

## SAFETY NOTES.

### ELECTRICAL.

#### Motorised Machines.

The machine must be connected to the mains supply via a standard 13A plug and socket. Fuse ratings are shown on the machine label.

When installing the machine follow the standard connection colour code for 13A plugs, ensuring that the earth wire (green or green/yellow) is connected correctly, AND that the socket to be used has a good earth connection back to the Electricity Board's earth at the mains inlet to the premises. If there is any doubt, consult your local Electricity Authority.

If electrical maintenance is necessary, SWITCH OFF THE MACHINE AND DISCONNECT THE MAINS PLUG BEFORE REMOVING ANY ELECTRICAL COMPARTMENT OR CONTROL BOX COVER.

REPLACE ALL COVERS BEFORE RECONNECTING TO THE MAINS SUPPLY.

#### Unmotorised Machines.

Apply the rules above to your own installation and ensure that ALL electrical connections are covered to prevent accidental contact.

Have your installation checked by a qualified electrician before putting into use.

### OPERATING.

All machine operations including tool grinding present a hazard, particularly to the operator's eyes. Swarf is sharp and hot, and it can be projected upwards as small, high velocity particles - this occurs particularly when machining brass. Therefore:

**ALWAYS WEAR PROTECTIVE GOGGLES WHEN USING MACHINES - DON'T TAKE CHANCES.**

Rotating parts are also a hazard, therefore:

1. Ensure that all work pieces and cutting tools are correctly and adequately secured before commencing machining and at intervals during prolonged machining operations.
2. Don't make measurements while the work is rotating.
3. Don't judge the finish by running your fingers along a machined part whilst it is rotating.
4. Don't use hand tools such as files close to the chuck.

THINK SAFETY.

#### WARNING

IF THESE MACHINES ARE TO BE USED IN INDUSTRY ADDITIONAL GUARDING MAY BE REQUIRED AS DEFINED IN THE FACTORIES ACT 1961 AND THE HEALTH AND SAFETY AT WORK ACT 1974.

## THE COWELLS 90 LATHE

The Cowells 90 Lathe is a conventional , backgeared, screwcutting centre lathe.

This Manual outlines its maintenance and operation and provides an introduction to the Centre Lathe for the novice and is also applicable to the 90 CW and 90 HS Lathes. The user's attention is directed to the 'Cowells 90 Lathe Handbook' (code 10-260) which provides further and more detailed descriptions of the machine and its application to a wide range of machining operations.

### SECTION 1

#### MACHINE PARTS AND THEIR FUNCTIONS.

##### Movements.

All movements affecting the cutting tool positions, including drilling, etc., using the tailstock are controlled by feedscrews and graduated handwheels. Note that the CW Lathe tailstock is lever operated. All the feedscrews have a pitch of 1mm and the handwheels 40 divisions. Therefore, one full rotation of the handwheel will produce a corresponding linear movement of the associated slide of 1mm and a rotation of one division will produce a movement of .025 mm (.001" approx.) NOTE : All feeds with the exception of the cross slide are direct reading, i.e. the handwheel dial indicates directly the length turned on the depth of the hole drilled.

With the cross slide, however, the handwheel dial indicates the depth of cut, BUT, if the tool is moved inwards one division (.025 mm) the diameter of the work will be reduced by TWICE that amount (.05 mm). THIS IMPORTANT FACTOR MUST BE REMEMBERED WHEN TURNING DIAMETERS.

Two additional 'preset' movements are provided at the Compound Slide and Tailstock to facilitate angle and taper turning.

##### Compound Slide.

The Compound Slide operates on a rotatable base secured to the cross slide by two angle pins and screws, thus allowing the slide to be set at various angles to the lathe axis for taper and angle turning.

To set the compound slide angle, slacken the two screws on the side faces of the cross slide immediately under the compound slide. The compound slide can then be rotated to the required angle using the angular scale on the cross slide face. Tighten the screws.

NOTE: Some accessories are attached to the cross slide using the compound slide mounting hole. For these accessories to be used the compound slide and its base must be removed as a complete unit.

To remove the compound slide assembly, remove the two screws to allow the angle pins to move outwards. Then, rotate the unit back and forth, pulling upwards to push the pins clear. Note that the assembly is a tight fit and some force is required to remove it.

##### Tailstock Set Over.

The tailstock centre can be moved out of alignment with the lathe centre line to enable taper turning to be carried out. The total movement is limited to 6mm and this method of taper turning is normally restricted to very small angles.

To set the tailstock over:

- a) Release the clamp lever at the rear of the tailstock body.
- b) Using the two screws (one at the front, and one at the back of the tailstock body) move the body sideways on its base alternately slackening one screw and tightening the other until the desired amount of set over, in the desired direction, is obtained. The tailstock can then be used in the normal way except that the parts turned will have a taper in diameter equal to twice the amount of set over.

To set the tailstock back to its centre position repeat the operations in (a) and (b) but in

the reverse direction, using a test bar and dial test indicator to obtain accurate alignment. Alternatively, alignment can be set by turning the ends of a bar between centres to check the setting. The setting is correct when the diameter obtained at each end of the bar is the same FOR THE SAME TOOL SETTING.

### Drive Systems.

#### **1. CW AND HS LATHES**

Single pulley and thyristor speed controller.

#### **2. 90 LATHE**

The headstock spindle is driven by a conventional 3 step pulley arrangement from a countershaft powered by the motor. Belt tensioning is achieved by means of a cam operating on a cam follower screw which projects through the countershaft bracket. Pulling the cam lever forward releases the belt tension thus enabling the various steps of the pulley system to be selected. Pushing the lever back tensions the belt.

### Backgear.

The backgear is a device used to extend the speed range of the headstock spindle by introducing gearing between the driven pulley and the spindle.

With the 3 step pulley, 6 speeds can be selected as follows:

#### a) Ungeared.

Disengage the backgear by releasing the grubscrew in the top face at the rear of the headstock casting. Push the lever on the backgear eccentric back until the gears are disengaged. Tighten the screw. Secure the 3 step pulley to the spindle by tightening the grubscrew in the centre 'Vee' of the pulley. The machine is now in direct drive and the 3 speeds available are 880, 500 and 280 r.p.m.

NOTE: These speeds apply to 50 Hz machines. For 60 Hz machines the speeds will be approximately 20% higher.

