

# AUTOOL

Automatic Grinding Machine & Eng. Co. Ltd.,  
PADIHAM ROAD, SABDEN, BLACKBURN, LANCs. BB6 9EW  
ENGLAND.

Tel. 0282 (Padiham) 771838/73821

Cables : AUTOGRIND, PADIHAM.

## AUTOOL GRINDER MODEL PR2

### Installation and Operating Instructions

### Parts Identification

'AUTOOL' PROFILE GRINDER MODEL PR/2Technical Specification

Grinding Wheel diameter	230 mm. ( 9 ins)
Grinding Wheel width	5 mm.
Grinding Wheel bore	1¼ ins.
Output of Grinding Wheel Motors	1 hp. standard 1½ hp. on request.
Maximum length of cutterhead	12 ins.
Maximum diameter of cutting circle	14½ ins. (standard)
Output of coolant pump motor	0.18 hp.
Coolant tank capacity	40 litres
Overall height	1600 mm.
Working width	1450 mm.
Working depth	1100 mm.
Electrical supply required.	220-580 volts 1 phase 50/60 Hz. (Standard)
Control voltage	110 volts

ATTENTION - Safety Precautions

Note the various safety points given below and in the text and observe them when operating the machine.

Isolate the machine before touching or changing a wheel and when setting up.

Carefully follow the safety instructions when changing a wheel. After switching the machine off wait until the wheel comes to rest before making any adjustment.

Rest the carriage in the rear position when setting up, changing over a cutterhead, shifting a knife or holder and when dressing the wheel.

Gently lower the cutterhead assembly onto the machine. DO NOT DROP. These cutters cut, watch your hands and fingers and keep them out of the way.

Do not fully tighten either a knife or a holder, nor loosen them from fully tight whilst the cutterhead is on the grinder. Fully tighten knives and holders immediately after removal from the grinder.

When in the area and using the machine wear suitably approved goggles or a visor.

Never run a grinding head without all the guards in place.

Check the wheel for clearance and the guards for security before starting up.

Grind wet, but do not run coolant against a stationary wheel.

Note that the wheel is of vitrified bond which by its nature is hard and brittle. Because of this, and its thickness, exercise caution when applying side pressure.

Read and follow the instructions given in this manual, and work in accordance with good safety and operational practices.

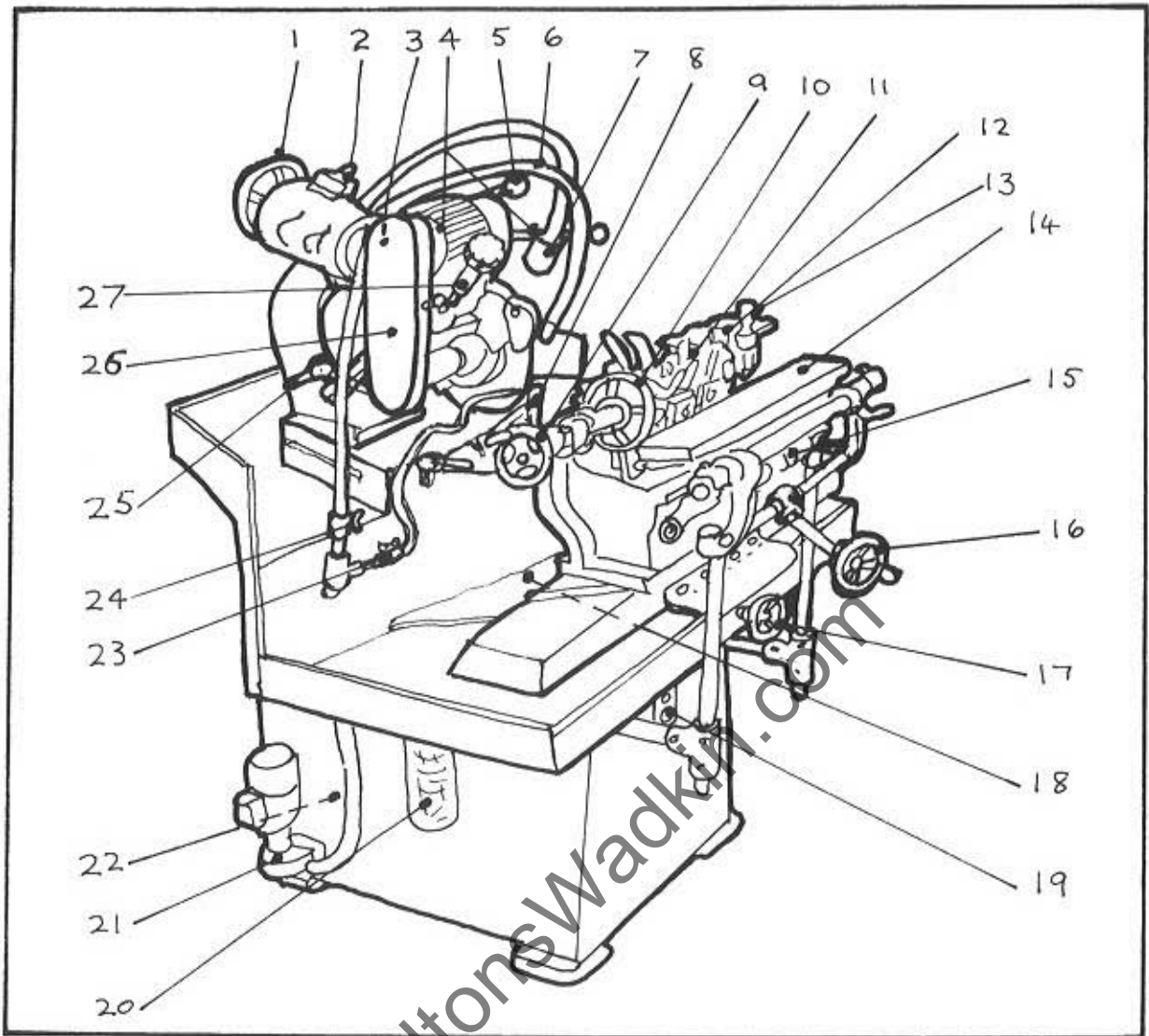


FIG.1

1. Handwheel for fine forward movement of grinding head
2. Spotlight switch
3. Lock for 1 and for swivel movement of grinding head
4. Locating lever for swivel movement
5. Lever for swivel movement
6. Upper coolant pipe
7. Spotlight
8. Knife support
9. Handwheel for left-hand adjustable centre
10. Handwheel used to rotate cutterhead when grinding to maintain contact between knife and support.
11. Cutterhead
12. Template holder
13. Handle for controlling movement of carriage
14. Elbow rest
15. Sample turning
16. Handwheel for adjusting rest position of carriage
17. Handwheel for positioning carriage.
18. Lockscrews for 17.
19. Control push buttons.
20. Coolant filter - wash out regularly, unscrew to remove.
21. Coolant pump
22. Coolant tank - access from rear
23. Control tap for lower coolant jet
24. Control tap for upper coolant jet
25. Lock for 27.
26. Swing away cover for two-speed drive.
27. Handwheel for adjusting clearance

## INTRODUCTION

The machine has been designed primarily for grinding hexagon cylinder heads as used on manual and automatic shaping lathes. By using a template shaped to the reverse of the turning profile required, the knives are accurately formed to the correct profile each time they are ground - without reliance on the traditional grinding skills. Accuracy and repeatability of profile is guaranteed regardless of the shear and cutting angles of the knives and of the style and pattern of the head being used.

By grinding knives 'in situ' on the head to be used, knife setting is eliminated and, in fact, greater accuracy of one knife profile to the next is possible than with conventional grinding and setting.

The front and side clearance angles are variable and, once set, remain correct for all shear and cutting angles of knives in any set-up.

In emphasizing that less skill is required to profile grind using this machine, it would be imprudent to employ an operator without previous grinding knowledge or skills. The use of this machine, of course, still requires the traditional skills in knife and holder selection and fitting, but the accuracy with which it can form complex profiles, and the special features it embodies, in many cases facilitate simplification of knife set-ups by allowing knives to complete more than one section of turning.

## INSTALLATION

When the machine is to be installed on a 6 in. thick solid concrete floor no special foundations are required. But 4" square holes for rag bolts as shown on the foundation plan. A good wooden floor is also suitable, and coach screws may be used.

### Lifting the Machine

Two lifting eyes are provided at the rear of the machine and slings should pass around the machine base and to the inside of the support rest arms at the front.

Remove the temporary supports locking the movements in place and secure the work table in position if supplied separate (locating studs provide accurate alignment).

### Fitting the Machine

Carefully level the machine, using jack screws in the tapped holes provided, placing a level on the arbor and on the stylus vee-ways. Grout the machine in position with liquid cement. After allowing time for the grout to set completely, tighten the bolts and again check for level.

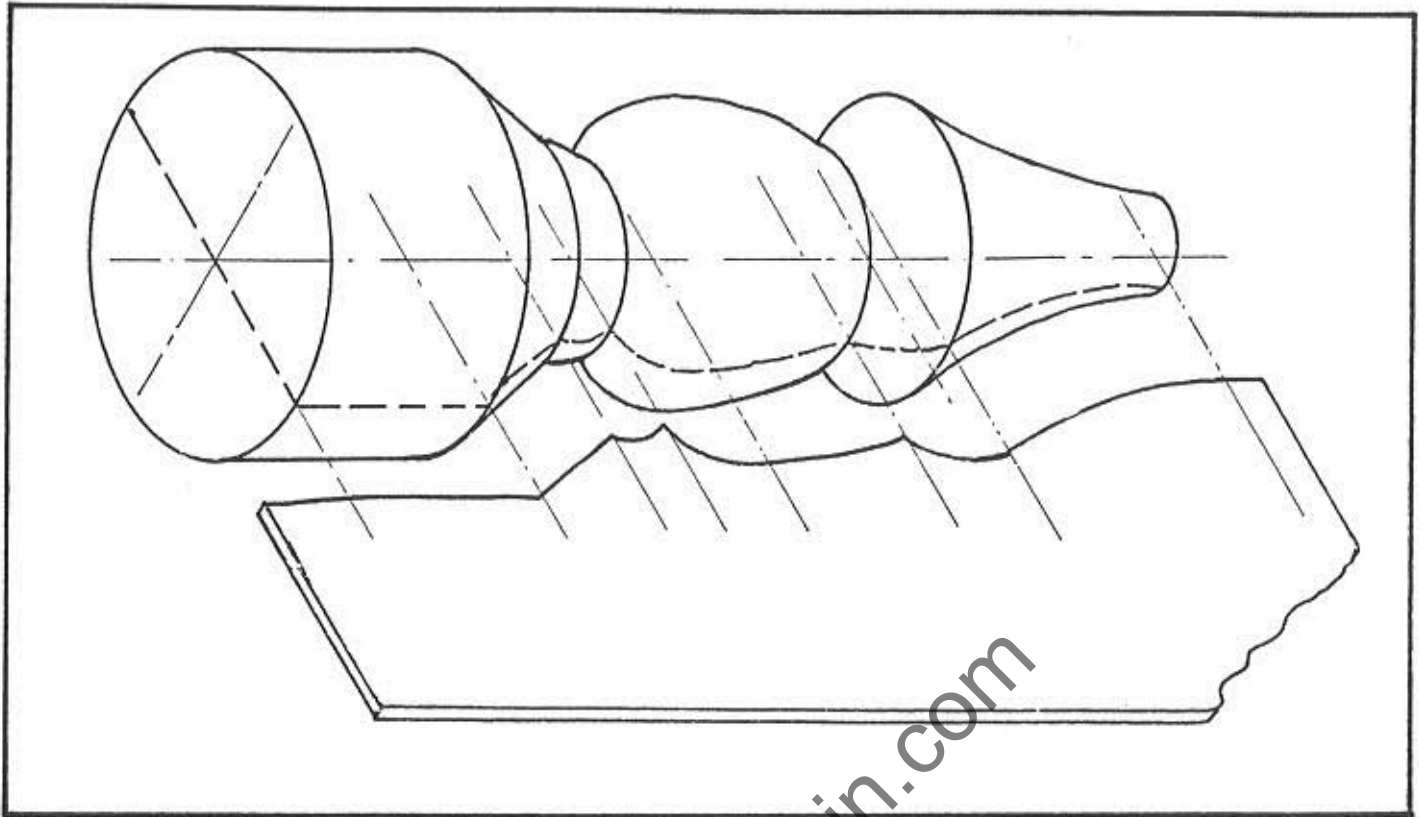
## Electrical Details

The electrical cabling between motors and control gear is completed before the machine is despatched, together with a short lead from the isolator for connection to the factory supply via a junction box or an approved 3 phase plug and socket.

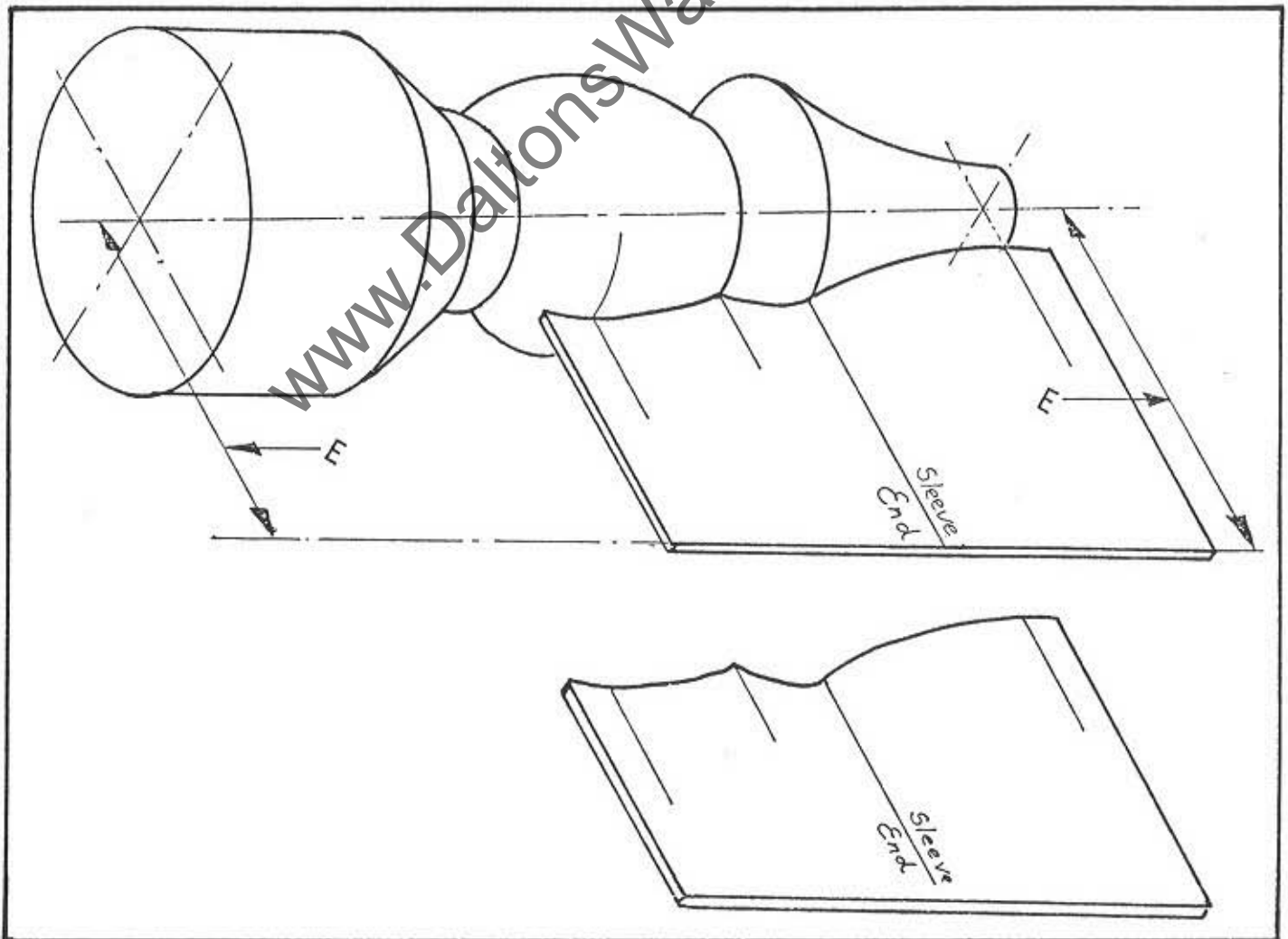
The colour codings are:-

Either    3 cables brown - live (hot)  
              1 cable Green/Yellow - Earth (ground)

