



**ULTRACARE**

*At the Cutting Edge of Industry*

**SILHOUETTE**

**PROFILE GRINDING  
MACHINE**

INSTRUCTION MANUAL No.4014/3



# **SILHOUETTE**

## **PROFILE GRINDING**

### **MACHINE**

MACHINE No.	
TEST No.	
YEAR OF MANUFACTURE	

**MANUFACTURERS E.C. DECLARATION  
OF CONFORMITY**

The following machine has undergone "Conformity Assessment" and has undergone Self Assessment in accordance with:-

Schedule IV of the Supply of Machinery (Safety) Regulations 1992  
and Amendment No. 2063

**COMPANY**

Wadkin Ultracare Limited  
Franks Road  
Hilltop Industrial Park  
Bardon  
Leicestershire  
LE67 1TT

**RESPONSIBLE PERSON**

Mr J P Smith (Director)

**MACHINE DESCRIPTION**

**TYPE** Profile Grinding Machine

**MODEL** SILHOUETTE

**DIRECTIVES COMPLIED WITH**

Supply of Machinery (Safety) Regulations 1992  
Amendment No. 2063 1994  
Draught Proposal CEN/TC 142  
ISO 9001 Part 1

**SIGNED ON BEHALF OF WADKIN  
ULTRACARE LTD.**



.....

# PREFACE

## IMPORTANT

IT IS OUR POLICY AND THAT OF OUR SUPPLIERS TO CONSTANTLY REVIEW THE DESIGN AND CAPACITY OF OUR PRODUCTS. WITH THIS IN MIND WE WOULD REMIND OUR CUSTOMERS THAT WHILE THE DIMENSIONS AND PERFORMANCE DATA CONTAINED HEREIN ARE CURRENT AT THE TIME OF GOING TO PRESS, IT IS POSSIBLE THAT DUE TO THE INCORPORATION OF THE LATEST DEVELOPMENTS TO ENHANCE PERFORMANCE, DIMENSIONS AND SUPPLIERS MAY VARY FROM THOSE ILLUSTRATED.

THIS MANUAL IS WRITTEN AS A GENERAL GUIDE. A TYPICAL MACHINE IS SHOWN TO ILLUSTRATE THE MAIN FEATURES.

**Failure to comply with instructions in this book  
may invalidate the guarantee.**

**BE CAREFUL  
THIS MACHINE CAN BE DANGEROUS  
IF IMPROPERLY USED**

Always use guards.  
Keep clear until rotation has ceased.  
Always operate as instructed  
and in accordance with good practice.  
Read instruction manual before installing,  
operating or maintaining machine.

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## HEALTH AND SAFETY

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The CE mark on this machine signifies that an EC declaration of conformity is drawn up indicating that the machine is manufactured in accordance with the Essential Health and Safety Requirements of the 'Supply of Machinery (Safety) Regulations 1992'.

The 'requirements for supply of relevant machinery' in the General Requirement of the Regulations are not only that the machine satisfies the relevant essential health and safety requirements, but also that 'the manufacture ..... carries out the necessary research or tests on components, fittings or the complete machine to determine whether by its design or construction the machine is capable of being erected and put into service safely'.

Persons who install this machine have duties under the 'Provision and use of Work Equipment Regulations 1992'. An indication of these duties is given in the following extracts, but the user should be familiar with the full implications of the regulations.

REGULATION 5 requires that;

Every employer shall ensure that work equipment is so constructed or adapted as to be suitable for the purpose for which it is used or provided.

In selecting work equipment, every employer shall have regard to the working conditions and to the risks to health and safety of persons which exist in the premises or undertakings in which that work equipment is to be used and any additional risk posed by the use of that work equipment.

Every employer shall ensure that work equipment is used only for the operations for which, and under conditions for which, it is suitable.

In this regulation 'suitable' means suitable in any respect which it is reasonably foreseeable will affect health or safety of any person.

The Provision and Use of Work Equipment Regulations also include requirements as follows:-

regulation 6 - maintenance

regulation 7 - specific risks

regulation 8 - information and instructions

regulation 9 - training

Note :-

Attention is drawn to those requirements of the 'Woodworking Machines Regulations 1974' which are not replaced by the Supply of Machinery (Safety) Regulations or other, e.g; Regulation 13 of the Woodworking Machinery Regulation, - 'Training', still applies.

Whilst the prime duty for ensuring health and safety rests with employers, employees too have legal duties, particularly under sections 7 and 8 of the Health and Safety at Work Act. They include :-

Taking reasonable care for their own health and safety and that of others who may be affected by what they do or don't do;

co-operating with their employer on health and safety;

not interfering with or misusing anything provided for their health, safety and welfare.

These duties on employees have been supplemented by regulation 12 of the Management of Health and Safety at Work Regulations 1992. One of the new requirements is that employees should use correctly all work items provided by their employer in accordance with their training and the instructions they receive to enable them to use the items safely.

Noise

Noise levels can vary widely from machine to machine depending on the conditions of use. Persons exposed to high levels, even for a short time, may experience temporary partial hearing loss and continuous exposure to high levels can result in permanent hearing damage.

The Noise at Work Regulations 1989 place legal duties on employers to prevent damage to hearing.

There are three levels of noise defined in regulation 2;

The first action level :-

a daily personal noise exposure (LEP,d) of 85dB(A)

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## HEALTH AND SAFETY

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The second action level :-

a daily personal noise exposure (LEP,d) of 90dB(A)

The peak action level :-

a peak sound pressure of 200 pascals (140dB re 20pa)

The exposure level is obviously influenced by the emission level of all the equipment in use.

Emission levels for machines are provided in the particular machine instruction manual.

These levels are measured in accordance with ISO 7960 under certain specified test conditions, they do not necessarily represent the highest noise level, which is influenced by many factors, eg number of spindles in operation, type and condition of work piece, spindle speeds etc.

For regulations and information on relevant personal protective equipment i.e. ear defenders, employers should refer to the Personal Protective Equipment at Work Regulations 1992.

### Dust

Wood dust can be harmful to health by inhalation and skin contact and concentrations of small particles in the air can form an explosive mixture.

The Control of Substances Hazardous to Health Regulations (COSHH) 1989 place legal duties on employers to ensure that :-

the exposure of his employees to substances hazardous to health is either prevented or, where this is not reasonably practicable, adequately controlled.

..... adequate control to exposure of employees to a substance hazardous to health shall be secured by measures other than the provision of personal protective equipment.

where the measures taken in accordance with the paragraph above do not prevent or provide adequate control of exposure to substances hazardous to the health of employees, then in addition to taking those methods, the employer

shall provide those employees with such suitable personal protective equipment as will adequately control their exposure to substances hazardous to health.

### Instructions for Use

Machinery manufacturers are required by the Supply of Machinery Safety Regulations to provide comprehensive 'Instructions for Use' of equipment, it is important that this information is transmitted to the person using the machine.



# SAFETY CONSIDERATIONS

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## IMPORTANT

### SAFETY PROCEDURES AND CONSIDERATIONS

To ensure safe working conditions, persons operating and assisting with the operation of this machine must ensure that they read and fully understand the instructions given within this manual and have received sufficient training in the use of the machine and the safety aspects to be observed.

Grinding wheels that are damaged or improperly used are dangerous. All users should take sensible precautions in their handling, storage mounting and use.

If a grinding wheel breaks whilst running, pieces fly from the wheel. The wheel guard must always be used.

The grinding process produces sparks and dust. Eye protection must always be used. Coolant should always be used to prevent airborne dust.

Safety requirements for installing, operating and maintaining the machine are described in the relevant sections of this manual.

Keep the floor area around the machine clean and free from refuse. Do not allow the floor around the machine to become slippery.

Stop the machine and report immediately to a person in authority any actual or potential malfunction or operator hazard. Do not attempt to repair or rectify the machine unless qualified and authorised to do so.

The operator must not leave the machine running whilst unattended.

Never by-pass interlocks.

Note :-Persons under the age of 18 years must not operate the machine except during a course of training under the supervision of a trained operator.

#### WARNING :-

Failure to observe correct operating procedures prior to and during operation of this machine can result in severe injury.

DO NOT attempt to operate the machine while under the influence of anything that reduces your alertness.





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### SECTION 1 : GENERAL DESCRIPTION

#### 1.1 MACHINE LAYOUT

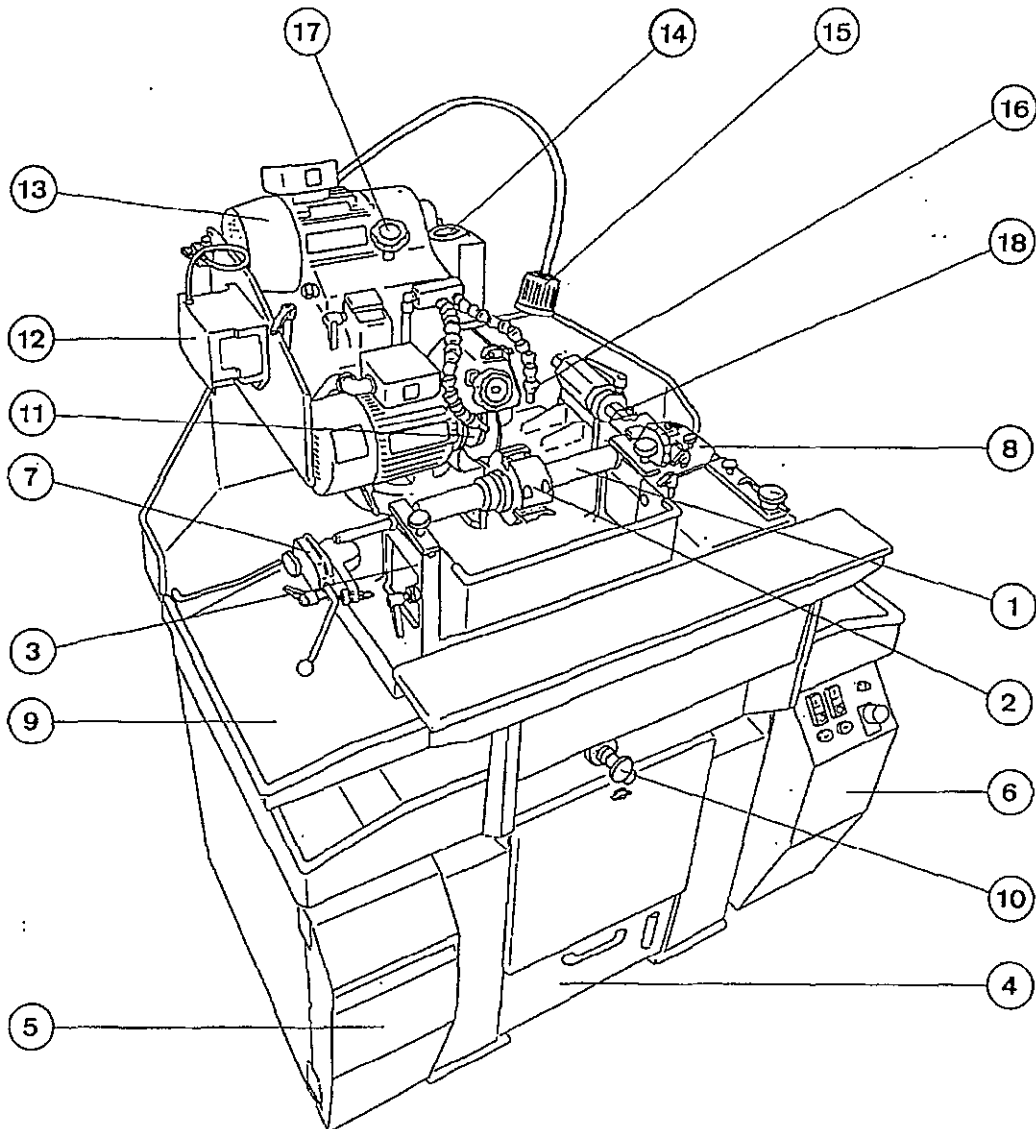


Fig. 1a

- |    |                              |    |                           |
|----|------------------------------|----|---------------------------|
| 1  | Arbor                        | 13 | Straight knife head motor |
| 2  | Cutterhead                   | 14 | Head tilt motor           |
| 3  | Arbor support                | 15 | Worklamp                  |
| 4  | Coolant tank                 | 16 | Coolant nozzles           |
| 5  | Tool cupboard                | 17 | Head rise and fall        |
| 6  | Electrical cabinet           | 18 | Stylus turret             |
| 7  | Dresser                      |    |                           |
| 8  | Template slide               |    |                           |
| 9  | Carriage                     |    |                           |
| 10 | Carriage locks               |    |                           |
| 11 | Profile grinding head        |    |                           |
| 12 | Straight knife grinding head |    |                           |



## 1.2 INTENDED USES

The Wadkin Silhouette profile grinding centre type NNU is a tool grinding machine designed for the grinding and re-grinding of various types of cutters used primarily in the woodworking industry. There are two grinding systems built into the machine with a separate grinding spindle provided for each. Only one spindle can be used at any time. Two spindles are provided to allow quick change-over without the need for re-mounting of the different types of grinding wheel and guards.