#### b) Geared.

Reverse the procedure in (a) to engage the backgear ensuring that there is a small amount of clearance between the gear teeth. Never run gears tightly meshed. Remember to secure the backgear eccentric locking screw and release the pulley locking screw. The machine is now in geared drive and the speeds at the pulley are reduced by a ratio of 4.6 to 1 giving 180, 107 and 60 r.p.m. at the spindle (50 Hz machine).

### Auto Traverse and Clutch. (90 Lathe only).

Auto traverse provides a means of moving the cutting tool along the axis of the lathe to perform turning operations automatically. It is achieved by driving the leadscrew through a series of gears driven from the headstock spindle, the rate of movement (feed) being determined by the gear ratio and the pitch of the leadscrew. Note that 'feed' is the term used to express the movement along the axis for each revolution of the workpiece and is constant for any given gear ratio regardless of spindle speed. The gearing fitted for the auto traverse provides a feed of .07mm (.003") approx.

The direction of traverse is controlled by the total number of gears in the 'train' which is arranged to give movement to the left or right. Movement to the left (toward the headstock) is normal.

The gears are fitted to a slotted plate clamped to a boss at the headstock end of the lathe. The slot in the plate allows for variations in gear centres if/when the ratio is changed, and the whole plate, complete with gears, may be rotated around its mounting boss to engage the driving gear on the tailend of the headstock spindle. As with all gears, leave a small clearance between the teeth when setting.

The leadscrew is connected to the gear system through a clutch operated by the lever at the front of the headstock. Moving the lever to the left disengages the drive, to the right engages the drive.

A trip bar is provided to disengage the clutch automatically as the tool approaches the headstock. The trip is in the form of a slotted bar mounted on the 'apron' at the front of the saddle, the slot allowing for adjustment of the precise point of trip. For instance, the trip

can be set to disengage the clutch when the cutting tool is about 1/8" from the chuck jaws. Then long turning operations can be performed automatically, each successive cut stopping at the same point without the risk of the tool or chuck being damaged should the operator's attention be elsewhere.

### Screwcutting. (90 Lathe Only)

The system of driving the leadscrew through a train of gears is also used for screw cutting. For this the gears are selected from the range provided in accessory set 10-206 together with those provided with the auto-traverse, to give the required rate of movement, but in this case the feed is equal to the pitch of the thread to be cut. When screwcutting, the clutch is NOT disengaged at the end of each cut. The machine MUST BE STOPPED, THE TOOL WITHDRAWN AND TRAVERSED BACK TO THE START OF THE THREAD USING THE MOTOR REVERSE. The tool is then set back to its previous position plus the amount for the next cut and the operation repeated until the required depth of thread is achieved.

## SECTION 2

### CARE OF THE MACHINE.

#### Lubrication.

Oiling points are provided for the headstock and leadscrew bearings. All other working surfaces such as slides, feedscrews, gears etc., are lubricated by applying oil directly to the surface. Use a good quality SAE 20 or 30 grade of machine oil such as Myford NUTO, for all lubrication. Do not use 'sewing machine' type oils of the 3 in 1 kind. These are for light duty only and are not suitable for the Cowells machine.

Frequency of lubrication is dependent upon the duty of the machine but:

- (a) Always lubricate before use and after cleaning down.
- (b) During prolonged machining operations lubricate at regular intervals paying particular attention to the headstock oil cups.

#### Adjustment.

##### 1. Gib Strips.

Gib strips are steel inserts fitted between the faces of sliding parts to provide accurate control of the fit of the parts, thus allowing for initial setting and compensation for wear. They are positioned and secured by means of screws and locknuts and are used on the compound slide, cross slide and saddle. To adjust any of the gib strips, slacken the appropriate locknuts and then set each screw in turn to achieve a good slide action, without sideplay and without undue loading of the feedscrew. Tighten the locknut as each screw is set to ensure that there will be no further movement when the effect of the setting is checked. Readjust each screw if necessary to achieve a good slide action for the whole of the travel.

##### 2. Feedscrew Backlash.

Feedscrew backlash is controlled by the position of the handwheel on the feedscrew extension. To adjust, slacken the screw in the side of the handwheel and then turn the slotted screw in the front of the handwheel clockwise until the backlash is 5 divisions or less of the graduations. Tighten the screw in the side of the handwheel. Note that it is impossible to eliminate backlash completely and that any backlash is always accounted for when performing machining operations.

##### 3. Headstock Spindle Bearings (90 Lathe).

HS Lathe has sealed ball bearings, no adjustment.

CW Lathe has taper cone bearings. Adjustment is provided at the rear cone.

90 Lathe adjustment is provided by means of split caps and screws. To adjust, top up the bearing cups with the correct oil, set the belt to give the highest speed (880 r.p.m.) and switch the machine on. After a few minutes, switch off and release the belt tension. Turn the bearing cap screws very slowly and a fraction of a turn at a time, clockwise to tighten the bearing whilst rotating the spindle back and forth by hand. The correct setting is when the screws are as far clockwise as they can be set without there being any drag on the spindle.

#### 4. Headstock Spindle End Float.

If end float adjustment is necessary, slacken the grub screw securing the large gearwheel to the spindle at the end of the headstock. Turn the screw collar immediately behind the gear clockwise (viewed from the rear) to reduce end float. Tighten the gear wheel securing screw. The setting should be sufficient to remove end float only; there should be no loading of the bearing faces.

#### 5. Belt Tension.

If adjustment of the belt (or belts) tension becomes necessary, proceed as follows:

- a) Position the belt on the centre step of the 3 step pulley.
- b) Slacken the locknut on the cam follower screw at the rear of the countershaft bracket (on the 10-200B also slacken the two screws on the right hand face of the motor compartment.)
- c) Set the cam lever to the tensioned position and adjust the cam follower screw to obtain the correct belt tension; tighten the locknut.
- d) 10-200B only. After (c) above, push down on the screw in the slot in the motor compartment, (b) above, to tension the motor drive belt. Tighten both screws on the right hand face of the motor compartment.

The setting is now correct for all 3 steps of the spindle pulley.

CW and HS Lathe belts are tensioned by adjusting the motor position.