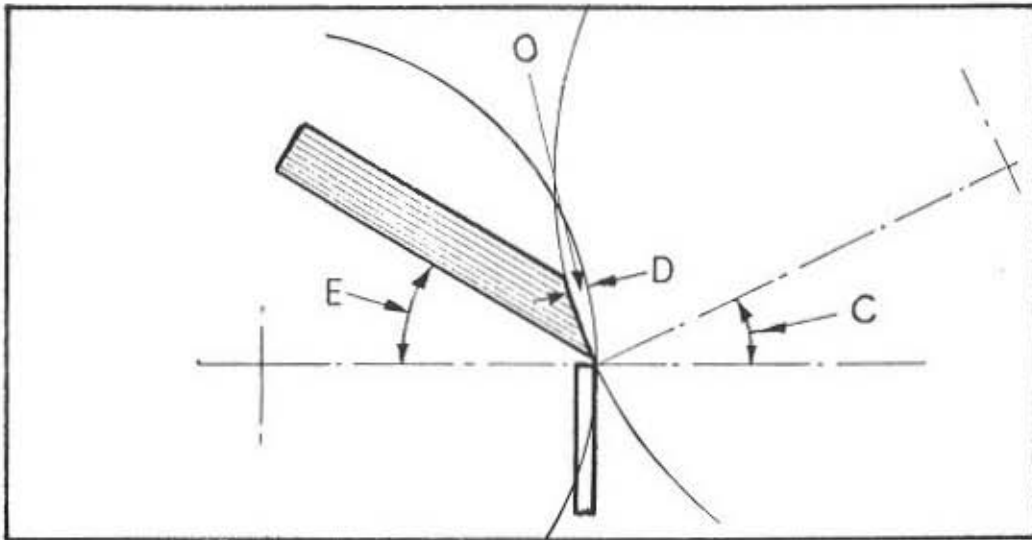
Or            1 cable Red        - live (hot)  
                  1 cable Yellow - live (hot)  
                  1 cable Blue     - live (hot)  
                  1 cable Green/Yellow - earth (ground)



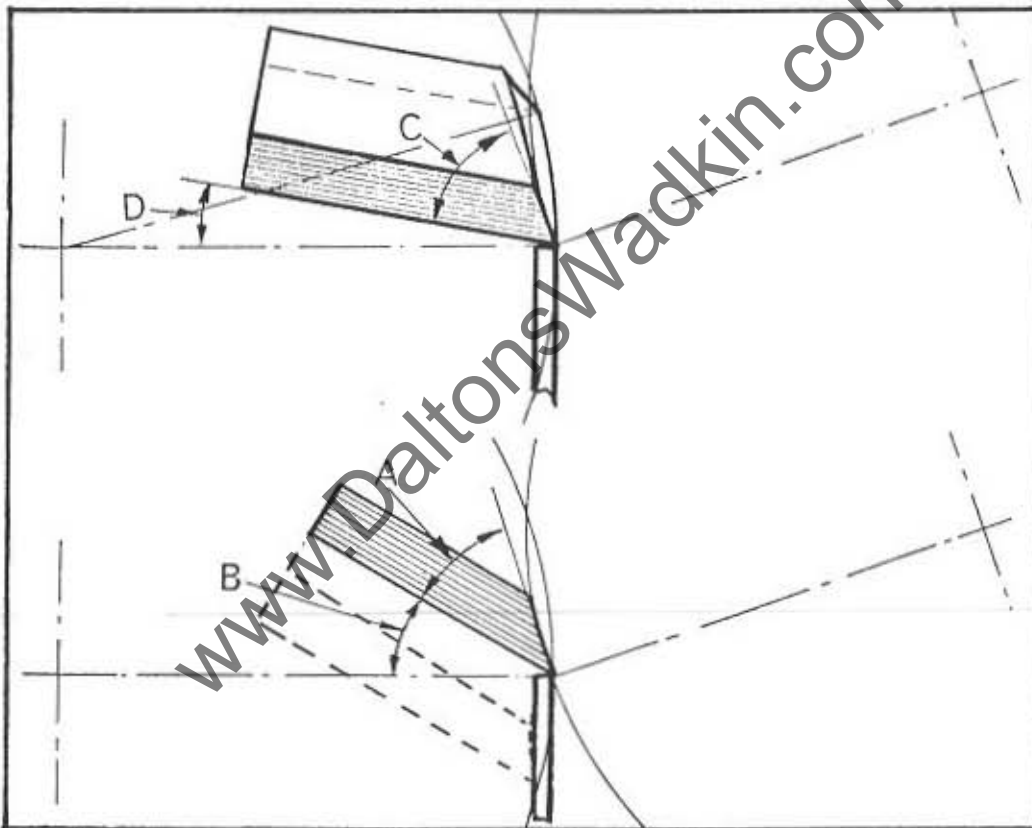
**FIG.2.** Fit of template to sample.



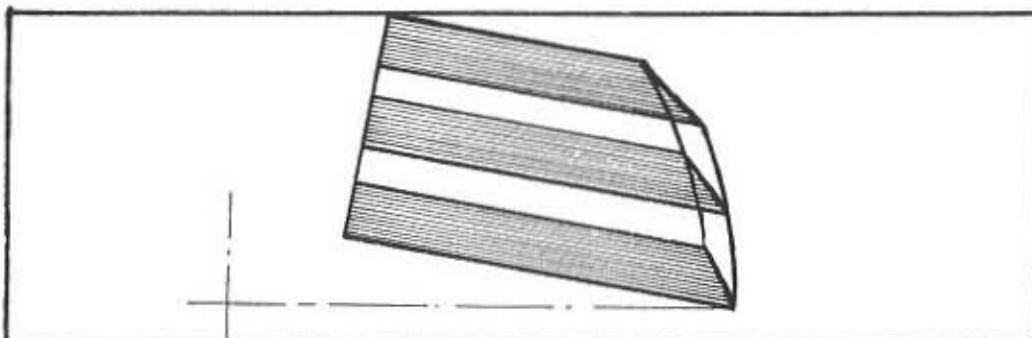
**FIG.3.** Mark the template for cylinder end and positions of holders and knives.



**FIG.4.** Clearance 'C' remains constant regardless of cutting and shear angles.



**FIG.5.** The grinding angle A & C vary according to cutting angles B & D.



**FIG.6.** Grinding angles vary across a shear-cut knife.



Check that the cabling and fuses to the main distribution board correspond to the details on the machine electrical plate.

It is important that the grinding wheel grinds in a downward direction, i.e. clockwise rotation when viewed from the left hand side of the machine. If this is not the case, reverse any two connections of the live (hot) cables. The pump motor (21) is wired prior to despatch and should be correct when the correct direction of rotation has been established with the grinding wheel motor. However, check the rotation by noting the arrow cast on the impellor casing.

### SETTING THE GRINDER

#### Grinding Coolant

The coolant tank (22) should be filled with a coolant consisting of soluble oil and water. Add oil to the mixture as recommended, usually in the ratio of one part of soluble oil to 30 parts of water. Replace the coolant by a fresh mix every 2-4 weeks.

'AUTOOL' supply a suitable concentrated soluble but the following are also suitable:-

Shell-Mex and B.P.Ltd.	- Shell Dromus 10
Vacuum Oil Co.	- Solvac Clear

#### Fitting the Cutterhead

The cutterhead must be fitted to an arbor prior to mounting on the machine. The arbor and type of fitting varies according to the types of head to be mounted.

#### Shaping Lathe Cutterheads

Pairs of short bushes are provided to correspond to the size of the shaping lathe arbor (one pair is provided for each size of arbor used). Lock these on the grinding machine arbor, as needed, to support the ends of the head in the required position. (Note the marks on the arbor indicating the maximum traverse positions of the table). Insert the arbor and bushes into the cutterhead and temporarily lock in place using the securing screws on the latter.

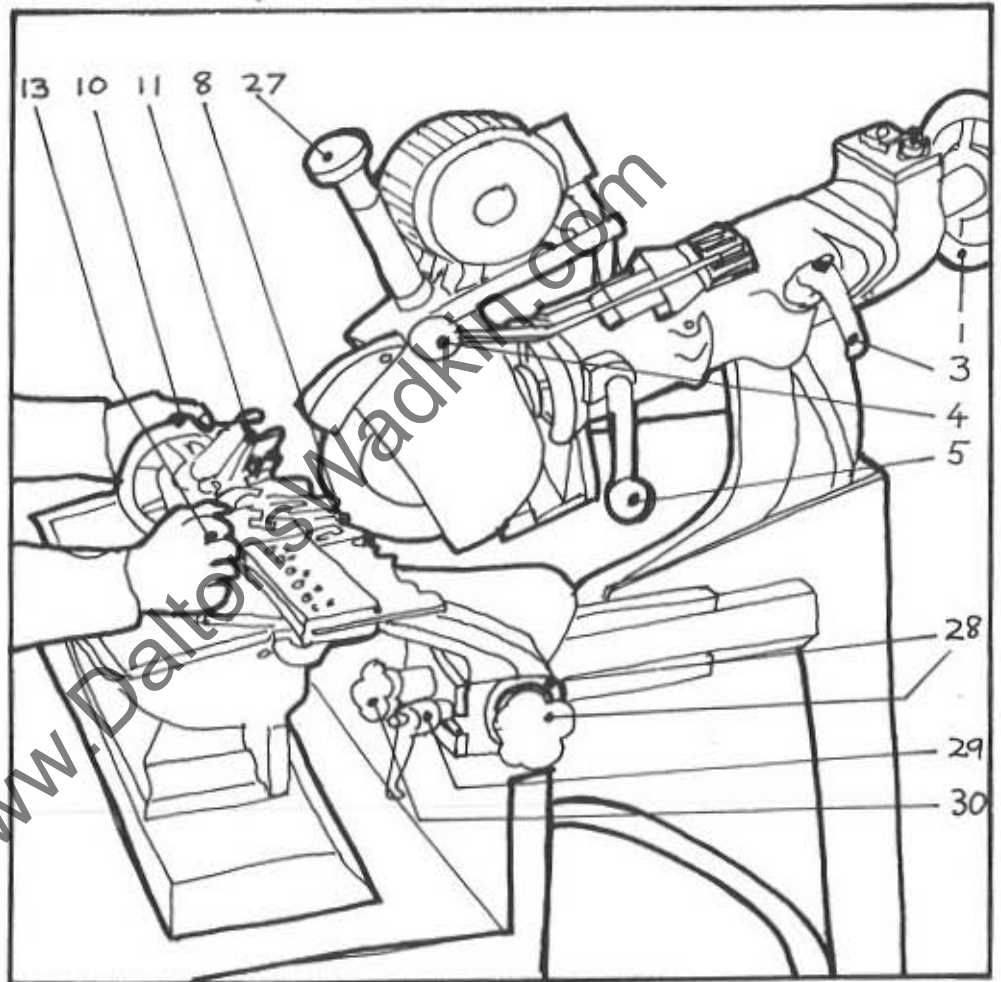
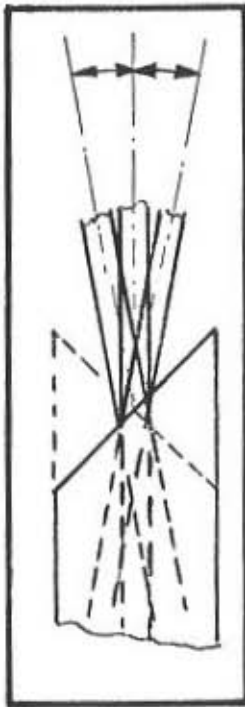
#### Moulder and Shaper Cutterheads

Select the appropriate arbor and bushes required and lock the head to the arbor, generally in a similar manner to that used on the parent machine. Use the spacing collar and end nuts to position and/or secure the cutterheads as required.

#### Fitting the Arbor

Smear a little grease into the centres of the arbor and screw on the end collars (56) (if not already in use for locking the cutterhead in position). Gently place the arbor unit on the machine table so that the end collars rest in the supports adjacent to the centres (57) See Fig.21. DO NOT DROP THE ARBOR INTO THE SUPPORTS. Screw in the lefthand centre (9) to grip the arbor sufficiently tight to take up any play whilst retaining a free rotary movement. Release screws (18) - under the rubber cover - and turn handwheel (17) until the cutterhead balances when in the grinding position. Lock screws (18)

**FIG.7** The effect of tilting the wheel to give clearance to right and left.



**FIG.8**

1. Handwheel for fine forward feed of grinding head
3. Lock for 1 and grinding wheel swivel movement
4. Locating lever for swivel movement of grinding head  
(locates with wheel vertical or tilted 5 or 10 degrees to right or left.
5. Swivel movement lever
8. Knife support
10. Handwheel for rotating cutterhead
11. Cutterhead
13. Handle for controlling movement of carriage.
28. Handwheel for slide adjustment of stylus.  
(indicating collar for 28, lock with zero mark opposite pointer when stylus has been positioned).
29. Lock for 28.
30. Handwheel for forward and backward movement of stylus.



### Template Preparation

The templates (49) used to guide the table during grinding can be made from sheet iron or steel of about 1/16" thick and should be accurately formed to the reverse of the turned profile required, i.e. so that the profile accurately fits the turning, see Fig. 2.

For turnings of above 10" in length the template is made in two or more sections each corresponding in length to one or more cylinder up to a combined length of 10", plus a suitable overlap where abutting any adjacent cylinder.

Template width should be not less than 2" at any point and the back edge must be parallel to the centreline of the turning when held against the latter. The distance is nominal, but must be common to all template sections forming a complete set. (See also notes on off-set centres under 'Operating the Grinder').

Carefully mark on each template the exact position of the cylinder ends and, for convenience, the position of the holders and knife-width coverages, see Fig. 3.

It is suggested that standing set-ups are reground initially before attempting new set-ups. This will allow special techniques to be perfected before attempting completely new work. During this time short-cuts in setting and the possibilities of using knives to cover more than one section of turning will become apparent - to the benefit of subsequent set-ups.

For more details see 'Operating Techniques'.

### GRINDING WHEEL ADJUSTMENTS

Both the main and side clearance angles are adjustable and should be set according to the nature of the work and the knife characteristics.

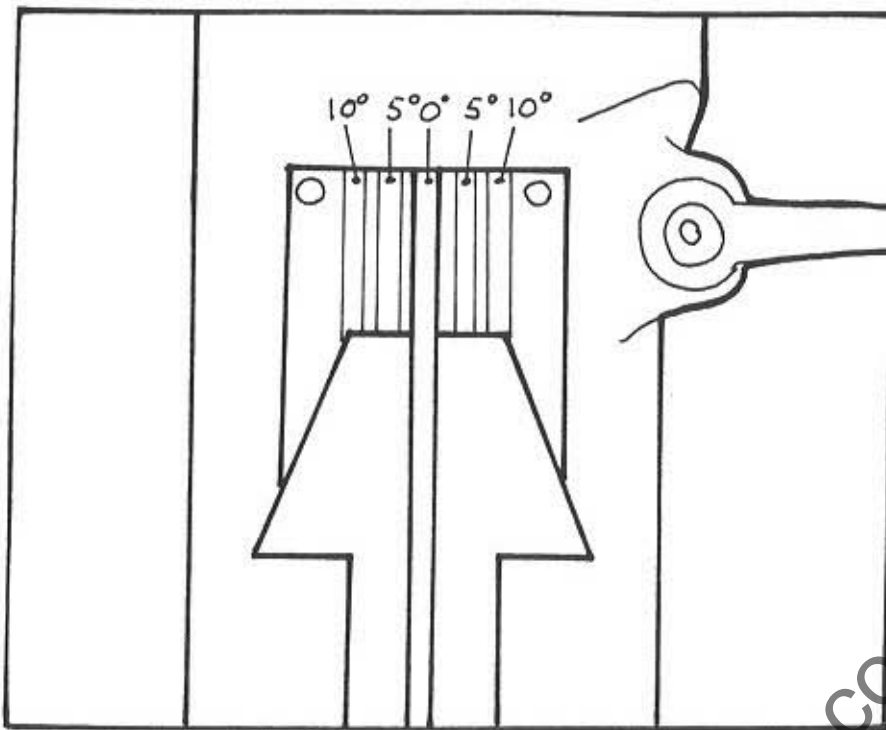
#### Main Clearance Angle

The main clearance angle is adjusted by handwheel (27) and the movement is locked by the lock lever (25). A scale indicates the height of the wheel above or below the tilting centre line. Adjustment of between 20° and 40° is possible.