Grinding wheels are not interchangeable between the two spindles. The wheel mountings and guards are of different designs which prevent this.

Profile grinding is used for the grinding and re-grinding of shaped profiles onto cutters used for producing timber mouldings.

The blank cutters are set into the cutterhead prior to profile grinding, and the cutterhead mounted onto the grinder. A 'mirror image' template, made 1 : 1, ensures that all the cutters are not only ground to the same shape, but they are also in the same position laterally, and as near as possible radially. The finished ground block containing 2, 4, 6, 8 or more knives is transferred to the machine on which it is to be used, without further movement of the cutters.

A bi-linear carriage is used to support the cutterhead on a free rotating arbor, together with the template and dresser unit. A cutter rest is mounted in front of the grinding wheel, and a stylus assembly is situated to the right of the head.

The template is made to match the required timber profile, and the grinding wheel is dressed to match the form of the stylus.

Grinding is a manual operation requiring the operator to control the arbor rotation to keep the cutter in contact with the cutter rest and move the carriage to keep the template in contact with the stylus.

Straight knife grinding is used for the grinding of planerheads and is carried out using the second grinding spindle.

Planerheads are used to plane flat surfaces on timber as distinct from profile cutterheads which are used to produce mouldings. Planerheads always use straight knives to form a cylindrical

type of cutterhead - hence the term 'straight knife grinding'.

The straight knives are set into the cutterhead prior to grinding and the cutterhead is mounted onto the machine. A knife guide in front of the grinding wheel is used to control the knife position during grinding.

Grinding is carried out using C.B.N. (Borazon) or diamond wheels with a solid aluminium core. Conventional bonded grit wheels must not be used on this spindle.

Straight knife grinding is a manual operation requiring the operator to control the arbor rotation to keep the cutter in contact with the knife guide, and move the carriage to feed the knife past the grinding wheel. In this case, one carriage axis is locked leaving only the left / right movement under manual control.

Solid profile cutter grinding can also be carried out if the appropriate optional extra equipment is supplied. Solid profile cutters are normally used to produce mouldings but do not involve the use of loose cutters or knives. The required profile is machined into the solid cutter during manufacture and the re-sharpening is done by grinding the face of the cutter.

Three sizes of CBN type wheels are available to suit the required throat depth. For each wheel size there is a guard which includes a cutter location finger (known as the philbus).

The straight knife grinding spindle is used for grinding solid profile cutters. An arbor rotation lock is used to lock the cutter in the position determined by the philbus. One axis of the carriage is locked. Grinding is once again a manual operation but in this case only requires the operator to move the carriage to feed the cutter past the wheel.

A wet grinding coolant system is provided with suitable outlets for all three types of grinding to prevent burning of the cutters and to remove the dust and debris generated during the grinding process.

Note: This machine is not designed for the grinding of aluminium, magnesium or other materials which might create risks of fire or explosion. It is not designed for use in an explosive atmosphere.



## 1.3 TECHNICAL SPECIFICATION

MACHINE CAPACITYMaximum length of cutterhead :

Using locking collars.....	315 mm	(12.4")
Hydro locking block.....	335 mm	(13")
Solid profile .....	245 mm	(9.6")

Maximum cutting circle :

Profile grinding .....	350 mm	(13.8")
Straight knife .....	300 mm	(11.8")
Solid profile .....	300 mm	(11.8")

Minimum cutting circle :

All types .....	70 mm	(2.75")
-----------------	-------	---------

Maximum depth of profile : .....

	40 mm	(1.57")
--	-------	---------

GRINDING WHEELSFor profile grinding :

Diameter .....	230 mm	(9")
Width .....	5 mm	(0.197")
Dressed width .....	4.7 mm or 3.0 mm	
Bore .....	31.75 mm	(1.25")

For straight knife grinding (C.B.N. type)

Diameter .....	100 mm	(4")
Bore .....	20 mm	(0.787")

For solid profile (C.B.N. type)

Diameter options .....	150 mm	(6")
.....	175 mm	(7")
.....	200 mm	(8")
Bore .....	20 mm	(0.787")

SPINDLE SPEEDS (Infinitely variable) :

Profile grinding spindle .....	1500 - 3000 rpm
Straight knife spindle .....	3000 - 6000 rpm

MOTOR OUTPUTS

Profile grinding spindle .....	1.5 Kw	(2 h.p.)
Straight knife spindle .....	0.75 Kw	(1 h.p.)
Head tilt .....	0.025 Kw	(0.03 h.p.)
Coolant pump .....	0.09 Kw	(0.12 h.p.)

COOLANT SYSTEM

Tank capacity - maximum .....	36 litre	(8 galls)
- minimum .....	18 litre	(4 galls)

WORKLAMP .....

24v / 20w Halogen

MACHINE DIMENSIONS

Height .....	1560 mm	(62")
Width .....	1150 mm	(45")
Depth .....	1090 mm	(43")
Weight (nett) .....	570 kg	(1256 lbs)

**Note** This unit will operate between 41 & 104 Deg. F (5 to 40 Deg. C); upto 3300ft (1000m); 20% to 95% RH (non condensing); and transportation and storage conditions of -13 to 131 Deg. F (-25 to 55 Deg. C).



NOISE EMISSION VALUES

**MACHINE CRITERIA :**

The machine was free standing on a concrete floor, not bolted down and not on any vibration dampening.

The figures quoted in the noise emission chart are emission levels and not necessarily safe working levels.

Whilst there is a correlation between emission levels and exposure levels, this cannot be used reliably to determine whether or not further precautions are required to achieve safe working levels.

**GRINDING CRITERIA :**

Knives : Solid HSS 8 mm x 60 mm serrated back

**Profile grinding :**

Wheel : GW 203, 230 mm dia.  
 Speed : 3000 rpm  
 Depth of cut : 0.3 mm

Factors that influence the actual level of exposure to the work force include the duration of exposure, the characteristics of the work room, sources of noise etc. i.e. the number of machines and other adjacent processes, also the permissible exposure levels can vary from country to country.

**Straight knife grinding :**

Wheel : GW 301, 100 mm dia.  
 Speed : 6000 rpm  
 Depth of cut : 0.1 mm

Emission levels, however will enable the user of the machine to make a better evaluation of the 'hazard and risk'.

NOISE EMISSION CHART		
MODEL :- <i>SILHOUETTE</i>		
TYPE :- <i>NNU 300 50Hz 415v</i>		
DECLARED NOISE EMISSION VALUE in accordance with ISO 4871		
	Idling	Operating
Declared A-weighted sound power level $L_{WAAd}$ in dB re 1 pW.		
Profile grinding .....	74	83
Straight knife grinding .....	83	84
Declared A-weighted emission sound level ( $L_{pAd}$ ) in dB re 20 $\mu$ Pa at the operator's position		
Profile grinding .....	68	74
Straight knife grinding .....	75	77
Environmental correction factor (K) .....		3
values determined according to specific test code ISO 3744		

VIBRATION LEVEL

At arm rest ..... Less than 2.5 m/s<sup>2</sup>  
 At arbor support ..... Less than 2.5 m/s<sup>2</sup>

Values determined using the machine and grinding criteria described above.

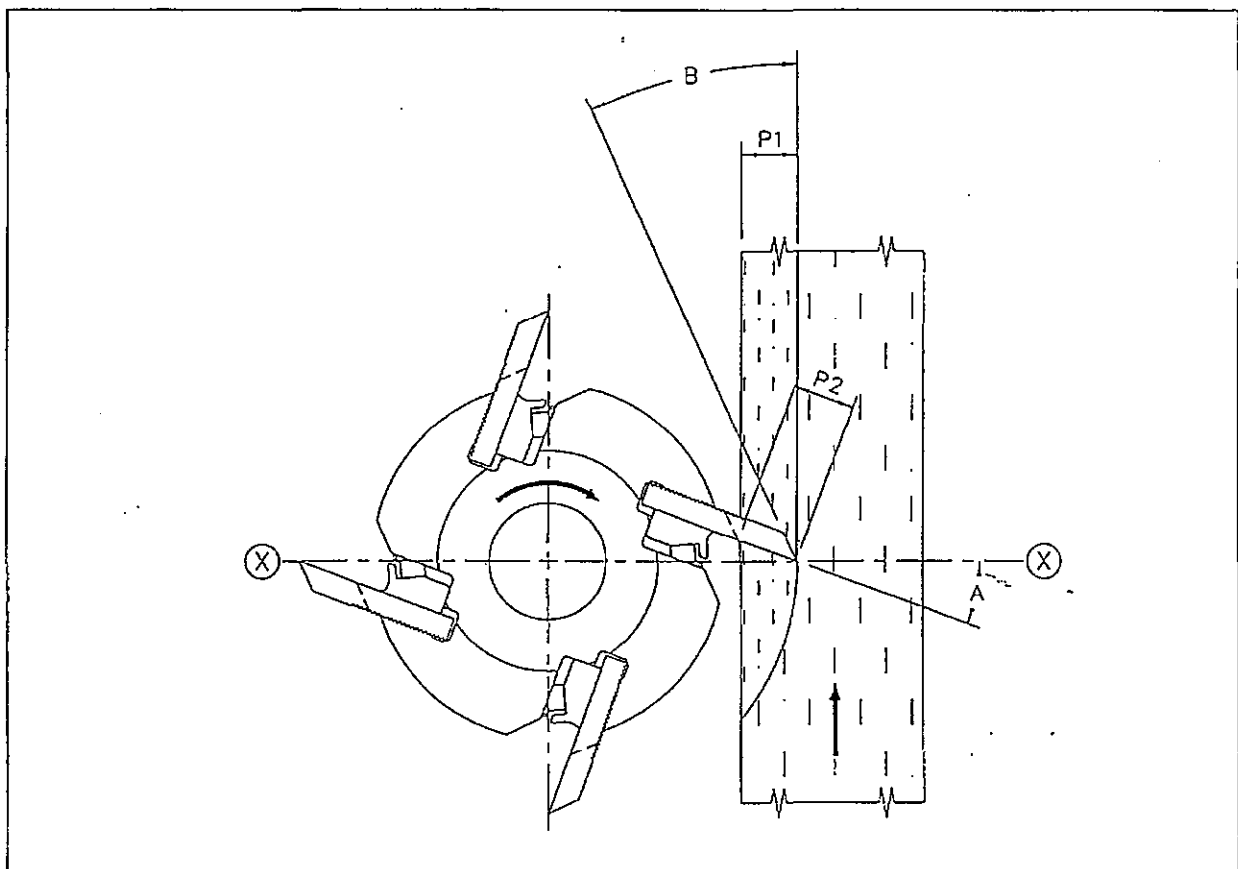
## 1.4 PROFILE GRINDING THEORY

## PROFILE DEVELOPMENT

The profile ground on a cutter is a geometrically developed shape of that profile which is to be machined onto the timber.

If the cutting action of a shaped cutter is examined, *Fig. 1b*, it will be observed that the outer cutting edge reaches the maximum depth of cut before the inner, and that the maximum depth of cut for both edges occurs when the edge passes a line drawn through the horizontal plane of the cutterhead, (X - X).

If the cutting angle (A) was  $0^{\circ}$ , the cutter would be ground in the horizontal plane (X - X) and the finished profile would match the template. However, most cutterheads have a cutting angle (A) of between  $15^{\circ}$  and  $45^{\circ}$ . This necessitates the use of the cutter rest, to allow rotation of the cutterhead whilst grinding.



