the other one in line ahead, this to allow slotting in very small holes as well as large ones. Turn the bar down to a full ⅝ in. dia., 5¾ in. and 5 in. as per drawings until they are a good sliding fit with no shake. Before removing from the lathe mark a line at each end dead centre on the side, this is to ensure that the slot is in line with the hole at the other end of the ram for the cutter bit. Remove ram,



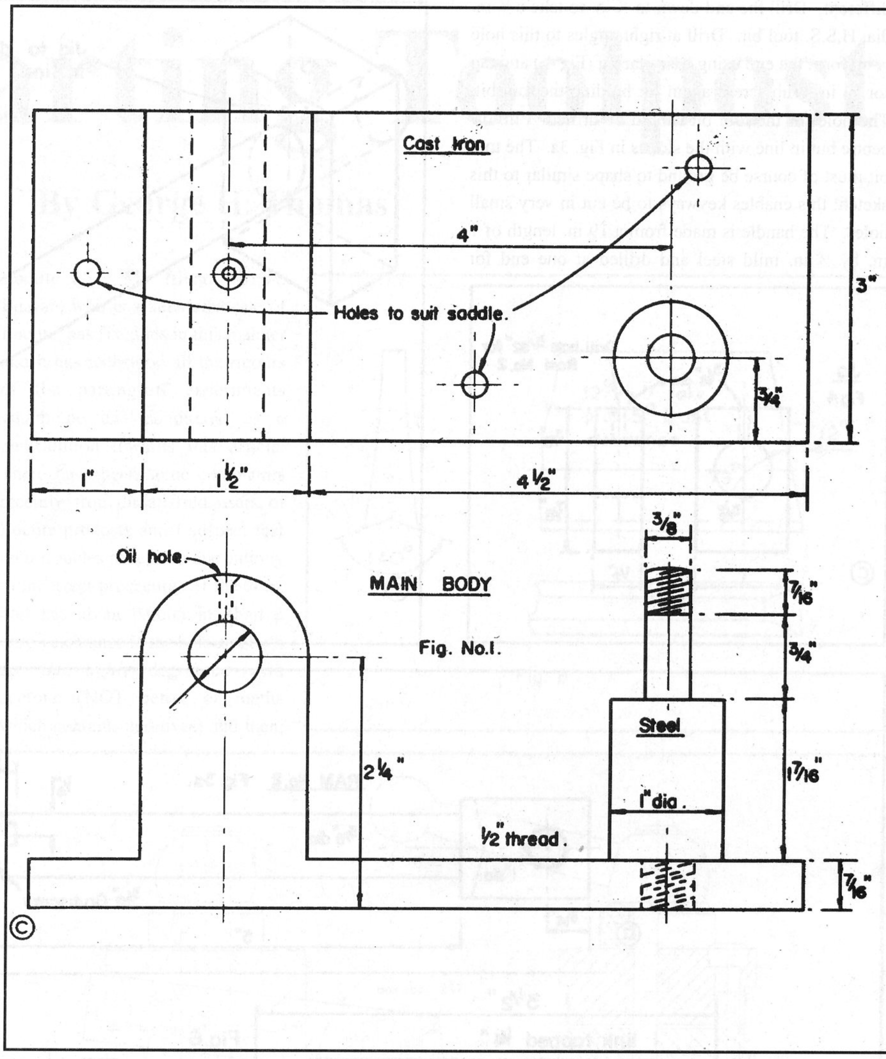



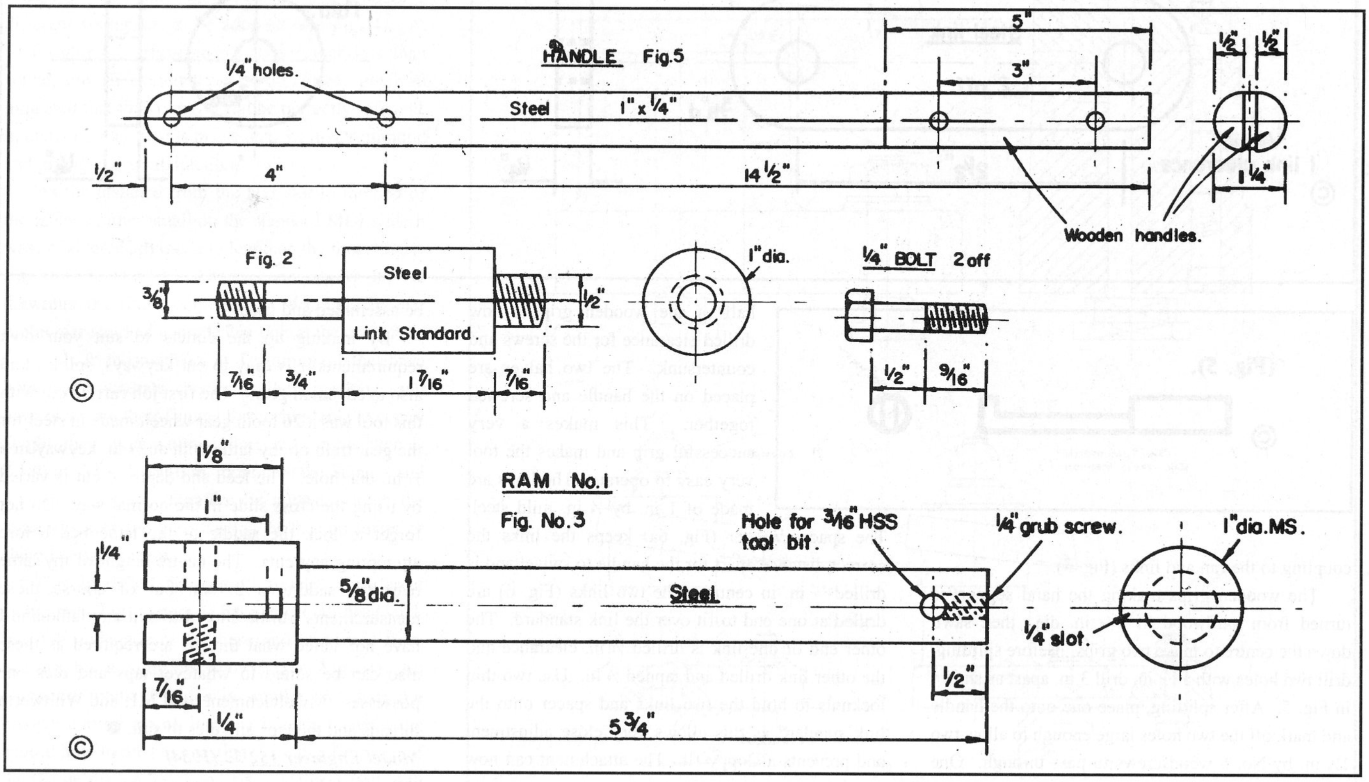


*The wooden pattern.*

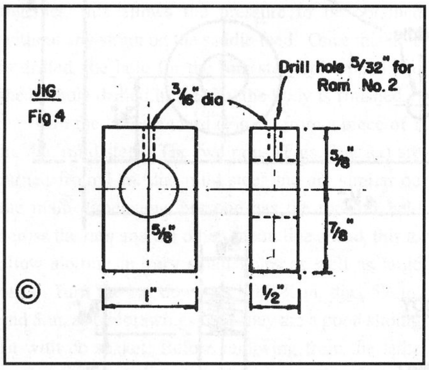
reverse in chuck, then drill down the 1 in. dia. end with $\frac{1}{4}$ in. drill to a depth of 1 in., this determines the depth of the $\frac{1}{4}$ in. slot, now remove from the lathe and drill a $\frac{1}{4}$ in. holes across cutting through the hole already drilled making sure you go through dead centre. This hole must be drilled central on the line already scribed on the side. Now mark off a $\frac{1}{4}$ in. slot using the $\frac{1}{4}$ in. holes as a guide, now cut down each line with a hacksaw and, finally, carefully file the slot to fit snugly over the handle material 1 in. by $\frac{1}{4}$ in. and relieve each side of the slot bottom as shown by dotted lines in drawing (Fig. 3a), this is to ensure the handle does not bind at each end of the stroke of the ram. Drill a hole at right angles to the slot $\frac{7}{16}$ in. from the end, one side to be tapped $\frac{1}{4}$ in. the other side $\frac{1}{4}$ in. clearance (Fig. 3). Both rams are the same at this end.

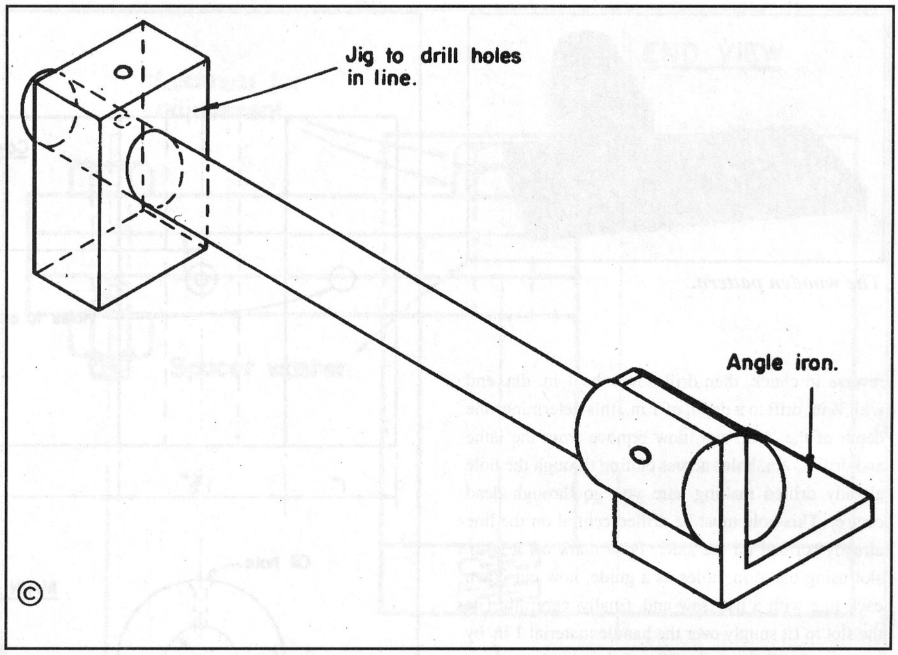
In order to ensure the tool bit is exactly central and level it is better to make a jig as in Fig. 4. Bolt the slotted end to a piece of $\frac{1}{4}$ in. thick angle iron, this ensures the slot is upright, now slide the jig over the $\frac{5}{8}$ in. dia. end of the ram and drill a $\frac{3}{16}$ in. hole right through the ram $\frac{1}{2}$ in. from the end (Fig. 3). Drill the end of the ram and tap $\frac{1}{4}$ in. for a grub screw to hold tool bit. The end of the shorter ram is a little

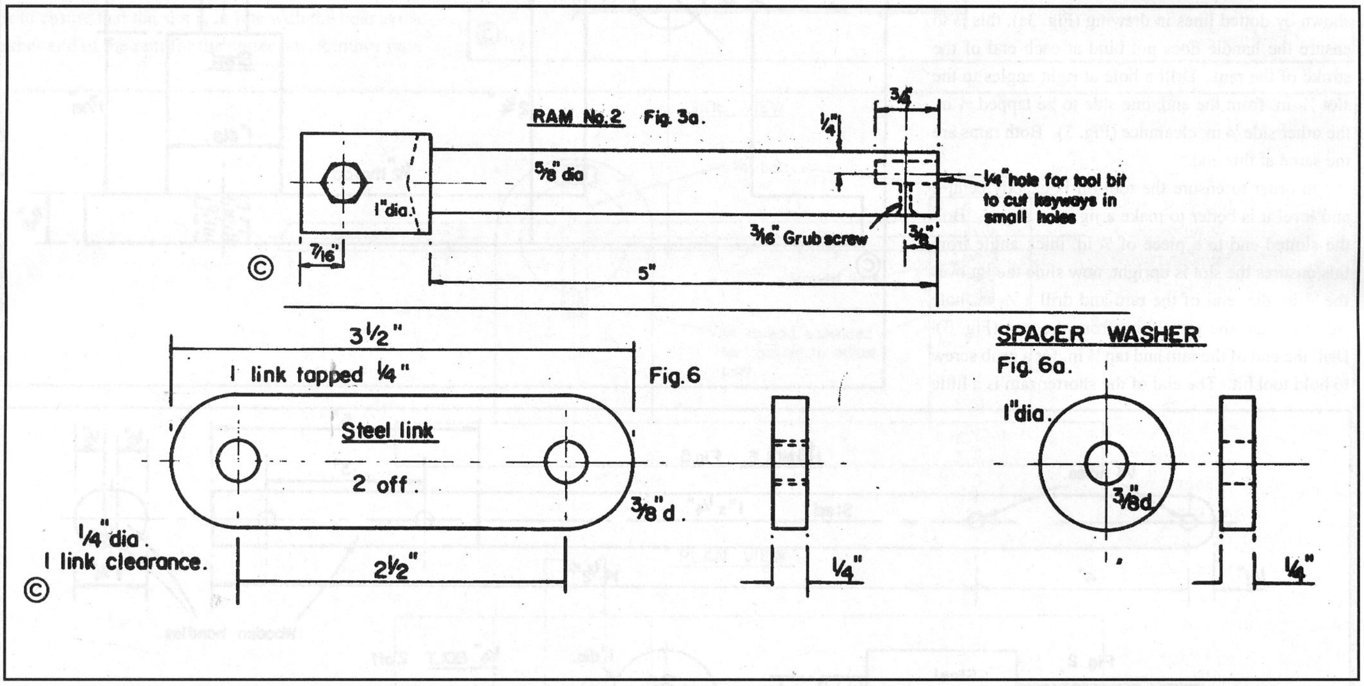


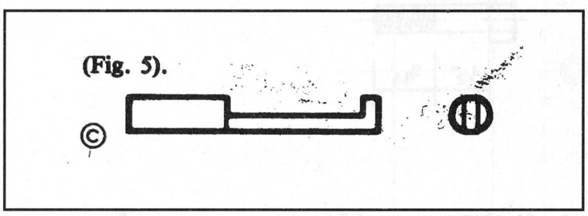



different. Drill the end down to ¾ in. to take a ¼ in. dia. H.S.S. tool bit. Drill at right angles to this hole ⅜ in. form the end using a similar jig (Fig 4.) and tap for 3/16 in. grub screw, again for holding the tool bit. The hole for the tool bit should be drilled ⅛ in. off centre but in line with the slot as in Fig. 3a. The tool bit must of course be ground to shape similar to this sketch: this enables keyways to be cut in very small holes. The handle is made from a 19 in. length of 1 in. by ¼ in. mild steel and drilled at one end for




coupling to the ran and links (Fig. 5).

The wooden grips making the hand support is turned from hardwood to 1 1/16 in. dia., then sawn down the centre to make two grips. Before splitting, drill two holes with a 3/32 in. drill 3 in. apart as shown in Fig. 5. After splitting, place one onto the handle and mark off the two holes large enough to allow two 1¼ in. by No. 6 woodscrews to pass through. One half of the wooden grip is now drilled clearance for the screws and countersunk. The two halves are placed on the handle and screwed together. This makes a very successful grip and makes the tool very easy to operate. The links are made of 1 in. by ¼ in. mild steel. The spacer washer (Fig. 6a) keeps the links the correct distance apart for the handle to swivel and is drilled ⅜ in. in centre. The two links (Fig. 6) are drilled at one end to fit over the link standard. The other end of one link is drilled ¼ in. clearance and the other link drilled and tapped ¼ in. Use two thin locknuts to hold the two links and spacer onto the link standard as this allows very close adjustment and prevents a sloppy fit. The attachment can now be assembled and used.

By making up the cutters to suit your own requirements it is easy to cut keyways, splines and also to cut small gears. The first job carried out with this tool was a 20 tooth gear wheel, made in steel for the gear train on my lathe with an ⅛ in. keyway in a ⅝ in. dia. hole. The feed and depth of cut is varied by using the cross slide in the normal way. Do not forget to lock the saddle to the lathe bed before attempting any cuts. The centre height of my lathe over the saddle is 2¼ in. but of course these measurements can be altered to suit any lathe and I have not stated what threads are required as these also can be suited to whatever taps and dies one possesses. My attachment used N.F. and Whitworth threads and the taps and dies to suit. ●

*Model Engineer* *152* *32 (1984)*

# Back Parting Toolpost

## By George H. Thomas

***Back Parting Toolpost.***

Any accessory by George Thomas will be worth making; though not necessarily the simplest, this solution to the time old problem of parting off is the most elegant available. Presentation of the blade at an angle of 7 degrees does make for long term preservation of the tool and the method of alignment described takes the guess-work out of setting up the blade. The original articles formed part of a much longer dissertation on parting off problems, so I trust I may be forgiven for a certain amount of editing.

This tool-post was designed specifically for use on the Myford super 7 lathe and its dimensions are, therefore, based on a centre height above boring-table of 2.070 in. which is the mean of two which I have checked. For use on the ML7 with the *long* cross-slide, exactly the same fixings are suitable, but for the ML7 with standard cross-slide or a 3½ in. Drummond, a different fixing has to be adopted (see Fig. 4). At first sight, the arrangements look rather less than sound, but an examination of the forces involved indicated that the fixing would be perfectly safe and, in fact, one such post is in use on a 3½ in. Drummond and giving every satisfaction.