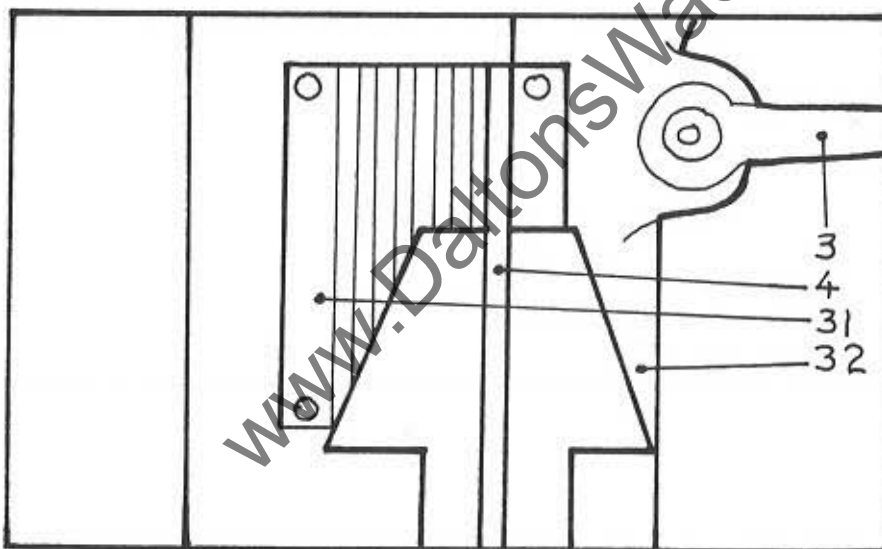
Unlike hand-ground cutters, the clearance angle remains consistent regardless of the shear or cutting angle of the knife, even though the ground angle on the knife varies between different knives and from edge to edge of each shear-cut knife. This gives a consistent clearance between the heel of the knife and the stock and does, in fact, considerably simplify grinding procedure, see Figs 4, 5 and 6.

For most work a clearance angle ('C', Fig.4) of  $27\frac{1}{2}^{\circ}$  suffices, and this is suggested as a starting figure. Below  $27\frac{1}{2}^{\circ}$  the cutting edge is stronger (as needed for hard timbers) but clearance is correspondingly less. Angles greater than  $27\frac{1}{2}^{\circ}$  are used only for very soft timbers, on larger diameter turnings or small diameter heads, to allow more honing between regrinds, or when subsequently grinding a secondary clearance angle. (0" on the scale is  $27\frac{1}{2}^{\circ}$  clearance angle).

Once set, the clearance angle needs no further adjustment for any individual set-up, and remains constant regardless of wheel wear.

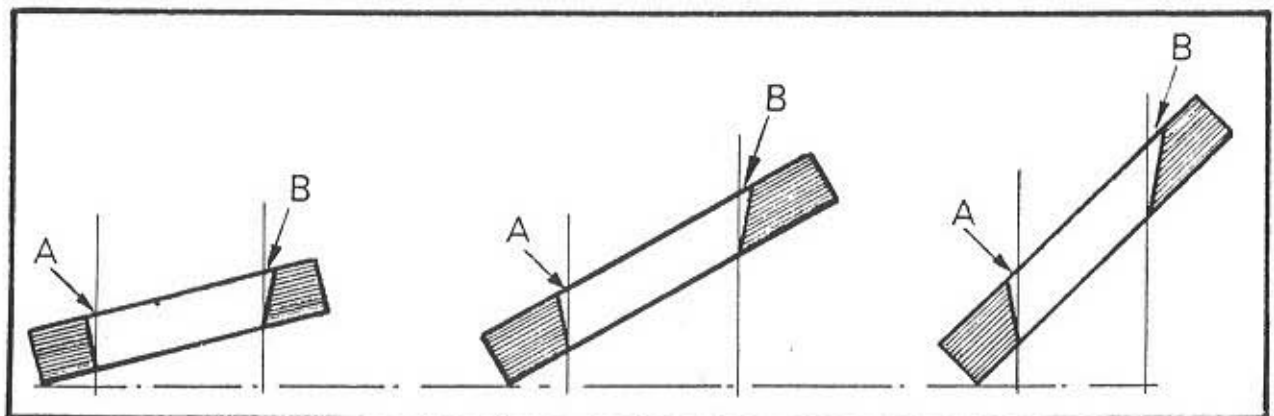


**FIG.9** Swivel locating lever in centre position giving vertical setting of grinding wheel.



- 3.Lock for swivel and forward feed movement of grinding wheel.
- 4.Swivel locating lever.
- 31.Swivel locating lever locator plate
- 32 Main grinding head support.

**FIG.10** Swivel locating lever in extreme right position giving 10° clearance of grinding wheel.



**FIG.11** Consistency of clearance angles A & B irrespective of varying shear angle.

### Side Clearance Angle

This can be set for either  $5^{\circ}$  or  $10^{\circ}$  clearance to right or left or to  $0^{\circ}$  (vertical) position, see Fig. 7.

The swivel movement is controlled by handlever (5) and locked by lever (3), see Figs. 8, 9 and 10. Lever (4) locates the head in the vertical position or to give  $5^{\circ}$  or  $10^{\circ}$  right or left side clearance. Depress the lever end to release the lock whilst applying downward pressure to lever (5) to balance the head assembly. Rotate the head to the required position, release lever (4) and lock by lever (3).

Normally  $5^{\circ}$  clearance will suffice for most work and this is suggested as an initial setting. By tilting the head, the grinding wheel grinds at  $5^{\circ}$  or  $10^{\circ}$  to the plane of rotation and gives a constant degree of clearance to all knives regardless of shear angle, see Fig. 11.

NOTE: No alteration of the main or side clearance angle is necessary when changing between left and right angled knives, or between knives of different shear angle seating.

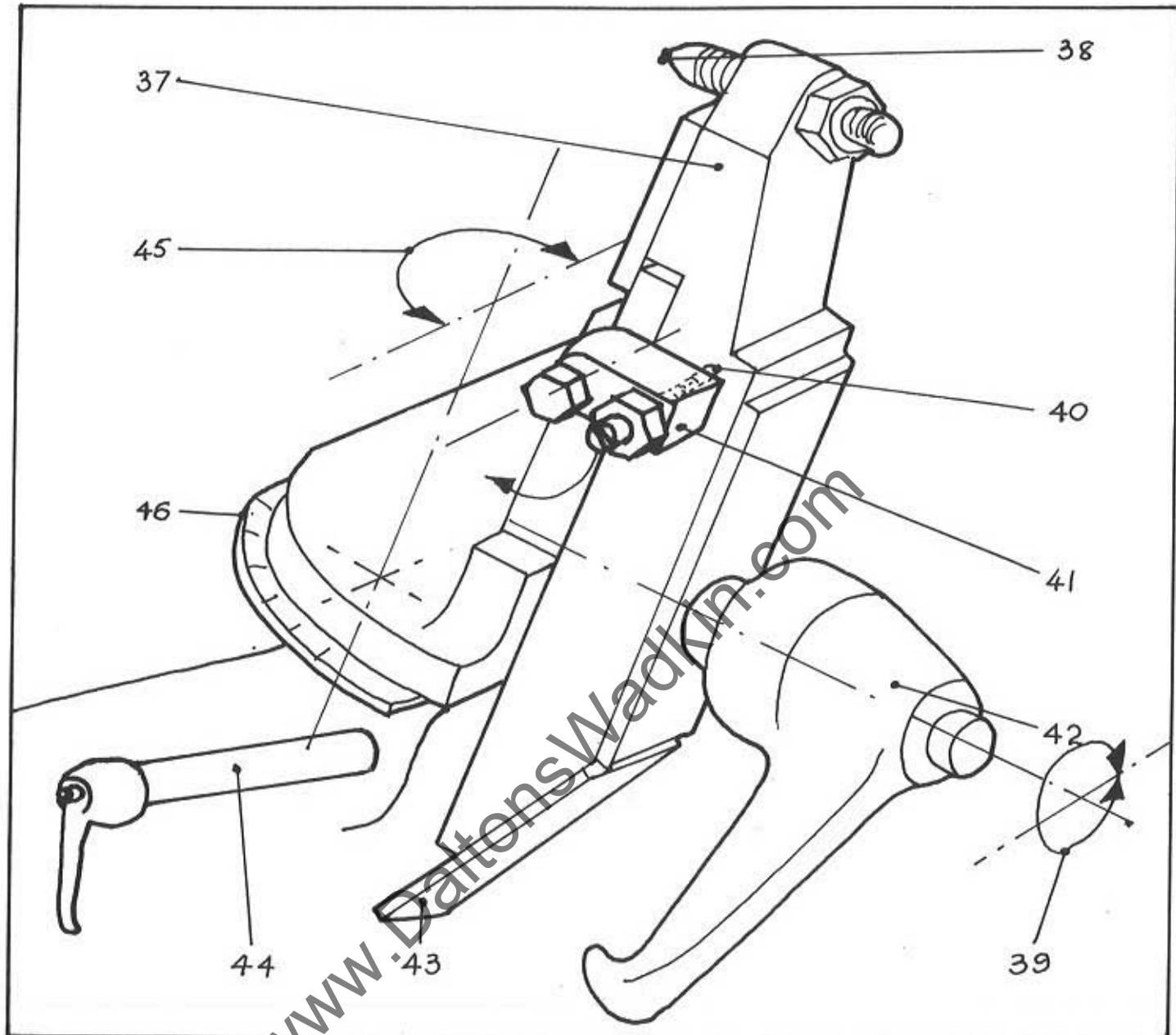
### MOUNTING THE WHEEL

Remove the guard side plate, nut and outer flange. Clean all mating faces. Check the wheel for soundness and, if correct, fit with a compressive sandwich washer between the wheel and each flange. Note the thread of the securing nut before tightening or slackening. Do not over-tighten when securing, and be sure to replace the side guard.

Check that the wheel is free to rotate before starting under power. Allow a new wheel to run free under power for a few minutes with all personnel standing well clear. Should a grinding wheel disintegrate whilst on the machine, check the spindle, flanges and guard thoroughly for damage before fitting a further wheel.

Take note of any safety regulations apparetaining to grinding wheel usage.

Dress the wheel before use.



**FIG.12** Adjustments of knife support and dresser, showing diamond dresser in position.

- 37. Knife Support Assembly.
- 38. Diamond Dresser.
- 39. Rotary movement of assembly to change from knife support to dresser and vice versa, also when dressing the wheel square, at an angle or to width.
- 40. Adjusting screw for alignment of 37 - see method of checking Fig.36 page 16.
- 41. Adjusting screw assembly - rotate downwards to allow knife support assembly to be rotated. Set horizontally to align assembly.
- 42. Lock for rotary movement 39.
- 43. Knife Support (interchangeable)
- 44. Lock for swivel movement 45
- 45. Swivel movement used when half-round dressing, or when setting dresser for square, angle or side dressing of grinding wheel.
- 46. Scale and indicator show swivel movement setting.

## STARTING AND STOPPING THE MACHINE

The controls are:-

In Control Box 19

Push button to start the motor.  
(note the safety precautions above).

Push button to start the lubricant pump.  
(do not run the pump with the wheel stationary)

Push button to stop both grinding head motor and pump. (Automatic lock-off, turn to release before starting motors).

Isolator (15) - (for safety reasons isolate the machine before setting up).

## DRESSING THE GRINDING WHEEL

Before grinding commences, and at intervals during the grinding sequence, dress the wheel to maintain its correct profile and position relative to the stylus, and to retain a clean cutting face, see Figs. 12 and 13.

The diamond dresser is mounted on the opposite end of assembly (37) to the knife support. To bring it into the operative position turn assembly (41) down to clear, release lever (42) and rotate the assembly until the diamond is uppermost. Turn assembly (41) to the horizontal position and rotate (37) until it abuts screw (40), then secure by lever (42). Abutt assembly (37) against screw (40) both when dressing to a half-round section and when using the knife support, and secure by lever (42).

**NOTE** Accurate abutment against screw (40) is absolutely essential when grinding shear-cut knives as failure to do this may result in inaccuracy of radial height of finished knives.

Periodically check the setting of adjusting screw (40) as described on Page 16.

The wheel can be dressed to a) a half-round, b) square-across or c) angled profile, but for most work a half-round section is used. Square-across and angled profiles are used for internal corners (although an overlapping knife technique can be used) or when grinding extra clearance on knives. See later notes on 'Operating Techniques'.

## Dressing to a half-round section (Fig.13)

Release securing screw (44) to allow the assembly (37) to swivel through 180° (45). Check that the diamond clears the wheel when the latter is turned by hand and the dresser swivelled through its full movement. If not, adjust as later described. With the wheel vertical and running, and with lock (3) released, feed the wheel towards the dresser, using handwheel (1), whilst swivelling the dresser left and right through the full 180° movement. Continue until the wheel is fully dressed, then lock (3) and stop the wheel. This action dresses the wheel to profile and to a zero position - which ensures accurate registration. Do not, therefore, re-set the wheel position in any way except as needed for side clearance grinding.

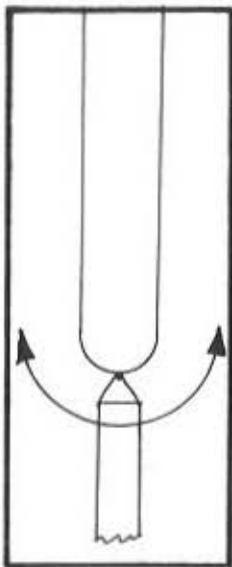


FIG. 13  
Half-round  
dressing.