*Fig. 1b* Note : Profile depth  $P_2$  is larger than  $P_1$ .



## GRINDING THE DEVELOPED PROFILE

On the grinder the cutterhead is rotated so that the cutter comes into contact with a fixed height rest, so ensuring that the cutter is brought into the same plane (X - X) and angle (A) as it is when cutting. This means that although the template is an exact 1 : 1 mirror image of the finished article ( $P_1$ ), because the grinding occurs at the same angle at which cutting takes place, a 'developed' shape ( $P_2$ ) is actually ground onto the cutter. This automatically elongates the profile so that it

produces the correct depth of mould on the finished article.

The cutter rest also ensures that each cutting edge ground is in the same plane as the template.

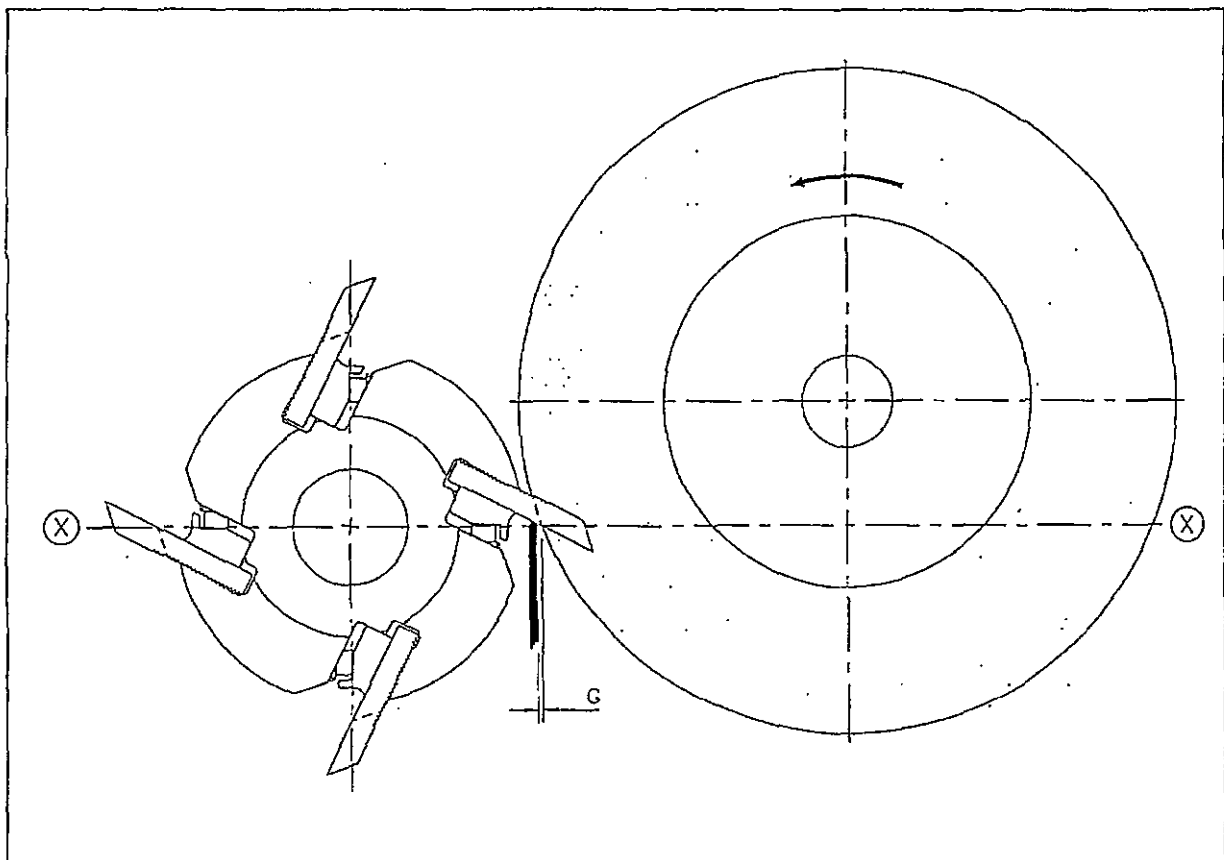


Fig. 1c

## CUTTER REST GAP

Theoretically the cutter rest and the ground edge of the cutter should be at the same point, [ the theoretical grinding point ], however for practical considerations there must be a gap (G) between the cutter rest and the wheel. *Fig. 1c.*

There should be a gap of about 0.5 mm for finish grinding to achieve the best accuracy of profile shape. The gap can be increased up to 2 mm when roughing out blank cutters to allow greater coolant flow for cooling and washing away debris.

The height of the cutter rest is also important to maintain the theoretical grinding point level with the horizontal plane ( X - X ) of the cutterhead. Deviations will create inaccuracies in depth of profile and require compensation when grinding side relief. The cutter rest should be kept in good condition and replaced when worn.

## CUTTING AND CLEARANCE ANGLES

The cutting angle (A) (*Fig. 1b*) theoretically varies from the top to the bottom of the profile as the cutterhead rotates. The angle is however determined by the particular cutterhead and cannot be altered on the profile grinder.

The clearance angle (B) (*Fig. 1b*) is set on the grinder by raising or lowering the position of the grinding wheel. The angle chosen will depend on the type of cutter, type of timber, jointing requirements etc. for the job in hand.

## SIDE RELIEF

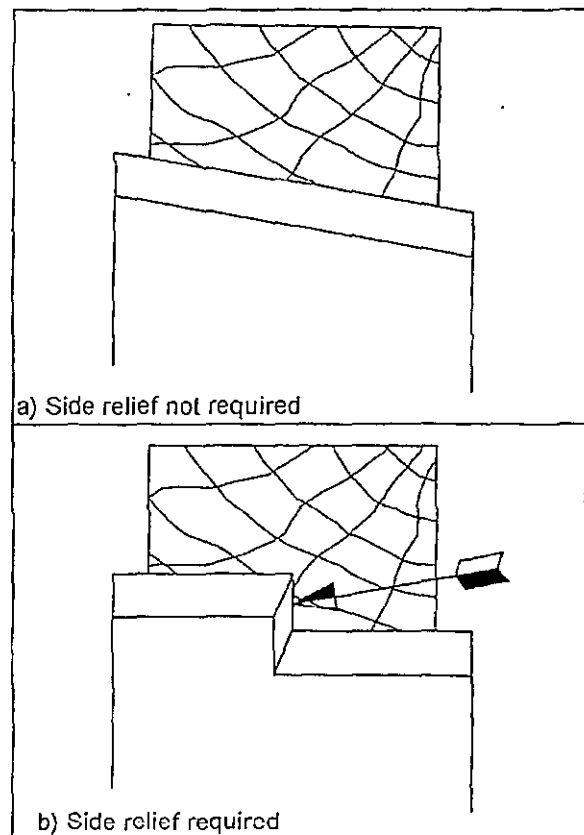
Side relief (or side clearance) may be necessary to prevent rubbing or burning of the cutters when machining timber, depending on the profile shape.

When the profile has been finish ground the head (wheel) is tilted to the left or right to grind side relief using the same template setting. The objective is to grind clearance without altering the shape of the ground profile. This is achieved in practice by leaving a small land or unground

portion of the ground profile. The smaller the land, the longer the cutter will perform without burning.

The machine is arranged such that the wheel tilts about the theoretical grinding point and a minimum land is produced. In practice however factors such as worn cutter rests, cutter rest gap, etc. may cause a larger land or alteration of the ground profile to occur. This should be compensated for by adjustment of the left / right template position.

Normally a relief angle of about  $5^{\circ}$  is sufficient but can be increased up to as much as  $15^{\circ}$  if required. Some profiles such as grooving cutters require both left and right side relief.



*Fig. 1d*

### 1.5 STRAIGHT KNIFE GRINDING THEORY

The basic objectives are to have all of the cutting edges on the same cutting circle (concentricity) and to produce a true cylindrical form on the planerhead i.e. identical cutting diameters at both ends of the planerhead. A typical figure quoted for the concentricity requirement is to have all knives within 5 microns (0.005 mm / 0.0002").

To achieve this level of accuracy it is necessary to have a rigid wheel and cutter support to avoid any deflection. A small diameter wheel is therefore used which allows for a rigid knife guide mounting.

The accuracy of the linear bearing rails of the carriage is used to generate the cylindrical form of the planerhead. This eliminates potential inaccuracies due to template making or mounting.

A face grinding wheel is used in preference to a peripheral grinding wheel for two reasons. Firstly, for a given clearance angle, a stronger cutter tip is produced (Fig. 1e) and secondly, the planerhead can be ground more times before the knives require re-setting (Fig. 1f).

A C.B.N. (Borazon) wheel wears far less quickly than a conventional bonded grit wheel and does not require dressing. This eliminates potential inaccuracies due to wheel wear.

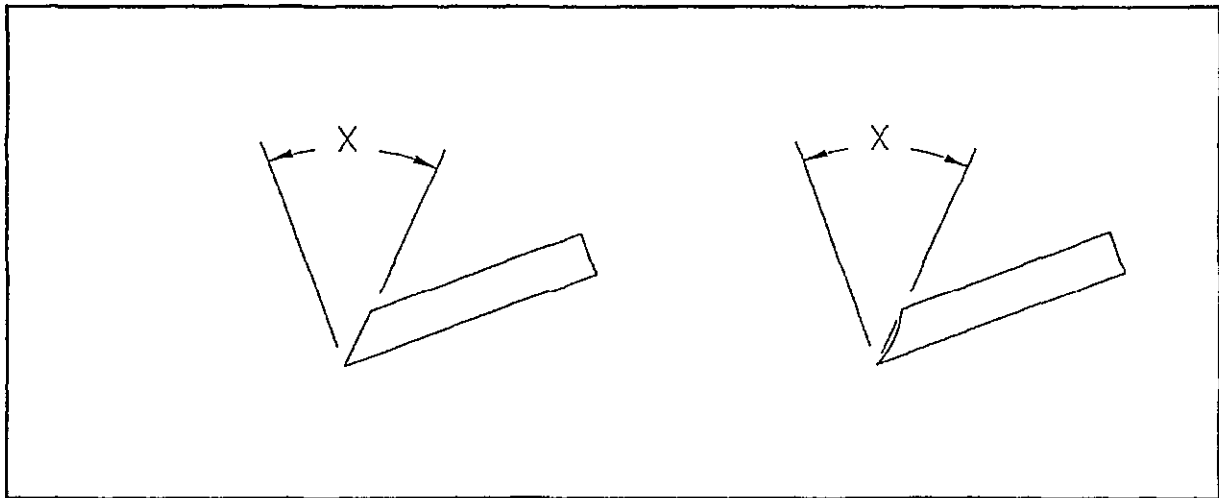


Fig. 1e

Face ground

Peripheral ground

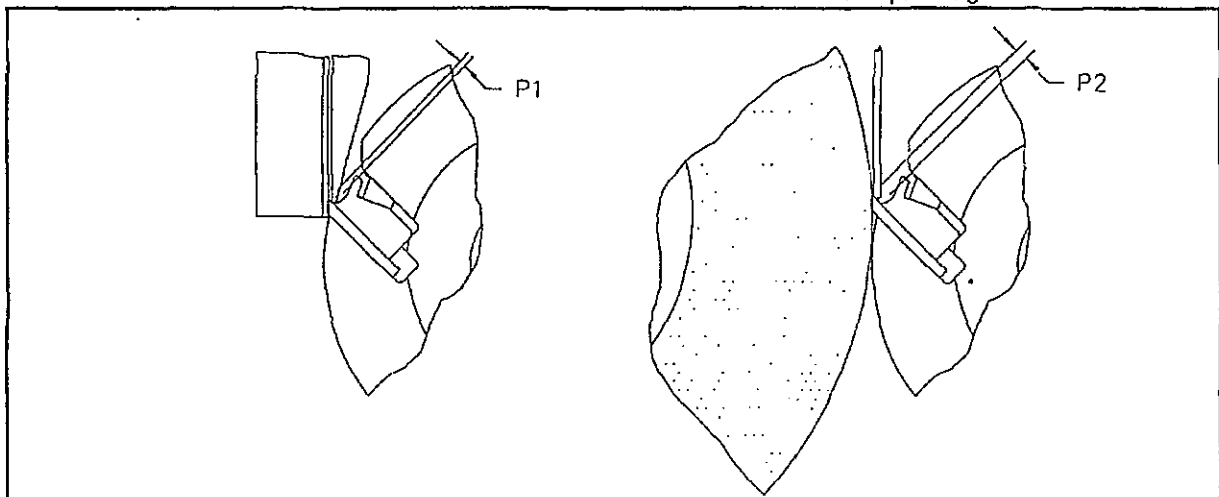


Fig. 1f

Face grinding

Peripheral grinding

The minimum knife projection which can be ground  $P_1$  is less than  $P_2$ .