#### General Rules.

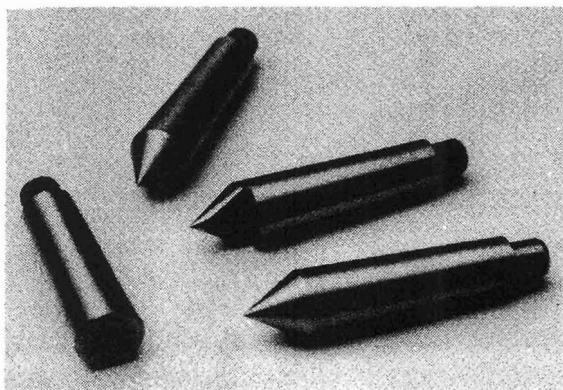
1. Pay attention to lubrication at all times.
2. Keep working surfaces clear of swarf as much as possible. Swarf is abrasive and in some cases can absorb oil, resulting in 'drying out' of a previously lubricated surface.
3. Always clean the machine, re-oil after use, particularly if water soluble oils or paraffin have been used as cutting lubricants. These products can cause rust.
4. Do not use abrasive fluids (metal polish etc.,) to clean the machine. Remove any swarf with a soft brush - wipe with a clean dry cloth and re-oil.
5. Never leave the machine unused for long periods with the belts tensioned. Always release the belt tension at the end of working period.

NOTE : These rules should also be applied to machine accessories.

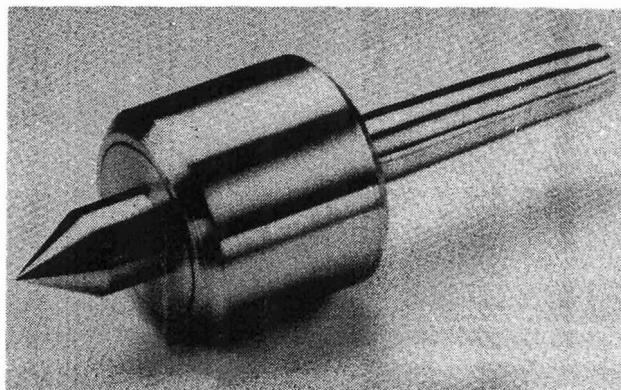
### SECTION 3

#### OPERATING THE MACHINE

##### WORK HOLDING AND SUPPORT



Centres



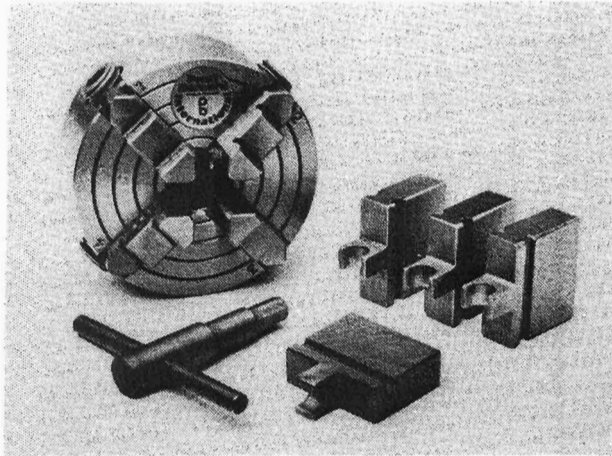
Rotating Centre

##### Between Centres.

This is the simplest method of work holding and consists of drilling a centre hole using a centre drill, in each end of the material. These are then used to support the material on the

centres in the headstock and tailstock. Note that the hard centre is fitted to the tailstock and the soft centre to the headstock. Rotary motion is imparted by means of a 'carrier' or 'dog' which is clamped to the work at the headstock end and is driven by a peg fitted to the faceplate. Note that the tailstock centre must be kept well lubricated and that, as turning progresses, the heat generated will cause the work to expand. This necessitates readjusting the tailstock centre at intervals to compensate for the expansion.

#### Four Jaw Chucks.



**Independent 4 Jaw Chuck**

This is the most versatile type of chuck. It is possible to hold irregular shaped articles, such as castings and square bar and give absolute accuracy when holding round work. The Jaws can be reversed to hold large objects, or just one or two can be reversed and the others left in their normal position when, for instance, rectangular objects need to be held. To reverse the jaws, withdraw them completely and remove the screw from its recessed tongue seating on the jaw. Turn the jaw over, refit to the screw and replace the chuck. The method of setting the chuck is to open each jaw in turn until the work will enter. Now tighten each jaw equally. Rotate the chuck by hand; any major error in truth will be very obvious and can be corrected by loosening the jaw on the low side as near as can be estimated by the half error. The opposite jaw is then tightened to take up the slack. Note that it may be necessary to loosen the other jaws slightly to enable the workpiece to move. The final setting is done using a dial test indicator.

There are many indicators on the market and we suggest that a low cost type such as the Verdict Junior is obtained. They are very robust and of a size easily managed on the Lathe. To use : Fit the indicator in the toolpost using a bar to hold it in a convenient position. Set the stylus of the indicator against the work to a point where the hand registers a mid point on the scale. Now, by turning the chuck until one of the jaws is directly in line with the stylus, note the reading of the dial. Without altering the position of the indicator turn the chuck until the jaw opposite the one just checked is in line with the stylus; the dial will indicate error. This can be corrected by loosening one jaw, the low reading one, and tightening the high reading one until the readings are the same for both jaw positions. Turn your attention to the other jaws and repeat the process until the work runs true.

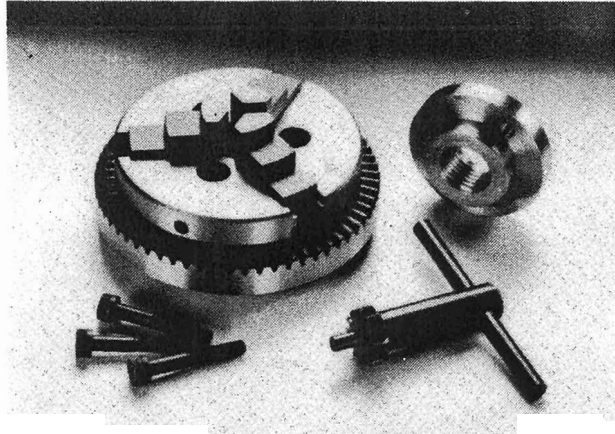
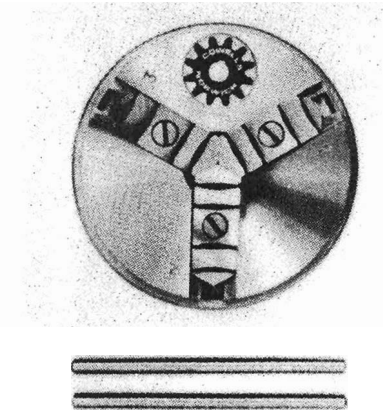
It takes practice to use the 4 Jaw chuck to the best advantage, but once you have gained the skill in adjusting the jaws, it takes very little time to set a job in it.