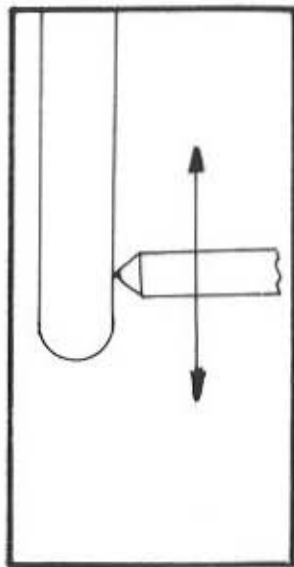


FIG 14  
Side  
Dressing

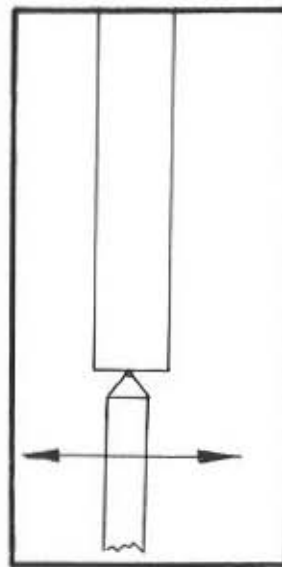


FIG 15  
Square  
Dressing

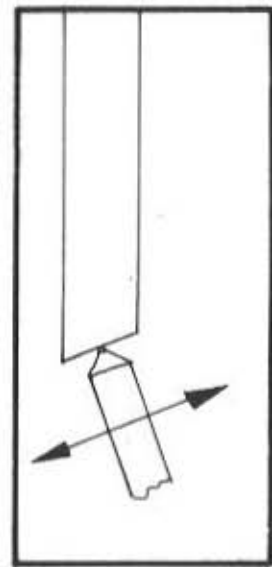


FIG.16.  
Angle  
Dressing

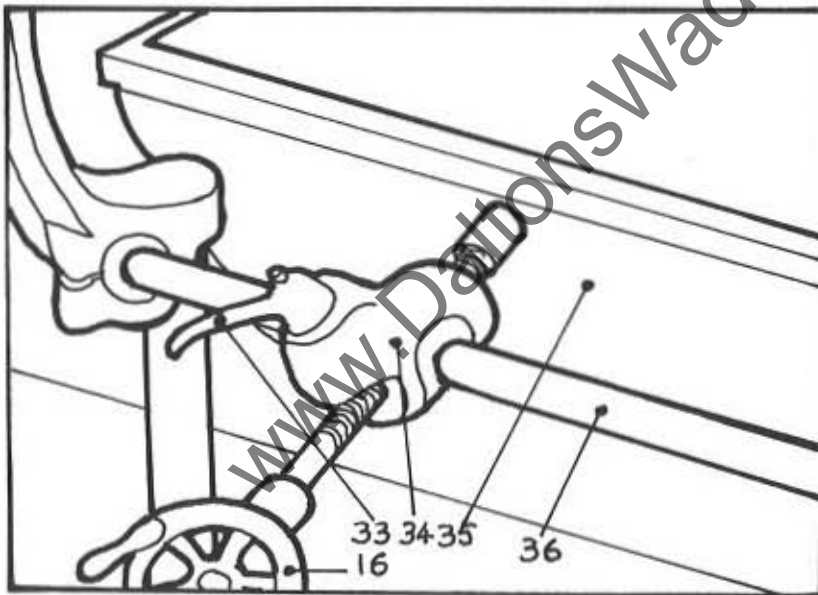


FIG 17

- 16. Handwheel for positioning carriage
  - a) when checking knives against pattern,
  - b) so that knives clear elbow rest when resting or,
  - c) so that knives are well clear of wheel when dressing wheel.
- 33. Handle lever for locking bracket 34 in position
- 34. Bracket for 16
- 35. Carriage
- 36. Tie shaft



Dressing over-thick wheels (Fig.14)

Wheels may vary in thickness and can be dressed true immediately after face dressing. Swivel the dresser to its extreme right hand position and lock screw (44). Release lever (42), and rotate the diamond clear of the wheel. With the wheel running, rotate the diamond across to dress the side of the wheel. Stop the wheel and repeat with the opposite side. This usually requires doing once with each wheel, thereafter face dress only.

Dressing to a square across or angled section (Figs.15 and 16)

Set the indicator against scale (46) to zero for square across or at the required angle, then lock screw (44). Release lever (42). Check the diamond and wheel for clearance and adjust if necessary. With the wheel running, rotate the dresser across the wheel until the latter is fully profiled.

After dressing, rotate the assembly until the knife support is uppermost, exactly central, and square to the arbor, then lock lever (42) and (44).

**NOTE:** The machine is primarily designed for use with half-round section wheels.. Wheels of any other section may foul the knife support necessitating a rearward adjustment of the grinding wheel before use.

KNIFE SUPPORTS

Knife supports (8) are provided for 36°, 45° and 55° shear angle holders. All are reversible for left or right hand shear. Clean mating faces before fitting and ensure that the support seats on the locating dowel before securing. The supports are jig bored for use with the special securing bolts provided. Use only these bolts.

Grind all knives of identical angle and hand of shear in sequence before changing the support. By dressing the wheel prior to final grinding, accurate alignment is assured regardless of the order in which knives are actually ground.

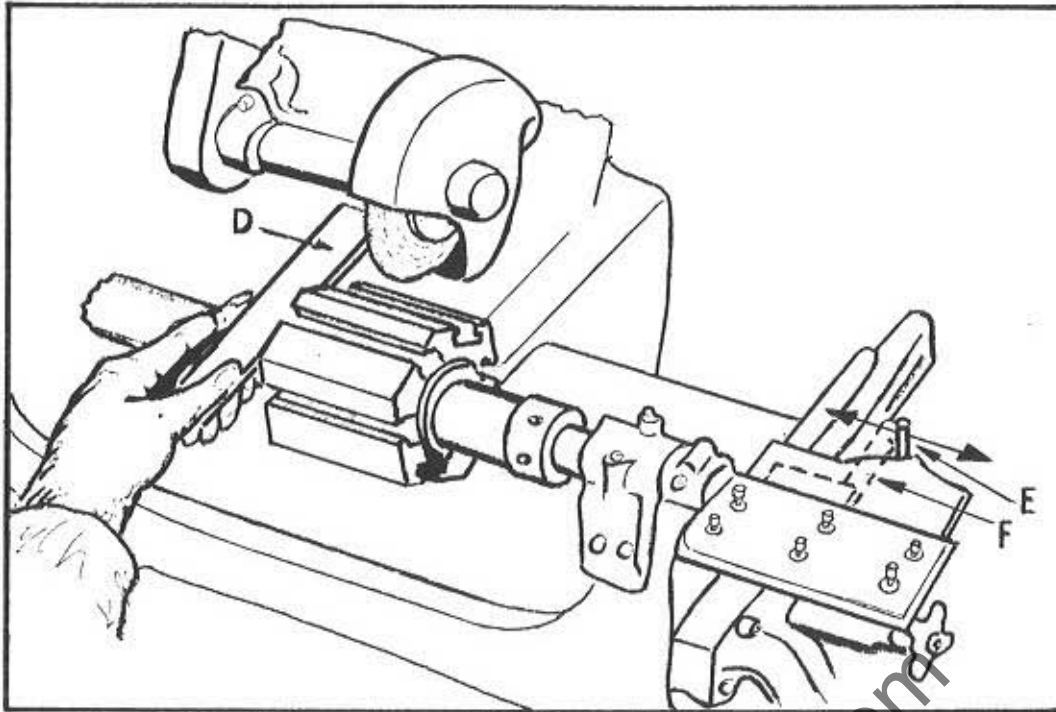
ALIGNING CUTTERHEAD AND TEMPLATE

Set the cutterhead on the arbor so that its full cutting width is within the table traverse relative to the grinding wheel.

**NOTE** A maximum traverse of 12 in. is provided. When a traverse in excess of this is needed, grind part of the cutterhead, then shift both cutterhead and template sideways to grind the remainder.

With the wheel upright set the table such that one end of the hexagonal disc and the wheel align exactly using a straight edge.

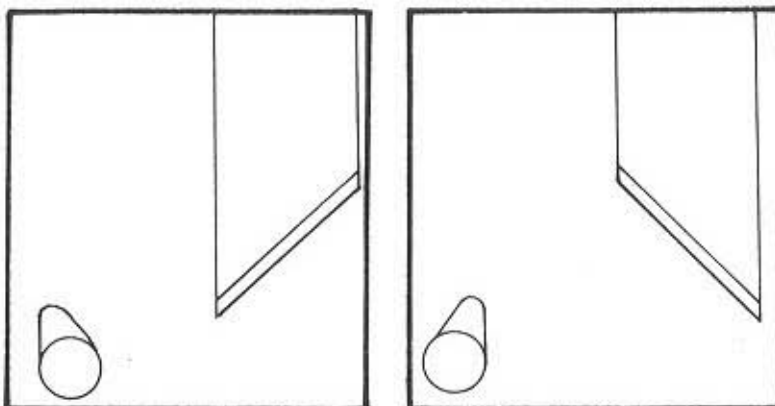
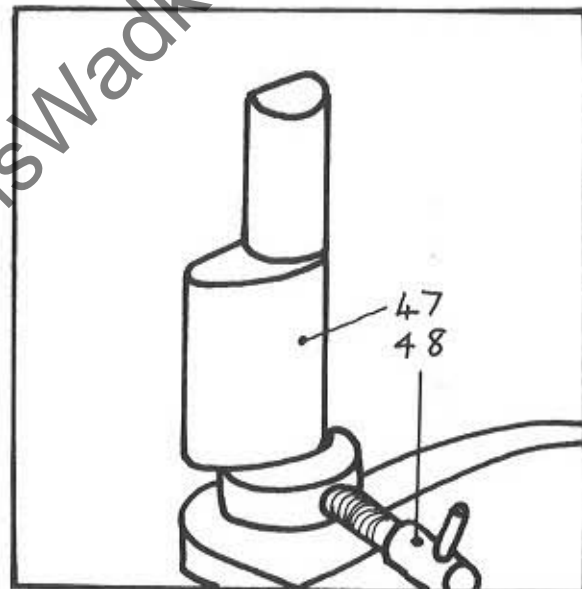
Fit a plain stylus. Fit the corresponding template (49) and adjust it, whilst keeping it back against the fence pegs (51) Fig 21, so that the disc end line on the template correctly aligns with the stylus, using a square, Fig. 18.



**FIG.18** Method of aligning hexagon disc with wheel using straight edge D, and to set template line to stylus E using a square F.

**FIG.19** Stylus Assembly.

- 47. Stylus in position
- 48. Lockscrew for 47 (locks against milled flat on stylus)



**FIG.20** Correct stylus setting for left and right hand shear supports.

Lock the template in position. Begin with the stylus in its mid-cross-traverse position, then use handwheel (28) for final, fine setting, (after releasing lock 29).

#### STYLUS SELECTION AND SETTING

Three are provided, coded A, C and E, also a plain stylus. Select the correct stylus according to the holder shear angle and main clearance angle in use by referring to the chart.

Fit the stylus (47) and secure against the flat using lockscrew (48), Fig 19, so that the point is towards the operator and at the same side as the high point of the knife support, see Fig. 20. Note that each stylus can be reversed end for end for use with a left or right hand shear holder.

The stylus (47) is used to create the exact turning profile throughout the cutting width (See 'Operating Techniques' for method of use).

#### Cross-adjustment

The stylus can be cross-adjusted using handwheel (28) and locked by (29). Once set (when aligning cutterhead and template) it should remain undisturbed throughout the complete cutterhead grinding. It can, however, be used to regulate additional side grinding clearance on non-cutting sections of each knife where this is thought necessary (see 'Operating Techniques'. Normally one complete rotation of the handwheel will form sufficient extra clearance where needed, but having done this be sure to return the original setting before commencing further work. A graduated loose indicator ring is provided for more accurate off and re-setting, having a zero line which is aligned to a pointer when the setting has initially been made. This is locked by an allen key.

#### Cutterhead diameter adjustment

The cutting diameter of the cutterhead is regulated by front to rear setting of the stylus. Fine adjustment is provided by handwheel (30). No lock is required. Having once set the stylus, the adjustment is normally left undisturbed throughout the grinding of the complete cutterhead, correction for wheel wear being made each time the wheel is dressed.

Stylus adjustment can be made, for example, when regrinding damaged knives or when blanking, but such knives then need resetting and the stylus re-set to its original position.

#### FITTING AND USING A SAMPLE TURNING (Fig.21)

A sample turning can be fitted as a guide when positioning knife blanks, when re-setting knives during regrinding, when checking finished knife profiles and when adding extra relief after final profile grinding. (See 'Operating Techniques' ).

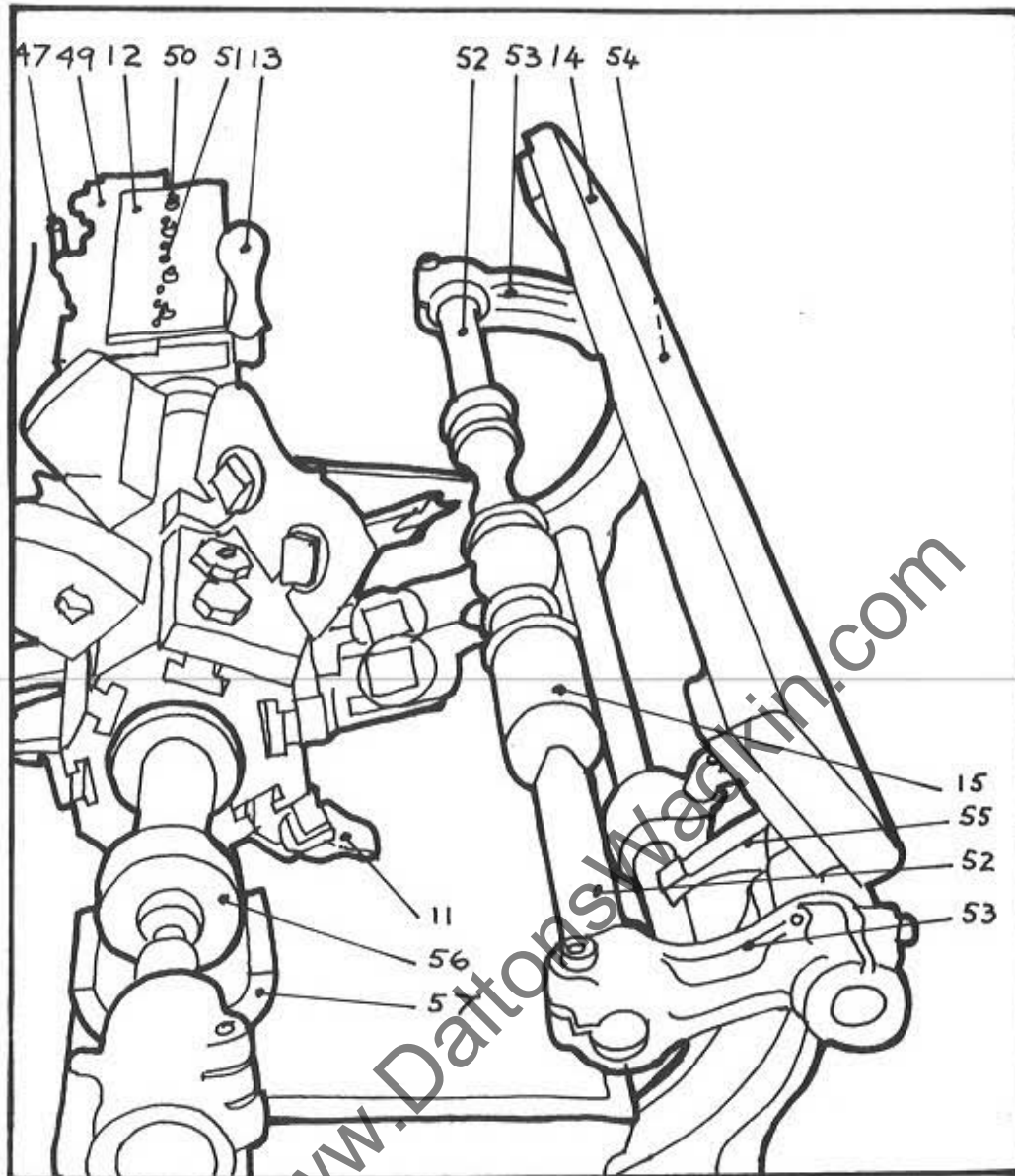


FIG. 21 Sample turning fixture

- 47. Stylus.
- 49. Template
- 12. Template Holder
- 50. Template securing screws (adjust screws near edge to correct for different thickness of template).
- 51. Fence pegs.
- 13. Carriage handle.
- 52. Adjustable centre for sample.
- 53. Bracket for 52 (can be reversed or placed inside or outside supports to suit various lengths of sample).
- 14. Elbow rest
- 54. Lock lever for locking sample or elbow rest in position.
- 15. Sample
- 55. Bracket for controlling position of sample turning and elbow rest.
- 56. Arbor collar.
- 57. Cup supports collar and arbor whilst being centred.

The turning is held between adjustable centres (52) which are initially set parallel to the arbor when the centres, swivel bar and arbor are all level. Swing the centres to this position on the swivel bar and secure.

With the turning between the centres, adjust both centres such that an appropriate section of the turning aligns with the corresponding knife. Lock the centres, then, for final fine setting, use the table cross-movement. (For short turnings fix the centres within the frame, reversing if necessary. For long turnings use an extended bar).

Use adjusting handwheel (16) see Fig 21, for final fine setting of cutterhead to pattern.

By pushing against lever knob (13), the cutterhead is temporarily shifted out of contact with the turning - as sometimes needed when rotating a cutterhead containing some knives incompletely ground - but then returns automatically to the original setting.

When reverting to grinding, return the arm rest and sample turning to their original positions moving the work table forward as required. The rest and operative positions of the arm rest and sample can be varied by adjusting bracket (55). (See 'Operating Techniques' for off-set centres). Use handwheel (16) to give a back position of the cutterhead so that the knives clear the arm rest when rotated.