## 1.6 SOLID PROFILE CUTTER THEORY

The profile ground into a solid profile cutter during manufacture is a geometrically developed shape of that profile which is to be machined onto the timber for the same reasons as described in section 1.4 for loose profile cutters.

The clearance angle (B) and profile shape are designed to last for the life of the cutter and should never be altered. Re-sharpening is carried out by grinding the cutter face. It is important to maintain the correct cutting angle (A) to retain the correct profile shape machined on the timber. Because of the geometrically developed shape on the cutter, an incorrect cutting angle will result in an altered profile on the timber.

There are two methods used for grinding solid profile cutters. The cutter manufacturer will normally state which grinding method should be used to maintain the correct profile.

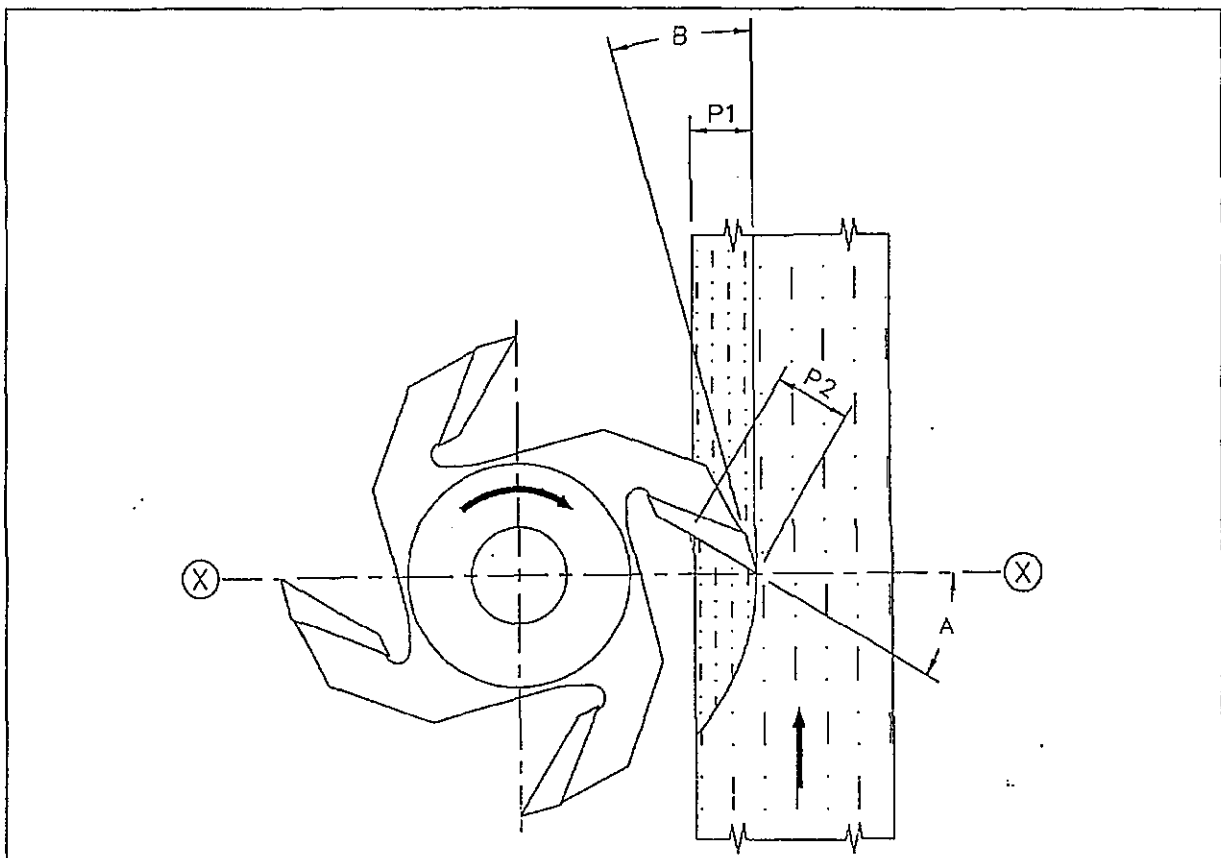


Fig. 19

## RADIAL FEED GRINDING

Most solid profile cutters are of the radial feed variety. Grinding is carried out with the wheel in a set position. Successive cuts are made by advancing the cutter face towards the wheel by rotating the cutter and arbor; hence the term 'Radial Feed'.

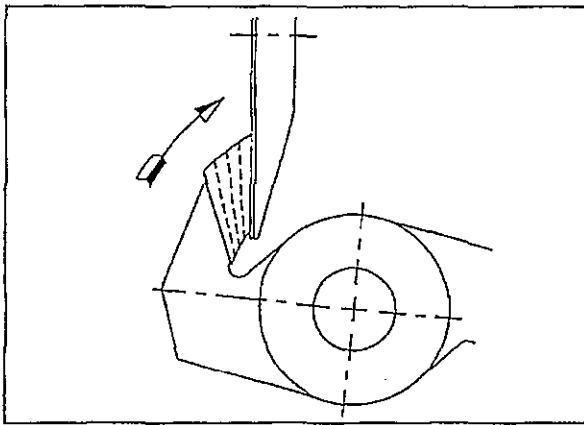


Fig. 1h

Radial feed grinding maintains a constant cutting angle throughout the life of the cutter. The cutter manufacturer will normally state the recommended cutting angle when supplying the cutter. This angle must be maintained if accurate profiles are to be produced.

## STRAIGHT FEED GRINDING

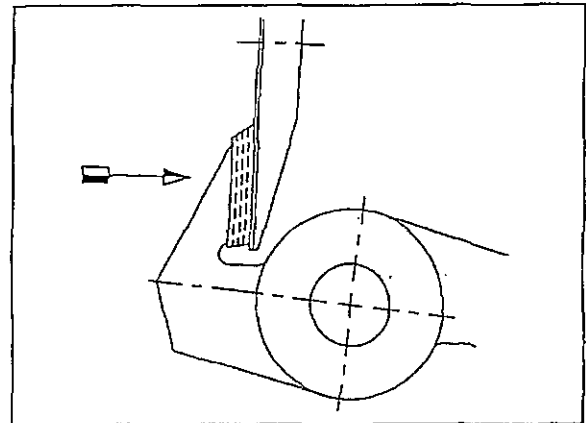


Fig. 1i

Straight feed grinding is carried out with the arbor rotation locked in a set position. Successive cuts are made by advancing the whole carriage assembly towards the wheel. With this type of grinding the cutting angle gradually changes throughout the life of the cutter, but the profile shape of the cutter is designed to compensate for this.

## SECTION 2 : INSTALLATION

### 2.1 MOVING THE MACHINE

Verify the weight of the machine which is given in the Technical Specification (see section 1.3). Ensure that all lifting equipment used is capable of lifting this weight as a minimum.

Always use the lifting points provided. Lifting using other parts of the machine can be dangerous and can cause damage to the machine.

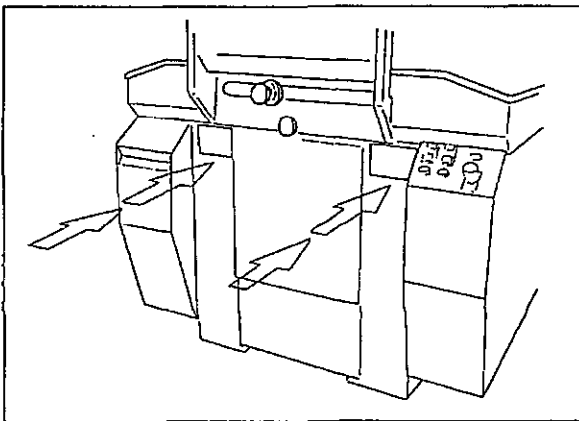


Fig. 2a Lifting points

The machine is designed to be easily lifted and manoeuvred using a fork lift truck. The forks should be at least 800 mm (32") long, not more than 125 mm (5") x 63 mm (2 1/2") in section, and capable of lifting the machine weight.

Carefully slide the forks directly into the rectangular hollow steel lifting sections and lift ensuring that the machine body remains parallel with the floor.

If slings are used to move the machine, place a suitable sling through each of the rectangular hollow steel sections of the machine base and bring one end of each up behind the rear coolant tray and the other end of each up the front of the machine.

It is very important to ensure that the lifting slings are suitably arranged to enable the machine to be lifted so that the body is parallel to the floor prior to its siting. Take care to ensure that the slings do not cause damage to the sheet metal covers etc. during lifting.

Note: Transit clamps are fitted by Wadkin to prevent damage to the machine during transit. If the machine is moved at a later date it is important that the transit clamps are re-fitted before the machine is moved.

### 2.2 SPACE REQUIREMENTS

The foundation plan Fig. 2b shows minimum distances for positioning the machine near to walls etc. It should be noted that these are minimum distances and more space should be provided if possible for ease of access during routine maintenance.

It is recommended that a workbench or table be located within easy reach of the machine for loading cutterheads onto arbors etc. An area should also be provided for work in progress.

The operator's working area at the front of the machine should allow sufficient space for safe loading and unloading of the machine. The actual size will depend on the layout of the toolroom, location of workbench etc. The working area should not be cramped.

### 2.3 FOUNDATIONS

If the floor consists of 100 - 150 mm (4 - 6") of solid concrete no special foundation is necessary. M12 'Hilti' type holding down bolts (not supplied) can be used to secure the machine to the floor.

A good wooden floor should provide adequate foundation for the machine provided that it does not transmit vibration from adjacent machinery.

The machine should be bolted down before use. Final bolting down is carried out during final levelling.



### 2.4 LEVELLING

**IMPORTANT : THIS MACHINE MUST BE CORRECTLY LEVELLED.**

The machine should be set to a spirit level by adjusting the four levelling screws on the machine base. At this point the transit clamps should be removed and final levelling carried out.

Level the machine such that the carriage will slide with equal ease to either the left or the right. The carriage must not have a tendency to slide towards the grinding wheel. It should be neutral, or tend to slide towards the operator to prevent unintentional contact with the grinding wheel when released.

### 2.5 TRANSIT CLAMPS

The transit clamps must only be removed from the machine after it has been finally sited and should be kept safe for possible future use if it ever becomes necessary to move the machine again.

There are two transit clamps which are fixed between the arbor supports and the arm rest bracket. The clamps and fixing screws should be removed from the machine. The arm rest which is shipped separately should be assembled as described in section 3.6.

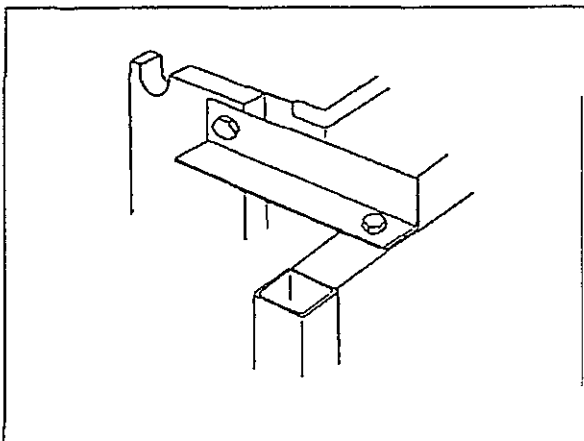


Fig. 2c Transit clamps

### 2.6 ELECTRICAL SUPPLY

**IMPORTANT : ELECTRICAL WORK SHOULD BE CARRIED OUT BY A COMPETENT ELECTRICIAN**

**US & Canada - All supply wiring and conduit sizes must be sized in accordance with the NEC (National Electric Code – NPFA 70) and applicable state, county or jurisdictional codes, or CEC (Canadian Electric Code)**

The customer is responsible for an adequate electrical supply. Details of the power requirements are provided on the machine nameplate. The electrical cabling between the motor and the attendant control gear has been carried out by Wadkin prior to despatch. It will only be necessary to connect the 3 - phase power supply to the incoming terminals L1, L2 and L3 at the disconnect switch in the electrical control cabinet.