As the distance from the rear slot to the end of the table is rather small on the standard ML7 slide it was considered advisable to lengthen the foot and use two slots for fixing. Although not shown on the drawings, the fixing contemplated was by a Tee-bar in the rear slot and a single Tee bolt at the end of the foot. My friends with 3½ in. Drummond lathes have both made accurate checks on their machines and have given me their figures for boring-table to centre height; they agree within 4 thou. and can be taken as 2.180 in. This is 0.110 in. more than the Super 7 and this amount must, therefore be allowed for in the dimensions of the base casting or the top turret or shared between them.

This modified fixing will require a different clamp bolt (Fig. 5, item 3) having a small head sunk into the underside of the base and prevented from turning by a snug as shown (see Fig. 4). An alternative method which is simpler and does not involve cutting a sink into the base is to ream the central hole in the base casting ⅜ in. dia. (in place of the 25/64 in. drilled hole) and fix a headless bolt with Loctite 35. My friend Mr. A. Beavan, who is a keen advocate of Loctite, has fixed his in this manner and it has withstood all the rigours of the parting-off experiments which he has conducted as a contribution towards this article. There have been some complaints recently fron dissatisfied users of Loctite products and I suspect that their troubles have been due entirely to incorrect procecure. If the ⅜ in. bolt has about 0.0005 in. (half a thou.) clearance in the hole and both are *thoroughly* degreased with acetone (NOT petrol or meths which contains additives) and then,

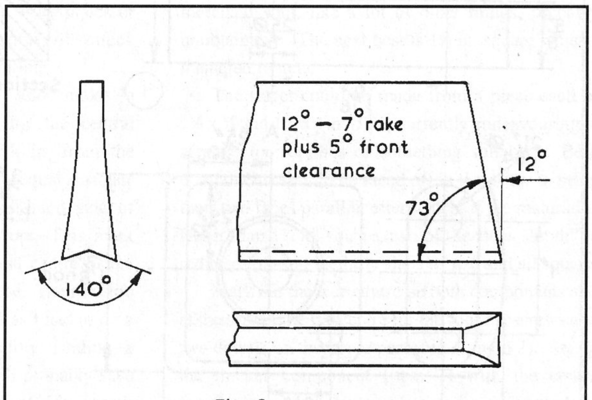


Fig. 8

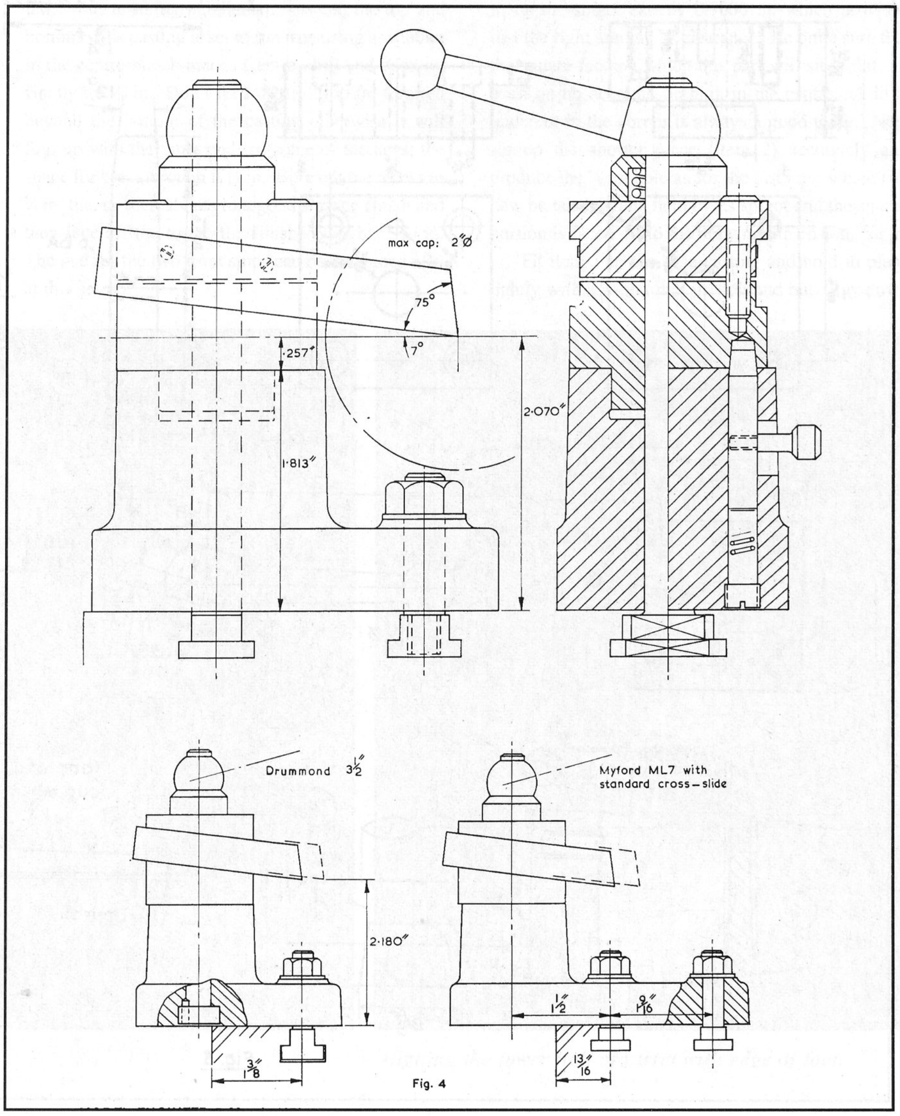


Fig. 4

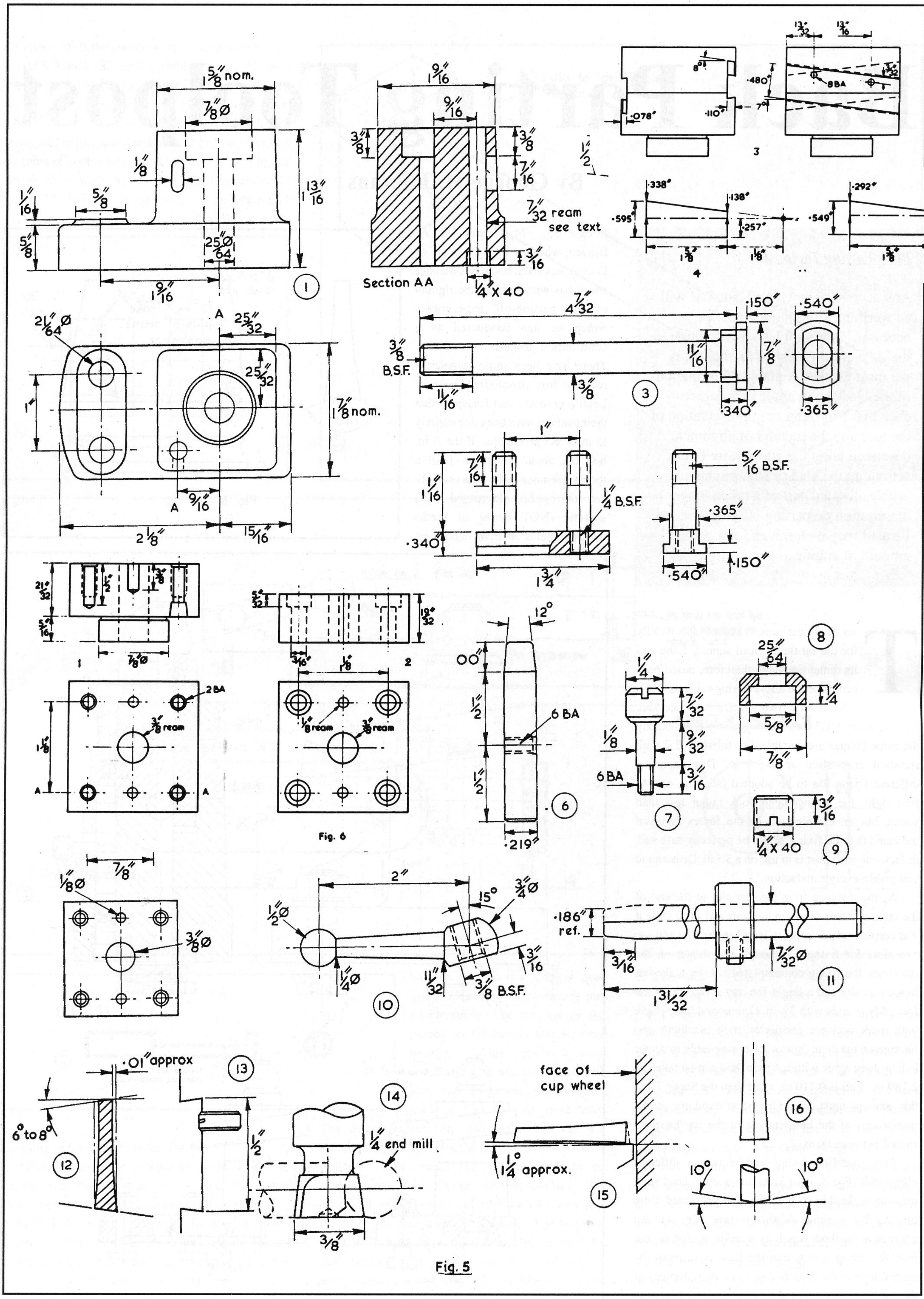
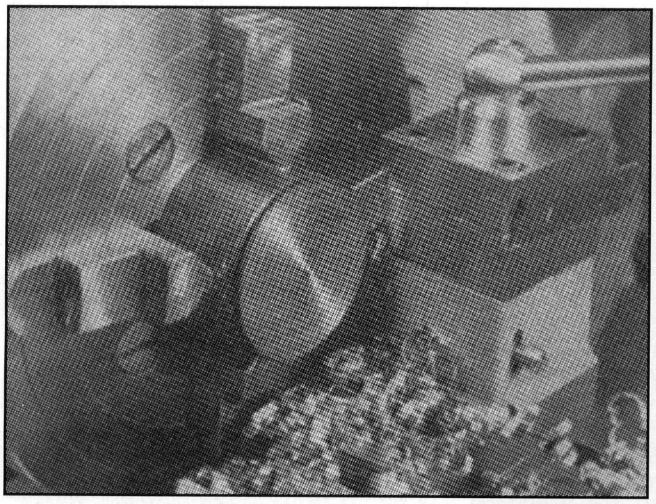

Section AA
7/32 ream see text
1/4 X 40
B.S.F.
1/4 B.S.F.
5/16 B.S.F.
3/8 B.S.F.
6 BA
2 BA
8 BA
3/8 ream
1/8 ream
.01" approx
6° to 8°
1/4 end mill
face of cup wheel
1 1/4° approx.
.186" ref.

Fig. 6

Fig. 5



***Parting off 1¼ dia. b.m.s. with 3/32 in. blade.***

preferably primed with Locquic, and cured at about 80°F after applying the adhesive to both the bore and the bolt and working the two together for a second or two, the joint should ultimately withstand a pull of about 4 tons. This figure is based on some practical tests carried out by Mr. Beavan and reported in the Journal of the SMEE, November 1973.

Start with the base-casting, machining the lower surface to leave the thickness of the foot ⅝ in. Next follow with the two sides which should be made square to the bottom and parallel to each other; only the minimum amount need be removed in order to clean up, the final width is quite unimportant. Clean up the back of the base square to the sides and then take a cut over the top of the square tower, leaving a little to be machined off later. The method used for these operations will depend upon the fancy and facilities of the constructor. I used a 2 in. shell end-mill on the milling machine and all six faces treated were completed in about a hour. Without the aid of a miller the work can readily be done in a 4-jaw chuck or a combination of chuck work and milling.

Mark out and make a centre-pop for the central bolt hole 25/32 in. from the back and an equal distance from the left-hand side of the square top. This mark will not necessarily be in geometrical centre of the top – it is not intended that it should be. The next job is obviously for the 4-jaw chuck and as I had to do a certain amount of 'conjuring' before finding a satisfactory set-up, a photograph will probably save some valuable time. Three short ends of ⅝ in. square b.m.s. were used between three of the jaws and the casting which rested on the upper steps of all four jaws, thus ensuring parallelism between the top and bottom. The casting is set to run true using a wobbler in the centre-punch mark. Centre, drill and open up finally to 25/64 in. Don't feed the drill too far through beyond the bottom of the casting otherwise it will foul up with the inner ends of some of the jaws; the space for breakthrough is 5/16in. Bore out the recess to ⅞ in. dia. or thereabouts to a good surface finish and then face off the top to the finished height, 1 13/16 in. The pad for the two front studs can be machined also at this set-up.

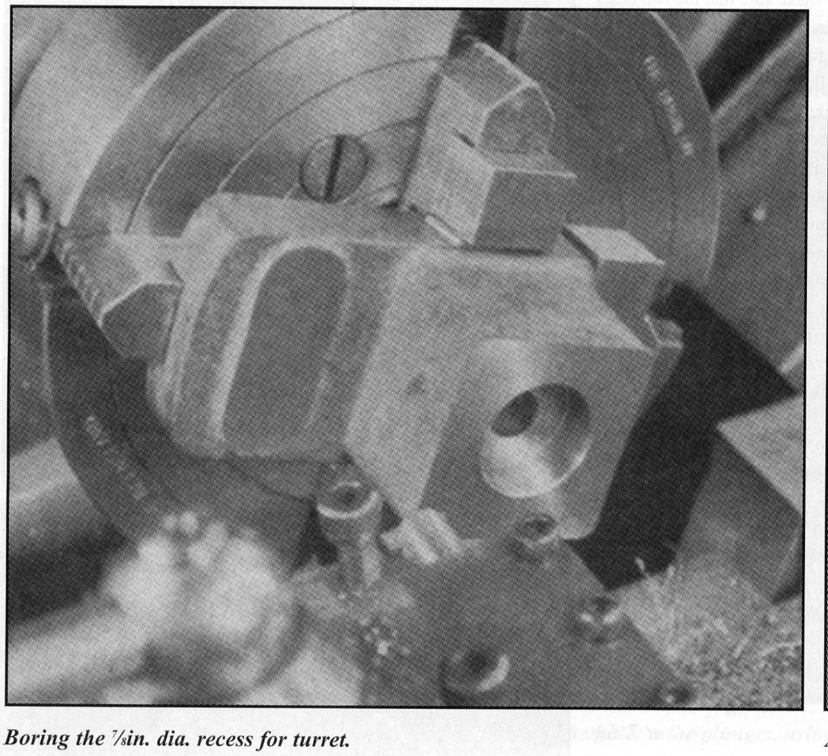
Now mark out the top for the plunger hole and on the underside for the two stud holes in the foot, being careful to hold the 1 9/16 in. dimension from the centre hole as this is the pitch of the Myford tee slots. From the top, drill through 3/16 in. dia. in the plunger position (this will be opened up later) and drill for the two studs. This completes, for the time being, work on the base.

The obvious material for the turret is 1⅝ in. square b.m.s. which is a listed size with the steel merchants but, like a lot of other things, probably unobtainable. The next best is 1¾ in. square which I managed to get.

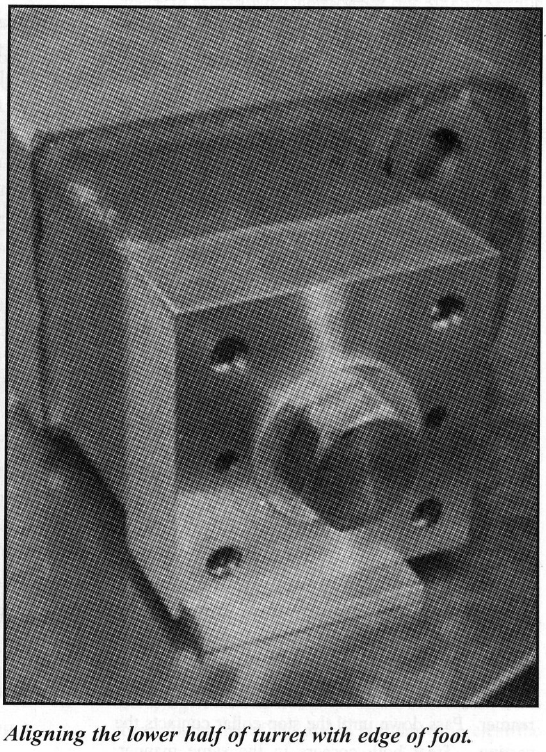
The turret could be made from a piece each of 1¾ x ⅝ and 1¾ x 1in. (I am currently endeavouring to arrange for supplies of something suitable). Both components should be faced off in the 4-jaw to bring their two faces parallel, after which, if the material is larger than 1⅝ in. square, two of the sides should be reduced to bring the little slabs to size and all square.