#### OPERATING THE GRINDER

##### CAUTION

DO NOT fully tighten either a holder or a knife, nor loosen them from fully tight, whilst mounted on the grinder. Pre-loosen any knife or holder before mounting on the machine (if adjustment may be needed) and fully tighten immediately after removal. Take care that no further shift takes place on final tightening.

## GENERAL OPERATION

Always grind wet. The direction and flow of coolant from both the overhead jet and side jets are controllable by shifting the jets and by regulating taps (23) and (24). Do not run coolant against a stationary wheel.

## GRINDING BLANKS

### Method of blanking

Set the wheel vertical.

With the knife resting on the appropriate support make a series of straight cuts at about 5 mm. pitch until the rough profile is formed. (To form cuts of closer pitch would result in applying side pressure to the wheel which could cause fracture in extreme circumstances). In the same way grind away all the uneven projections remaining before finally traversing the knife fully across (see later notes on final and regrinding knives).

### Regular Stylus Setting

Knife setting is outside the scope of this instruction book but, nevertheless, affects the grinding method.

- a) Assuming that short holders and short knives are used for the largest diameter of turning, set the stylus whilst grinding one of these knives. Adjust the stylus progressively towards the rear until the full width of knife is fully formed. Use this stylus setting when grinding the remaining blanks.
- b) Alternatively, adjust the stylus for each knife individually as needed to roughly form the profile across the full width. Check the knives against the sample pattern and either re-set or further grind them (at the discretion of the operator) until they all align. Finally rough grind at the average stylus setting so established.

### Stylus Setting when using Support Segments

Roughly grind all knives as at b). Check them against the sample turning and note those needing further grinding or re-setting. Select and fit suitable segments to give minimal grinding and/or re-setting of the knives. Set the stylus to the segment (see full notes in "Final and Regrinding of Knives"). Re-set and re-grind all knives to this new stylus setting.

### Frequency of wheel dressing

Always dress the wheel when vertical.

Regular wheel dressing is not essential when rough grinding except immediately before a final light grind when setting the stylus or when completing knives. As wheel wear takes place it is an advantage to periodically advance the wheel to maintain slightly more than normal clearance between wheel and support. To even out wheel wear, which is unbalanced and uneven, rough grind right and left hand shear knives alternatively.



## FINAL AND REGRINDING OF KNIVES

### Method of Grinding

Traverse the knife fully across the wheel, maintaining contact between knife and support by rotating handwheel (10) and between template and stylus by manoeuvring handle (13), see Fig. 8. Contact between template and stylus is indicated by lamp (2). Note that such contact will be prevented in the initial stages by contact between knife and wheel, grinding being complete only when the light remains on during full traverse of the knife across a newly dressed wheel.

It will be found easier to traverse downwards, beginning with the knife resting on the high point of the support and to the side of the wheel. Begin the traverse with only nominal forward pressure on hand (13), allowing the assembly to move out as the wheel contacts the knife - so avoiding excessive grinding pressure. Never apply heavy forward pressure against handle (13), use it to guide the template around the stylus allowing the wheel to grind freely.

With experience, it will be found that certain shear angles and/or profiles will allow traversing in both directions, but initially this should be attempted only with low shear angles and plain profiles.

### Grinding side clearance

During initial profiling use the grinding wheel in the vertical position. Add side clearance by tilting the wheel towards the high point of the knife support and re-grind.

When grinding knife profiles which cover sections intended to be worked by opposite hand shear knives, i.e. multiple bead work, grind a second time with the wheel tilted away from the high point of the knife support. This adds clearance to the non-cutting sections. (See notes on multiple beads, also Fig.11 where 'A' shows clearance of non-cutting edges and 'B' clearance of cutting edges).

### Regular Stylus Setting

Check that sufficient clearance exists on each cutterhead (needed to form the complete turning) to allow further 'in situ' grinding of knives without the grinding wheel fouling any holder.

If clearance exists, choose a knife having most natural wear - not chipped cutting edges and grind this whilst adjusting the stylus until the edge is fully restored. Regrind the remainder at this stylus setting (see notes on 'Operating Techniques' for chipped knives).

If there is insufficient clearance, then re-set all knives forward by an appropriate amount, using the sample turning for setting purposes and regrind as above.

### Grinding when using Segments

Set the stylus in correct relationship to the segment (see note below) and re-set all knives on their holders such that their cutting edges are then fully restored on grinding. (Assuming that an even amount of grind is needed on each knife, the sample turning can be used when re-setting knives after spacing this from the initial cutting circle by the appropriate amount).

Alternatively, without first re-setting any knife, grinding can be carried out by adjusting the stylus for each knife individually. Naturally, though, the knives will then require re-setting and the degree of accuracy achievable

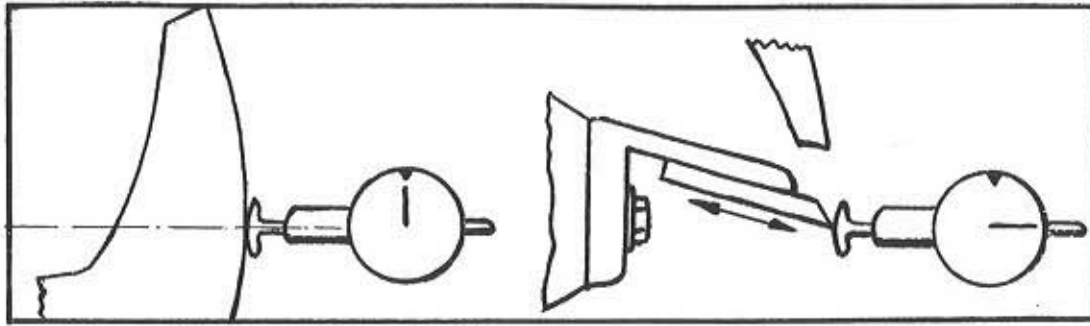


FIG.22 Setting of dial to segment. FIG.23. Setting of knife to dial.

FIG.24. Initial grinding of internal corner.

- 58. Round-nosed grinding wheel
- 59. Knife
- 47. Stylus
- 49. Template.

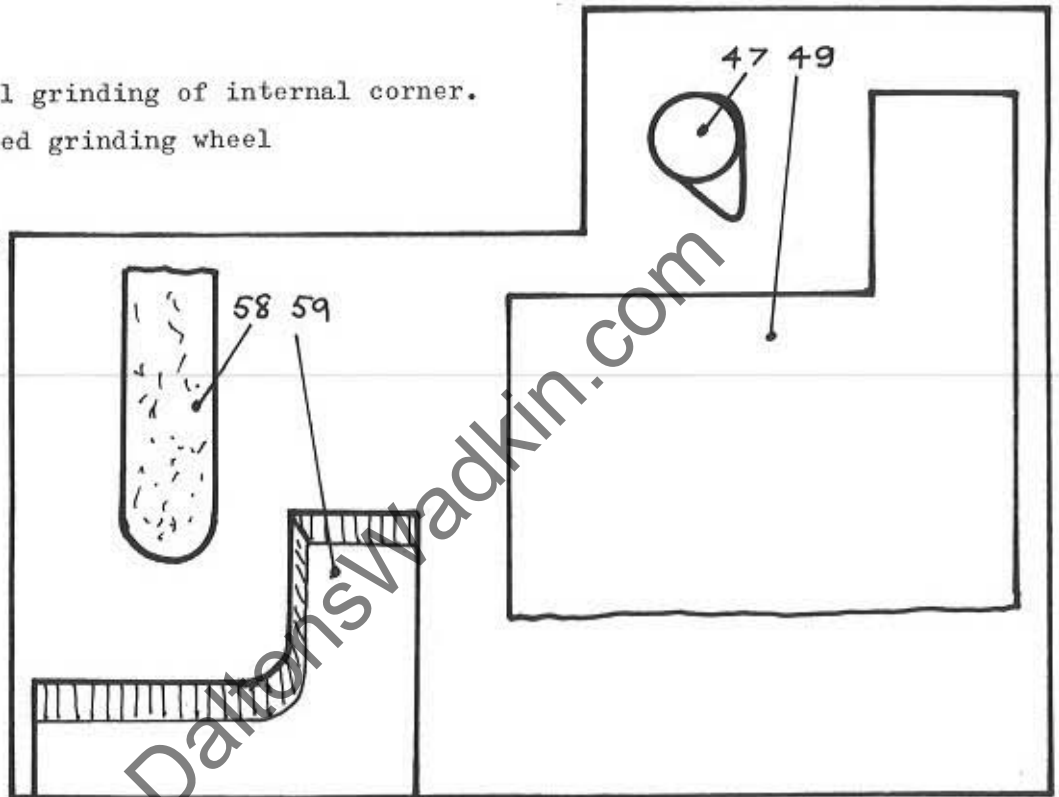
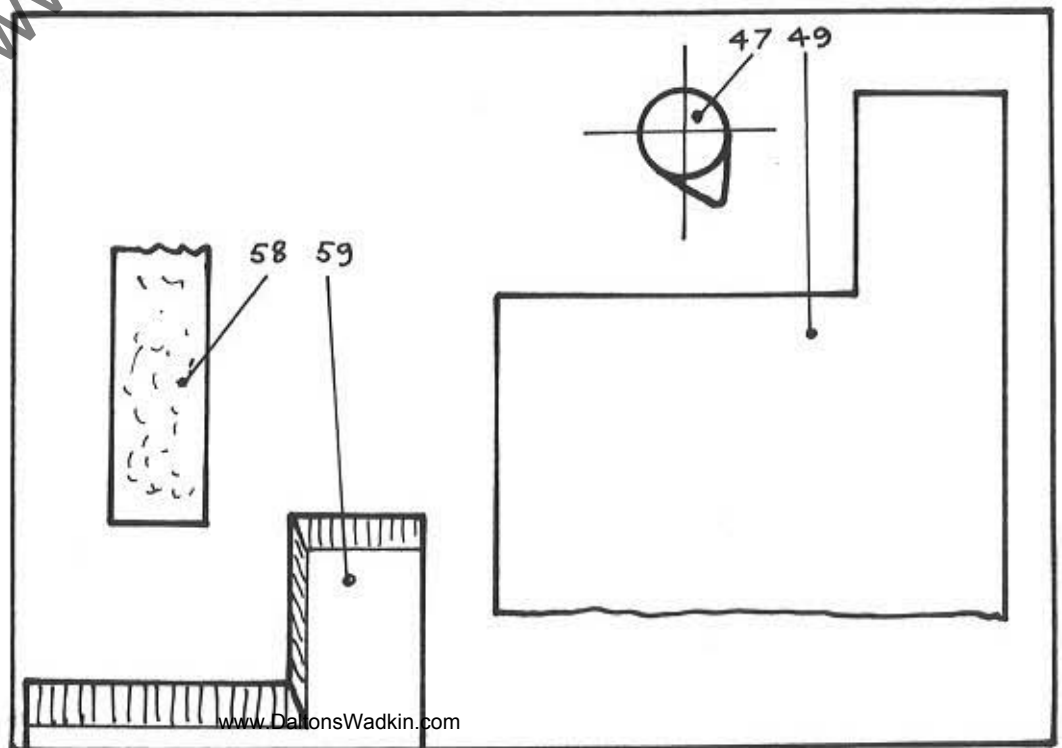


FIG.25. Final grinding of internal corner.

- 58. Square across wheel (an angle needed to give a square grind)
- 59. Knife
- 47. Stylus
- 49. Template.



by the method previously described will not be realized.

**NOTE:** If the support segment can be finely adjusted in height by shimming, or can be shifted sideways to contact another section of turning of smaller diameter, then it may be possible to regrind all knives without re-setting - which will make the task easier. This possibility should be noted when initially setting the cutterhead.

#### Stylus setting when using a Support Segment

Profile grind the knife fitted in line with the support segment. Fit the optional dial gauge and set it to register against the segment. Zero the dial on this setting by rotating the outer ring, see Fig. 22. Hone way the knife wire edge, then draw the ground knife outwards until it registers the correct amount in advance of the segment reading, and secure, see Fig. 23. (The normal amount is 10/1000 in., but this may vary at the discretion of the operator according to the diameter and length of the workpiece and the number of segments used). With the knife secured, set it on the support and against the newly-dressed wheel. Finely adjust the stylus until the wheel just contacts the knife when the template is in contact with the stylus.

#### Regrinding Chipped Knives

Knives having chipped edges should be advanced step by step on their holders during grinding until (with the stylus in the original setting and the wheel freshly dressed) the chips are completely ground out.

Alternatively, progressively retract the stylus during grinding until the chips are completely ground out. Reset both the knife and stylus, then finally regrind the knife for absolute accuracy.

#### Frequency of Wheel Dressing

Always set the wheel vertical before dressing (see previous notes).

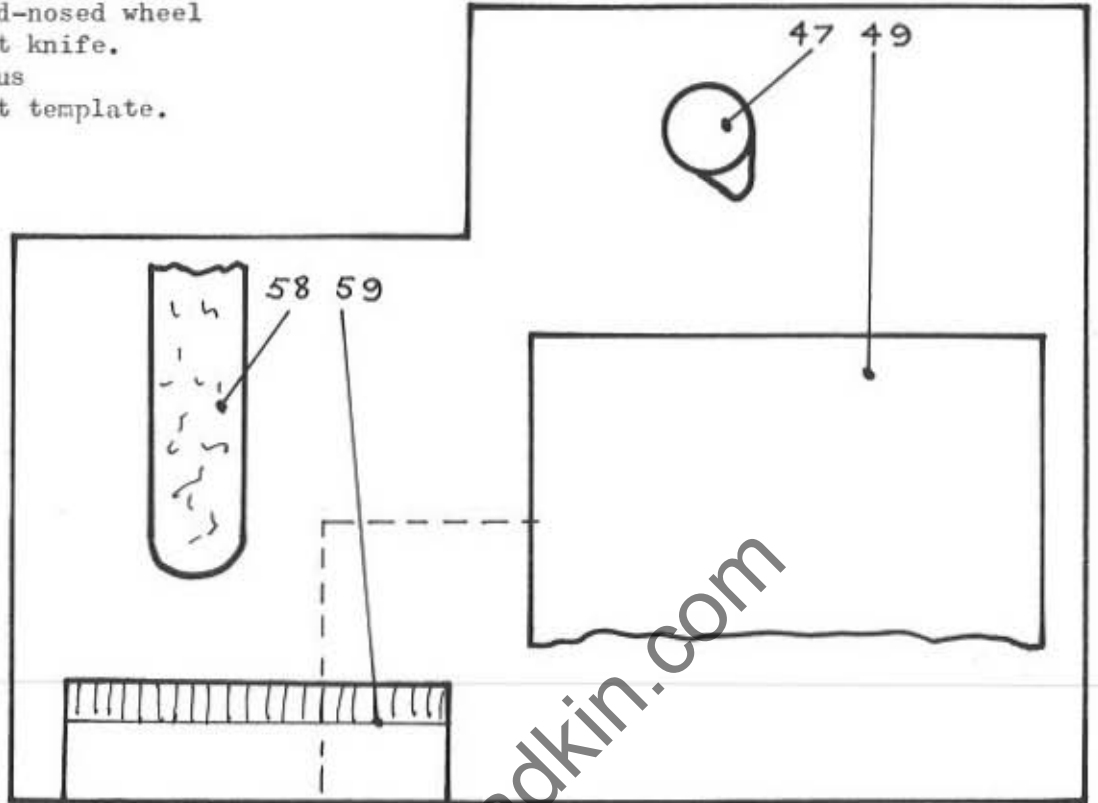
Regular wheel dressing is essential to guarantee accuracy of profile and knife registration as, due to the nature of the operation, wheel wear is unbalanced and uneven. For best results progressively and lightly grind all knives of the same hand and angle of shear in the same way and then in reverse sequence, dressing the wheel between sequences. (The technique is similar to that when grinding planer knives on their cutterhead). Finally grind using a freshly dressed wheel against all these knives before changing to the other knives.

#### WHEEL DRESSER MAINTENANCE

The diamond dresser is correctly set before despatch and should require no further attention apart from cleaning and greasing the movements. Periodically check the diamond for wear and adjust as needed (after releasing the locknut) until it barely contacts the inner flange side of the wheel when set to dress the wheel to width (see previous notes). Ensure for this setting that the grinding head is correctly seated, vertical and the wheel fitted with the correct thickness of compressive paper washer.