**ENSURE THAT THE MACHINE IS CONNECTED SOLIDLY TO EARTH.**

1) Check that the electrical supply details on the machine nameplate correspond to the electrical supply available and select the size of main cable to correspond to the current indicated on the machine nameplate.

2) Check that the fuses at the electrical supply distribution board are correct.

3) Check that all connections are sound.

Power line to machine should be protected with in-line fuses, rated as listed below, or with equivalent fuses to meet local requirements.

Fuse Details :		
	<u>GEC Spec.</u>	<u>Fuse Size</u>
575v	NIT 16 BS 88	16 Amp
460v	NIT 16 BS 88	16 Amp
415v	NIT 16 BS 88	16 Amp
380v	NIT 16 BS 88	16 Amp
230v	NIT 20 BS 88	20 Amp





### 2.7 LIGHTING

The area where the machine is installed should be provided with ambient lighting of normal intensity. The machine is equipped with a worklamp for illumination of the immediate working area around the grinding wheel. Adequate lighting is essential for safe operation of this machine.

### 2.8 CLEANING

The machine is despatched from Wadkin with all bright surfaces covered with a rust preventative. This must be carefully removed with a cloth damped with paraffin or diesel.

Ensure that the area around the machine is clean, free from oil, and anything that is likely to cause tripping or slipping.



## SECTION 3: PREPARATION FOR USE

### 3.1 TRAINING

Grinding operators should be trained in the safe use of each machine which they operate. They must also be given instructions in the safe use of grinding wheels.

It is recommended that personnel involved with the machine are acquainted with the Woodworking Machines Regulations 1974 and also Booklet Number 14 'Safety In The Use Of Woodworking Machines', issued by the Department of Employment and available from Her Majesty's Stationary Office. Also Code of Practice 'Safeguarding Woodworking Machines' Part 1 BS6854.

Personnel involved with the use of grinding wheels should be acquainted with the Abrasive Industries Association leaflets 'Safety In The Use Of Abrasive Wheels (General)' and 'DO'S and DONT'S - Safety Guide For Grinding Wheel Users'. Also the Health and Safety Series Booklet HS(G)17, FEPA Safety Code 12-GB-1987 and HSE Guidance Book Note PM22.

In the U.K., the Health and Safety at Work Act (1974) requires that :-

**NO PERSON SHALL MOUNT ANY GRINDING WHEEL UNLESS HE HAS BEEN TRAINED AND APPOINTED IN ACCORDANCE WITH THE ABRASIVE WHEELS REGULATIONS 1970 No.535 (REGULATION 9).**

It is a statutory requirement that the person who mounts grinding wheels onto the grinding machine shall be a trained and competent person appointed by the factory occupier, and whose name must be registered in an appropriate register.

In other areas local regulations should be checked and adhered to.

In-house training courses for grinding machine operators are run by Wadkin at the Green Lane Road works in Leicester. Demonstrations can also be arranged, contact Wadkin for further details.

### 3.2 COOLANT SYSTEM

Before handling coolant fluids all operators should be familiar with the appropriate Health and Safety precautions - see Appendix A2.

Refer to *Fig. 3a*

Remove the coolant compartment door from the front of the machine by releasing the quarter turn latch and lifting from its location on the lip of the coolant tank. Slide the tank [9] forwards and lift off the coolant pump [7]. The pump is attached to a plate [8] which locates onto the lip of the tank. It is not necessary to remove any screws.

Coolant fluid supplied with the machine should be mixed according to instructions and the tank filled to the correct level. The pump is then replaced and the tank slid back into position in the machine base.

If the machine is fitted with a pump-out facility check that the flow control tap handle [5] is pointing to the left and that the end of the coiled pipe [6] is over or into the tank.

If the optional additional filter tray [10] is to be used it should be positioned as shown on top of the coolant tank. Filtration papers can be placed in this tray to filter out non-magnetic tungsten carbide materials if required.

Replace the coolant compartment door.

The two metal filtration magnets [3] should be placed in the separation trough [1] close to the drain hole positions [2]. Take care to ensure that fingers are not 'nipped' - the magnets are very strong. At the rear of the machine check that the two drain pipes [4] are correctly located in the holes directly over the tank.

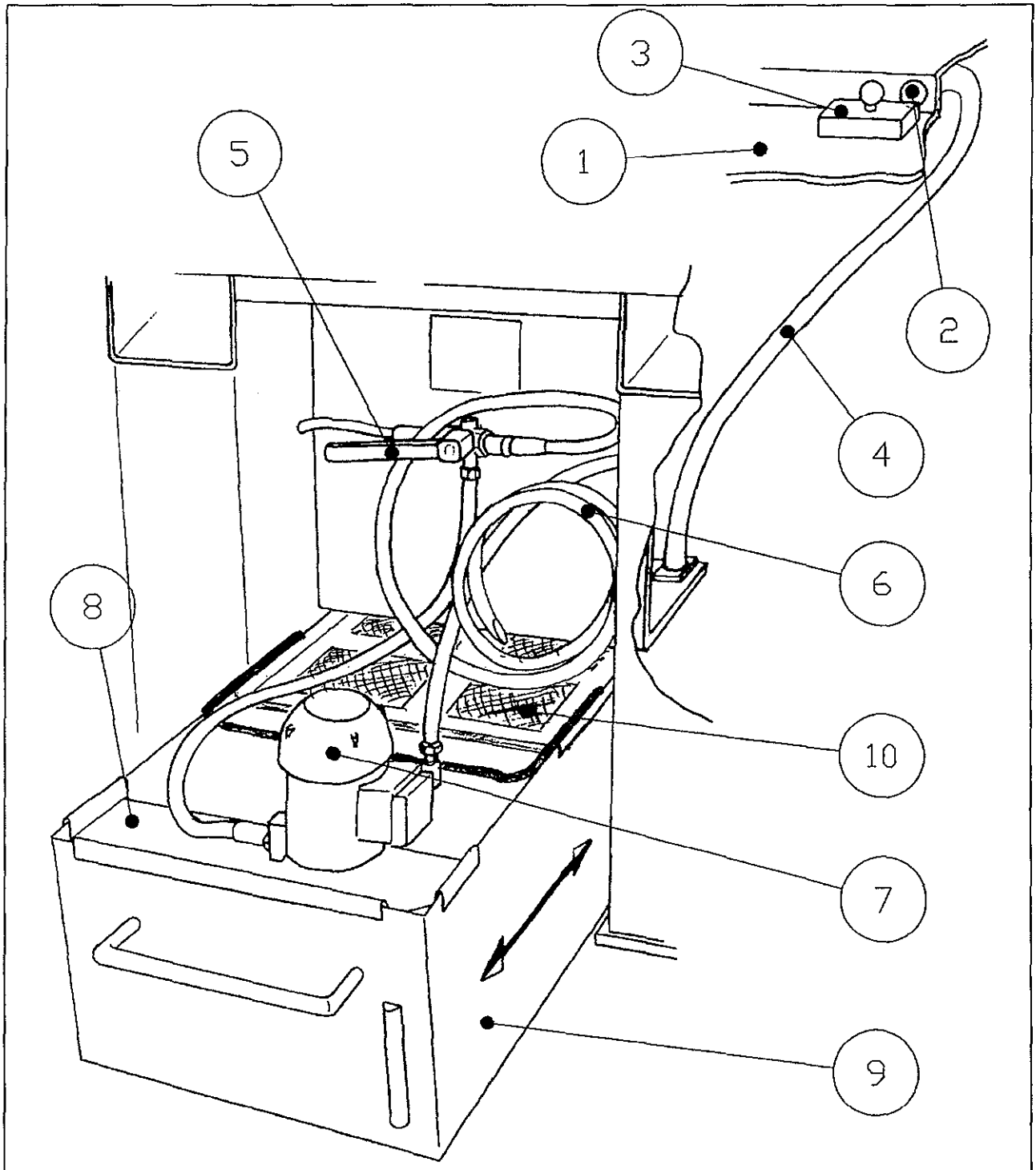


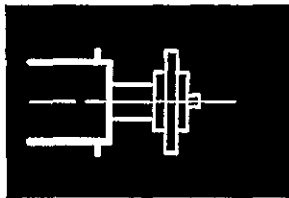
Fig.3a

Coolant system

3.3 CONTROLS

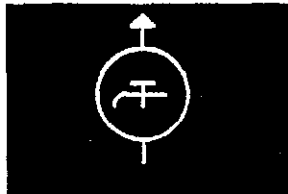
The operator should be familiar with the electrical controls before the machine is used. All the controls are located on the panel to the right hand side of the machine.

1) The grinding spindle start / stop buttons are marked with the symbol :-



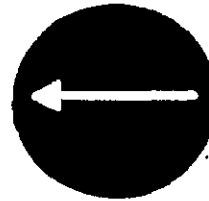
There are two grinding spindles on the machine. These buttons will start / stop whichever spindle is in the operating position. If the head is not correctly positioned, these buttons will be inoperative.

2) The coolant pump start / stop buttons are marked with the symbol :-

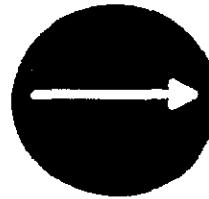


3) The speed control knob is a single turn rotary potentiometer which is used to select the speed of whichever grinding spindle is in the operating position. Graduations are provided to indicate the selected speed. The lower speed refers to the profile grinding spindle and the higher speed to the straight knife spindle.

4) The head tilt left button is marked with the symbol :-



5) The head tilt right button is marked with the symbol :-



The head tilt buttons are used to tilt the head for side relief when profile grinding. These are hold to run buttons i.e. the movement will stop when the button is released. When the straight knife spindle is in use the tilt left button is used to lower, and the tilt right button to raise the head position.

6) The emergency stop button is used to shut the machine down in an emergency.

7) The isolator (disconnect) switch is mounted on the electrical cabinet door.

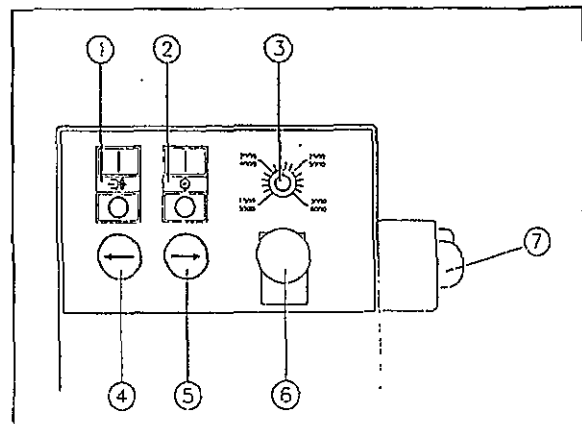


Fig. 3b Electrical controls

### 3.4 TEMPLATE MAKING

Both steel templates made by hand and plastic templates made by machine are suitable for use on this grinding machine.

Note : Detailed instructions are provided as part of the Wadkin in-house training course on profile grinding. In addition an instruction manual is included in the Wadkin template making toolkit (see Appendix A5).

#### HAND MADE TEMPLATES

Steel templates should be made from blanks (NXT 6) as supplied with the machine. They should always be made at least 20 mm wider than the cutter [1] and should have at least two fixing holes if screw fixings are to be used. Fixing holes are not required if template clamps are used.

An exact mirror image of the finished moulding [2] is drawn on to the template [3]. If the cutter projects [P] beyond the moulding, a similar projection should be included on the template. The blank is then cut out using a hacksaw and filed very accurately to shape. Due to the relatively thin steel used, this is easily achieved, although it still produces a stiff and stable template. The template should fit precisely on to the moulding.