Mark out the true centre on both components and at the same time the centre for the four capscrews and two dowels on the upper part (Fig. 6, item 2). Set up the thicker component (item 1) with the centre running true, drill, bore and ream the centre hole ⅜ in. dia. and turn the spigot to a good fit in the base. The recess in my base measured 0.9005 in. and I made the spigot exactly 0.9000 in. which provided just the right amount of clearance. Be quite sure that the square face on which this part will sit is flat – it must on no account, be high in the centre. A little undercut in the corner is always a good thing. Now set up the shorter piece (item 2) accurately and produce the ⅜ in. hole as for the last item which can now be taken again, held by its spigot and the square portion is faced off to the drawing dimension, 21/32 in.

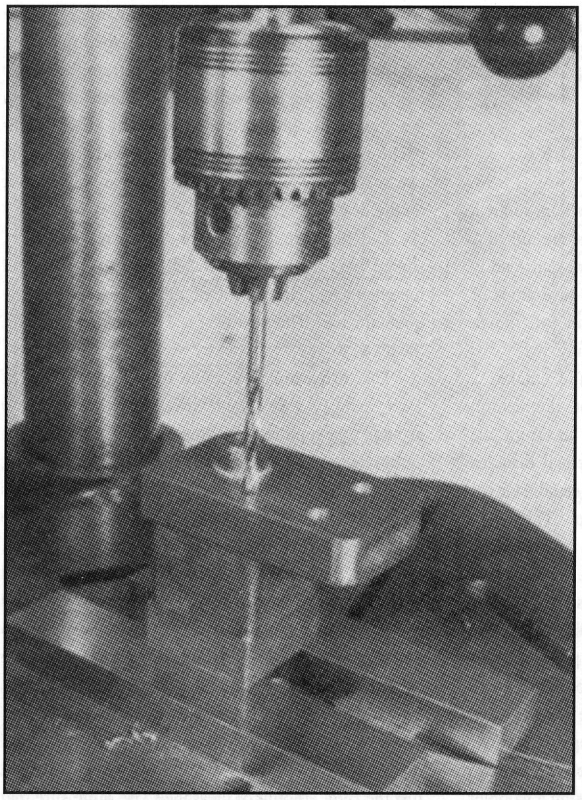
Fit item 1 to the base casting and hold in place lightly with a 5/16 in. or ⅜ in. bolt and nut. Lay down



***Boring the ⅞in. dia. recess for turret.***



***Aligning the lower half of turret with edge of foot.***



*Transferring the locating hole into the turret.*

on the surface-plate with the base resting on its left-hand edge (i.e. that side nearest to headstock when in use). Insert a piece of parallel material under the turret – the thickness should be just enough to lift the casting very slighty so that the contact with the surface plate is along the lower corner formed by the underside and the edge. A slip about 3/32 in. thick will probably be found to be about right. Tighten the bolt whilst pressing the whole assembly down on to the plate. Rest the top of the turret on a pair of parallels under the drilling machine and pass a 3/16 in. drill down through the plunger hole into the steel a distance of 1/4 in. to the lips of the drill. Release the bolt, turn the top through 180 deg. and repeat everything exactly as before. We now have the location for the two tapered indexing holes in line with the plunger.

Open up the plunger hole in the casting to No.3 drill and then ream 7/32 in. dia. I used my tapper which helps to avoid bell-mouthing the hole. Note, that as the parallel portion of the reamer flutes is shorter than the hole through the casting it is as well to open up the lower 1/2 in. or so of the No. 3 hole with a No.2 drill before the reaming op. for which a special tapered D-bit is required. This is shown in Fig. 5, item 11. The end is turned to an included angle of 12 deg. for the distance as shown. Make a stop collar to suit.

Pass the D-bit up through the casting and set the stop collar so that the business end of the reamer protudes by 5/32 in. Fit the turret to the base again and line-up and clamp exactly as before – and don't put one of the blank corners above the plunger hole! The reaming is best done in the drilling machine at reasonably low speed and with a little oil on the reamer. Pass down until the stop collar contacts the casting. Treat both corners in the same manner. Remove the sharp edges from the tapered holes with a small half-round scraper – an invaluable tool to have around.

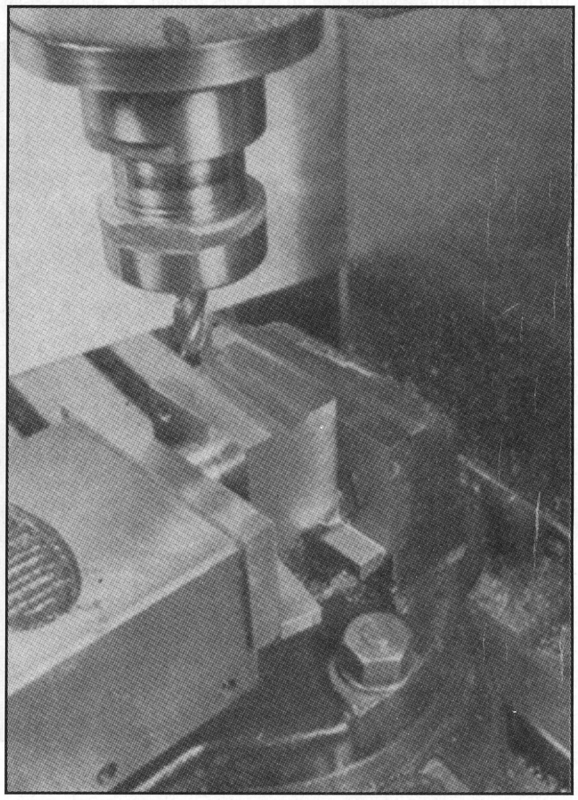
To fit the top plate, first drill the four corner holes No. 22 and the two holes for the dowels about 7/64 in. or so. Using a short length of 3/8 in. silver-steel as a dowel in the centre holes, clamp the two parts together with their edges nicely lined up. A couple of 2 in. tool maker's clamps will do the job nicely. Take No. 22 holes down 1/2in. into the lower portion and the 7/64in. holes for 1/8in. Open up the latter with a 3.15 mm drill (0.124 in.) and follow with a 1/8in, hand reamer as far as it will go. Mark one side on each part for identification and separate. Open the No. 22 holes in the top cap to 3/16in. and counterbore for 2 BA socket head screws. Take all c'bores to the same depth (5/32in.) to leave just the tops of the screws standing proud. Run the 3/16 in. drill down about 1/32 in. or so into the tops of the 4 holes in the lower portion before tapping 2 BA full thread depth 3/8 in. Remove any small burrs from the two mating faces and assemble with the 3/8 in. dowel and two short pieces of 1/8 in. silver-steel as temporary dowels. If everything has gone as it should the two parts will hold together as one piece without using screws.

Now make sure that the two sides of the assembly which are to be grooved for the blades are nicely flat and parallel to each other, but do not remove any metal from the lower portion because this is the reference face for milling the grooves. Fig. 6, item 4 shows clearly the derivation of the dimensions for the grooves and these are based on a lathe having a centre-height from boring table of 2.070 in. and a base casting finished to a height of 1.813 in. Any departures from these two basic dimensions will have to be taken into account and adjustments made accordingly to the dimension 0.257 in. Stand the turret on a pair of parallels and mark out the two heights, 0.349 in. and 0.395 in. at the edges of the faces where the blades protrude. Carry these marks also just around the corner. If you have no height-gauge, mark out at 11/32 in. and 25/64 in. which will be near enough for all practical purposes. Starting from this corner, mark the width of the grooves at 7 deg. across the faces.

The photographs show the grooves being milled and undercut on a milling machine with the vice swivelled through 7 deg. Those readers with no facilities of this kind will find that the job can be done on the lathe using either a fixed or swivelling vertical-slide. Use an end-mill about 3/8 in. dia. and take a first pass through the middle of the 1/2 in. width. When down to depth work towards the lower line. The short line scribed "around the corner" will show clearly when the correct position is reached, as owing to the direction of rotation of the cutter, no burr will be raised at this point. Move over to the other edge and bring the groove to width – anywhere from 0.480 in. to 0.500 in. will do; it is important, however, that the grooves on both sides are made to the same width. If no other means are available, make a little gauge piece.

Depending on the set-up, it is most likely that it will be necessary to undercut the edges on the first side before turning over for the second. A simple cutter was made for this job (Fig. 5, item 14) which is carried out admirably. The undercut should be just deep enough to leave a witness (of the original parallel side) about 1/64in. wide. This requires a theoretical in-feed of 0.013 in. It would be difficult to work strictly to this dimension but it does serve as an indication. Don't forget that the groove starting at 25/64 in. up is the deeper one.

It now remains only to mark out, drill and tap for the 8 BA grub screws and to turn about 30 or 40 thou. off the underside of the top plate to enable it to close down and clamp the blades. The two parts are assembled using 2 BA by 3/4 in. sockethead screws.



*Milling the blade slots at 7 deg.*

Make up and fit the two dowels and don't omit to dome and polish the ends which will be seen. If ⅛in. silver steel is used it will be a light drive fit into the slightly-tapered bottoms of the holes. Fit the 8 BA grub-screws which serve as side supports to keep the blades in an upright position.

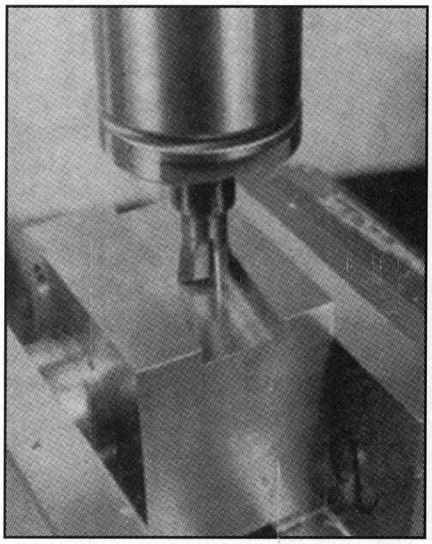
The central bolt is a straightforward job. The intermediate portion between the head proper and the shank should not be omitted as it adds materially to the stiffness of the head. The tee-bar is milled from 3/8 in. x 5/8 in. flat to the dimensions shown which give a free fit in the slots whilst providing good bearing surface to take the load. For those who fear that their marking-out and drilling might not be up to the standard required I suggest that the stud holes in the casting be drilled No. 5 in the first instance. Now mount the assembly, with the central bolt in its slot on the boring table (or on the table of a vertical-slide), slide the tee-bar into its slot and wedge it. It will now be possible to spot through with a No. 5 drill into the bar which can then be removed, drilled right through and tapped ¼ in. BSF, the holes in the casting being now opened up to 5/16 in. clear. The indexing plunger is made from 7/32 in. silver steel, left soft. The tapered portion should not be made longer than drawing dimension or it might bottom and fail to locate accurately.

The little knob which pushes the plunger down passes through a slot milled through the side of the casting. Mark out for it and drill a 3/32 in. hole at one end. Use a ⅛ in. end-mill or slot drill starting from the end with the hole. After milling through take a light cut on each side in order to provide some clearance for the stem. A suitable spring can be wound from 25 SWG (0.020 in.) wire, about 18 coils with a free length of 1⅜ in. Whilst on the subject, the spring under the top cap consists of 3 coils of 16 SWG wire. This must be stiff enough to resist the plunger spring and hold the turret down tightly on to the top of the casting to prevent the ingress of swarf.

The remaining components are a few very simple turned items needing no description except to suggest that the ¼ in. BSF threads would best be screw-cut in order to give a good clean thread right up to the shoulder at the undercut. When everything has been assembled and tried in place it would be a good thing to remove these studs from the bar, clean the threads and those in the bar with carbon tetrachloride and then screw them well home again with a little Loctite which will prevent them from turning instead of the nut. If you don't keep CT in the workshop, buy a bottle of Thawpit and hide it from the wife!

## Setting up

As mentioned previously, this tool-post is intended to be used with "Eclipse" hollow-ground blades which are ½ in. deep and obtainable in widths of 1/16 in., 3/32 in. and ⅛ in. A check over my stock indicates that they are within a tolerance of about 5 thou. on the ½ in. dimension, but there is a rather larger variation in the width along the narrow edge. I found a variation, also, in the angle of the bevelled edges which varied from 6 deg. to 8 deg. Although I have shown the angle of the bevel cutter as 8 deg., this might equally well be made 6 or 7 deg. As

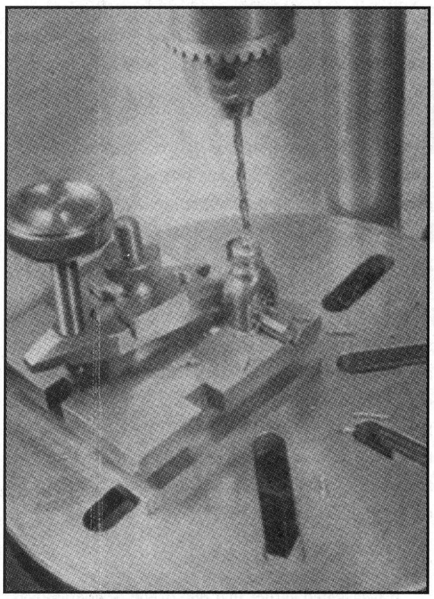


***undercutting the blade grooves.***

bought, these blades are too long (4½ in.) and will have to be shortened back to leave not more than, say, ¼ in. projecting beyond the back of the turret. This can be done by grinding a nick across the blade on each side, using the corner of a grinding wheel, hold the required portion in the vice, nicks level with the jaws, and a smart tap with a hammer will remove the unwanted portion. Whatever you do, don't remove the wrong end of the blade because you can't put it back again! The blade can be mounted in the turret *only one way* and this will determine which end should be removed.

It might seem a pity to remove a lot of potentially useful blade, but it would take a lifetime to use up all the available "spare" length. I find that these tools will do a considerable amount of work before requiring sharpening.

When re-sharpening the blades it is necessary to remove no more than two or three thou. to bring up a keen edge. Before using them, the lower bevel – on the wider edge – should be removed for a short distance (see Fig. 5, item 15) and the front ground to an angle of 77 to 75 deg. which, allowing for the built-in 7 deg rake, will give a front clearance of 6 to 8 deg.



***Drilling the hole in the plunger, using a cross-hole jig.***

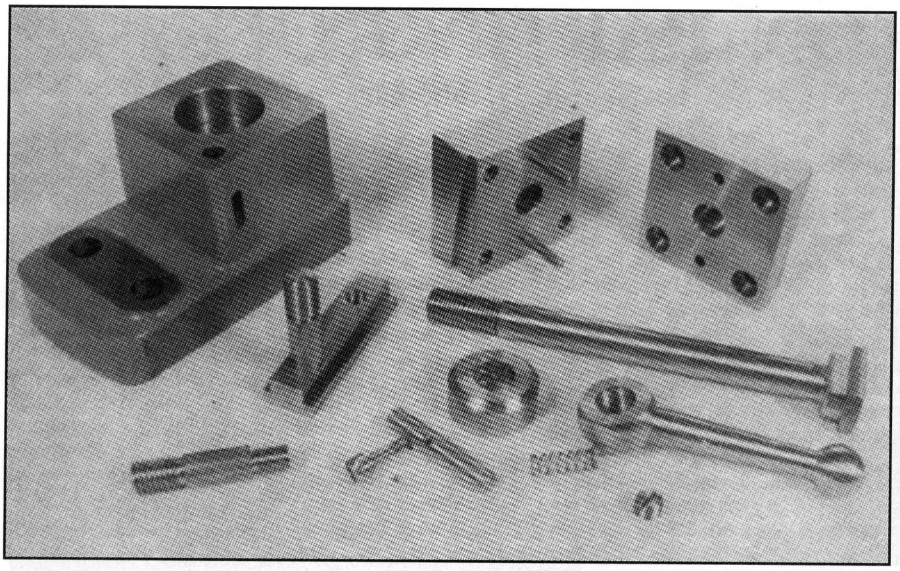
Stand the turret (without a base) on a surface-plate and adjust the 8 BA screws until the blade stands upright as judged by a square held first against one side and then the other. When the gap between the upper (thin) edge of the blade and the square appear to be equal on both sides, the adjustment of the screws can be considered correct. When both blades have been fitted, the top screws can be finally tightened down and the turret replaced on its base.

The best place to mount the tool-post on the Super-7 is on the extreme left-hand side of the cross-slide, utilising the rearmost two tee-slots. It is very rarely indeed that it will be in the way when so mounted although it might occasionally be found convenient to turn the turret through 90 deg., leaving the blades athwartships so to speak.

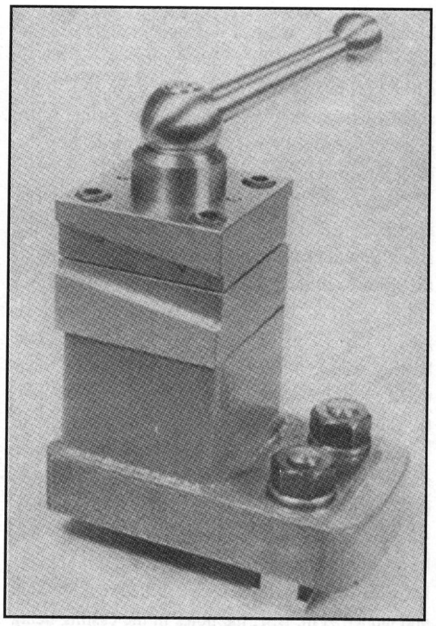
The most convenient position for the locking lever when it is pulled up really tight, as it should be, is pointing to the right. Its final position can be adjusted by turning a little off the top of the pressure collar and, if necessary, giving a half turn to the head of the bolt in the tee-slot. It is most important that the tool-post is so mounted that the baldes are truly square to the lathe axis and if there is any appreciable error here trouble will arise, especially when parting large diameter material. If the tool-post has been made carefully and accurately to the instructions, the tool should be dead square to the axis when the left-hand edge of the base is lined up to the edge of the cross-slide. A simple way to check this set-up is to bring the side of the blade up very close to a chuck jaw or preferably, a piece of material about 1 in. dia. accurately faced off in the chuck. With a mirror or a piece of white paper underneath one should see the narrowest parallel line of light. Finally, clamp up all round. For the benefit of those who possess new machines with unsullied boring tables it might be appropiate to mention here that a thin smear of petroleum jelly (Vaseline) over the table where the tool is to be clamped will, to a large extent, prevent staining due to soluble oil seeping in between the two clamped surfaces.