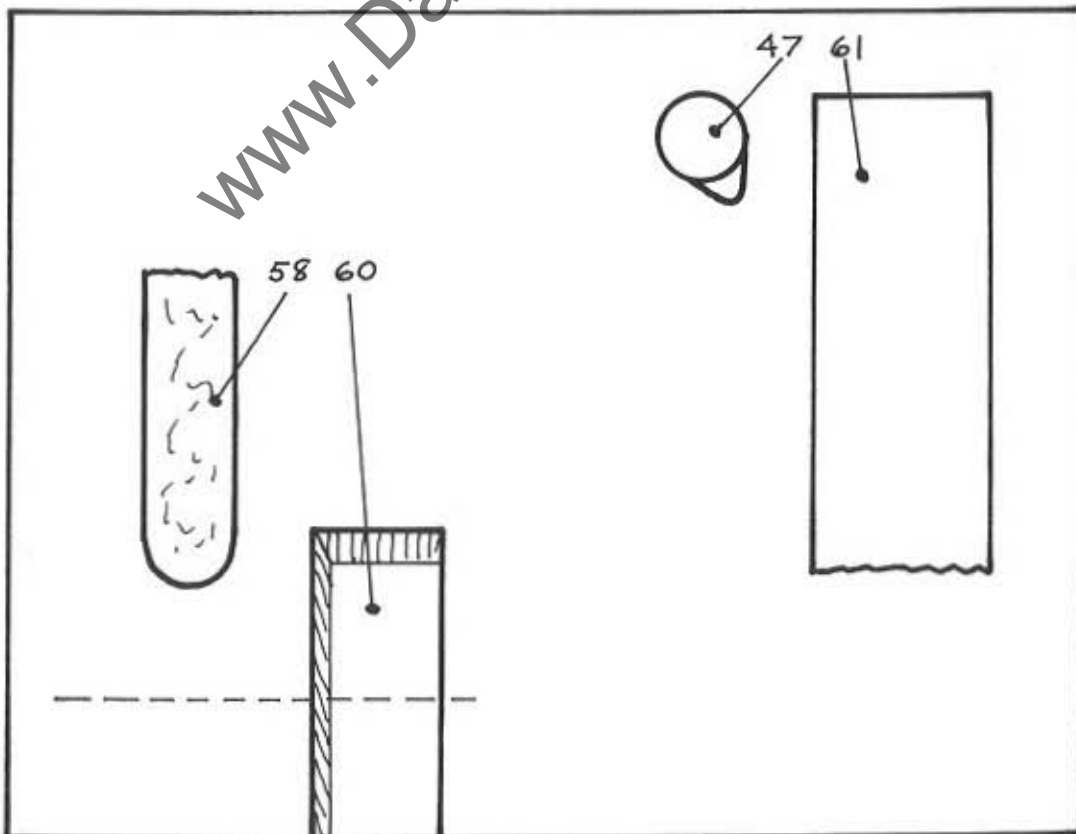
**FIG.26** Alternative method of forming a corner with overlapping knives.

- 58. Round-nosed wheel
- 59. First knife.
- 47. Stylus
- 49. First template.



**FIG.27.** Second stage to 26

- 58. Round-nosed wheel
- 60. Second knife.
- 47. Stylus.
- 61. Second interchangeable template.



## OPERATING TECHNIQUES

### Square-in and Deep Radius Knives

When regrinding, fine adjustment for grind depth is in a radial direction only, i.e. knife edges parallel to the arbor are fully restored, whilst those at right angles (to form square shoulders) are merely skimmed. For most ornamental work such adjustment suffices, but for square or near square edges a small sideways adjustment of the knife is necessary to properly restore such edges.

The most convenient way is to slightly loosen the holder prior to fitting on the grinder, then fractionally move the holder (rather than the knife) to give the sideways adjustment needed - leaving the stylus as set - and re-grind.

Alternatively, the sideways adjustment of the stylus could be used for this purpose to give very fine control, after which the holder and stylus both will require re-setting accordingly.

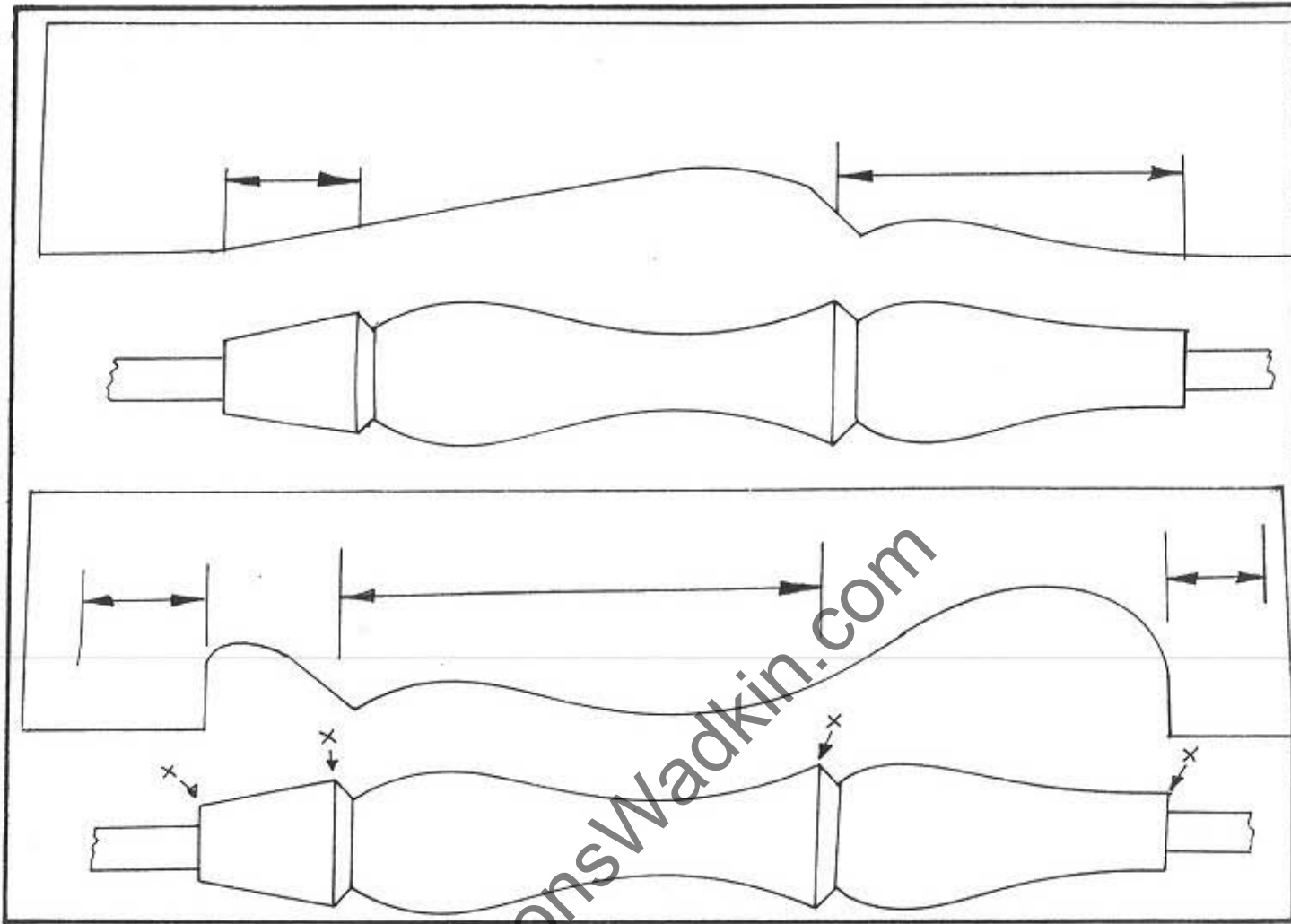
### Square External Corners

Square external corners of turnings can be formed by grinding internal corners in the knives using square or angled wheels. The sequence is to form to general shape using the half-round wheel which then leaves a small radius at the internal corner of the knife. This radius may, in fact, be acceptable but, if not, the corner can be ground by using the normal stylus and template but an angled wheel grinding with the corner of the latter. The angle of the wheel varies according to the shear angle of the holder, the clearance angle and the pattern angle and is best established by experimentation. (The angle should be noted on the graduations and recorded for future use), see Figs. 24 and 25.

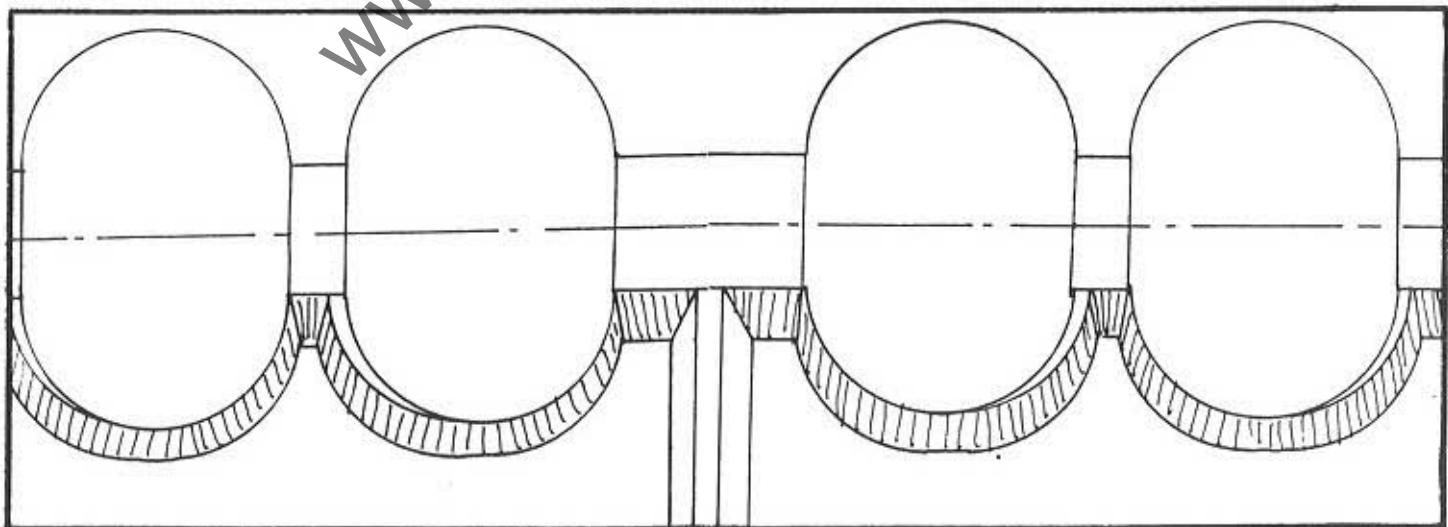
Alternatively, overlapping knives can be used. This gives a clean corner which is easier to maintain by honing than an internal corner on a knife. Two separate, interchangeable and overlapping templates are used for this purpose, as shown in Figs. 26 and 27. After using the first template to grind the appropriate knife, its end is registered by using a temporary end stop. The template is then replaced by the second one to register against the same end stop and the remaining knives ground. Obviously the templates must correspond exactly in width and length. Where the turning incorporates several such corners, two overlapping templates only are needed, as shown. In this case identification of the actual working edges by colouring is essential. The actual shape of the non-working profile is not important, but should continue the working line to beyond the knife edge used to form it - unless it then interferes with a further section of profile, see Figs. 28 & 29.

### Multiple Beads

The normal practice is to use separate knives for each section of beading, resulting in overcrowding of knives and holders on finely detailed work. By skilful use of the grinder it is possible in many instances to form more than one section with a single knife, skipping over any intermediate section which requires forming by a knife of opposite hand shear. The section skipped requires additional relief grinding on the knife profile at this point. The technique for this varies according to the profile, as follows:-



**FIGS. 28 and 29** Two templates used interchangeably for a turning having 4 external corners at 'X' Sections actually used are between arrows.



**FIGS. 30 and 31.** Left and right hand shear knives each forming part of two beads and ground using the side adjustment of the stylus. (Using the indicating collar 28 to allow exact re-setting of the stylus).



### Square Joined Beads

Where the beads are joined with a short section parallel to the centreline, the side adjustment feature of the stylus is used. By using this section of the stylus, the non-cutting section of the knife profile is relieved by approximately 1mm. (1/25 in.) measured axially. This gives approximately 1 mm. clearance between the non-cutting point of the knife and the base of the bead, which gradually reduces as the point of the bead is approached blending with the profile at about  $5^{\circ}/10^{\circ}$  short of the apex, see Figs. 30 and 31. The same relative clearance is given to all moulds formed with a parallel joining section, or where a continuous curve is formed. This relieved section of stylus is, in fact, used for all general purpose work with the exception of vees and vee-joined moulds. Resetting is realized by turning handwheel (28) to register the mark against the pointer.

### Vee Joined Beads

Typical vee-joined beads are shown in Figs. 28, 29 and 32. These cannot be formed using the side adjustment feature of the stylus as by so doing off-set points would be created (although the necessary relief of the non-cutting sections of knives would be formed automatically). It is necessary, therefore, to use the normal setting of the stylus, but in this case all knives are then ground exactly to profile. There are three alternative methods of grinding the required relief, as follows:-

- a) Profile the knife initially using the normal setting of the stylus, Fig. 32. Adjust the stylus sideways by one full turn, then grind the non-cutting sections of profile, stopping short of the vee point. The result will be as shown on Fig 33. Reset the stylus to the mark. (Use the indicator collar to allow exact resetting of the stylus).
- b) Profile the knife initially using a conventional template and normal setting of stylus, see Fig. 32. Replace the template with a general purpose one having a right-angle, cut-out, and set the radial face of this to align with the vee. Fit an end stop to limit the traverse movement to between the vee and short of the apex of the bead. By use of this template (and by adjusting the stylus as required), the knife can be accurately relieved on the non-cutting section by grinding-out a right angle, Fig. 34. As the machine setting is totally upset by this process it is best undertaken after fully profiling the cutterhead. The right angled grind is not critical, however, and need be repeated only infrequently, perhaps after every 3rd or 4th regrind. Where beads are narrow, use an angled wheel.
- c) Prepare two interchangeable templates, one for each hand of shear (though still covering the full width of profile being ground). So profile each that the necessary relief is incorporated at the appropriate sections. Use the two templates in sequence to profile and relief grind automatically. Ensure that the templates accurately interchange and use an end stop for positive re-location, Fig. 35.

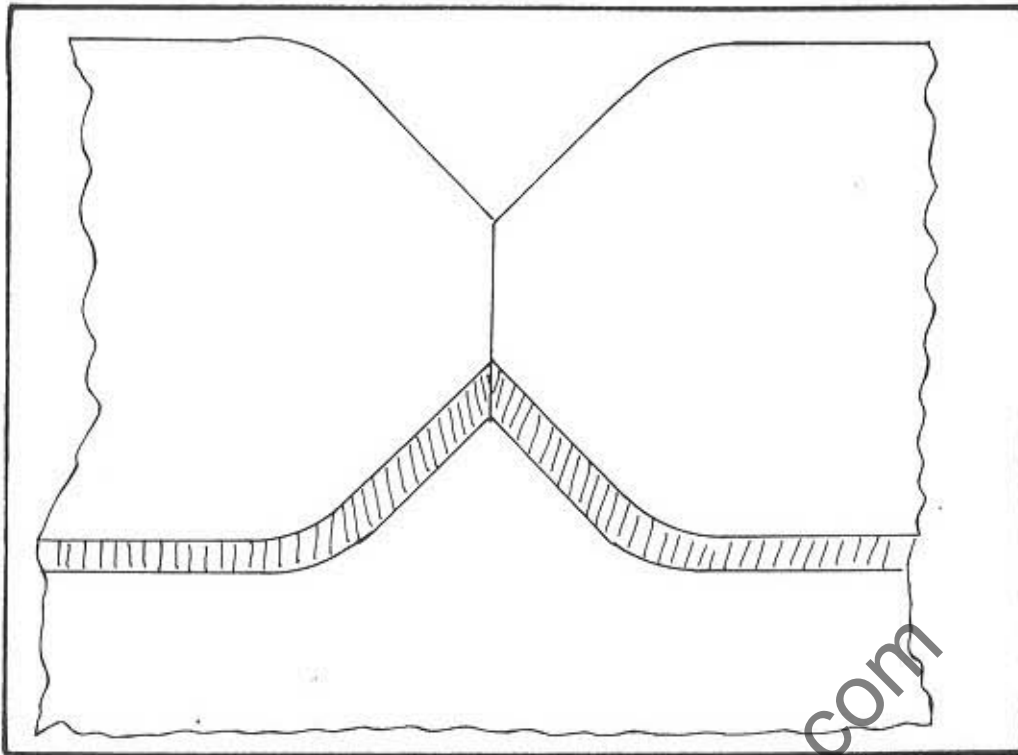


FIG. 32. Profiled knives using a conventional template and full section of stylus.