#### The Three Jaw Self Centering Chuck.

This is useful for holding round and hexagonal material. It is quick and easy to operate and is favoured by many users. Its main disadvantage is that it is rarely accurate, and error of 0.075mm (.003") is usual, even when new, and the error can vary on different diameters of workpieces. This does not detract from the usefulness of this accessory as long as the user is aware of its limitations.

All 3 jaw chucks can be used as 'outside' jaw or 'inside' jaw chucks. This is achieved on larger chucks by having two sets of jaws. On the Cowells chuck Part No. 10-208 changing from one mode to the other is done by removing the slotted screw in the centre of each jaw, reversing

the jaws on their carriers and securing them with the screws.



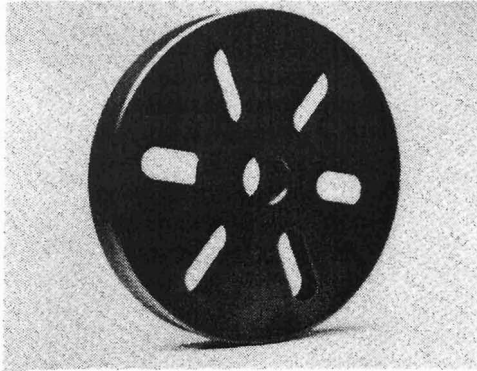
**3 Jaw Scroll Chuck**

**Cowells 3 Jaw Scroll Chuck**

Other chucks have jaws which can be reversed. In this case when the jaws have been completely removed, rotate the scroll until the thread is in position to engage the teeth of the jaw No.1. in slot No.1.

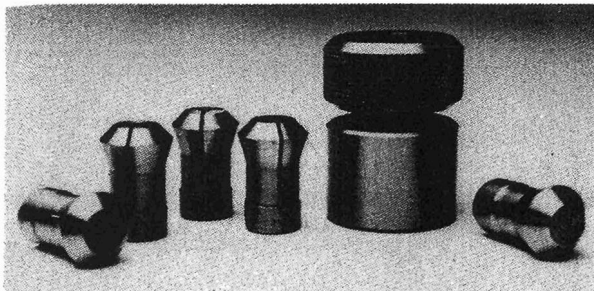
Note that the jaws are used in the same slots, i.e. No.1. in slot No.1. and so on. If this sequence is not followed the jaws will not run true.

### Faceplate.



This is used for objects which are too awkward to hold in the chucks, or discs which cannot be swung over the bed. The work is clamped to the faceplate using nuts, screws and clamp plates.

### Collets.



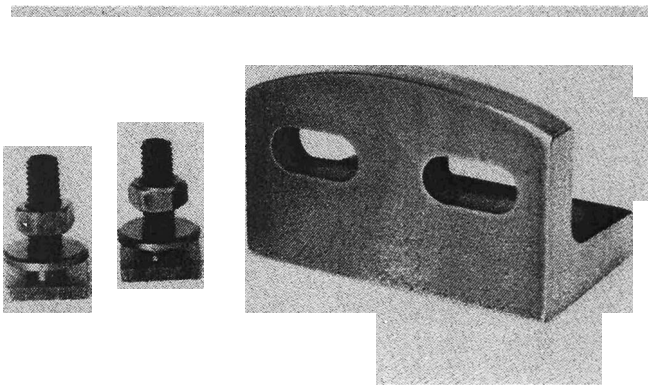
**Collet Adaptor with Collets**

Collets are used to hold round material which is reasonably accurate in size, but they will only hold the size of material for which they are bored. Their advantage is that they are accurate, easy to use and are particularly useful for repetitive and small diameter work.

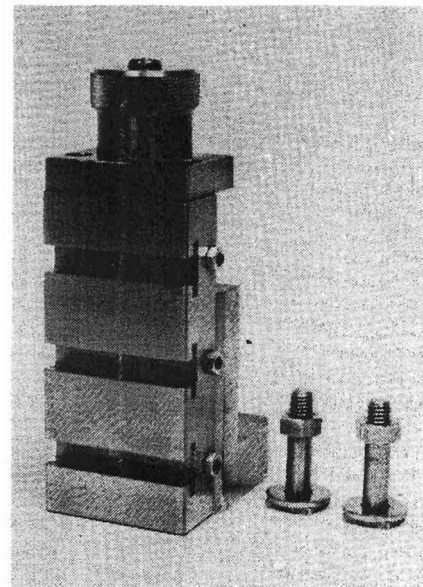
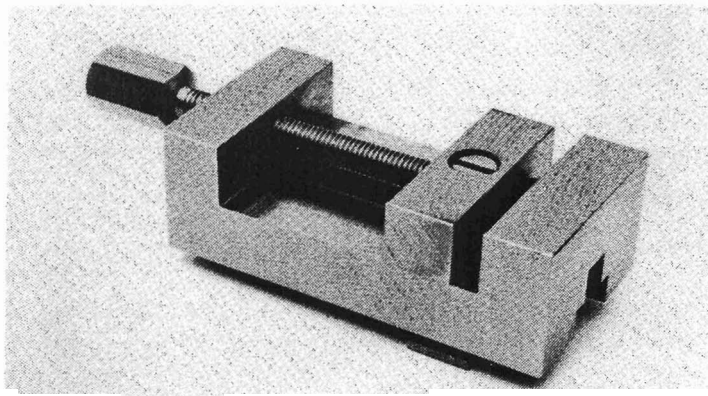
**Maintain scrupulous cleanliness at all times with collets. Wipe the nose socket clean of chips and swarf before inserting the collet. Do not tighten until you have pushed the material into the collet. Always wipe the material clean and check that there are no burrs marring the surface as any defects can result in inaccuracy. Blank collets are available which users can finish to their own requirements.**

**Work Holding on the Cross Slide.**

**So far, the methods of work holding have been concerned with turning, that is, the technique where the work is rotated and the tool is moved along or across it.**



**Angle Plate**



**Vertical Milling Slide**

**Machine Vice**

**The alternative to this is to have the work clamped to the cross slide by means of various accessories, then carrying out the machining operation by traversing the work across or along a rotating cutter. This method is used for milling on the lathe, the milling cutter being held in a chuck. Note that for milling it is normal to use a vertical slide mounted on the cross slide to give the 3rd axis of movement necessary for this operation, the work being clamped to the vertical slide.**