## Performance

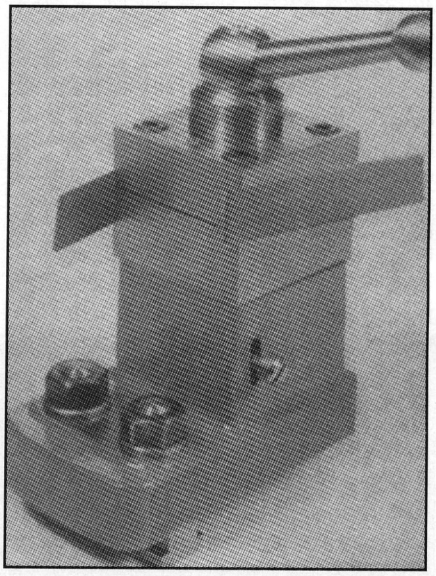
With the very small tools ground from 3/16 in. dia. H.S. bits no troubles have ever been experienced when parting off small nuts, bolts and washers, etc. from materials such as mild steel, brass, gunmetal and free-cutting stainless steels at speeds up to 1500 r.p.m. Washers as thin as 0.005 in. have been parted off quite easily leaving a clean surface. When using the rear tool-post for larger work no troubles are encountered, with brass at very high speeds, f.c.m.s. and silver steel. Ordinary m.s. can, however, play up at times due to the chips which are retained in the groove 'welding' on to the sides. Before such seizures occur the sound emanating from the tool usually becomes harsher due, possibly, to the scraping of the retained chips against the sides. It has been found that if the tool is withdrawn to clear the chips as soon as the sound changes and then a liberal



*The component parts of the mark II parting-off toolpost.*



*Assembled toolpost showing the screws for vertical alignment of blades.*



*The finished toolpost fitted with $^1/_{16}$ in. and $^3/_{32}$ in. blades.*

dose of lubricant applied as the tool is fed again, normal cutting will be resumed. In the event of a complete seize-up then, as I stated before, ease the chuck back whilst withdrawing the tool about ¼ in. or so, apply some lubricant and carry on carefully; the tool will cut through the jammed up chips and then get down to business again.

| *Material* | *Normal Turning* | | *Parting* |
|---|---|---|---|
| | ft./min. | r.p.m. 1"dia. | r.p.m. 1"dia. |
| Bright mild steel | 100 | 400 | 200 |
| Cast & Silver steel | 60 | 240 | 120 |
| Cast iron | 70 | 280 | 140 |
| Brass & Al. alloys | 300 | 1200 | 600 |

On the fairly important matter of speeds, it is impossible to give hard and fast rules as so much depends on the design and condition of the lathe etc., so each individual worker will have to establish his own standards in the light of his experience. Some initial guidance can, however, be obtained from a study of average cutting speeds for various materials which have been published in numerous text- and hand-books of various kinds. Although, for understansdable reasons, there is considerable variation in the published data, there is a zone of overlap from which the following figures have been selected.

The first two columns refer to average turning or boring speeds which might have to be reduced for heavy roughing and increased for fine finishing cuts. The third column indicates suitable speeds for parting-off which are one-half of the normal turning speeds. These figures will provide a basis for beginners to start on, but they might be varied, up or down, according to circumstances. If, for example, the selected speed gives rise to chatter, then the speed should be lowered until chatter is eliminated. Good quality leaded f.c.m.s. can be worked at higher speeds than those indicated for b.m.s. My own practice with this material is to operate at about 150 to 200 ft./min., normal turning.

As the speed for parting is determined by the outside diameter, it often pays, when cutting off large material, to increase the speed progressively as the diameter is reduced – exactly as is done when facing. For example, b.m.s. 1½ in. dia. start at 120 -150 r.p.m., increase to 200 at 1 in. dia. and to 400 at ½ in. dia.

It is generally considered advisable to lock the saddle whilst parting off though I rarely do this myself even though I have fitted a locking handle to save fiddling with a spanner. The saddle-lock on the Myford lathes clamps the saddle down on to the rear shear which is ideal when using a rear tool-post as it prevents lift under the cutting load.

## Lubrication

For most purposes soluble oil has proved to be reasonably satisfactory lubricant; the one I generally use being "Shell" Dromus B at a dilution of about one part in 12 of water – adding the oil to the water whilst stirring, *not* the water to the oil. Apart from the fact that it is a good general cutting lubricant, it has the added advantage that, unlike most other soluble oils, it has no disagreeable odour. Whilst I use this oil extensively, I am not satisfied that it is the *best* available for deep parting and I am proposing to carry out experiments with cutting oils having high-pressure additives incorporated in the hope of overcoming the scoring and seizure troubles. There is another "Shell" soluble oil known as Dromus 908 which might have more desirable qualities for parting-off. An inherent disadvantage of the inverted tool is that it is difficult to get the lubricant to the cutting edge which is underneath and centrifugal force tends to throw the lubricant off before it can be carried round to the point where it is needed. This applies, in the main, to brush application; a drip-can might prove a little better but the best is, obviously, a continuous pumped supply which would flood the tool and work. Though I have the facilities, they are not used, mainly because of the variety of materials which are machined in the course of a few days and the attendant cleaning-up operations.

## Tools

It was stated earlier that one of the desiderata was that the tool should be wider at the front than at the back and I have wondered whether this is merely to take care of slight errors of squareness in the mounting of the tool or, perhaps, to ensure that the tool isn't wider at the back than at the front! With the "Eclipse" type of blade there is no back taper, hence the necessity for making sure that the tool is mounted square to the lathe axis. I have found that the blades are not always quite parallel end for end; some have shown about 0.004 in. taper across the cutting edge. This would be of no consequence if the "business" end were wider than the back but this is not always so (bear in mind that the blades cannot be turned round end-for-end owing to the bevelled edges). In these cases it probably pays to correct them, bringing them parallel, with an India stone before using them.

One is frequently advised to grind the front of a parting tool at an angle, the purpose of which is to sever the component from the stock leaving no pip. This might be sound practice on commercial work where it would save an expensive second operation, but I suspect that readers are not concerned with such economics and prefer, in any case, to take a finishing cut across a parted surface. Apart from this, there are two disadvantages to the oblique fronted tool: an angle on the front cutting-edge will tend to deflect a slender tool sideways and produce a concave face on the component and possibly end by jamming up. Furthermore, the chip produced will be slightly wider than the groove. If it is essential to part-off leaving no pip on the components then the tool should be as short and as wide as possible – within reason.

In an endeavour to overcome the seize-up troubles when deep parting I tried a vee-fronted tool (Fig. 5, item 16) which, I hoped, would produce a chip with a "broken back" and therefore less likely to jam in the groove. Tools ground at the angle indicated (160 deg. incl.) gave somewhat indeterminate results – not noticeably better, nor worse, than the straight front – but a tool ground at 140 deg. did seem to be slightly superior.

If all else fails when dealing with deep cuts on difficult materials there is always the time-honoured dodge of cutting a wide groove with a narrow tool by taking step by step cuts adjacent to each other. Using this method on a piece of stock, say 1½ in. dia., start the cut in the desired place using a sharp 3/32 in. blade ground dead square across the front and when about 3/16 deep withdraw the tool and move the carriage to the left by a bare 3/32 in. Now proceed to feed until the tool has penetrated about 3/16in. further than the previous cut. Withdraw the tool again and move back to the right until it just touches the face and then feed in another 3/8 in. and so on. This method never fails to work but, for some obscure reason, I regard it as cheating!

Another small point; if possible, start the parting operation on a surface which has previously been turned true. If a narrow tool starts its cut on an irregular surface it will be inclined to pick up a sideways wobble which will tend to be maintained throughout the operation and this might lead to jamming as the tool penetrates deeper. For this reason special are should be exercised when parting-off irregular sections such as rectangles. A photograph shows the parting operation on pressure pads for tender axleboxes. These were produced from a length of milled section by turning and parting-off. When working on sections of this kind there is always the possibility that the sharp edges around the cut might be damaged due to chips being sheared off by the "scissor" action of the revolving rectangle against the stationary blade.

Whilst in the final stages of writing this article I was shown a 1/8 in. wide parting-tool blade which was made with a shallow vee groove along its top edge (bottom edge when in the rear tool-post). This was supplied for use in the Tri-pan tool holder and I gathered that it was trouble-free in use. I decided to try out the idea for myself and, being unable to get a 1/8 in. "Eclipse" blade "off the shelf", I ground a groove for about 1 in. along the edge of a 3/32 in. blade. This was done by dressing the edge of a saucer-wheel to an included angle of 130 deg. and holding the blade in the universal vice on my "Union" T & C grinder. The groove was taken just deep enough to meet the sides of the blade within a thou. or two. The results were very encouraging indeed and I have since made a few 1/16 in. blades on similar lines except that the angle has been increased to 145 deg. and, on the most successful blade of all, I added a vee front with an included angle of 140 deg.

The chip produced by these tools is of vee formation which is free within the width of the slot and it tends to curl out in continuous form instead of being retained as a collection of short chips or tight spirals; furthermore, the surface finish on the work is, in general, much superior to that obtained with the conventional blades.

The pronounced vee section of the chip is not a result of the shape of the front of the tool which is almost a straight line. It must be remembered that the vee groove is not down the front of the tool but along the horizontal surface against which the chips slide. As is well-known, the chips from many metals, including steels, tend to lift or curl up from the top surface of a tool and with the tool under consideration the vee channel will cause the two sides of the chip to curl towards each other, thus bending it along its centre and reducing its overall width. It would appear that the improved performance of this tool is due to the slight contraction in the width of the chip which enables it to escape readily from the deep groove instead of being retained, broken up and compacted with resulting scoring of the sides, and on occasion, complete seizure. As will be gathered, I have not yet had much experience with this form of tool apart from the series of tests made with each blade and if, as a result of further tests, any more is learned about them, I shall, with the Editor's permission, report at a later date.

To beginners and less experienced workers I would like to emphasise that, in order to improve their parting-off performance, it is not necessary to make the more complex forms of tools which have been described; they have been made and tried out in an endeavour to overcome the few remaining difficulties which sometimes crop up due, largely, to the failure of the swarf to disengage itself from a deep groove. Some two dozen rear tool-posts have already been made to the drawings in this article and, as far as I am aware, they are doing what was intended – making parting-off easier. Over the years there have been many rear tool-posts, good and bad, described in M.E. and while the best of them couldn't make a poor lathe into a good one, even the least good probably helped its maker out of some of his trouble. The Mk. II tool-post has been evolved over a number of years and incorporates features which I find convenient and which suit my own method of working. Other workers can, if they desire, modify it to suit themselves.

Both forms of foot casting (and possibly 1¾ in.. square steel) will be available from Messrs. A. J. Reeves & Co. Ltd., of Birmingham, by the time this article appears. ●

***Model Engineer <u>142</u> 228 (1976)***

Tailstock Turret

In small batch production the ability to change tailstock tools easily is very valuable, enabling the holding of centre drill, twist drills, D-bits, Reamers, Taps and die around the turret. This design from 40 years ago has a good positive location to resist torque and will help anyone who likes making his own nuts and bolts. Should the constructor wish to source castings for this design, I can help in this direction and I may be contacted through the Editor of Model Engineer.

# Tailstock Turret

**EXACTUS DESCRIBES A USEFUL LATHE ACCESSORY FOR SAVING TIME ON REPETITION WORK,, EMBODYING ORIGINAL FEATURES OF DESIGN, AND SIMPLIFIED METHODS OF CONSTRUCTION**

Many types of multiple fixtures to carry pre-set tools have been devised to extend the scope of the engineer's lathe and speed up production. This series of articles will describe the construction of a four- or six-station turret for mounting in the tailstock barrel socket, designed specially to suit the requirements of ME readers, and having important advantages over the conventional type.

The work was carried out on the ML7, for which this holder is basically designed, but don't let that put you off. It can be adapted to suit almost any kind of lathe from 2½ in. upwards.

Its main features are six tool stations and positioning leg to the lathe bed to maintiain correct alignment. Those who like an interesting turning job will get many hours of pleasure in its making.

I made patterns for my two castings, and it is

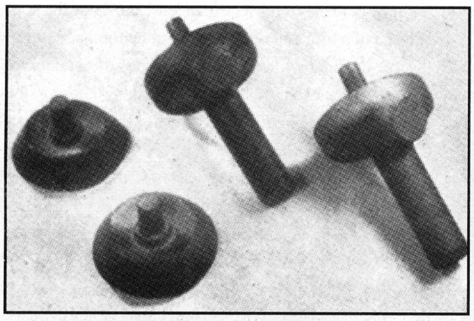


*Fig 1: The patterns and castings*

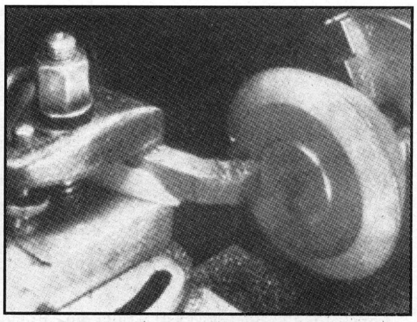


*Fig 2: Machining the bottom face.*

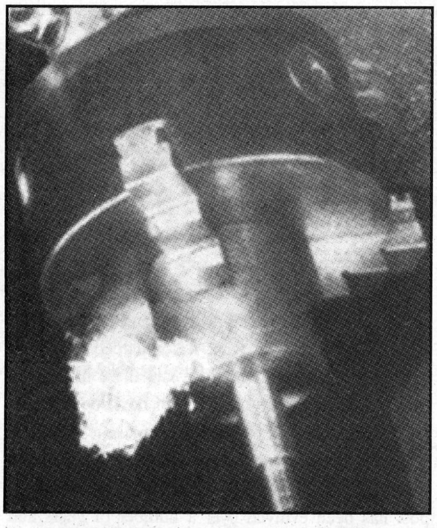
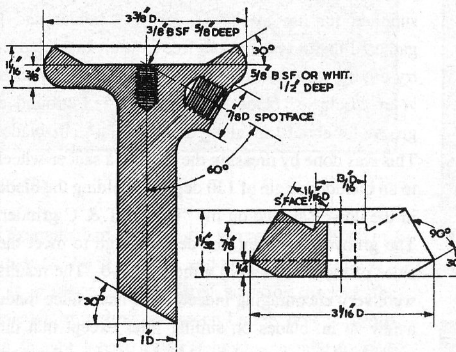


*Fig. 3: The mandrel.*




*Details of the machining of the castings*

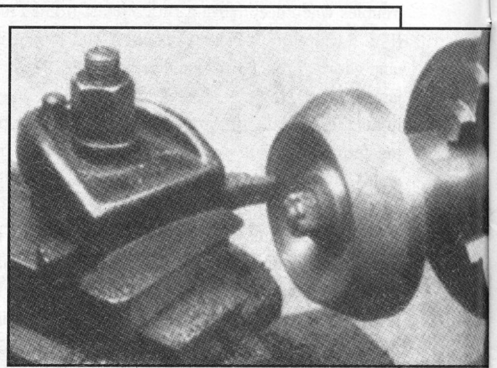


*Fig. 5: Machining 30 deg. angle on the top face*

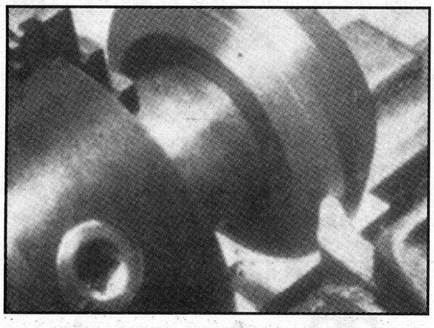


*Fig. 4: Machining the 30 deg. angle bottom face.*

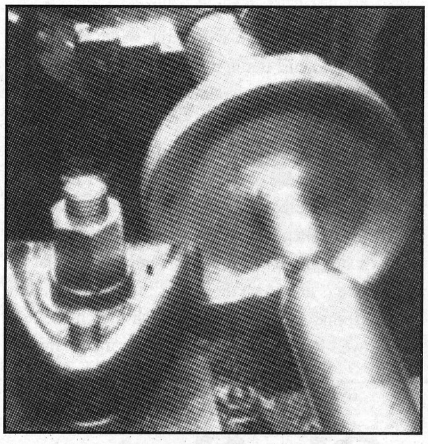


*Fig. 6: Truing the chucking piece.*

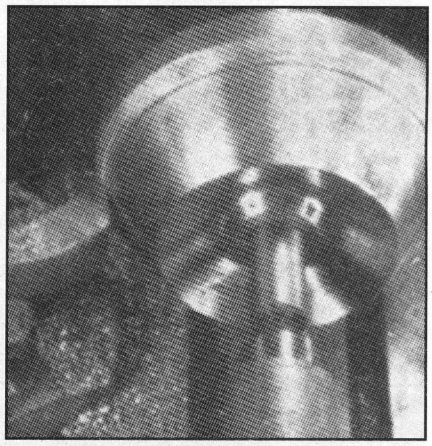


*Fig. 7: Cutting the 60 deg. angle on the main casting.*

hoped that shortly one of our advertisers might make them available. Those who wish to make their own patterns should not experience any difficulty.