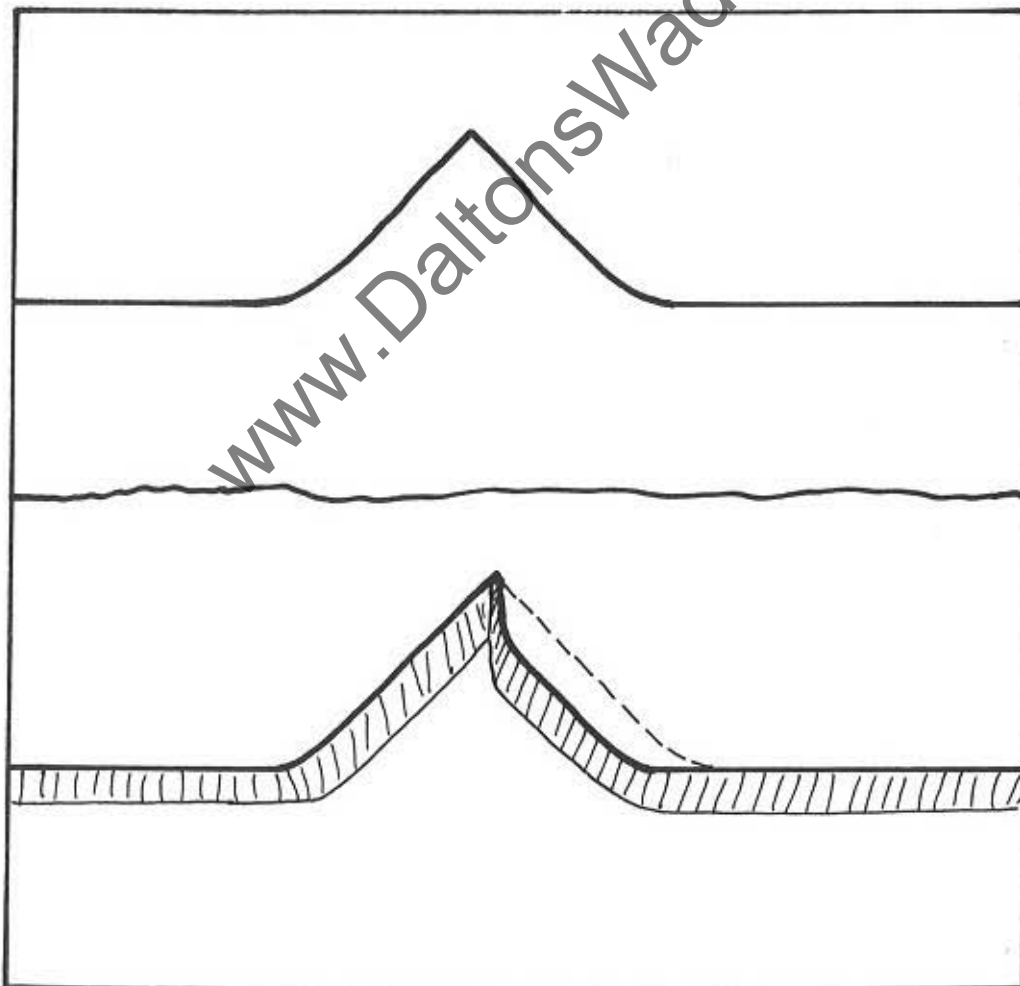


FIG. 33 Grinding relief on the non-cutting portion using side adjustment of the stylus in conjunction with the indicating collar.

Decorative Vees (See Figs. 32-35)

Use one template for the main body in the manner already described for square external corners. Use interchangeable templates to form the vee knives as follows:-

- a) Single template technique. Form a single template to the exact vee shape needed and initially use it to form exact vee profiles on both hands of shear knives.

Fit an end stop to the template in line with the vee and to expose the non-cutting section of the profile (for the hand of shear of knife being ground). Grind as described under a) in 'Vee Joined Beads'.

- c) Use two templates with built in relief as described under c) in 'Vee Joined Beads'.

Conventional Side Relief of Knives, (Fig 34)

It is common to side relieve knives where they project beyond the intended width-on-cut. This process can be undertaken on the grinder after initial profiling the knives across their full width.

It is carried out by using square or angled general purpose templates. Width and depth on cut are controlled by the stylus adjustments. The progress of relief grinding is best judged by comparing the ground knife with the sample turning. Sufficient relief should be ground in the knife so as to require no further relief grinding.

Knives forming beads with parallel joining sections would normally be relieved at right angles just short of the next section at the join, but allowing an overlap at the crest. Knives forming vees would normally be relieved at right angles just beyond the actual vee. The exact profile of knife at this section is left to the discretion of the operator. Unlike with hand grinding it is accurately controlled by the stylus setting and the template shape used.

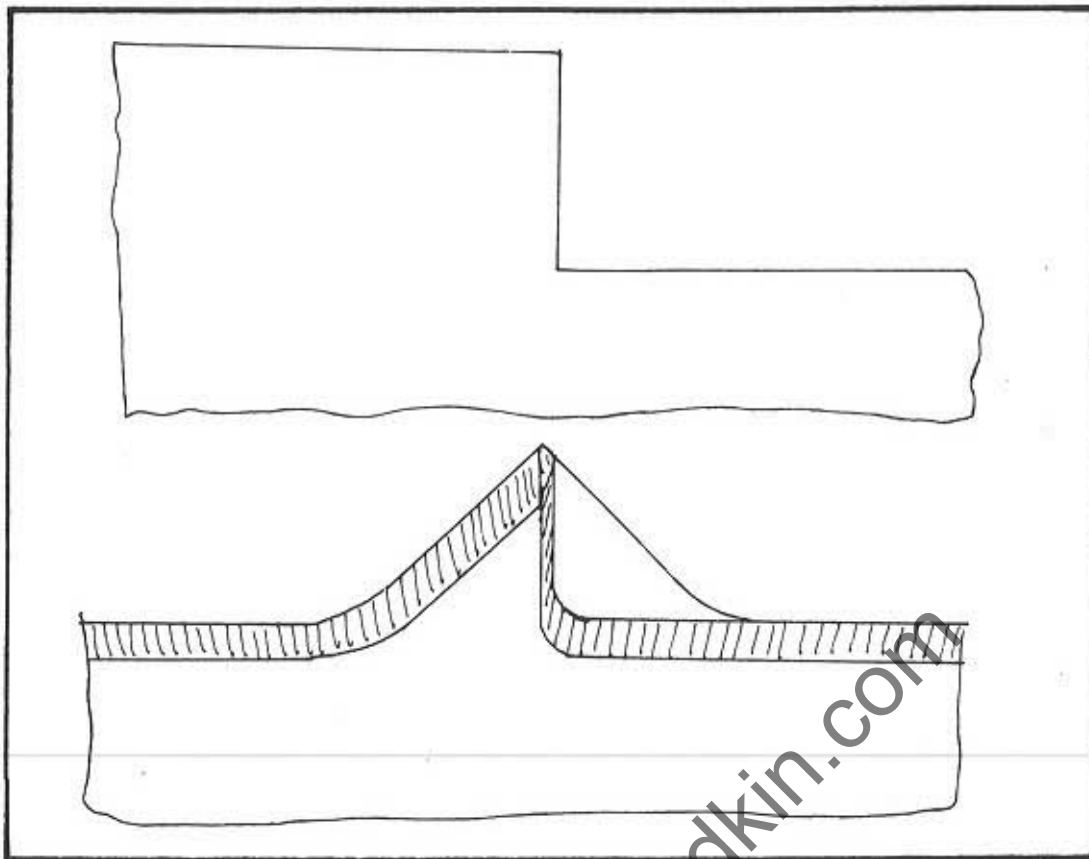
When side relieving closely-spaced beads, dress the wheel to an angled profile.

Truing Support Segments

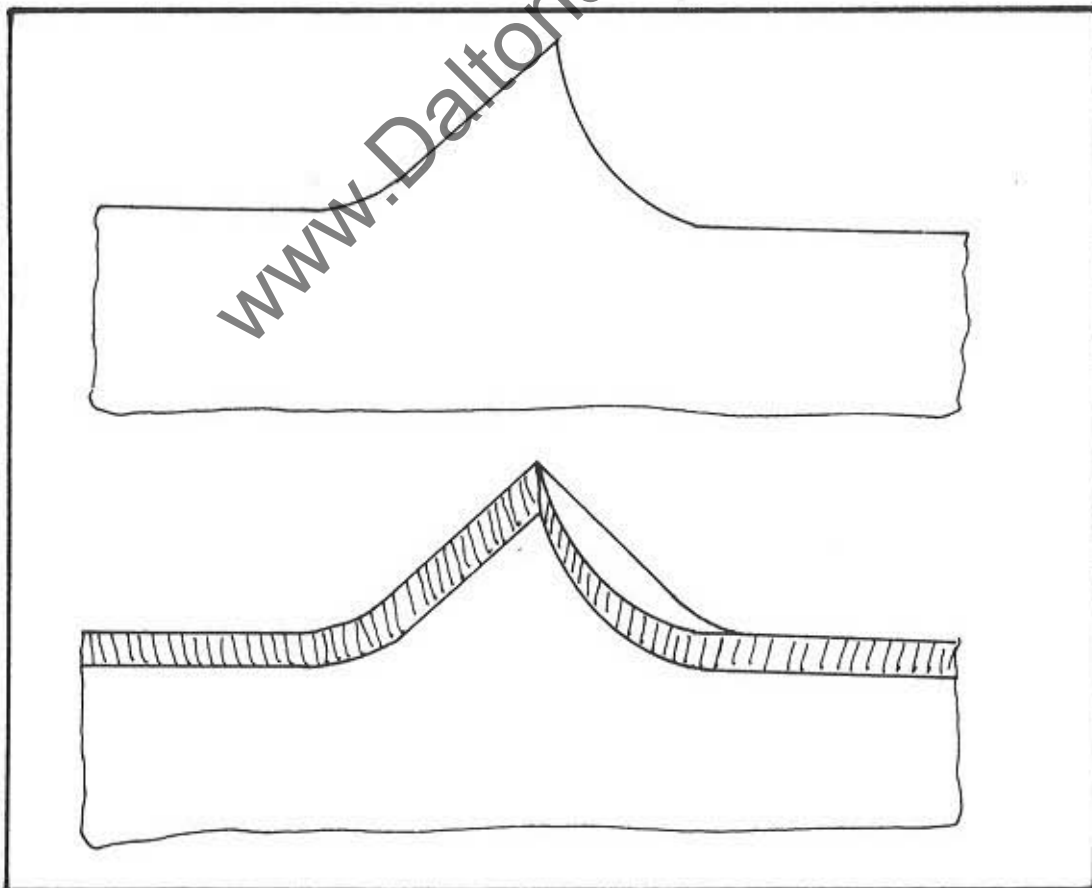
Support segments can be trued and/or reduced to smaller operating diameter on the grinder. Mount the segments in position on the sleeve and secure. Fit a straight-edged, parallel template and a plain stylus. Square dress the wheel and remove the knife support.

Rotate the cutterhead under control of the handwheel - whilst advancing it by fine adjustment of the stylus to engage the segment with the wheel. Continue until the segment is fully trued.

Normally the segment will be given a flat face, but it may be an advantage to form a slightly rounded contact face. In this case form a template to the profile required and use a half-round wheel profile, with a plain stylus. At each fresh setting in depth-on-cut, track fully across the segment step by step by adjusting the table cross-traverse each time sweeping through the complete arc of both segments forming a pair. Where segments are considerably out of true, initially trim using the square across wheel.



**FIG.34.** Grinding relief using a second, general purpose template with a right-angled cut out.



**FIG.35.** Grinding relief using two interchangeable templates. (one only shown).

### OFF-SET CENTRES

Where off-set centres are used, the exact amount of off-set should be decided before preparing templates. The back edge of the template should then be off-set from the sample centreline by the same amount pro-rata the length of the template. Care should be taken to ensure common dimensions where adjacent templates overlap on long turnings.

When fitting a sample turning to the grinder, use the optional off-set centre in place of one regular centre and set accordingly.

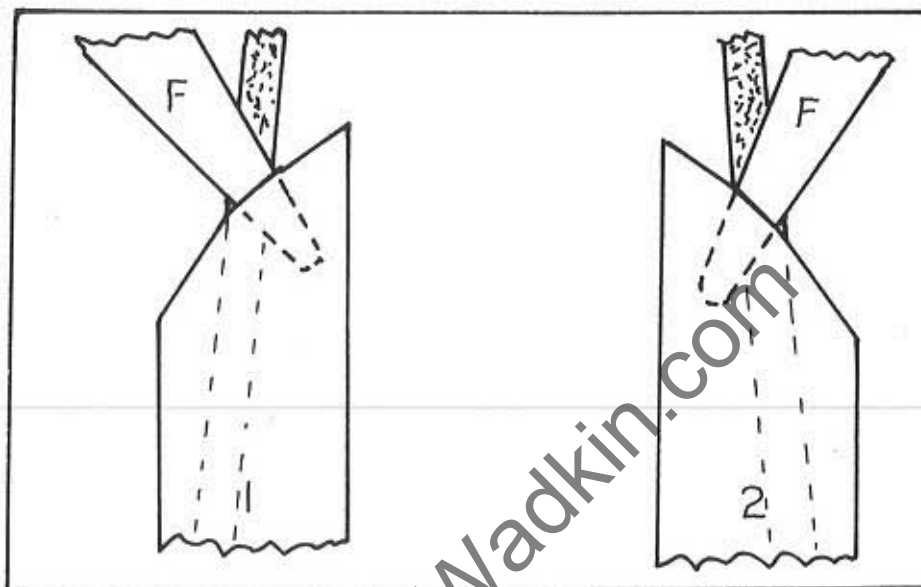


Fig. 36

### KNIFE SUPPORT ASSEMBLY ALIGNMENT

Adjustment screw (40) is correctly set when the machine is despatched from our works. Its setting should, however, be checked periodically and corrected if need be, as follows:-