**Fixed (3 Point) Steady.**

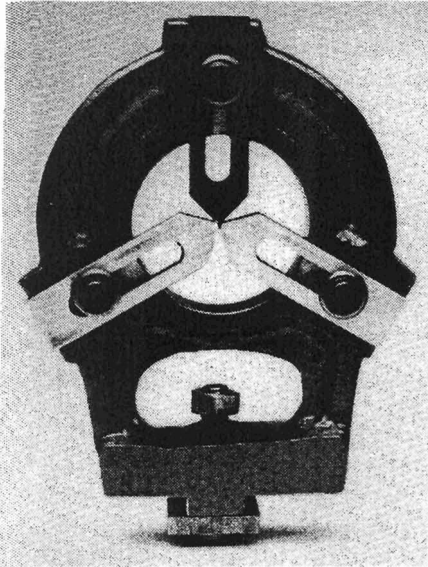
**This is a device having 3 arms which are used to support long workpieces whilst machining operations are performed on the free end. It is fitted in the lathe bed slot and is used by adjusting the bearing arms to the diameter of the work (this is best done with the work held in a chuck and the steady positioned as close to the chuck as possible). After setting, it can be moved to the required position to support the work and clamped in the slot in the lathe bed. Note that the bearing arms must be kept lubricated when in use.**



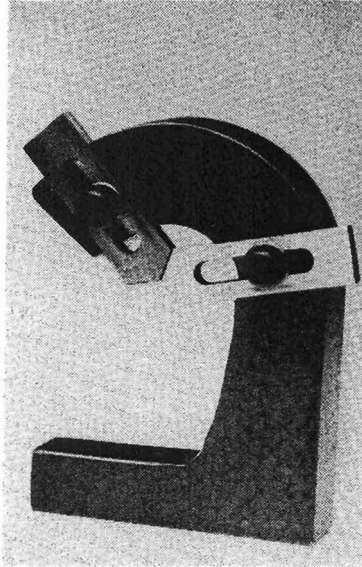
### Travelling Steady.

This is a similar device to the fixed steady but has only two arms and is mounted on the lathe saddle. It is designed to travel along the work as machining is carried out thus providing a support immediately above and behind the tool when cutting slender workpieces.

Note that lubrication is necessary when in use and that the arms must be readjusted after each cut.



Fixed Steady



Travelling Steady.

## TOOLS, SPEEDS AND MATERIALS.

### Tools.

All turning tools have two basic requirements to their shape. These are:

- 1) **Clearance:** This is the slope downwards and back from the cutting edge and is applied at the front and side (both sides in some cases e.g. a parting off tool). Normal clearance is between  $3^{\circ}$  and  $10^{\circ}$ .
- 2) **Top Rake.** This is the slope of the top face of the tool and is applied downwards and away from the cutting edge. The amount of top rake is DEPENDENT ON THE MATERIAL TO BE CUT and can range from zero to  $20^{\circ}$  or more.  
The included angle made by the clearance and the top rake is called the cutting angle.  
A range of preground tools for various types of operation is listed in our catalogue; alternatively, they may be ground from tool steel blanks which are normally available from tool stockists in various lengths and sizes. The correct size for Cowells machines is  $\frac{1}{4}$ " (6mm) square or smaller.

### Tool Sharpening.

High speed and carbon steel tool bits can be sharpened on a standard carborundum wheel. Take care not to burn the tool, especially at the tip, by prolonged grinding without cooling. Tipped tools are ground on a 'green grit' wheel especially made for this purpose.

### Safety Note.

- 1) Use only a proprietary manufactured grinder. Do not 'lash up' your own. Excessive wheel speeds can be lethal.
- 2) All grinding should be carried out on the FRONT of the wheel. NEVER use the sides.
- 3) Wear protective goggles at all times.

### Tool Setting.

The cutting edge of the tool must be set exactly at the centre height of the lathe using shims

if necessary to achieve the correct height and must be firmly clamped with a minimum overhang to prevent deflection due to the cutting load. The position of the tool relative to the lathe axis is dependent on the type of tool to be used and the work to be done. Normally the tool is fixed at 90° to the lathe axis but this can be varied to suit particular requirements, e.g. when facing.

### Speeds.

The cutting speed for a given material is the speed at which the surface being cut passes the tool and is expressed in feet per minute. From this it can be seen that for a given material cutting speed, as the diameter increases the lathe speed (RPM) must be decreased and conversely as the diameter decreases the RPM must be increased.

In theory this requires an infinitely variable control of spindle speed without the loss of torque at low speeds. This is not normally available on small lathes which are generally provided with stepped speeds. In practice therefore it is necessary to compromise and select the nearest speed (preferably lower) to the ideal speed and generally speeds can be described as 'slow', 'medium' or 'fast', some variation being allowable around these terms because of the relationship between the type of material and its diameter. When in doubt start with a low speed and work up.

### Applications.

#### **Cast Iron.**

- 1) Slow Speed.
- 2) No top rake on tool (preferably use a tungsten carbide tipped tool).
- 3) Do not use a cutting lubricant.

#### **Mild Steel.**

- 1) Medium speeds.
- 2) Medium to large top rake on tool.
- 3) Use cutting lubricant.

#### **Brass.**

- 1) High speeds.
- 2) No top rake on tool.
- 3) Do not use cutting lubricant.

#### **Bronze.**

- 1) Medium to high speeds.
- 2) Top rake on tool, depending on copper content.
- 3) Cutting lubricant may be required depending on copper content.

#### **Light Alloys.**

- 1) High speeds.
- 2) Large top rake on tool.
- 3) Use paraffin as cutting lubricant.

#### **Castings.**

All castings have a hard skin and it is recommended that the first cuts are made with a tipped tool at a slow speed. When the skin has been removed normal speeds and tools for the material can be applied.

#### **General Notes on Turning.**

- 1) Feed the tool along the work smoothly using both hands. Variations in feed will be evident as rings around the work.

**2) Use the appropriate cutting lubricant wherever possible. This will produce a better finish and prolong the tool life.**

**3) Wherever possible avoid using sharp pointed tools for turning and facing, the point disappears very quickly giving a rough finish to the work. A tool with a small radius has a longer life and produces a better finish.**

**4) Chatter.** This is a phenomenon which occurs in machines and is a function of their natural resonance. There will be no doubt when it occurs. There will be significant vibration accompanied by noise and the surface of the work will be very rough almost to the extent of having 'flats' on it. Once chatter has started on a workpiece it is extremely difficult to overcome.