In Fig. 1 can be seen the pattern alongside the casting giving a clear indication that there is nothing complicated about it.

The first casting to machine is the small one, the tool holder. Hold it by its chucking piece in the three-jaw and face across the bottom until it cleans up (Fig. 2). With the same tool reduce the diameter of the casting to 3⅛ inch.

Now centre drill the bottom face and starting with a small drill, about a ¼ in., make a hole 1¼ in. deep and open it up to ½ in. dia.

Remove from the chuck and cut off the chucking piece with a hacksaw. Change the chuck jaws so that you can grip the casting on its 3⅛ in. dia. and set the tool to face off the boss that has just parted from the chucking piece until the distance through the ½ in. hole measures ⅞ in. deep.

The next stage is to machine the angles. A far greater degree of accuracy is assured if all the machining can be done without disturbing the casting. I did this by making a mandrel that enabled me to machine every angle. If possible make the mandrel from a piece of solid material. I used a piece of 1⅞ in. dia. bar and reduced 1¼ in. of its length to ½ in. dia. so that the casting slid over.

When approaching the finished diameter check it with the casting in case the drill cut a little on the large size, and turn the mandrel to suit. Should you find this is the case, make a note of the size of the mandrel for future reference when you come to make the centre stud.

Turn 7/16 in. of the ½ in. dia. to 5/16 in. dia. and cut a BSF or Withworth thread. The finished mandrel should look like the one in Fig. 3. You can now machine all the angles in comfort.

First set the topslide to machine the bottom 30 deg. angle. You can check whether you have removed the correct amount by placing a straight edge along the bottom face and measuring to where the cut commenced. The finished distance should be ¼ in. In Fig. 4 is illustrated the amount of clearance. When completed, keep the topslide at the same angle but reset the tool to machine the top face (Fig. 5).

Check for removal of the correct amount with a pair of outside callipers. When it is down to 15/16 in. the finished size and you have blended the bottom with a small radius into the boss, set the topslide to do the 60 deg. face. Remove sufficient metal until the 3⅛ in. dia. becomes a very fine line. This completes all the turning on the tool holder.

Now to come to the main casting. Hold in the three-jaw by the end opposite the chucking piece, and centre drill. Remove the drill chuck and insert a hardened centre. Bring into position to steady the casting while the chucking piece is trued (Fig. 6) making sure you don't go under 33/64 in. dia.

When it is cleaned up turn the casting round, holding it by the chucking piece this time. Repeat the operation as before, centring the end and take the diameter of the locating leg down to 1 in. as far as the boss. With both ends now cleaned up and centred, remove the casting from the chuck and reverse it, holding it by the locating leg as in the first instance.

You will find that you have the added advantage of working closer to the chuck, as the reduced diameter allows the work to enter deeper.

Position the tailstock centre and set the topslide round for turning the 30 deg. angle.

First take a cut along the chucking piece until it is ½ in. dia. so that the tool holder casting can slide over it. If the hole is over ½ in. turn the chucking piece to suit (you will know the size from the mandrel) then turn the 30 deg. angle seating and facing across.

When it is down to size try the holder on its seating, and if it fouls the bottom remove the holder and take a light cut across. If it does seat correctly set the topslide to cut the 60 deg. angle, on the outside of the main casting.

When I did mine I slid my tool holder on to the chucking piece (Fig. 7) so that the two blended in without producing a step.

The next step is to remove the chucking piece as it is no longer required. Cut it off with a hacksaw and face across flush with the bottom. Centre drill and drill a letter O hole, then tap out ⅜ in. BSF or Whitworth, ⅝ in. deep.

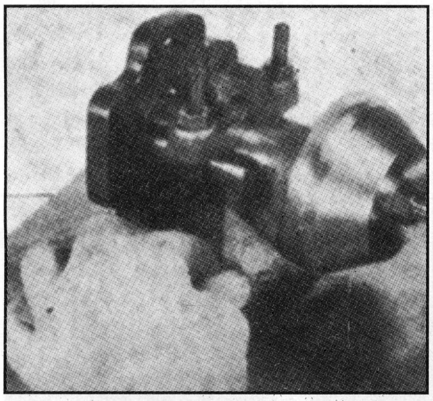


***Fig. 8: Marking off the indexing pin at 45 deg.***

The turning of both castings completed, the next item to be made is the centre stud. Assuming the ½ in. dia. hole in the top casting is to size and that your three-jaw runs true or if you are the proud possessor of a set of collets, you can use ordinary bright mild steel. If you are not so fortunate use a piece, ⅝ in. dia.

Make the stud to the dimensions given in the drawing. The important point to remember is that the bottom thread of the stud must be concentric with its ½ in. dia. If you use a die in a holder have the die face against the tailstock mandrel, not the die holder. Put a small undercut at the shoulder of the thread to ensure that the stud sits square in the casting when screwed home.

When the small casting is placed over the stud it should sit perfectly on the 30 deg. angle seat of the main casting. Check by using a smear of engineer's marking blue or a number of chalk marks at equal intervals on the seating. If there is any slight discrepancy a rub with a fine carborundum paste

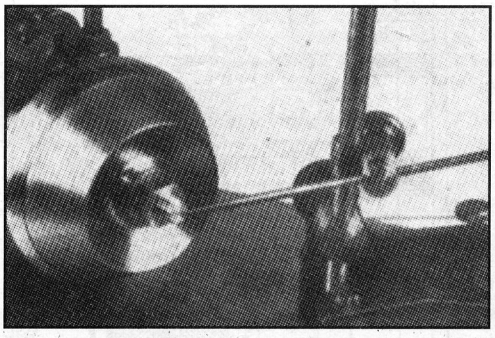


***Fig. 9: Setting the scribing block.***

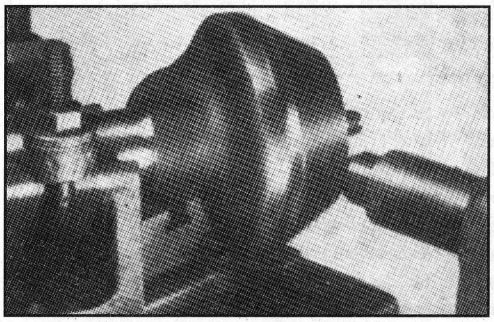


***Fig. 11: Lining up the centre pop with the tailstock centre.***

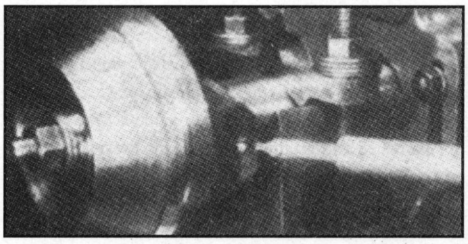


***Fig. 12: Centre drilling the boss foor the morse taper shank***

should soon put things right. When they are satisfactory, assemble with a ⅜ in. BSF nut and prepare for marking off.

Give the areas to be markef off, the boss, the position of the indexing pin, and the whole of the outside of the top casting, a coating of Talbot Blue or Spectra colour.

A Keats V-block will be a great advantage for the pending machining operations so if you have one press it into service from the start. If not an ordinary V-block and clamp can be used. The first stage is to mark off for the indexing pin. Although this turret has six tool stations you may decide that you only want four. This will mean a different position for the indexing pin. Set it at 45 deg. of the boss for the four tool type and 90 deg. for the six.

To set the 45 deg. angle make a small triangular jig from any stiff material (thick cardboard will be all right). Cut out a 2in. square and then cut it diagonally across the corners. Set the casting by placing this little jig against the boss (Fig. 8) and with the scribing block set to the centre from the stud (Fig. 9). Scribe a line across the casting above the boss. To make the 90 deg. position, set the boss parallel with surfce plate. Next square the boss to the base

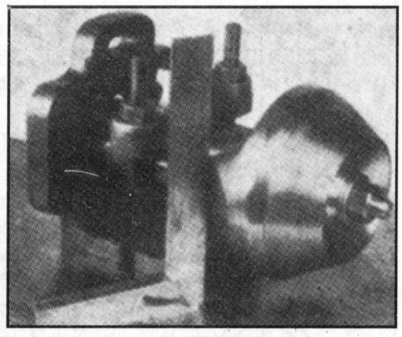


***Fig. 10: Squaring the boss.***

for the Morse taper shank (Fig. 10) and, with the scribing block still set to the centre, scribe a line across the boss and the small casting.

With a pair of odd legs, divide this line on the small casting exactly half way across the face and put a small centre pop where the lines cross. Remove the small casting but leave the main casting clamped in the V-block. It will save time resetting when the time comes for machining.

The last stage of marking out is the six indexing holes. Replace the mandrel you used for turning the small casting in the three jaw and mount the small casting on to it, leaving the nut loose. Place the scribing block on the lathe bed and set to the mandrel centre. Have a block of wood

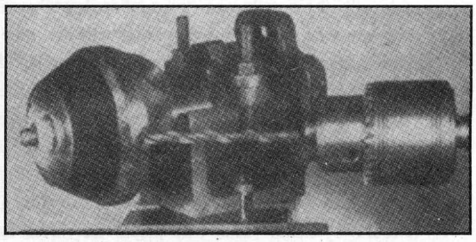


***Fig. 13: Drilling indexing holes through the 45 deg. position for the four tool holder.***

handy, about 3 in. in height and place it between one of the chuck jaws and the lathe bed. Hold the chuck firmly against the block and turn the casting until the scriber point locates in the centre pop, then thighten the nut.

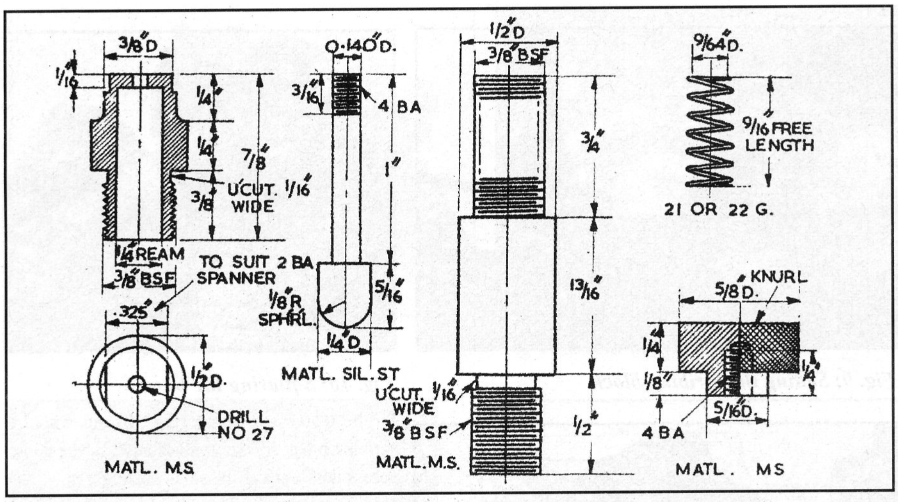
This existing line is the first of the six. Witb the chuck still held firmly against the block scribe a line on the opposite side of the casting to make the second. Remove the block and engage with the next chuck jaw and repeat the process until you have six equally spaced.

## Setting up the lathe

Replace the topslide with the vertical slide and bolt the Keats V-block to it. In the absence of a vertical slide obtain suitable packing so that the centre line of the casting corresponds with the centre line of the lathe mandrel.

Now you will need a centre drill with an extension. I made mine from a piece of ½ in. dia. bright mild steel 3½ in. long, drilling one end sufficiently deep with a ¼ in. drill to take my centre drill. It was a push fit in the hole and sweated round with soft solder.

Assemble the two castings but don't tighten the




nut yet. With the Keats V-block on the vertical slide make sure the boss is parallel with the cross slide before tightening up. Insert a hardened centre in the tailstock and the extended centre drill in the three-jaw. Check that your casting is all right for height and set it to the centre line. Travel the cross-slide until the tailstock centre positions itself in the centre pop on the top casting (Fig. 11). Tighten up the nut and the cross slide when all is correctly set.

It will be obvious now that by adopting this method the holes for the Morse taper shank and the tools will all be on the same centre line, but what is more important is that the tool holes will be in the centre of the casting and not off set.

Start drilling in the usual way with the centre drill (Fig. 12) and follow up with a small drill about 3/16 in. taking it 5/8 in. deep. Open up with a 33/64 in. drill for tapping 5/8 Whitsworth or 35/64 in. for tapping BSF. Start the tap by putting it in the three-jaw and pulling it round by hand. This will ensure the thread is square an a little paraffin as a lubricant will make the job a lot easier. Finish the tapping by holding the casting in the bench vice. Spot face boss to 7/8 in. dia.

Now the hole for the indexing pin. There are two ways of setting the casting at the correct angle. One is to set the V-block from the cross slide with a protractor, the other is to put up the face plate and square the 60 deg. angle from it. Secure the V-block and slacken the casting to bring the scribe line up to the centre. Tighten the casting when central and remove the small casting from its body.

Put the extended centre drill in the tailstock drill chuck and bring it up to the 30 deg. seating. Adjust the cross slide so that the centre drill is in the centre of the seating and tighten up the cross slide. Because of the absence of a boss this is the only sure method of positioning the hole.

Centre drill and drill a letter C or 15/64 in. hole (Fig. 13) at the back of the casting. Replace the small casting and then line up one of the scribe lines with the line on the casting and tighten the nut. Using the same drill continue the hole into the top casting to the depth of 1/4 in.

Slacken the nut and line up the next line, drill, and repeat until you have six index holes. Open up the holes with a 1/4 in. drill using the same method as that used for drilling for positioning. When they have all received the same treatment remove the top casting. Open up the hole in the main casting with a letter O drill and tap 5/8 in. BSF. Counterbore, leaving the hole 5/8 deep.

I think the items for the indexing plunger are straight forward enough and do not require a detailed explanation. Mild steel is a suitable material except for the indexing pin, where silver steel is more suitable. The dimensions for the spring are not rigid, if you have a suitable spring that does the job without having to use two hands and one foot on the lathe, use it. My sizes are more for guidance.

## Morse taper shank.

For the No. 2 Morse taper shank obtain a piece of good quality steel in the high tensile range. If you are able to give it carburising treatment and have it hardened and ground, by all means do so. The aim should be to get the best finished product possible. I made mine from Macready's Usamild, BS 970 : 1955 EN 1A, which is easily obtainable. This soft shank is giving good service and there is no reason why it should not continue to do so.

Chuck a piece of 7/8 in. dia. material 4 in. long in the three-jaw and face and centre drill both ends. At one end follow up with a No. 5 drill, taking it 1/2 in. deep, and tap it 1/4 in. BSF for the draw bolt.

For turning the taper, I set my topslide from the taper shank of the tailstock die holder. Remove the die holder and grip the parallel part in the three-jaw. Fix a test dial indicator to the topslide and move it round until the t.d.i. rgisters it as feeding parallel to the shank. If you have no t.d.i. the setting can be done quite satisfactorily with a feeler gauge.

Set the topslide by eye parallel to the shank and take a tool up to it. Place a feeler gauge in between and note the reading on the dial of the cross-slide. Return the tool sufficiently to free the feeler gauge then traverse the tool to the other end. Take the cross-slide in to the same reading on the dial and check the gap between the tool and the job. Make the necessary adjustment until the topslide is correct.

When set, remove the three-jaw and insert centres in the headstock and tailstock mandrels and screw on the driving plate. Fix a suitable carrier to the bar at the opposite end to the 1/4 in. BSF hole and mount between the centres ready for turning.

To remove some of the unwanted metal, take parallel cuts to start with by engaging the saddle in the fine feed. Reduce the diameter to 0.725 in. overall. This diameter will act as a guide when nearing the compeletion of the taper. Proceed to turn the taper with the topslide and when nearly up to the end take it down from its centres and try it in the tailstock mandrel. This will enable you to see how much more can be taken off.

If the taper in the mandrel is true in angle, and accurate dimensions it will leave a 3/16 in. gap between the end of the mandrel and the shoulder. This can be clearly seen in Fig. 14.

Reduce the end for 1/8 in. to 1/2 in. dia. when the taper is finished. Now to come to the other end and the cutting of the 5/8 in. Whit. or BSF thread whichever you used in the casting.

The correct method is to transfer the carrier to the opposite end and carry on between centres. It can also be done by removing the centre from the headstock and inserting the newly turned taper. To be different I adopted this method and it was highly successful (I didn't use a draw bolt); moreover, it will soon bring to light any faults if the taper does not fit properly. Even if you decide on this method I recommend the use of a draw bolt; it is better to be safe than sorry.