#### TEMPLATE MAKING MACHINE

Template making machines which produce plastic templates suitable for this grinding machine can be supplied by Wadkin. Contact Wadkin for full details.

Using CNC technology, complex profiles can be drawn on screen and downloaded to the machining unit for rapid template production.

Some of the benefits of this method are :-

- Consistent accuracy guaranteed
- The facility to scale down existing profiles to suit variations in timber sizes.
- Profiles can be stored on file for immediate production of duplicate templates
- Finish component checking gauges can also be made.

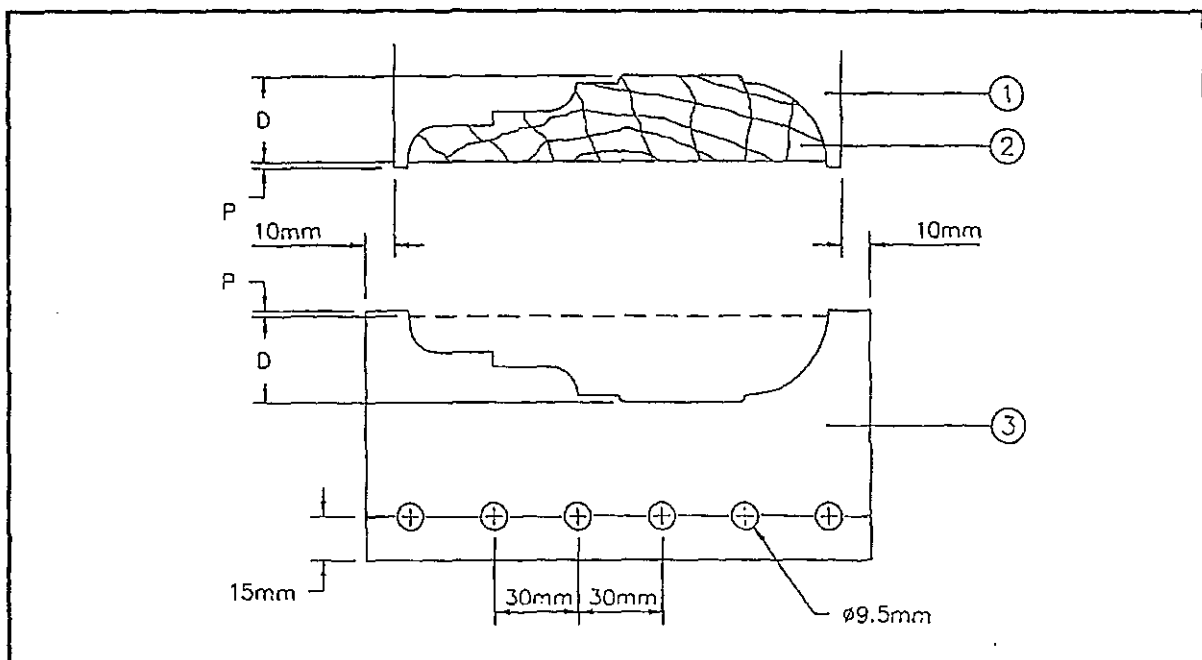


Fig. 3c

### 3.5 ARMREST ADJUSTMENT

The armrest is adjustable in both height and position and should be set to give a comfortable posture for the operator.

Four height settings are available by arranging the loose collars [1] above or below the fixing bracket [2]. With the fixing nuts loosened the armrest can be moved forwards or backwards to suit the operator's forearm length, and the diameters of cutterheads to be ground. If a wide range of cutterhead diameters are used it may be necessary to move the armrest to the forward position for small diameters and to the outer position for large diameter cutters. Short operators may require a duckboard to stand on to avoid excessive reaching.

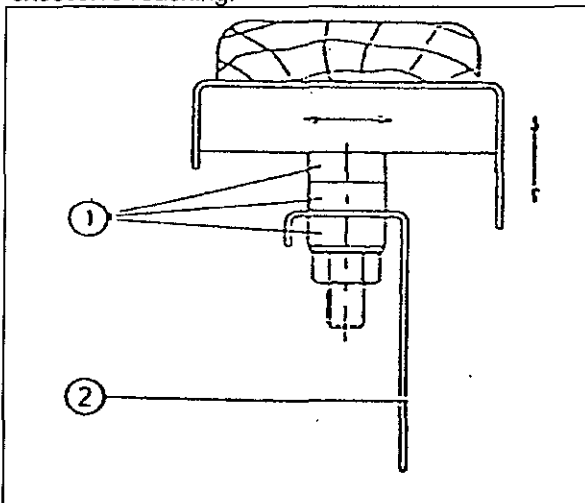


Fig. 3c

### 3.6 TOOLS AND ACCESSORIES

The tools and accessories supplied with the machine should be unpacked and checked (Appendix A4) to ensure that the machine is complete. Hand tools should be conveniently placed for use by the operator as and when required.

Grinding wheels must be stored carefully to avoid damage.

On some machines a tool and wheel storage cupboard is provided on the left of the machine. Storage for spanners and other equipment is provided in the door and the sliding middle tray, and for grinding wheels in the slide-out lower tray.

### 3.7 TESTING THE MACHINE

Check that all guards and covers are correctly fitted - particularly the wheel guards.

Check that the carriage movement is free and does not tend to move towards the grinding wheel when released.

Check that there are no loose items on the grinding spindle before starting the machine

Switch power on and check that the worklamp is working correctly.

It is important to check that the machine has been connected to give the correct direction of rotation:-

On machines without a variable speed facility start and stop the grinding spindle and check the direction of rotation. The profile grinding spindle should rotate anti-clockwise when viewed from the right hand side of the machine.

If a variable speed facility is fitted the above method **cannot** be used as the spindle rotation will be correct even if the connections are incorrect.

Where a powered head tilt is fitted, the left arrow button should cause the head to tilt down to the left. Check that the limit switch will prevent movement beyond the limit of travel.

As a final check on all machines, make sure that the rotation of the coolant pump corresponds to the arrow on the pump body. NOTE: Do not run coolant on a stationary grinding wheel

If any of the above criteria are wrong, any two of the line lead connections at the incoming supply should be reversed by a competent electrician, and the rotations rechecked.



### SECTION 4 : OPERATION

#### 4.1 SAFETY

Wheel Guard - The Wheel guard serves two purposes :

- 1) To avoid, as far as possible, the chance of an operator coming into contact with the wheel.
- 2) The guard should contain the majority of wheel fragments if it shatters.

The wheel guard should ALWAYS be in the correct position.

Safety Goggles - Eye protection is of the utmost importance in the presence of sparks and flying particles caused during grinding. Safety goggles should be worn at all times in the grinding area.

Protective clothing - Safety aprons, gloves and safety shoes should be worn particularly when handling woodworking cutters.

Dust protection - A coolant flow from above aids the cooling of the cutter, but more importantly it washes away all the wheel and grinding dust. Always use coolant when grinding or dressing the wheel.

Note : Dry grinding requires extraction.

Grinding wheels - Must always be correctly mounted, and only by suitably trained personnel. The profile grinding spindle is designed to use conventional bonded grit wheels. The straight knife spindle is designed to use only C.B.N. or diamond type wheels with a solid aluminium core.

Conventional bonded grit wheels MUST NOT be used on the straight knife grinding spindle.

Personal items - such as jewellery, rings, watches, bracelets etc. should be removed. Remove or fasten loose articles of clothing such as neckties, and confine long hair to avoid risk of entanglement.

Barrier cream - the use of a barrier cream is recommended when working with coolant fluids.

Stop the machine - before making adjustments, measuring, loading or unloading, etc. to avoid unintentional contact with the grinding wheel.

Keep clear until rotation has ceased.

Lighting - Always ensure adequate lighting. Areas of poor lighting or shadow can create unnecessary risks for the operator.

Care of the machine - Clean down regularly and ensure that the machine is kept in good condition.

Safe operation - of machinery requires constant alertness and close attention to the work in hand.

Materials - This machine is not designed for the grinding of aluminium, magnesium, or other materials which might create risks of fire or explosion.

## 4.2 GRINDING HEAD POSITION

The machine is equipped with two grinding spindles. This allows very quick changeover from profile grinding to straight knife grinding without the need to change wheels, guards, or cutter rests / knife guides.

To change position the headlock [1] is released leaving the head assembly free to rotate through  $90^{\circ}$  in the horizontal plane. The required spindle should be moved into the grinding position and the headlock securely tightened. Take care to keep the carriage assembly clear as the head is rotated.

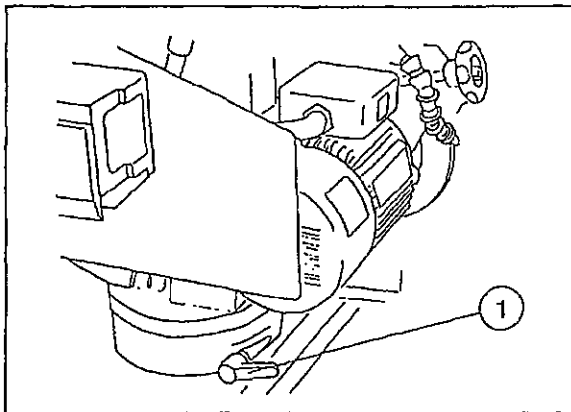


Fig. 4a Headlock

Stops are provided within the head assembly to locate the head position. Make sure that the head is brought gently into contact with the stop before locking.

The coolant supply and electrical controls are automatically switched to whichever spindle is in the operating position.

Always wait until the wheel rotation has ceased before moving the head.

## 4.3 PROFILE GRINDING

The profile grinding spindle should be set in the grinding position as shown in Fig. 4b.

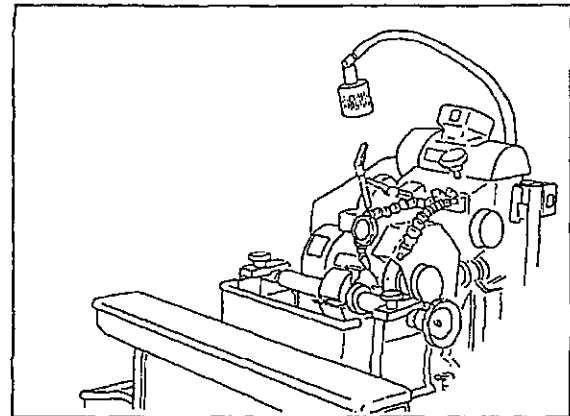


Fig. 4b Profile grinding position

## PROFILE GRINDING WHEELS

In the U.K., the Health and Safety at Work Act (1974) requires that :-

NO PERSON SHALL MOUNT ANY GRINDING WHEELS UNLESS HE HAS BEEN TRAINED AND APPOINTED IN ACCORDANCE WITH THE ABRASIVE WHEELS REGULATIONS 1970 No.535 (REGULATION 9).

It is a statutory requirement that the person who mounts grinding wheels onto the grinding machine shall be a trained and competent person appointed by the factory occupier, and whose name must be registered in an appropriate register.

In other areas local regulations should be checked and adhered to.

### CHOOSING THE WHEEL

Aluminium oxide vitrified bonded grit wheels are normally used for profile grinding solid H.S.S. and H.S.S. on iron cutters. The various wheel options are listed in Appendix A5

As a general guide, the wheels used for profile grinding are coarser and softer than those used for hand grinding, so a much faster grind is possible.



A 60 grit wheel is normally used for roughing out and a 220 grit wheel for finishing.

New wheels should always be 5 mm wide. Subsequent dressing will bring the wheel to the required width and form to match the stylus.

The wheel speed should be checked. Grinding wheels should never be operated at a speed in excess of the permissible speed (r.p.m.) marked on the wheel. The speed of the grinding spindle is marked on the machine.

#### CHECKING THE WHEEL

The wheel should be closely inspected for any signs of damage (e.g. chips, cracks, discolouration, etc.) which may have occurred in storage, or in transit. The 'Ring Test' should be carried out in a place where the 'ring' may be easily heard.

The ring test depends on the fact that the damping characteristics of a cracked wheel alters the sound emitted when a wheel is lightly tapped. It is subject to interpretation by the operator and is primarily applicable to vitrified bonded wheels. To perform the ring test, wheels should be tapped gently with a light non-metallic implement such as the plastic handle of a screwdriver.