The normal cause of chatter and points to check are:-

**1) Too much overhang on the work or tool (or both).**

**2) Too high a speed.**

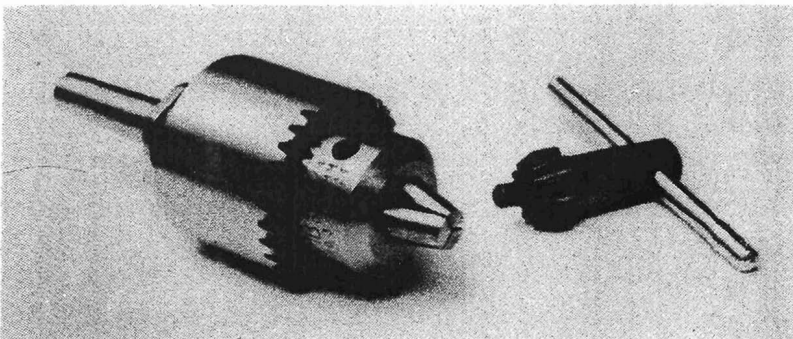
**3) Too much of the tool edge in contact with the work.**

**4) Work not clamped securely.**

Chatter is much more easily overcome by checking the possible existence of these causes BEFORE starting machining.

### Other Machining Operations.

#### Drilling:



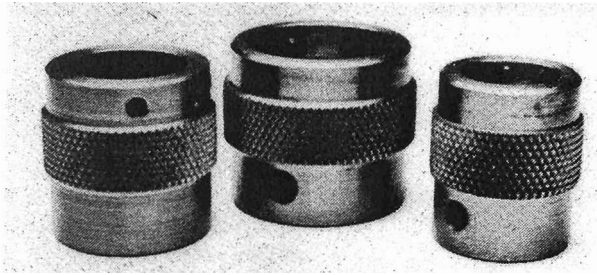
**1/4" Drill Chuck and Key**

Drilling (along the axis of the lathe) can be carried out in three ways using a drill chuck mounted on a suitable arbor (see accessory list).

The normal method is to fit the drill chuck in the tailstock whilst the work is held in a chuck etc. and rotated; the tailstock feedscrew or lever being used to feed in the drill. Alternatively the drill chuck can be held in the headstock and rotated whilst the work is clamped to the cross slide, the lead screw being used BY HAND to feed the work. This technique can also be used with a tailstock drilling pad where the work is held against a pad (plain or vee) fitted in the tailstock; the feed being imparted by the tailstock feedscrew or lever.

When drilling always start the hole with a centre drill and, during drilling, withdraw the drill partially from time to time to clear the swarf. Large diameter holes may need 'piloting' that is, drilling a small hole first and then following with the larger drill.

## Thread Cutting.



### **Die Holders**

#### Button Dies.

Button Dies are used extensively to cut external threads. They are used on the Lathe in a holder which consists of a body which is bored through to a sliding fit on the tailstock barrel; the end of the body being recessed to take standard button dies. The holders are available in the sizes (Cat. No. 10-226, 10-227, 10-228) to accept dies of 13/16", 1" and 1 5/16" dia:

To use:-

- 1) Fit the die in the dieholder recess, securing it with the 3 screws fitted to the holder. Note that the centre screw engages the split in the die and is used to set the thread diameter by varying the gap.
  - 2) Extend the tailstock barrel 20-25mm and slide the dieholder onto the barrel.
  - 3) Feed the dieholder to the work, rotating the spindle BY HAND to cut the thread. Use a cutting lubricant. When threading in this way it is essential to break off the swarf chips by rotating a fraction of a turn back for each full turn forward.
- After completing the cutting remove the die by rotating the spindle BY HAND in the reverse direction. DO NOT drive the die off under power.

#### Tapping.

Holes can be threaded by using the appropriate tap held in a drill chuck fitted to the tailstock. As with dies, the complete operation is carried out by hand, again rotating back a fraction for each turn to break off the swarf chips.

Note that when tapping, the tailstock is left free to slide along the lathe bed. Feeding is by hand pressure only behind the tailstock.

#### Screwcutting (90 Lathe only).

Both external and internal threads can be cut using a single point tool as briefly described in the section on Auto Traverse and Clutch. However, although this is a simple process in principle it should be regarded as a more advanced turning skill and is therefore considered to be outside the scope of these notes.

The user's attention is now directed to the 'Cowells 90 Lathe Handbook' which deals in depth with this subject and the further application of specialised accessories and techniques.

## SECTION 4.

### TURNING EXERCISE

For the purpose of the exercise assume that a piece of 19mm ( $\frac{3}{4}$ " ) Dia. mild steel bar, 25mm ( 1 " ) long, must have its diameter reduced to  $\frac{1}{2}$  " at one end for a length of 10 mm., the turned diameter.

**Procedure.**

1. Fit the 4 jaw chuck to the lathe - set the bar in the chuck with  $\frac{1}{2}$ " projecting outside the jaws - adjust the jaws so that the work runs true, using the technique outlined in the description of the 4 jaw chuck.
2. Fit a side turning tool similar to (No.7. from set No. 10-230A or No.4. from set No. 10-230) in the tool holder slot nearest the chuck so that the cutting edge is exactly at the lathe centre height and at  $90^{\circ}$  to the lathe axis using shims if necessary to obtain the correct height setting. Clamp the tool securely.
3. Select the lowest of the ungeared speeds (280 r.p.m.), that is, the drive belt must be on the largest diameter pulley vee on the headstock spindle. DO NOT SWITCH ON.
4. Using the leadscrew and cross slide hand wheels, set the tool position so that it just touches the end of the work. Note the reading on the leadscrew dial. Using the cross slide hand wheel, move the tool back to clear the bar diameter and then towards the chuck, turning the leadscrew 10 FULL TURNS from the reading noted. Move the tool in until it just touches the bar and turn the spindle BY HAND one revolution. You will now have a line scribed around the bar exactly 10mm from the end; this can be used as a guide to the finished length when turning.
5. Move the tool clear of the work back towards the end of the bar. Switch on. (Note that the direction of rotation is anticlockwise looking at the chuck jaws).
6. Move the tool in to just touch the bar and then move it to just clear the end. Note that from this point on the tool will only be moved INTO the work using the cross slide hand wheel, thus accounting for backlash, and that the cutting movement is obtained by use of the leadscrew handwheel.
7. Set the tool 0.25 mm ( $\frac{1}{4}$  turn) in and take one cut along the bar, stopping just short of the scribed line. Feed the tool slowly and evenly, using BOTH hands, when cutting. Move the tool back to the end of the bar and then take a second cut of 0.25 mm. Switch the machine OFF, and move the tool back to the end of the bar.  
Note that switching off before moving the tool stops any tendency to cut on the return movement. This practice should be followed at any measurement stage and when finishing.
8. Using a micrometer, measure the diameter of the turned length. Assuming that the diameter is  $\frac{3}{4}$ " (.750") and that you are using a 0-1" micrometer, the reading obtained should be .750" minus the material removed. 2 cuts of 0.25 mm (.020" total) will have reduced the diameter by 0.040", therefore the reading should be .710" approx.  
Let us say the reading is .710". Then, the amount of material still to be removed is .710" - .500" (the required diameter) = .219" but remember that the tool only has to be moved in by HALF the amount, therefore a further .105" has to be set on the cross slide handwheel to bring the bar to the finished size. This can be done by using say 4 cuts of .020" (.5 mm) = .080", followed by a check measurement, then a cut of .008" (.2 mm) followed by a check measurement. At this stage you will be close to the required diameter and a further reduced depth of cut can be made to leave a final cut of approximately .003".  
This finishing cut should be made as slowly and evenly as possible. Move the tool BACK from the work at the end of this cut and switch the machine off.  
Note that each cut should be 10 mm long, that is, to the leadscrew dial reading obtained when scribing the mark in 4 above.
9. The turning exercise is now complete and the turned portion will be  $\frac{1}{2}$ " diameter, 10 mm long and concentric with the  $\frac{3}{4}$ " diameter.