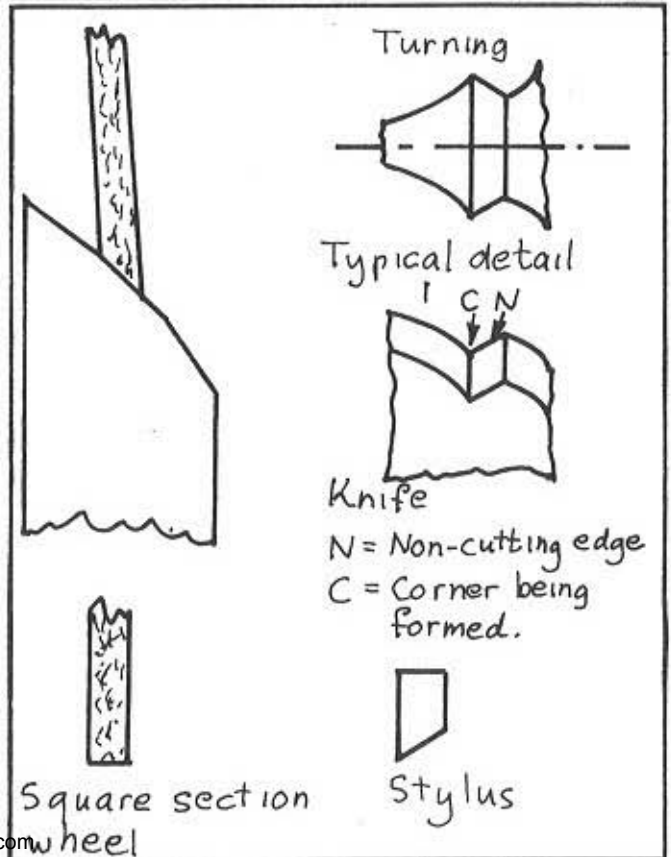
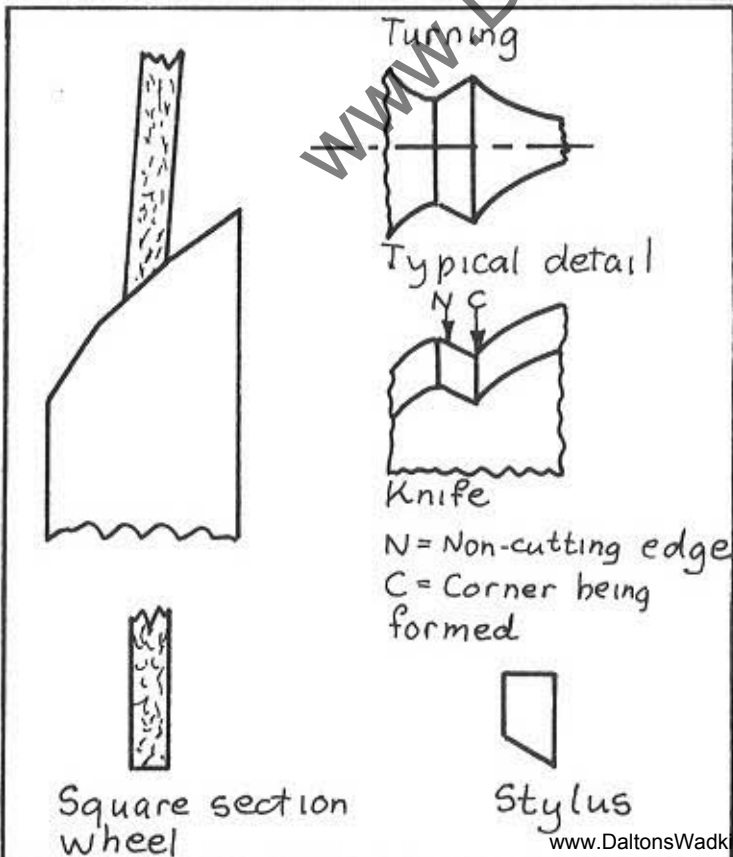
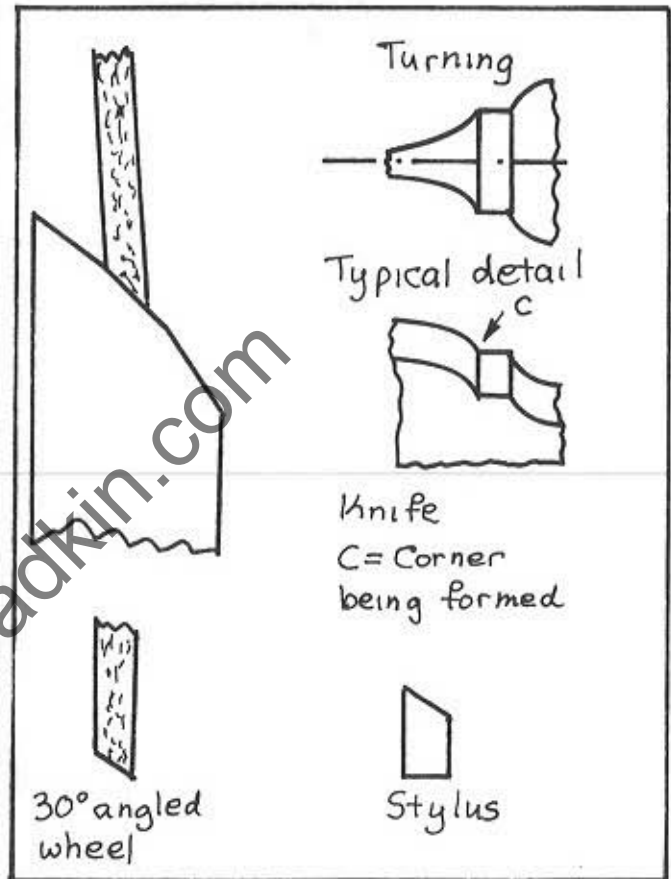
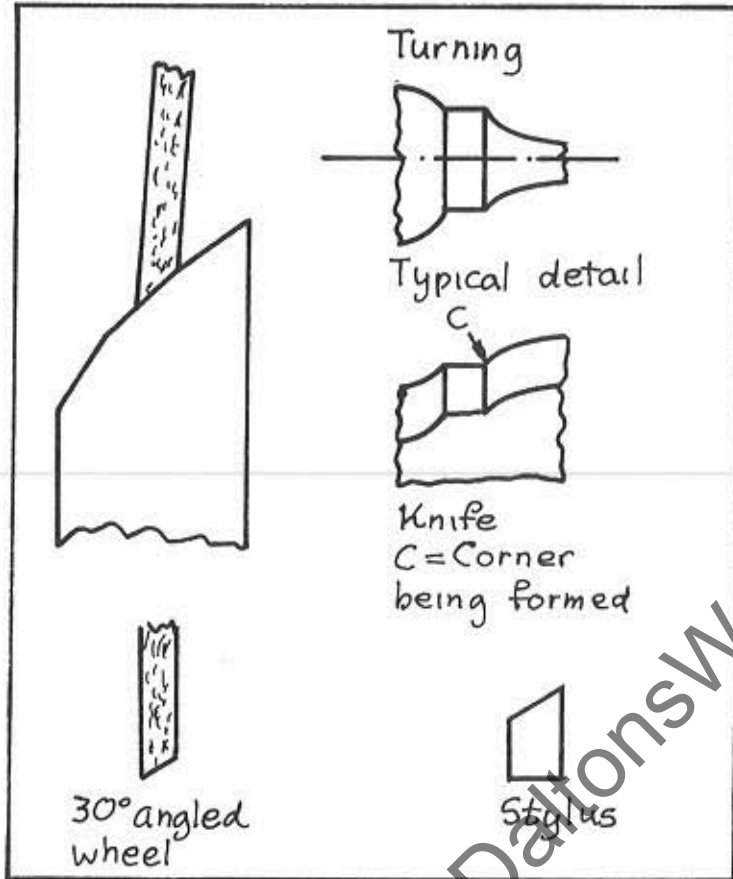
Dress the wheel to a half-round section. When re-setting the assembly (37) for grinding ensure that it abutts screw (40) and secure by lever (42). Fit the 45° knife support and tilt the wheel as Fig.36.1. Measure and note the gap between the knife support and the grinding wheel using feeler gauges (F). Reverse the knife support and wheel tilt as Fig. 36.2 and again use feeler gauges (F) to measure the gap between the knife support and the wheel. The gap should be identical in both cases. If the gap is not identical, adjust screw (40) accordingly, re-set assembly (37) to abutt it and re-check.

As a final check, grind both left and right hand shear cutters to a straight and parallel template and check for equal contact against a parallel turning

# USING THE SQUARE CORNER STYLUS

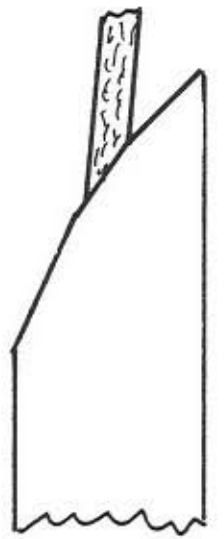

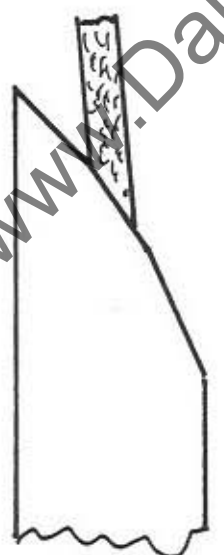
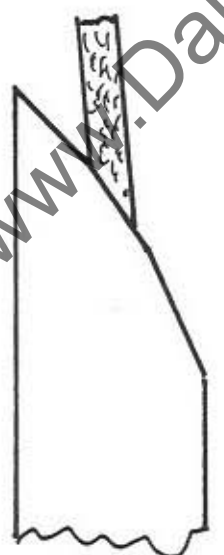

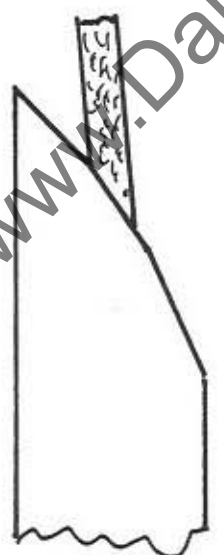
The square corner stylus can be fitted in any one of four positions and is used with a square wheel or one dressed to a  $30^{\circ}$  angle, see panels below. Use with  $45^{\circ}$  shear angles and  $25^{\circ}$ - $30^{\circ}$  clearance angles.

To prevent excessive wheel wear, form the cutter profiles with the standard half-round section wheel. Use the square corner stylus method merely to remove and square-up the remaining internal radius. Use the stylus fine screw adjustments to blend the grinds in. Use a fine wheel.





## SPECIAL 55° KNIFE SUPPORT

Knife Holder	Shear Angle	Stylus Position	
A-71 A-72 A-73	55°		
Clearance Angle.	Stylus Used	Scale Reading *	
40°	A	+ 1"	
35°	A	+ 5/8"	
30°	A	+ 3/16"	
25°	C	- 3/16"	
20°	C	- 1/2"	
Knife Holder	Shear Angle	Stylus Position	
B-71 B-72 B-73	55°		
Clearance Angle	Stylus Used	Scale Reading*	
40°	A	+1"	
35°	A	+ 5/8"	
30°	A	+ 3/16"	
25°	C	- 3/16"	
20°	C	- 1/2"	

\* Not applicable to PR/3 Machines.

The average clearance angle setting is 25° - 30°, approximately 0" on the scale setting (not PR/3 machines). The only variation is for very hard timbers a decreased angle 20° - 25° (scale setting - 3/8" approx.) or for very soft timbers an increased angle 30° - 35° (scale setting + 1/2" approx.). It will be seen that for the average clearance angle of 25°-30° (0" scale setting) and standard knife supports of 45° and 36°, the regular stylus is type 'C'.

## STYLUS SELECTION

Three standard stylii A, C and E are used with 5mm thick half-round section wheels and for shear angles between 36° and 55°. The panel below identifies the three stylii (shown enlarged) select the stylus according to the shear angle and clearance angle - see previous panels.

A half-round section wheel produces a radius of about 1.5 mm on cutter internal corners. To produce perfectly square corners order the square corner stylus - see panels overleaf.

STYLUS A



STYLUS C



STYLUS E



# KNIFE SUPPORT AND STYLUS SELECTION CHART

## STANDARD 45° KNIFE SUPPORT

Knife Holder	Shear Angle	Stylus position	Diagram
A-50 A-51 A-52 A-53 A-53	45°		
Clearance Angle	Stylus Used	Scale Reading *	
40°	A	+ 1"	
35°	A	+ 5/8"	
30°	C	+ 3/16"	
25°	C	- 3/16"	
20°	E	- 1/2"	

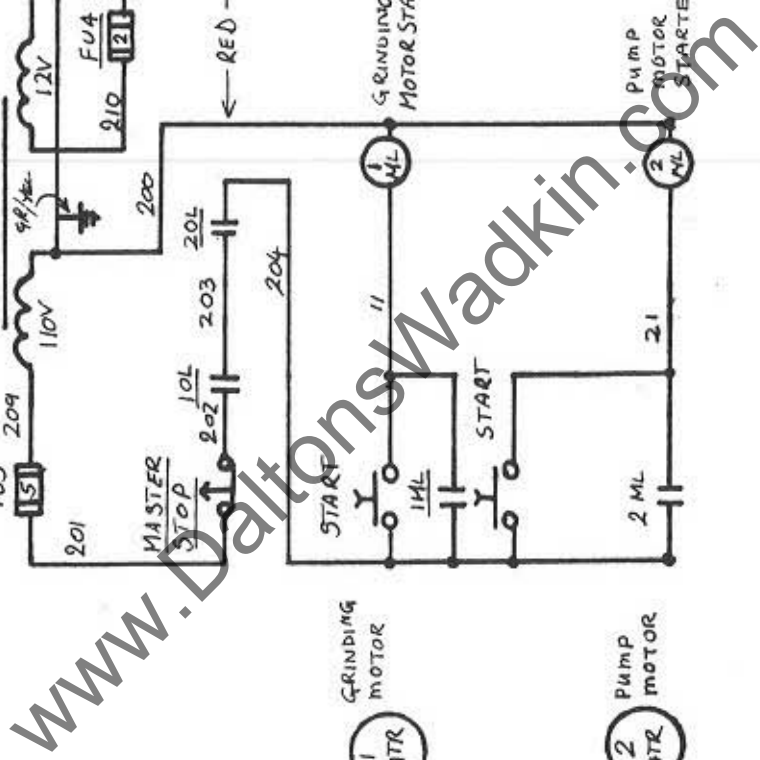
  

Knife Holder	Shear Angle	Stylus position	Diagram
B-50 B-51 B-52 B-53 B-54	45°		
Clearance Angle.	Stylus Used	Scale Reading	
40°	A	+ 1"	
35°	A	+ 5/8"	
30°	C	+ 3/16"	
25°	C	- 3/16"	
20°	E	- 1/2"	

Knife Holder	Shear Angle	Stylus Position	Diagram
M-55 M-56 M-59 M-82 M-83	36°		
Clearance Angle	Stylus used	Scale Reading *	
40°	C	+ 1"	
35°	C	+ 5/8"	
30°	C	+ 3/16"	
25°	E	- 3/16"	
20°	E	- 1/2"	

Knife Holder	Shear Angle	Stylus Position	Diagram
W-55 W-56 W-59 W-82 W-83	36°		
Clearance Angle.	Stylus Used	Scale Reading *	
40°	C	+ 1"	
35°	C	+ 5/8"	
30°	C	+ 3/16"	
25°	E	- 3/16"	
20°	E	- 1/2"	



**AUTOMATIC GRINDING MACHINE  
AND ENGINEERING Co. LTD.  
PADINAM ROAD. SABDEN BB6 9JF**

28-6-78

## PR/2 Electrical

The PR/2 Electrical Circuit is quite simple

2 Mains Grinder Motors

AEG Type AM/80/KX2

0.75 (1 H.P.) 50/60 HZ.

Dual Wound 220-240/380-440 volts

Amps. 3.15/1.81

TEFC 2810 r.p.m.

1 Pump Motor SACEMI

Type EMU 0.18 h.p.

Dual Wound 220-240/380-440 v.

Amps. 1.3/.0.6

TEFC - 2810 r.p.m.

Telemechinique Components with 110 v. push button control circuit.  
Sensitive Work Lamp with a high density quartz Halogen bulb giving an excellent light.

All motors are direct on line contactor standing. Mains voltage is red via Klockner-Mouller isolator to a multi-input transformer.  
110 v output to control switches.

12 v. output to inspection lamp and stylus indicator light.

Customer's mains voltage through contactors to motor. Motors are protected by thermal overloads and fuses.

### Switch Controls

Motor Start Button

Pump Start Button

Stop or Panic Button

Transformer is protected by 5 amp fuses FU1 and FU2 on the main input supply.

Output from transformer is protected by 5 amp. FU3 for the 110 v. circuit and 2 amp FU4 for the 12 v. circuits.

### Control Circuit

The 110 v. control is fed from the transformer to the normally closed master Stop Button through the overloads to pump and IML contactor, also main motor start button.

The output from Transformer 12 v. is fed through switch to LO-Volt inspection lamp.

The secondary contactor on IML is to the stylus indicator light. Contact is only made when the template is in contact with the stylus and the grinding wheel motor is running.

The electrical system is built to high specification and will suit most standard authorisations throughout the world.

Fault finding is extremely simple. Each cable is marked with an identification number which can be traced with the use of the electrical schematic drawing.