Whichever method you prefer, turn down to 5/8 in. dia. for 1/2 in. and screwcut the thread. Don't forget

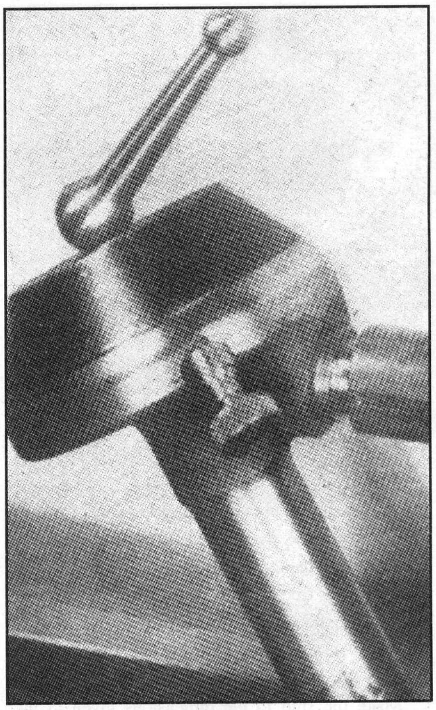
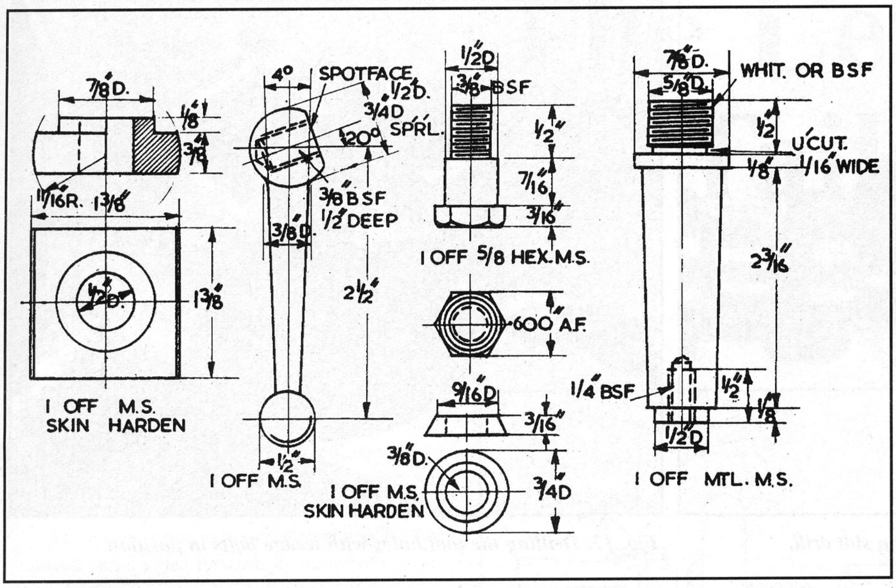


***fig. 14: The holder in position with the square tenon.***

the undercut to enable the shoulder to sit flush against the square face on the casting. When you have it screwed home, the next job is to cut the positioning stalk to the correct length.

Set the holder in the tailstock and scribe a line on the same plane as the top of the lathe bed (Fig. 15). Remove form the tailstock and cut along the scribed line and clean up with a file. This sounds a straightfoward job but you may be surprised when you try it in position for the first time.




The fly in the ointment is the 1/16 in. offset of the tailstock in relation to the gap in the bed, and it is so easy to tilt it a little too much either way. If you are going to file it, leave it for a moment and start on the tenon. With the tenon fitting in the gap you will have something to work to.

The alternative to filing is to set up in a V-block on the cross-slide as in previous operations, and face off with a fly cutter or a side and face milling cutter. Run the lathe at a slow speed for this job. This tkes a little while to set up but it is accurate and needs no further attention.

There are two kinds of tenons which can be used, one is round – which is quick and simple to make – and the other is square and involves a little more work. If the gap in lathe lathe bed is not parallel, make the square one. For the purpose of this article I made the square one and give the dimensions in the drawing. To make the round one turn a piece of 1½ in. diameter bar to the size of the gap in the lathe bed. This should be 1⅜ in., but check it – mine was on the plus side – and make it to suit. All the other dimensions are the same as the square one but the advantage here is that it can be turned at one setting.

To make the square one obatin a piece of 1½ in. x ½ in. bar of suitable length, to be held between centres with room for a carrier. Hold in the four-jaw and centre one end in the middle of the 1½ in. dimension, but 1/16 in. off centre to the ½ in. This is the centre line through the tenon and allows ⅛ in. for the boss.

Turn the end down to about ⅝ in. dia. for the carrier. Centre the other end the same and, if you are not too sure about the centres being in line, hold it by the round part in the three-jaw. It may seem a lot of bother changing chucks just to do this, but it does eliminate any error.

The next stage is to place the bar between centres and turn to fit the gap in the bed. Check it between the gap before taking the final cut. When to size, cut to length and clean up with a file or in the four-jaw – whichever you prefer.

## Turning the boss

To turn the boss scribe a line from corner to corner and mark the centre with a centre punch. Place in the four-jaw and set it to run truly. In marking out the centre make sure you have it on the right side of the 1/16 in. offset. Centre drill and open up to ½ in. dia. and finish the boss to ⅞ in. dia. Remove sharp corners with a file, and to protect it from knocks skin harden it with Kasenit.

The shoulder screw for fixing it to the stalk is made from a piece of ⅝ in. hexagon bright mild steel bar. For the round tenon continue the ½ in. dia. to permit the tenon to turn; for the square one make as to drawing. You can mark the position of the hole in the stalk by offering the tenon up in position and marking through the hole with a bent scriber or setting up in a V-block on the surface plate. In either case, remember the 1/16 in. offset.

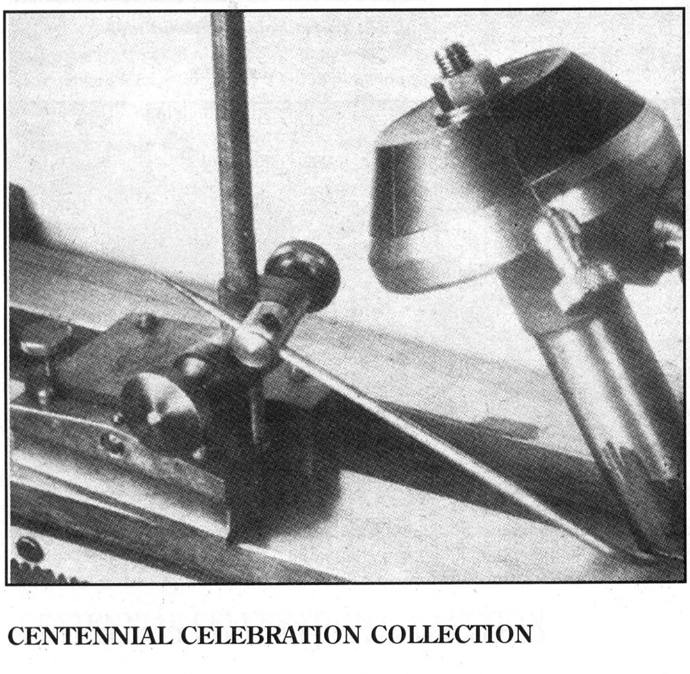


*Fig. 15: Marking off the stalk*

I have given the dimensions of the ball handle seen in Fig. 15. This is a matter of personal choice. I like to see a nice ball handle, it makes all the difference to the appearance. There are many types of handle to choose from and those who would like a ball handle but fight shy of tackling it, could fit a plastic ball to a piece of round metal.

## Tool Positions.

The holes for the tools, the wedge bolts and the bolts themsleves are all that is required to complete this useful tool. Like the number of tool holes, there is nothing rigid about their size, so if you prefer something different from those I am describing then use them.

I have one hole ½ in. dia. because I have found from personal experience this can be very handy, but the remainder are ⅜ in. dia. I think this size is average for most needs and for smaller tools a split sleeve is required.

I have included a general arrangement of a sleeve in the drawings and I recommend making the sleeves from brass in preference to mild steel. I expect you have odd scraps that will do the job nicely.

Mark off the position of one of the wedge bolt holes by first scribing a line on the tool face of the small casting, central to any two of the indexing holes (see illustration). Now scribe a line ¼ in. from the first one for ⅜ in. tool holes and 5/16 in. for ½ in. tool holes.

Take this line on to the top face of the casting and make a centre pop on it 21/64 in. from the tool face. Place the casting back on the main casting and mount the whole assembly in a Keats or ordinary V-block, whichever you used for the previous operation.

Set the block at 30 deg. on the cross slide with the top of the toolholder facing the chuck. Insert a centre in the headstock mandrel and turn the casting until the centre pop mark coincides with the centre.

When you are satisfied you have achieved this, tighten up the clamp on the V-block and lock the cross slide. Replace the centre with the drill chuck and centre drill the pop mark. Turn the casting to the next indexing hole and repeat the drilling.

When each position has been centre drilled follow up with a letter D drill. Take this sufficiently deep to let the point just break through the other side. Spot face each hole to ⅝ in. dia. In the illustration (Fig. 16) this is being done with a Clarkson ⅝ in. slot drill held in an auto lock chuck.

For the benefit of those who are not acuainted with these products I would suggest that a postage stamp for a price list is a good investment. Cutters are so reasonably priced that I would no more consider making such cutters than I would a drill. They are all h.s. and the slot drills are guaranteed to cut a slot dead to size at one go. I think it worthwhile passing this information on because they are not available from the ordinary tool supplier but only direct from Clarkson, and I think this is the reason

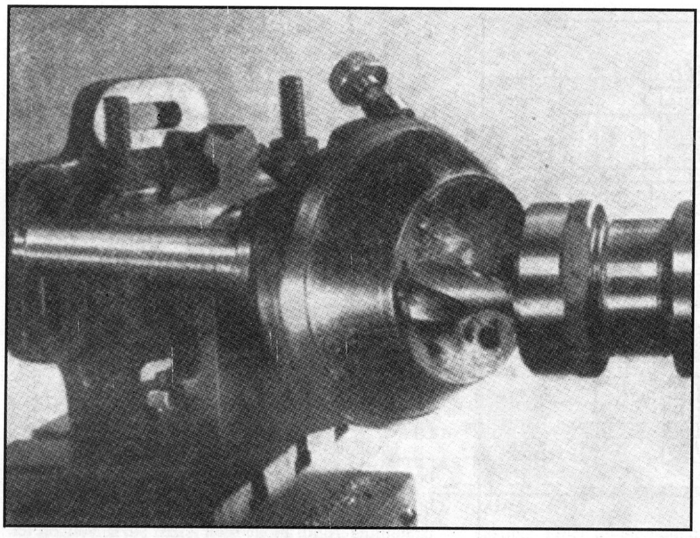


*Fig. 16: Spot facing wedge bolt holes with Clarkson slot drill.*

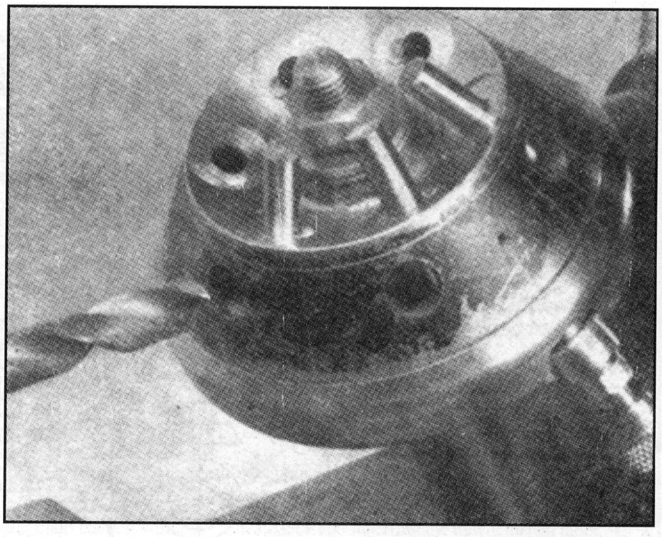
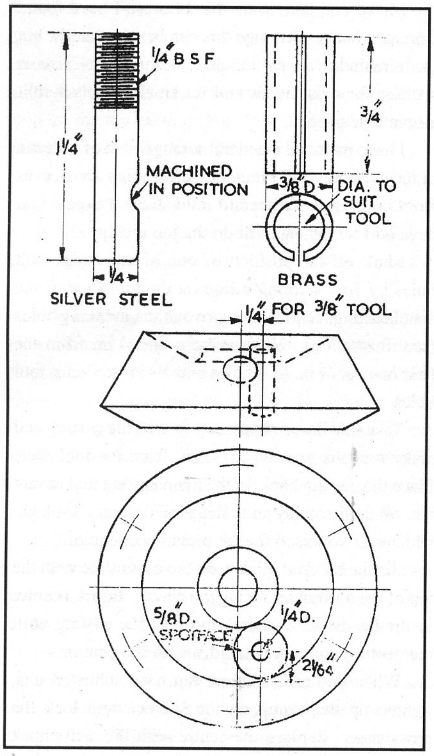


*Fig. 17: Drilling the tool holes with wedge bolts in position.*




*Marking off wedge bolt holes*

why some are unaware of their existence.

When you have completed the spot facing remove the casting from the V-block, then ream the letter D holes with a hand reamer. It will not remove a lot of metal and being a hand reamer the hole will have a slight taper.

There is a particular reason for this. The wedge bolts have a slight recess and this can be more easily done when drilling the tool holes.

For the wedge bolts cut four or six pieces of silver steel (according to the number of tool stations you have) ¼ in. dia., and about 1½ in. long. You will need to get a spanner on the nut so don't make them too long. Make the silver steel a sliding fit in the holes until they are ⅛ in. from the bottom, then give them a light tap to hold them firm. Don't make them a press fit otherwise you will be unable to remove them later.

Now for the last little job of machining. Place the complete tool in the tailstock and bring it up to a centre drill held in the drill chuck. Centre drill each tool position, indexing each one in turn. Change the centre drill for a small drill about 3/16 in. and drill ¾ in. deep. Open up to ⅜ in. and ½ in. (Fig. 17) or any other size you decide on.

With the tool holes finished withdraw each wedge bolt in turn and ease off until they fit freely. Finish to length and thread the top ¼ in. BSF.

Harden and temper the bolts as follows. Heat to a cherry red and quench in oil or water, oil for prefernce. Clean them up with emery cloth until they are bright all over. Temper to a dark straw and blue the thread. If you do this over an open flame let the flame concentrate on the thread and watch the colour change run along the bolt. Quench in oil when you obtain the correct colour.

So we come to the end of these instructions. I hope that you have had much pleasure in its construction and that it will be a useful accessory to your lathe. The last two illustrations show the completed tool, Fig. 18, without any cutting tools and Fig. 19 in position bristling with a variety of tools making it look like a sputnik. ●

*Model Engineer 117 842 (1957)*

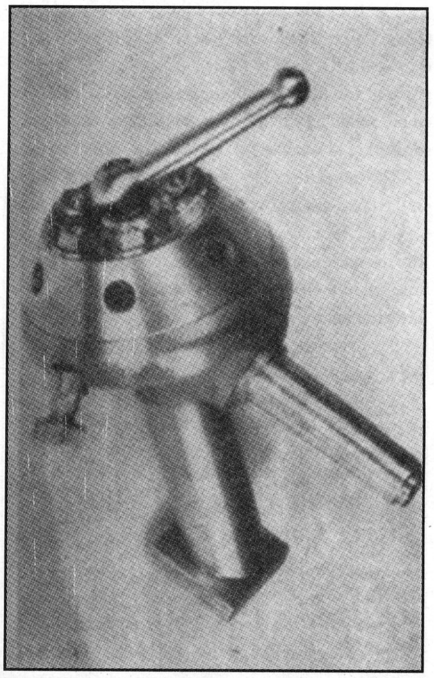


*Fig. 18: Turret holder without tools.*

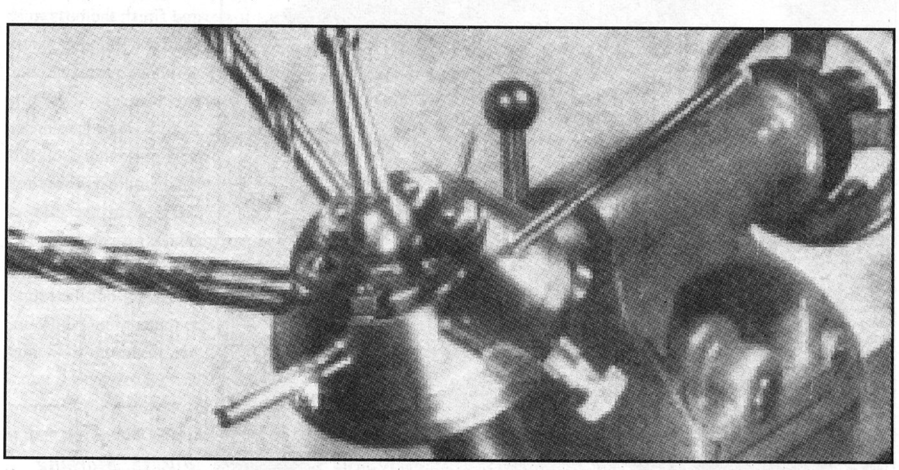


*Fig. 19: Turret holder loaded with tools.*

Lever Feed Tailstock

Changing the tailstock feed to lever operation has advantages when doing repetitive operations, enabling "Woodpecker" action in drilling without fatigue. I was an early admirer of "Duplex" in the 1950's and their method is still evergreen and can be easily adapted to most modern lathes.