If you wished, you could now carry on and practise drilling and tapping on the same workpiece. If this is done without disturbing the bar in the chuck, the hole will also be concentric with the diameters.

The principles used throughout the exercise are the basis of all machining operations and can be applied to any work.

## Wheel and pinion cutter Mounting and maintainance

### **1, SECURING OF MOTORISED COUNTERSHAFT TO LATHE BASE:**

TWO M6 TAPPED HOLES ARE PROVIDED IN THE REAR SURFACE TABLE AREA OF THE LATHE BASE. THE TWO FIXING BOLTS ARE SUPPLIED. REMOVE THE KNURLED ADJUSTER, SPRING AND SEATING WASHERS FROM THE WHEEL AND PINION MOTOR MOUNTING PLATES. COUNTERBORED SLOTS WILL BE SEEN IN THE BOTTOM PLATE. THE UNIT MAY THEN BE BOLTED TO THE REAR SURFACE TABLE AREA IN THE DESIRED POSITION.

### **2, MOUNTING OF THE VERTICAL MILLING SLIDE:**

THE SLIDE SHOULD BE SECURED INTO THE TWO REAR MOST TEE SLOTS OF THE LATHE CROSSLIDE WITH ITS TABLE FACING THE LATHE HEADSTOCK. ENSURE CLEARANCE FOR ITS TABLE TO MOVE VERTICALLY.

TO ENSURE THAT THE TABLE IS SQUARE TO THE LATHE HEADSTOCK IT IS ADVISED THAT THIS BE 'CLOCKED' SQUARE USING A DIAL TEST INDICATOR.

### **3, MOUNTING OF THE MILLING SPINDLE HEAD:**

THE MILLING SPINDLE HEAD MAY BE MOUNTED IN A VARIETY OF POSITIONS UPON THE VERTICAL MILLING SLIDE DEPENDING ON THE WORK UNDERTAKEN.

ATTACH THE SPINDLE HEAD TO THE SLIDE BEFORE HOOKING UP THE TOOTHED BELT DRIVE. A LOCATING TENON IS PROVIDED ON THE MILLING HEAD BODY AND TWO M5 CAP HEAD SCREWS AND TEE NUTS TO SECURE IT IN PLACE.

IT WILL BE NOTED THAT THE CARTRIDGE HOLDING THE MILLING SPINDLE MAY BE REMOVED. THIS IS TO ALLOW THE MILLING HEAD BODY TO BE INVERTED AND THEREBY GAIN EXTRA HEIGHT ABOVE THE WORKPIECE. ONE M5 CAP HEAD SCREW LOCKS THE CARTRIDGE IN PLACE.

A LUBRICATION HOLE WILL BE SEEN IN THE CARTRIDGE BODY. FROM TIME TO TIME THE CARTRIDGE SHOULD BE REMOVED OR SLID BACK SO AS TO ALLOW A FEW PUMPS OF OIL. IT IS NOT POSSIBLE TO OVER OIL THIS CARTRIDGE, SO PUMP THE OIL CAN UNTIL OIL SEEPS FROM THE LUBRICATION HOLE..

### **4, TENSIONING AND POSITIONING OF THE TOOTH BELT DRIVE:**

THE TOOTHED DRIVE BELT BETWEEN MILLING HEAD AND MOTORISED LAYSHAFT SHOULD BE TENSIONED VIA THE KNURLED SPRING ADJUSTER. DO NOT BE TEMPTED TO OVERTIGHTEN THIS ADJUSTER AS UNDUE TENSION WILL BE EXERTED ON THE LATHE SLIDWAYS MAKING THEM STIFF TO OPERATE. IT IS ONLY NECESSARY TO TIGHTEN UNTIL ANY TENDENCY TO BOUNCE IS ELIMINATED. CORRECT TENSIONING WILL SOON BECOME APPARENT WITH USE.

THE TOOTHED BELT DRIVE SHOULD RUN IN A VERTICAL POSITION AUTOMATICALLY; BUT IT MAY BE NECESSARY TO MOVE THE BOTTOM PULLEY (**WITH MOTOR STATIONARY**) INTO THE CORRECT POSITION.

## **5, TENSIONING OF THE VEE BELT DRIVE**

THE VEE BELT DRIVE BETWEEN 3 STEP MOTOR PULLEY AND LAYSHAFT PULLEY MAY AFTER SOME TIME REQUIRE ADJUSTMENT.

IT WILL BE NOTED THAT THE MOTOR HAS A MOUNTING CRADLE WITH 4 X M5 HEX. BOLTS. THE CRADLE ITSELF HAS TWO RUBBER MOUNTS BENEATH IT. IT IS POSSIBLE TO FINE TUNE THE ADJUSTMENT OF THE BELT BY TIGHTENING OR LOOSENING THE HEX. BOLTS.

SHOULD THIS PROVE INSUFFICIENT, IT WILL BE NECESSARY TO MOVE THE MOTOR BACK.