Tap the wheel approximately 45 degrees each side of the vertical centre line and approximately 1 or 2 inches from the periphery, then rotate the wheel 45 degrees and repeat the test.

A sound, undamaged wheel will give a clear tune. If cracked, there will be a dead sound and not a clear ring, and the wheel must NOT be used.

#### DAMAGED WHEELS MUST NOT BE USED.

#### MOUNTING THE WHEEL

The machine should be electrically isolated to prevent unexpected start-up of the spindle whilst mounting the wheel.

When the spindle rotation has ceased the wheel guard should be opened. Note : The wheel guard is designed to be opened by the use of a spanner to deter unauthorised access.

If a wheel is already fitted it should be gripped to prevent it rotating whilst the spindle nut is

loosened. The nut [1], washer [2], outer flange [3] and wheel [4] can then be removed. The rear flange [6] can be left in position on the spindle.

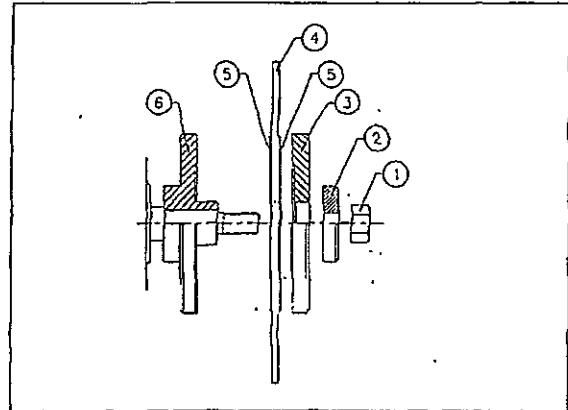


Fig. 4c Grinding wheel mounting

Check that the wheel flanges are in good condition, free from burrs, and seat correctly on the grinding spindle. Wipe the spindle and flanges clean before re-assembly.

When fitting a new wheel, one side of the wheel should be marked as datum.

Whenever a wheel is fitted the marked (datum) side should always be brought up against the rear flange [6].

It is most important that soft card washers (blotters) [5] are fitted between the wheel and the wheel flanges. These ensure that the tightening stresses are evenly distributed around the inner and outer flanges, prevent slipping at lower clamping pressures and reduce wear on the flanges.

Note : Wadkin wheels are normally supplied with the blotters already fitted to the wheel.

The wheel bore should always give a good location fit. Do not attempt to force a wheel on or modify the bore size. With the wheel and blotters correctly seated, re-fit the outer flange [3], washer [2] and nut [1]. The wheel should be gripped to prevent rotation and the spindle nut tightened. Excessive clamping of the spindle nut should be avoided to prevent damage to the wheel.

Note : The method of gripping the wheel by hand when tightening the locknut ensures that only a limited amount of torque can be applied. The correct tightening torque required is 12 Nm (9 ft lbs).



### RUNNING THE WHEEL

The wheel guard must be closed and securely locked before the wheel is started.

A newly mounted wheel and a wheel being re-mounted, should run free for a short period (1 minute is recommended) before it is used, and everyone should stand clear. Note : A re-mount should always be treated as a new wheel. If damage to the wheel has gone undetected it is possible that the wheel could disintegrate when it is started up.

### IMPORTANT

SHOULD A WHEEL DISINTEGRATE, ALWAYS CAREFULLY EXAMINE THE SPINDLE, THE GUARDS AND THE FLANGES TO ENSURE THAT THEY ARE NOT DAMAGED.

A small amount of unevenness is not uncommon on new wheels, but any high spots are normally removed when the wheel is dressed.

### Grinding wheel DOs and DON'Ts

#### DO

- 1) HANDLE and STORE wheels in a safe manner.
- 2) VISUALLY INSPECT and RING all wheels before mounting, for possible damage.
- 3) MAKE SURE OPERATING SPEED established for machine does not exceed speed marked on wheel.
- 4) CHECK MOUNTING FLANGES for equal and correct diameter and that they are clean, free from burrs and recessed where applicable.
- 5) USE MOUNTING BLOTTERS where required.
- 6) Be sure CUTTER REST is not more than 2 mm away from the periphery of the wheel.
- 7) Always USE THE WHEEL GUARD.
- 8) Allow NEWLY MOUNTED WHEELS to run at operating speed with guard in place for at least one minute, with ALL PERSONNEL STANDING CLEAR before grinding.
- 9) Always WEAR SAFETY GLASSES or some type of eye protection and protective clothing, where necessary, when grinding.
- 10) TURN OFF COOLANT before stopping wheel to avoid creating an out-of-balance condition.
- 11) DRESS the wheel regularly to avoid loading.

#### DON'T

- 1) Use a wheel that HAS BEEN DROPPED.
- 2) FORCE a wheel onto the machine spindle OR MODIFY size of the mounting hole.
- 3) EVER EXCEED MAXIMUM OPERATING SPEED established for the wheel.
- 4) Use mounting flanges on which the bearing surfaces ARE NOT CLEAN AND FLAT.
- 5) TIGHTEN the mounting nut EXCESSIVELY
- 6) TRAP the workpiece between the wheel and cutter rest.
- 7) Start the machine until the WHEEL GUARD IS IN PLACE.
- 8) Grind on the SIDE OF THE WHEEL
- 9) STAND DIRECTLY IN FRONT OF a grinding wheel whenever a machine is started.
- 10) Grind material for which the WHEEL IS NOT DESIGNED.
- 11) ROLL WHEELS ALONG THE FLOOR.
- 12) BANG THE WORKPIECE AGAINST THE WHEEL.



### DIAMOND WHEELS

Diamond wheels are normally used for profile grinding T.C.T. cutters. The various wheel options are listed in Appendix A5.

Diamond profile grinding wheels have a relatively thin layer of diamond abrasive bonded onto a solid aluminium core.

### DIAMOND WHEELS SHOULD NOT BE DRESSED.

Because dressing is not used, the correct width and form of wheel must be selected to match the stylus used. Diamond wheels are mounted using the normal wheel flanges, but blotters should not be used.

A small amount of unevenness is not uncommon when these wheels are started up, but the wheel should quickly bed down as any high spots are worn down during grinding.

### DRESSING THE WHEEL

The purpose of dressing the wheel is :-

- 1) To produce a wheel profile identical to the stylus.
- 2) To compensate for wheel wear.
- 3) To 'open up' the wheel for free cutting by presenting new sharp grains of abrasive to the surface.

A full width rounded wheel should be dressed for most cutter profiles as this wears down more or less evenly. It may be used to rough and finish grind external corners, external curves, bevels, straight sections and internal curves with a radius larger than that of the wheel.

A suitable small radius or sharp edged wheel should be used to complete those parts that the half-round wheel cannot finish. The contact area of small radius and corner grinding wheels is small, so it is advisable to use a harder wheel. When changing the grinding wheel shape it is essential to make sure that it matches the stylus and that it is aligned correctly.

THE DRESSER

The dressing diamond is mounted onto the end of a screw [1] which allows for initial alignment, compensation for diamond wear and can provide for variations in radius of dressing.

The dresser has two basic movements. One is a rotary movement about a vertical axis, which is used to dress a radius on the periphery of the wheel (rounded). A lock [3] is provided for this movement.

The second is a swivel movement about a horizontal axis which is used to dress the sides of the wheel and to dress the periphery to a square edge or angle.

The movements are controlled using a hand lever [2] which allows dressing to be carried out with the hands well clear of the wheel and coolant flow. The dresser is located in its vertical position by spring plunger [7]. The plunger can be dis-engaged by a quarter turn. The swivel movement can be locked using the knurled knob [8].

When the dresser is not in use it should be parked swivelled down to the horizontal position to avoid possible foul conditions with the spindle drive motor.

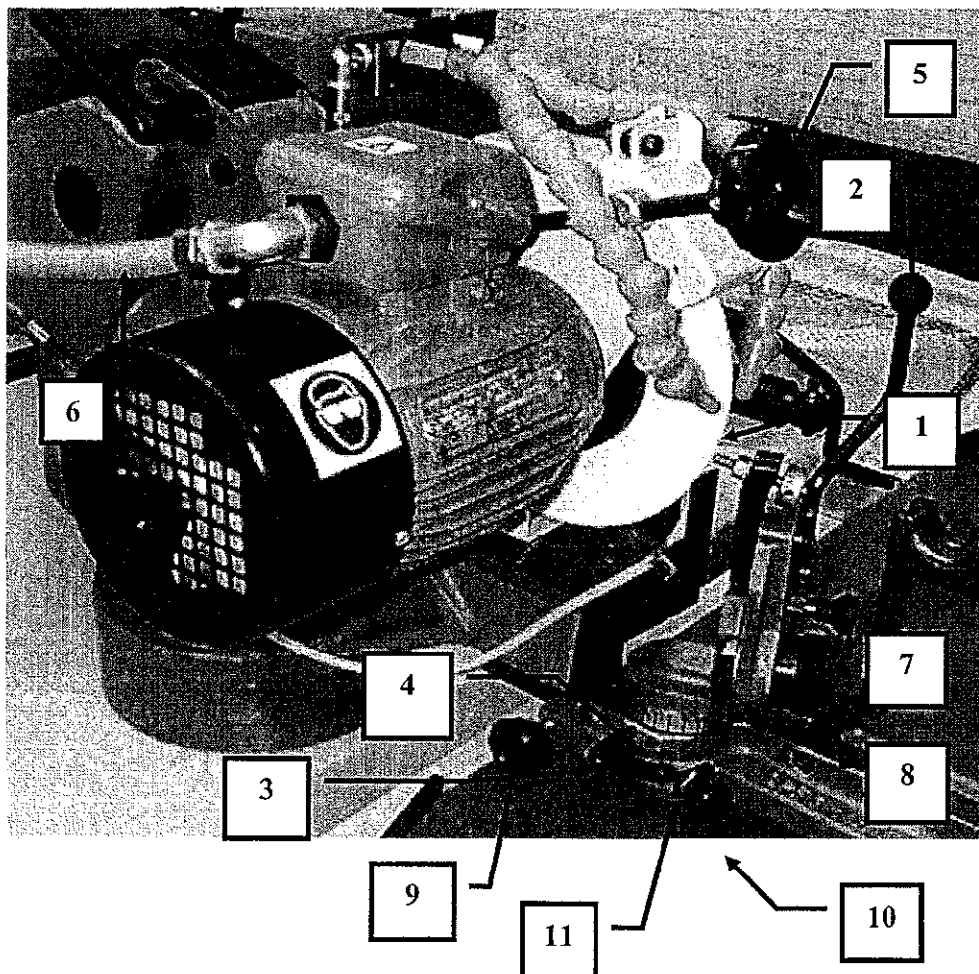


Fig. 4d

DRESSER LOCATION

The positioning of the dresser relative to the grinding wheel is determined by the fork assembly on the front of the dresser unit which should be engaged with the location plate mounted directly below the cutter rest.

The lateral adjustment screw on the right hand side of the dresser fork is factory set, such that the dresser rotates symmetrically about the grinding wheel and should not be tampered with.

A handwheel [9] is provided on the left hand side of the dresser fork which is used to secure the dresser in position.

The adjustment handwheel [10] positions the dresser relative to the cutter rest and hence determines the gap between the grinding wheel and the cutter rest. Winding the handwheel in will reduce this gap whilst winding it out will increase it. The gap should be set between 0.5 mm and 2 mm as described in section 1.4.

The locking nut [11] should always be secured after making this adjustment.

With the dresser securely located, the set relationship between the stylus, dresser, template and wheel ensures that, when dressing is carried out, the wheel is automatically re-aligned to the stylus. As the wheel reduces in diameter no additional adjustment is needed for re-alignment.

DRESSER OPERATION

## IMPORTANT :

The dressing movement should be un-hurried and the cut light to avoid ripping out and wasting grit, to achieve a good surface finish from the single point diamond, and to avoid unintentional contact with the wheel.

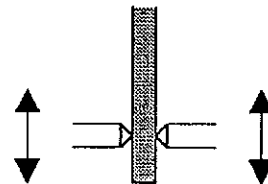
Coolant should be used whilst dressing to prevent dust formation, and to prolong the life of the diamond.

Eye protection must be used.  
The wheel guard should be closed.