# The Lever Feed Tailstock

by "Duplex"

The lever feed tailstock, sometimes called a handlever tailstock, is a device that enables drilling, reaming, counterboirng, tapping and threading to be carried out quickly in the lathe.

As the name given to the attachment implies, the tailstock barrel is fed forwards by means of a lever instead of by the usual handwheel. The lathe user has, therefore, very sensitive control over operations such as drilling; moreover, withdrawal of the drill is almost instantaneous, so that, when drilling a deep hole, the speed of penetration is rapid because the chips can be cleared quickly.

The device is, therefore, analogous to a sensitive drilling machine but, in this instance, the drill is not rotating. With suitable equipment, such as a small turret, it is possible to make use of a lever feed tailstock for the small quantity production of parts that need no very great accuracy.

This is an aspect that will appeal to those who run small commercial machine shops, but the ability to drill rapidly when using a tailstock fitted with lever feed is the application that has the more general interest.

## Commercial Attachments and Devices

In the commercial field, two distinct types of device are obtainable. The first pattern for use with tailstocks having the working thread formed upon the outside of the barrel. The second pattern, to be employed with tailstocks that have the working thread formed within the barrel. These two differing arrangements are illustrated in Fig. 1A and Fig. 1B respectively, where it will be seen that, whereas the first pattern of tailstock had a handwheel bearing directly upon the tailstock barrel, as in the Myford ML7 and Drummond lathes, for example, the second type of tailstock employs a threaded spindle to engage the working thread. The operating handwheel is then mounted upon the end of this spindle. It will also be observed that the handwheel illustrated in Fig. 1A is retained in place by a key that fits into a slot formed in the casting of the headstock itself. In this way axial movement of the handwheel is prevented. Thus, when the wheel is turned, the tailstock barrel only will move endwise.

In the illustration (Fig. 1B) the tailstock feedscrew will be seen to be provided with a collar formed integrally with the screw itself. This collar fits into a recess machined in the tailstock casting and all end wise movement of the feedscrew is prevented by the cover plate. This plate, which is furnished with a spigot to register with the recess in the tailstock casting, also serves as a bearing for the spindle.

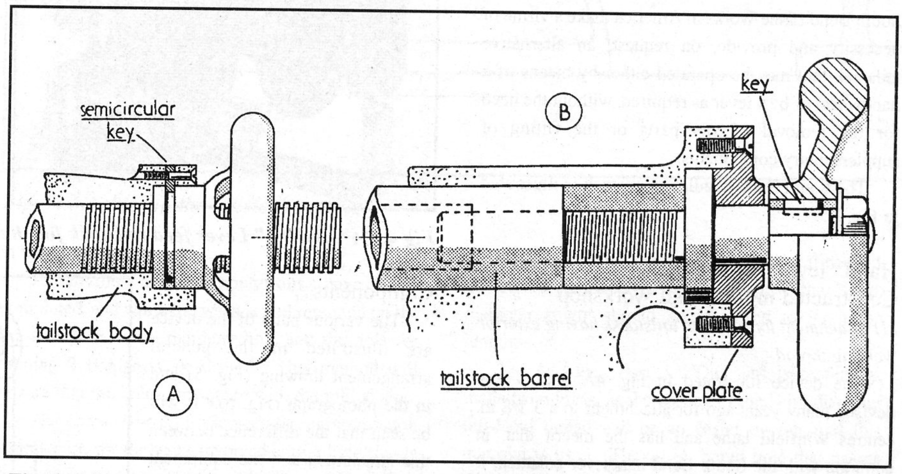



*Fig. 1: (A) – Methods of tailstock operation . Barrel threaded externally: (B) – Methods of tailstock operation. Barrel threaded internally.*

## Simplest to Convert

When the necessity occurs for adapting either of these arrangements to lever feed, the pattern illustrated in Fig. 1A is clearly the simplest to convert. Once the key has been removed and the handwheel withdrawn, the tailstock barrel is left free to move endwise when operated by a suitably mounted hand lever. The method employed by the Myford Engineering Co. on their M.L. 7 lathe is illustrated in Fig. 2. This device consists of a bracket (A) to clamp on the machined end of the tailstock casting, a threaded adapter (B) to engage the tailstock

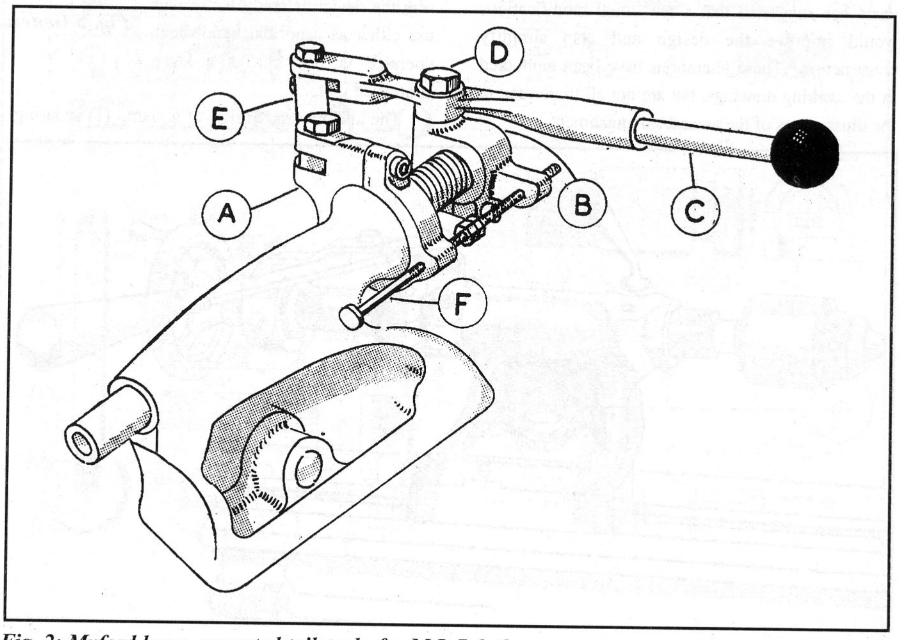



*Fig. 2: Myford lever -operated tailstock for M.L.7. lathe.*

barrel, and the operating lever (C). The threaded adapter is provided with a shouldered hexagon screw (D) and the operating lever swings upon it. A swinging link (E) engages both the end of this lever and the bracket (A). In addition, an adjustable depth stop (F) is fitted to the adapter. The stop is provided with a collar to prevent the tailstock barrel being withdrawn too far, and is also fitted with two lock-nuts for making the necessary depth adjustment. The application of lever feed to the second pattern of tailstock is a more difficult matter, for it is not possible, with this particular design, to provide an attachment that may rapidly be fitted to or removed from the tailstock. For this reason, no doubt, the South Bend Lathe Works of America make a virtue of necessity and provide, on request, an alternative tailstock that may be operated either by means of a handwheel or by a lever as required, without the need for the removal of any parts or the fitting of supplementary components.

The South Bend handlever tailstock is illustrated in Fig. 3.

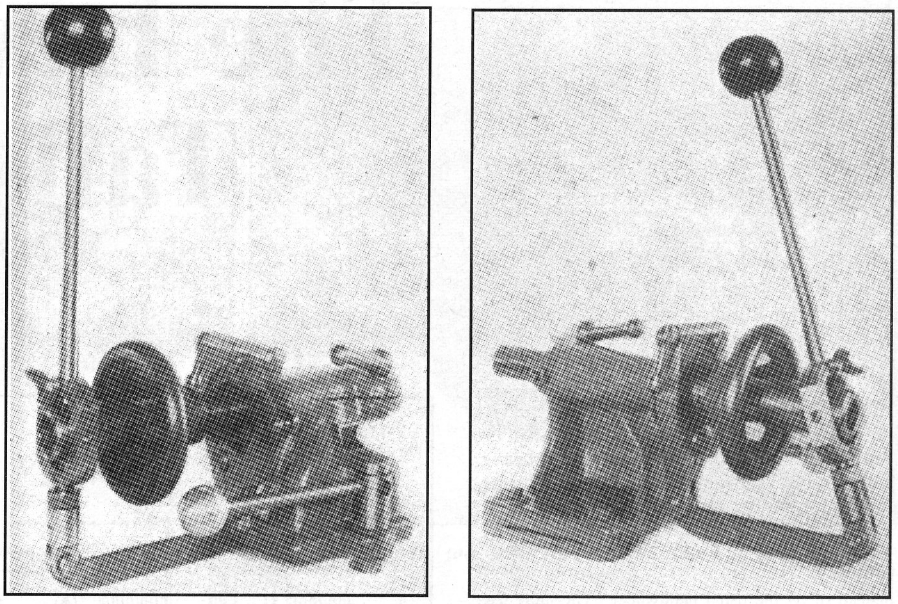


*Fig 4. "A" and "B" Lever feed tailstock for the Winfield lathe*

## Hand lever Attachments that may be Constructed in the Small Workshop

*(1) Attachment for use with tailstocks having exterior working thread*

The device illustrated in Fig. 4A and B was devised many years ago for attachment to a 3 1/8 in. centres Winfield lathe and has the meerit that, in common with the South Bend handlever tailstock, it enables either the handwheel or the lever to be used at will for controlling the tailstock barrels. The attachment was described in The Model Engineer ten years ago. In response to many requests, however, the device is now being described again, together with such modifications as have been made to it. In case some may suggest that this device bears a marked similarity to the Myford M.L. 7 attachment, it should perhaps be mentioned that it was from the attachment illustrated that the Myford Engineering Co. drew their inspiration. Much use of the device during the past ten years has suggested that a few small modifications would improve the design and also simplify construction. These alterations have been embodied in the working drawings, but are not all to be seen in the illustrations of the assembled attachment.

## Components

The various parts of the device are illustrated in the general arrangement drawing (Fig. 5) and in the photograph (Fig. 6). It will be seen that the difference between this attachment and the equipment made by the Myford Engineering Co. for the M.L.7 lathe lies in the provision of a swinging latch to engage the circular slot in the handwheel hub. This provision allows the wheel to remain in position on the tailstock barrel but to be prevented from endwise movement or allowed to move axially simply by throwing the latch in and out of engagement. In this way the device is ready for instant use either as a normal handwheel-operated tailstock or as a lever-controlled unit.

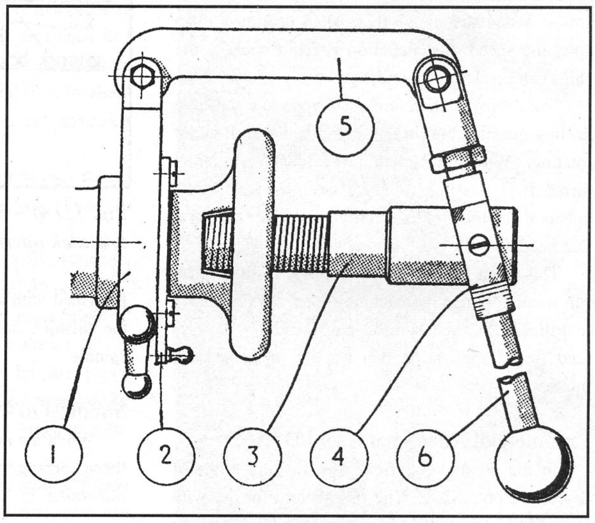



*Fig. 5 General arrangement of the lever feed tailstock*

The attachment consists of a clamp (1) securing the whole device to the tailstock casting. This clamp is provided with a latch (2) to engage the handwheel when it is necessary to use the tailstock the normal way. An adapter (3) is screwed to the end of the tailstock barrel and carries two segments to receive the hinge pins of the bridle (4). The bridle itself is fitted with an adapter for the detachable handle and also with a fork to accommodate the link (5) connecting the bridle to the clamp. The detachable handle (6) is made so that it may be quickly removed for safety.

The attachment may be unclamped and swung round the axis of the tailstock by undoing the ball-ended lever seen on the underside of the clamp. This allows the handle to be brought into the most comfortable position for working.

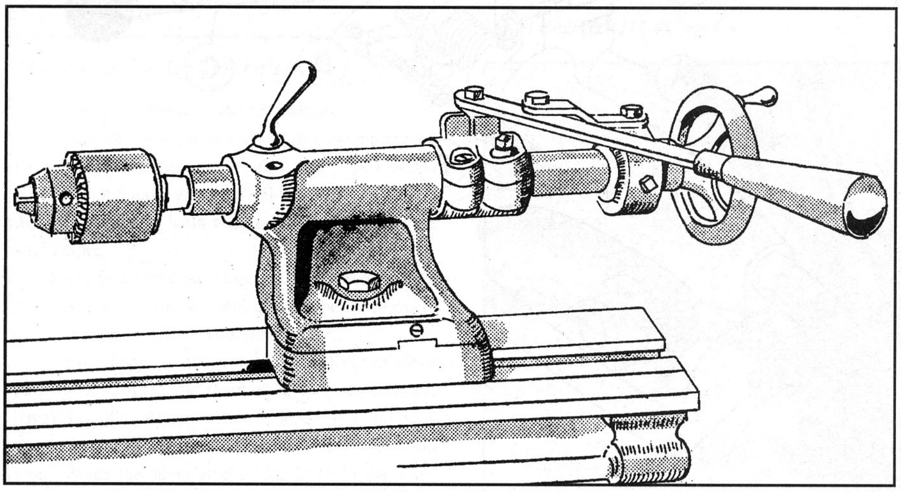


*Fig 3. South bend handlever tailstock*

## Making the Lever Feed Attachment

Examination of the detail drawings (Fig. 9) will show that there is little difficulty in making the various parts. The machining of the seating for the

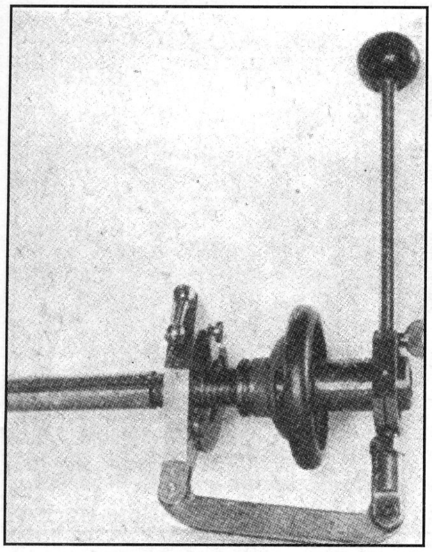


*Fig. 6: The parts of the lever feed tailstock.*

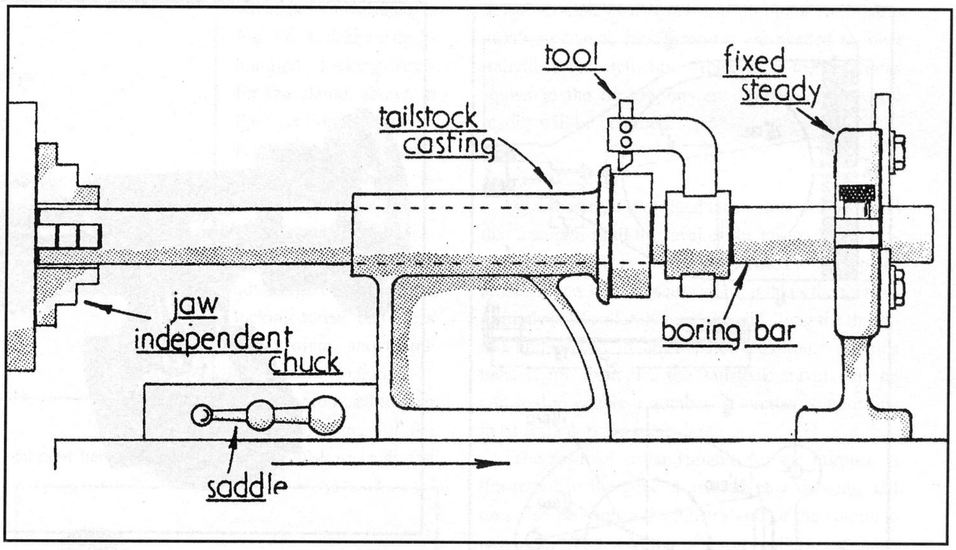




*Fig. 7: Machining the tailstock casting.*

clamp (1) on the tailstock casting, on the other hand, does pose a small problem, particularly when the machining must be carried out on the lathe to which the tailstock belongs. In this instance a special boring bar must be made and inserted through the bore of the casting, as illustrated in Fig. 7. The boring bar is mounted in the four-jaw independent chuck and is set to run truly; the other end of the bar is supported by a steady. The work is fed towards the tool by means of the lathe saddle. In order to do this the saddle is first brought into contact with the casting; the saddle automatic traverse is then engaged and the casting is thus pushed along the bed of the lathe towards the tool mounted in the boring bar. In carrying out this operation it is advisable to strap the saddle and the tailstock casting together, though this procedure is not essential. The depth of cut should not be too great. It is better to carry out the machining in easy stages, taking light cuts.