## **6, SLOW SPEED MOTOR PULLEY**

PULLEYS ARE SECURED TO THE END OF THE MILLING SPINDLE VIA TWO GRUB SCREWS AT 120 DEGREES APART. THE MILLING SPINDLE IS HARDENED THROUGHOUT SO NO DAMAGE TO THE SPINDLE CAN OCCUR.

## **7, MILLING SPINDLE BEARING ADJUSTMENT**

IF END FLOAT CAN BE DETECTED BETWEEN THE MILLING SPINDLE AND ITS BEARINGS, IT WILL BE NECESSARY TO ADJUST THE SPLIT NUT ADJUSTER. DO NOT OVERTIGHTEN THE SPLIT NUT ADJUSTER; THE SPINDLE SHOULD REVOLVE FREELY WITHOUT END PLAY. UNHOOK THE TOOTHED DRIVE BELT TO VERIFY THIS.

## **8, FITTING THE DIVISION PLATE, DETENT AND ADAPTOR TO THE 90ME LATHE.**

TO FIT THE ABOVE ON THE 90ME LATHE IT WILL BE NECESSARY TO REMOVE THE LATHE'S GEAR TRAIN.

1. REMOVE THE COLLAR HOLDING ON THE LARGE 64 TOOTH GEAR AT THE BOTTOM OF THE TRAIN.

2. SLACKEN THE M5 CAP HEAD SCREW OF THE GEAR CARRIER PLATE WITHDRAW THE 64 TOOTH GEAR ALONG WITH THE COMPLETE GEAR TRAIN. NOTE THAT IT IS NOT NECESSARY TO DISTURB THE SETTINGS OF THE TWO DOUBLE GEARS ON THE TRAIN.

3. REMOVE THE KNURLED LOCKNUT FROM THE LATHE HEADSTOCK SPINDLE, 20 TOOTH GEAR (**BE CAREFUL NOT TO LOOSE THE TINY KEY BENEATH THE 20 TOOTH GEAR**), AND THE ROUND BEARING ADJUSTER NUT. **DO NOT REMOVE THE 64 TOOTH SPINDLE GEAR, IT IS NOT NECESSARY TO DISTURB ITS SETTING.**

4. THE DIVISION PLATE ADAPTOR WILL NOW SCREW INTO PLACE. IT CAN THEN BE LOCKED IN PLACE VIA THE GRUB SCREW, BENEATH WHICH IS A BRASS PAD SO AS NOT TO DAMAGE THE SPINDLE THREAD.

5. THE DETENT MECHANISM MOUNTS IN THE SAME MANNER AS THE GEAR TRAIN PLATE.

## **9, LUBRICATION**

THE LAYSHAFT SPINDLE RUNS IN OILITE BUSHES IMPREGNATED WITH OIL. HOWEVER, IT IS ADVISABLE TO LET A LITTLE OIL INTO THESE BUSHES FROM TIME TO TIME. NO OILERS ARE PROVIDED, BUT THE OIL WILL INGRESS IF THE ENDS OF THE LAYSHAFT ARE LUBRICATED.

ALWAYS KEEP THE LUBRICATION HOLE ON THE MILLING SPINDLE CARTRIDGE IN THE UPRIGHT POSITION SO AS TO PREVENT DRAINAGE.

**10, FITTING THE DIVISION PLATE AND DETENT PLUNGER TO THE 90CW LATHE.**

IT WILL BE NOTED THAT TWO M5 THREADED DIAGONALLY OPPOSED HOLES ARE SITUATED IN THE HEADSTOCK END OF THE LATHE'S BED. THESE HOLES MARRY TO THE DETENT PLUNGER MOUNTING PLATE. SECURE THE PLATE IN POSITION WITH THE TWO M5 COUNTERSINK SCREWS PROVIDED.

**TO FIT THE DIVISION PLATE AND ITS ADAPTOR TO THE LATHE HEADSTOCK SPINDLE.**

REMOVE THE ALUMINIUM END CAP FROM THE END OF THE LATHE'S HEADSTOCK SPINDLE.

IT IS THEN NECESSARY TO REMOVE THE SPLIT SPINDLE ADJUSTER NUT. THIS CAN BE ACHIEVED BY CAREFULLY SPLAYING THE NUT WITH A SMALL DRIFT.(A SMALL SCREWDRIVER WILL SUFFICE IF A DRIFT IS NOT TO HAND).

THE DIVISION PLATE AND ITS ADAPTOR MAY THEN BE SCREWED ON TO THE FINE THREAD IN PLACE OF THE SPLIT ADJUSTER.

SCREW ON THE PLATE AND ATTACHED ADAPTOR UNTIL IT GENTLY BUTTS AGAINST THE BACKFACE OF THE BEARING CONE.

TWO M6 SCREWS WILL BE NOTED IN THE ADAPTOR AT 120 DEGREES APART. BENEATH THESE SCREWS ARE BRASS PADS;THIS IS TO ENSURE THAT NO DAMAGE CAN OCCUR TO THE FINE THREADS OF THE LATHE SPINDLE.

THE CORRECT TENSION IS ACHIEVED WHEN THE LATHE SPINDLE ROTATES FREELY WITH NO END PLAY IN THE LATHE SPINDLE.

SECURE BOTH M6 GRUB SCREWS.

**NEVER USE THE LATHE UNDER POWER WITH THE DIVISION PLATE AND ADAPTOR ATTACHED.**

**NOTES:**

**DETENT MECHANISM FOR THE 90ME LATHE:-**

**THE SPACER(16mm dia. Tapped M6 and M5) BETWEEN THE SLOTTED PLATE (substitutes for the gear train plate) AND THE DETENT ARM (carries the detent plunger) HAS BEEN DELIBERATELY MADE OVER LENGTH. THIS IS BECAUSE THERE MAY BE A VARIATION IN HEADSTOCK CONFIGURATION FROM MACHINE TO MACHINE.**

**THE IDEAL LENGTH FOR THE SPACER WILL BECOME APPARENT ONCE THE DIVISION PLATE AND DETENT MECHANISM HAVE BEEN MOUNTED ON YOUR LATHE.**

**THE SPACER CAN BE REDUCED TO THE REQUIRED LENGTH ON YOUR LATHE- IT IS RECOMMENDED THAT AN EQUAL AMOUNT BE MACHINED FROM EACH END OF THE SPACER.**

**COWELLS WILL BE HAPPY TO CARRY OUT THIS WORK (without charge) SHOULD YOU NOT WISH TO DO THIS ON YOUR LATHE.**

**IN THIS CASE,PLEASE ADVISE US OF THE EXACT OVERALL LENGTH REQUIRED.**