If a large lathe is available, the machining of the casting is readily carried out by mounting the work on a mandrel held in the chuck and supported by the tailstock. The turning operation is, then, carried out at a slow speed using a right-hand knife tool. After the casting has been machined, a start can be made with forming the Clamp Part No. 1.

The clamp, Part 1, is made from a piece of mild-steel that is bored to fit the machined end of the tailstock casting firmly. For this purpose the work is first marked out and is then set up in the four-jaw independent chuck. After the bore has been completed, the hole for the clamp-bolt is drilled. Perhaps the easiest way to carry out this part of the work is to catch the component under the top-slide tool clamp, aligning the work parallel with the chuck face and packing it to centre-height. The component may then be centre-drilled, pilot drilled and finally drilled 1/4 in. diameter to receive the clamp-bolt. The work is next removed from the lathe, and the packing-pieces used to set the component at centre height are carefully preserved, as they will be needed again at a later stage. The part is then cut to shape before again being returned to the lathe for drilling and tapping the 2 B.A. hole and milling the 3/16 in. slot in the projecting lug.

After the milling operations have been completed, and while the work is still mounted on the top-slide, the 3/16 in. diameter hole and the hole for tapping 2 B.A. may be drilled. This method will ensure that the holes are square with the milled slot.

*The Latch. Part 2.* Little need be said in relation to this part, for the work involved is of a kind that is familiar to readers. The small knob used for lifting the latch is made a press fit and may, also, if needed, be riveted in place. For this purpose the 5/32 in. diameter spigot should be increased to 5/32 in. in length.

*The Adapter. Part 3.* This part is preferably, made from brass, as the cutting of the 3/4 in. diameter left-hand thread will be an easier operation if this material is used. The 9/16 in. bored hole that passes through the adapter is intended to receive the driving

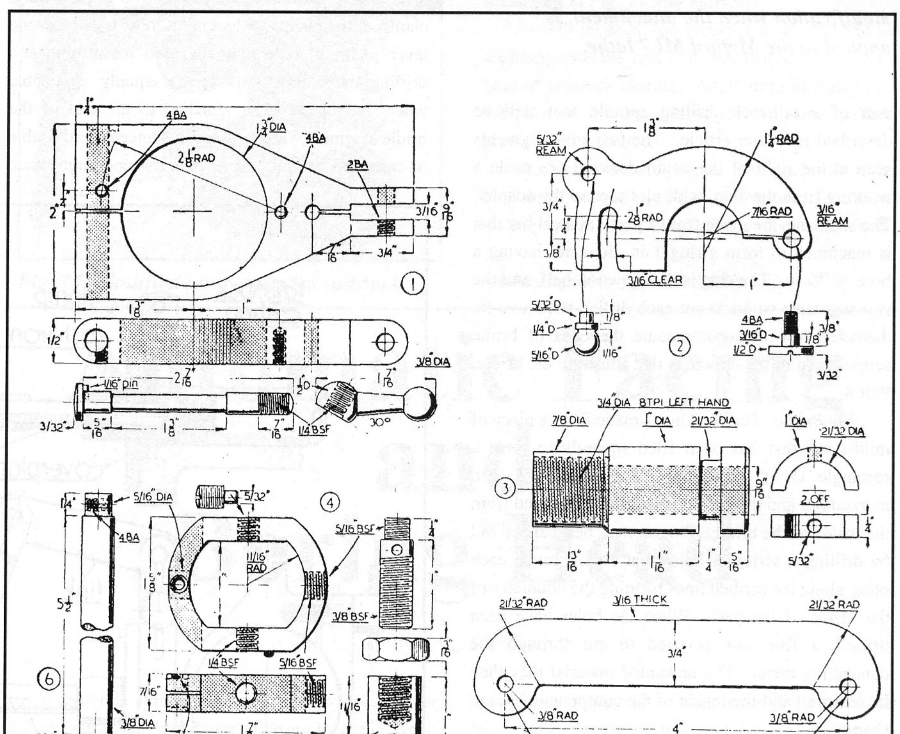




*Fig. 8: Working drawings of the various components.*

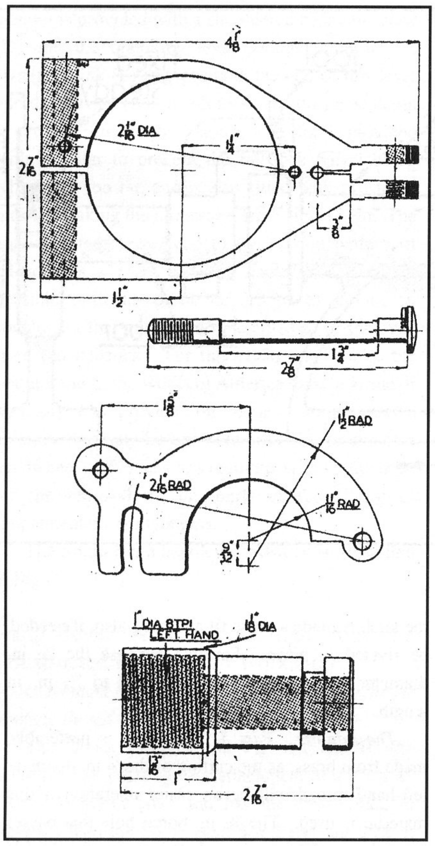



*Fig. 9: Drawings of the parts requiring modification when the attachment is applied to the Myford ML7 lathe.*

unit of a tailstock drilling spindle that will be described in a later article. The two steel segments seen at the right of the detail drawing are made a working fit in the ¼ in. wide slot seen in the adapter. The segments are made from a piece of steel bar that is machined to form a ring 1 in. diameter having a bore of $^{21}/_{32}$ in. The ring is then sawn in half, and the two segments so made are each drilled with a $^{5}/_{32}$ in. diameter hole to accommodate the ends of bridle screws seen in the drawings that illustrate the bridle, Part 4.

*The Bridle. Part 4.* This is made from a piece of mild-steel, that has been filed squarely to form a rectangle 1⅞ in. by 1⅝ in. The material is then marked out and the surplus material is removed from the inside of the bridle. This work is best carried out by drilling a series of holes that almost touch each other along the scribed lines forming the boundary of the inside of the part. When the holes have been drilled, a fine saw is used to cut through the connecting metal. The unwanted material may then be removed and the inside of the component filed to shape.

## Drilling and Tapping

When this has been done, the work is mounted in the four-jaw independent chuck in order to drill and tap the four holes that accommodate the two bridle screws, the fork stud and the lever. It is best to carry out this work in the chuck so as to ensure that the holes are tapped square. The $^{5}/_{16}$ in. diameter seating for the lever should be formed with a small boring tool.

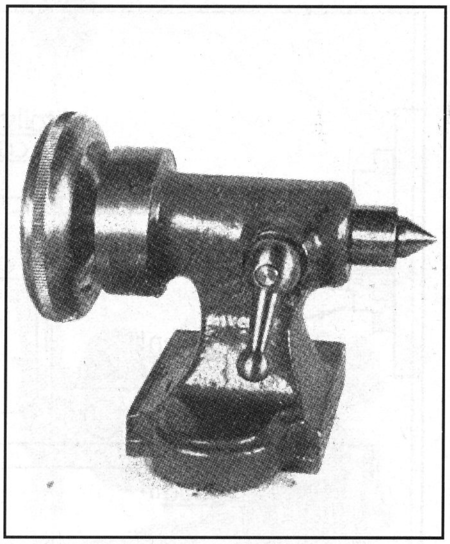


*Fig. 10: Tailstock having an internal working thread.*

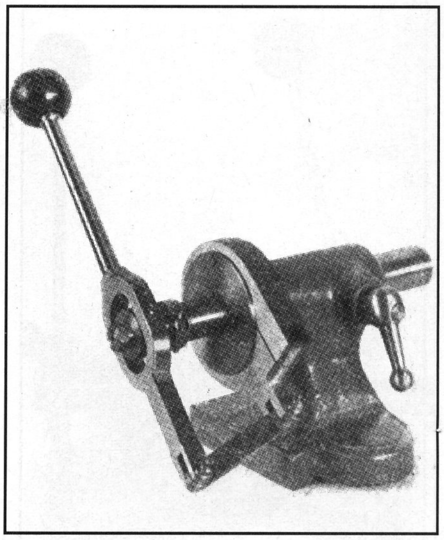


*Fig. 12: The complete attachment for converting the tailstock to lever feed.*

As soon as the machining is complete the bridle is finally filed to shape, and a saw cut is made across the end of the lever seating. This saw cut enables the locking-screw fitted to the bridle to clamp the lever. It will be observed that the lever itself is tapped 4 B.A. for half its diameter. If the tapping of both the lever and the bridle is carried out with the two parts clamped together, the locking screw will hold the lever securely. The methods used for milling and drilling the clamp, Part 1, are equally applicable when making the fork attached to the end of the bridle assembly, Part 4. In this instance it is advisable to carry out the milling as the first operation made upon the fork. For this purpose a piece of round material some four inches long is gripped under the tool-clamp in the top-slide; the work will then be held securely. The simple turning operations are carried out after the milling has been completed.

The link, Part 5 and lever, Part 6 require no detailed comment.

## Lever Feed Tailstock for the Myford ML7 Lathe

The lever attachment described above can also be used with the Myford ML7 lathe. Naturally, certain of the parts need some modification; but this relates to dimensions only, and these are shown in Fig. 9 that illustrates those components requiring alteration.

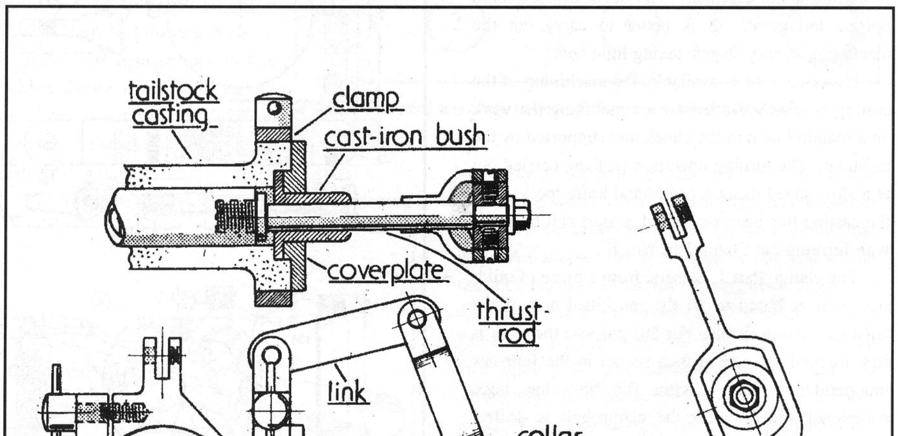



*Fig. 11: Method of adapting the tailstock illustrated in Fig. 10 for handlever operation.*

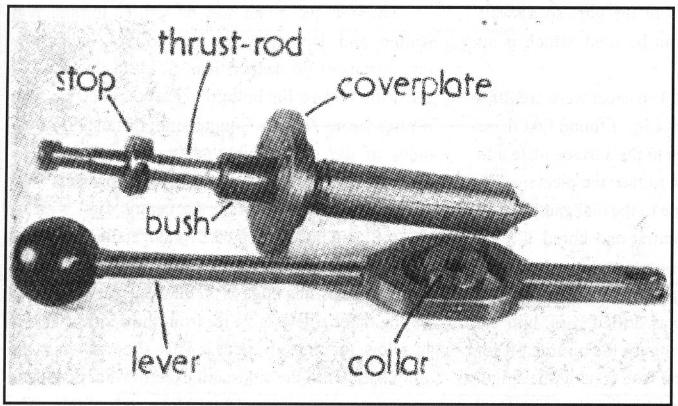



*Fig. 13: The parts of the attachment.*

These drawings must be read in conjunction with those in Fig. 8 that relate to similar parts. In Fig. 9 only those measurements that need modification are given; the remaining information will be found in the previous set of drawings.

## Hand Lever Attachments That May be Constructed in the Small Workshop

*2. Attachments for Tailstocks Having an Internal Working Thread.* The conversion of the type of tailstock illsutrated in Fig. 10 and, in section, in Fig. 1B, is a somewhat more difficult matter; moreover, it is not possible to arrange matters so that the tailstock barrel can be moved either by the handwheel or by means of the lever at will. The user will, therefore, have to content himself with providing lever operation only.

The handwheel and feedscrew seen in the illustrations are removed and replaced by a thrust-rod and cast-iron bush, as depicted in Fig. 11. The thrust-rod screws into the barrel of the tailstock and is moved by means of a lever acting on a collar attached to the thrust end. The collar is free to turn on the rod; so by loosening the clamp on the tailstock casting, the lever may be set in any desired position around the axis of the tailstock. The complete tailstock is illustrated in Fig. 12. If desired, the T-handled locking-screw for the clamp, shown in the sectional drawing Fig. 11, may be replaced by an Allen cap-screw, as seen in the illustrations of the complete tailstock. This arrangement has the advantage of providing a locking-screw that does not project above the surface of the clamp.

It is not proposed to give detailed drawings of the fitment here. Those readers who wish to apply the device to their own lathes will no doubt find that a number of small modifications are needed to meet individual requirements. However, if the principles shown in the illustrations are followed, successful results will be obtained.

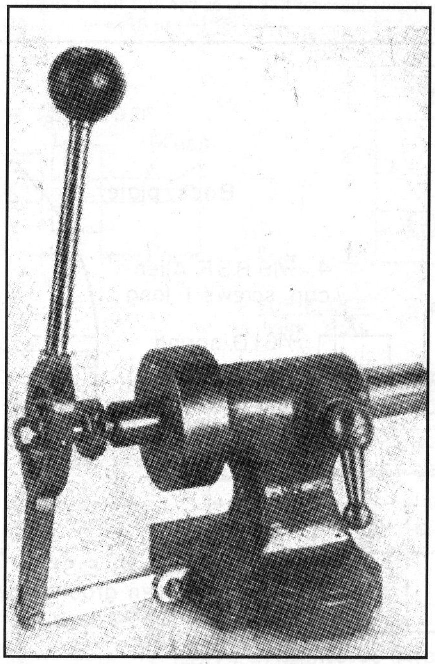


*Fig. 14: Simlified lever-operated tailstock.*

### A Useful Stop

When using a lever feed tailstock it will be found that a stop to limit the tavel of the tailstock barrel is an advantage. This stop is easily fitted to the type of tailstock now being discussed, for it takes the form of a simple split collar that may be slid along the thrust-rod and locked in any desired position. By this means, for example, the tailstock travel can be adjusted to enable a number of similar components to be drilled to the same depth.

The form of collar suitable for the purpose is illustrated in the general arrangement drawing and may also be seen in the illustrations of the complete tailstock. The making of these collars has been described many times in the past, so requires no further comment now.

The conversion, to lever operation, of tailstocks fitted to precision lathes such as the Boley, though practicable is, perhaps, inadvisable. Makers of precision lathes do not sell conversion attachments; they supply complete interchangeable tailstocks only.

For those who do not need a lever feed attachment that can be adjusted and swung around the axis of the tailstock, the simplified device illustrated in Fig. 14 may suffice.

As will be seen, the clamp is discarded and the anchorage for the link is a fork that screws into the base of tailstock casting. Apart from this alteration the parts of the attachment are the same as those previously illustrated.

In making the attachment it is advisable to lap both the thrust-rod and the cast-iron bush; in this way the movement of the parts will be made smooth. ●

***Model Engineer* 106 445 (1952)**

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<u>Boring/Facing Head</u>

The ability to face a casting fixed to the lathe saddle is very valuable, especially as it is not always possible to swing work over the bed, nor indeed to hold it in some circumstances. In choosing among the designs of head available, I was looking for elegance combined with simplicity, the ability to index out to larger diameters at each revolution and inbuilt rigidity which stems from a short overhang beyond the lathe mandrel. Radford's design fulfils all these criteria.

# Automatic Facing and Boring Head

by J. A. Radford

I have recently designed and made an Automatic Facing and Boring head which will bore and face to a maximum diameter of 6½ in. with an automatic facing feed of 0.005 in. per turn, which may be of interest to readers. In addition to these orthodox functions, the head may be used for fly-cutting, setting the diameter swept by the cutter to the most suitable size and traversing the job by means of the cross-slide. If suitable split bushes are made, the crank and cam journals on crank-shafts can be machined, the throw being accurately set by means of the index plate on the feed screw of the head.

The usual orthodox facing feed is outwards from the centre, but a third hole is provided so that facing can be done towards the centre as for instance when it is necessary to face up to a shoulder. With the cutter bar in this position, turning a spigot on a part that is too big to swing in the lathe can be done, the job being held on the cross-slide or vertical-slide.

I used the $\frac{3}{8}$ in. BSF thread provided in the Myford head for the collet attachment, for supporting a hardened steel roller against which the ten point star wheel impinges, this moves a $\frac{3}{8}$ in. BSF feed scew (20 t.p.i.) so giving the 0.005 in. per turn of the head. For boring, the roller is positioned clear of the star wheel