WIDTH DRESSING

Because of the firing process in the manufacture of vitrified wheels, the wheel cannot be guaranteed to be perfectly flat and the right thickness. Although dressed and sized wheels may be purchased, truing is best carried out on the grinding machine.

Wheels are generally supplied at 5.0 mm width and so the wheel must be sized to the selected stylus width ( generally 4.7 mm or 3.0 mm wide).



Using the handlever the dresser should be rotated to the stop position at the right hand side of the wheel and locked [3] in position. With the spring loaded plunger [7] dis-engaged the dressing diamond can be moved along the side of the wheel.

The dressing diamond [1] should be screwed in until it touches the side of the wheel and the locknut locked. The wheel and coolant are then started and the side of the wheel dressed.

Stop the wheel and rotate the dresser through 180° to the opposite side.

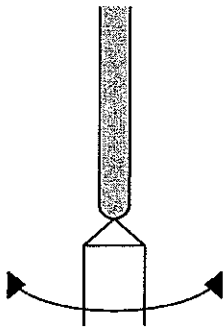
Lock [3] in position and dress the left hand side of the wheel.

With both sides dressed and the wheel stopped, the width of the wheel should be measured using a micrometer or vernier calliper, and compared to the stylus width. The difference between the two measurements is halved and this distance is the amount the dressing diamond will need to be moved in, in order to size the wheel.

Successive dressings may be required from both sides of the wheel to bring it to the required width. A maximum dressing cut of 0.1 mm (0.004") is recommended. Each graduation on the dressing diamond scale represents 0.05 mm (0.002").

Note : Machines are often despatched from Wadkin with the dresser set to suit a 4.7 mm stylus and a wheel which has been dressed to width during machine testing.

#### DRESSING A RADIUS



Using the handlever [2] the dresser should be brought up to the wheel and, with the plunger [7] engaged, rotated through  $180^\circ$  to dress the radius. Successive dressing cuts are taken by moving the wheel towards the dresser using the handwheel [5] (Fig. 4d) at the top of the wheel guard. The lock [6] should be released when moving the wheel.

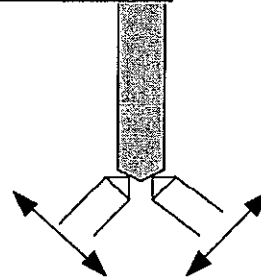
Note : When dressing a radius on a new wheel or changing shape, the wheel should be backed off from the dresser and then advanced taking a series of small cuts. Regular changing of shapes by dressing can be wasteful on wheels. It may be preferable to change wheels.

#### DRESSING SQUARE



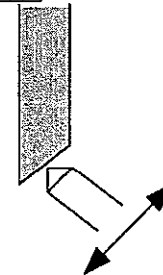
The dresser is brought up to the front of the wheel and set at  $0^\circ$  using the scale [4] (Fig. 4d). The rotation should then be locked [3]. With the plunger [7] dis-engaged, the front of the wheel is dressed by moving from side to side.

#### DRESSING A 'V' FORM



The dresser is used as for square dressing but with the required angle set on the scale to suit the stylus shape. A series of cuts should be used if changing the wheel shape.

#### DRESSING AN ANGLE



Dressing is again carried out as for square or 'V' dressing but in this case the dresser location position must be changed by adjustment of handwheel [10] (Fig 4d) and the cutter rest gap reset. Note : If the dresser location position is changed part way through a cutter grind, the automatic datum is lost and must be compensated for by adjustment of the template slide.

## MOUNTING THE CUTTERHEAD

**IMPORTANT :** The grinding wheel must be stationary when loading or unloading the machine to avoid unintentional contact with the wheel.

Hydro-lock type cutterheads should be pressurised to lock the block onto the arbor. All other cutterheads should be locked to the arbor using the locking collars supplied.

One half of the locking collar set [6] is clamped either side of the cutterhead. To lock the cutterhead in position, the lock nut [7] of the larger collar is wound firmly against the cutterhead using the tommy bar provided.

Fit the cutterhead onto the arbor or, if the same arbor has been used on the setting stand, simply transfer it over to the grinder. The arbor should be loaded onto the grinder with the handwheel [1] to the right. The pair of arbor bearings should locate over the axial location key [8]. The arbor clamps [2 & 3] should then be 'nipped' in position - do not over-tighten.

**Note :** The machine is normally supplied with a heavy duty arbor which is fitted with a 37 mm outside diameter bearing [4]. Arbor sizes below 40 mm (1 1/2") diameter are fitted with a 28 mm outside diameter bearing to allow removal of the cutterheads. If the smaller arbor sizes are used, alternative sizes of shell [5] and clamp [3] must be used. (See Appendix A5).

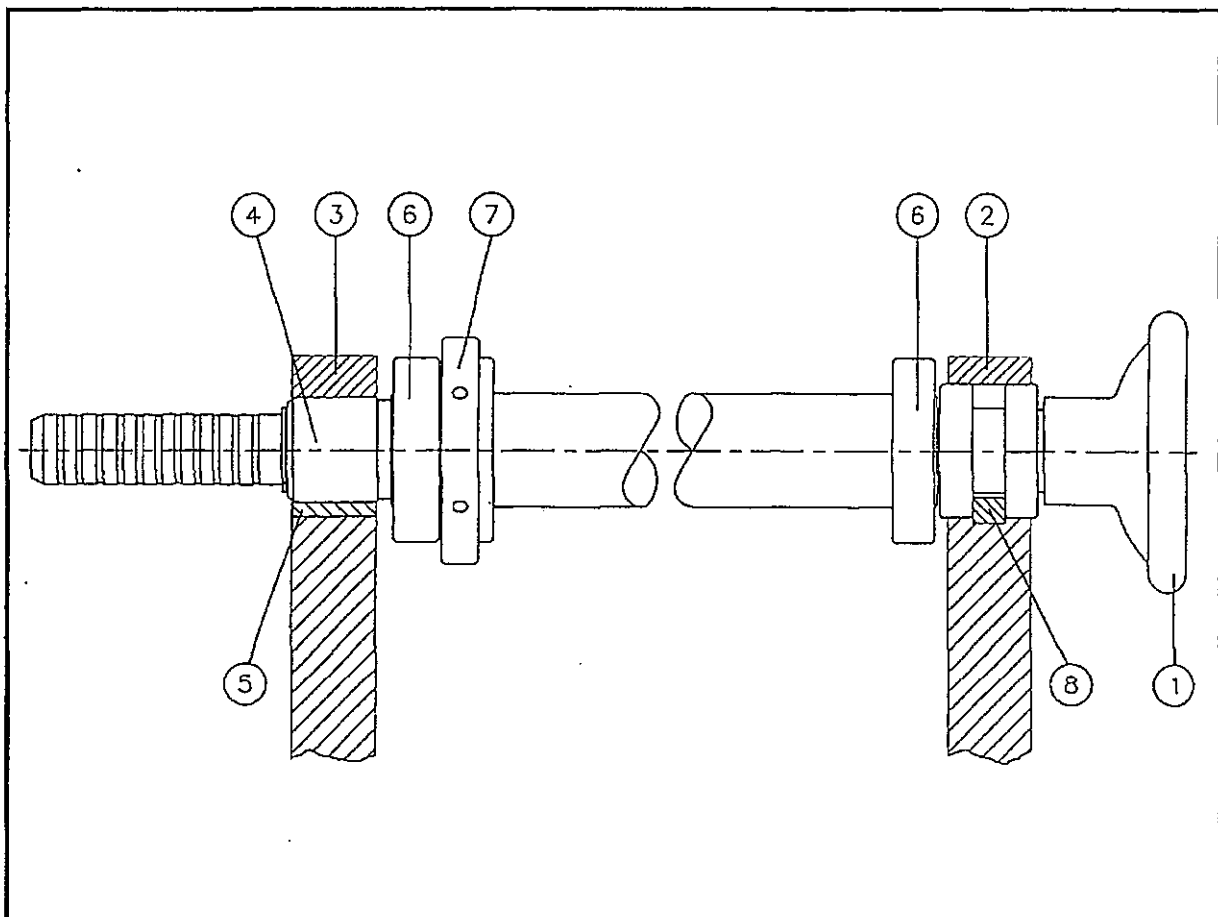
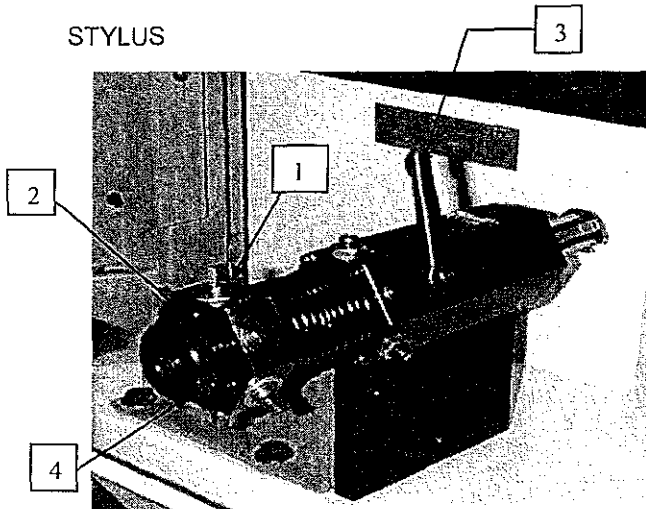


Fig. 4f Arbor assembly

The cutterhead should not be locked to the arbor until the template and stylus are fitted. The cutterhead is positioned along the length of the arbor to align the position of the cutter profile and grinding wheel with that of the template and stylus. When in approximately the correct position the cutterhead should be locked to the arbor.

#### STYLUS



Stylus Turret Mount

Fig. 4g

Six styli to suit various profiles are supplied mounted in an hexagonal turret. The most commonly used stylus is 4.7 mm wide, half round at one end and square at the other. The stylus can be rotated in its holder to present either of these forms to the template. For the majority of profiles the radiused form is used throughout the grinding process. If features such as square corners are contained within the profile then it will be necessary to turn the stylus round. More intricate profile shapes may require the use of the alternative styli. Before using any particular stylus it will be necessary to square it up to the template location using either a template with a square end, or an engineers square. The stylus is locked in position using the locking screw [2].

The turret is rotated by releasing lock [3] and pushing the turret to its furthest back position where it is free to rotate. With the selected stylus in position the turret is moved forward re-engaging the hexagon location.

The stylus should be positioned to suit the diameter of cutterhead to be ground and locked using handle [3]. This sliding stylus arrangement provides a quick set facility when grinding cutterheads of widely differing diameters.

In order to maintain the automatic dressing datum, the stylus turret position should not be moved part way through grinding a cutterhead. The turret can be rotated by releasing knob [4], and rotating to the selected stylus. The turret is positioned by a pin location. Lock knob [4]. This can be carried out without losing the dressing datum.

Note : Whenever the stylus is changed it will be necessary to redress the wheel.

#### POSITIONING THE TEMPLATE

The grinding wheel must be stationary whilst positioning the template. Ensure that both the template and the template carrier are clean and that the location edges are free of bumps or bruises. The template is fixed in position [6] (Fig. 4h) on the carrier using either two M8 screws in the tapped holes provided, or, using the two template clamps. Ensure that the template seats correctly.

The template and stylus positions must be set to bring the cutter into the correct position relative to the grinding wheel.

When the stylus has been locked in position, fine adjustment is made by moving the template slide in and out. The lock [2] should be released and adjustments made using the handwheel [1].

The axial (left / right) position of the template is adjusted by unlocking the handle [5] and adjusting the handwheel [8]. It may be necessary to make repeated adjustments of the in / out and axial windings before the template is positioned sufficiently accurately relative to the cutter when regrinding existing profiles.



When grinding, the depth of cut is controlled by movement of the template slide using handwheel [1]. Locks [2] and [5] should always be secured whilst grinding is carried out.

Dial indicators [3] are provided for both axes of the template slide to allow for accurate positioning. The amount of travel on the dial indicators is less than that provided for the template slides. The locking knobs [4] should be left unlocked whilst setting up the templates to avoid damage to the dial indicators. When required, the appropriate locking knob [4] should be secured and the indicator dial rotated to set to zero. The dial indicator will then indicate the amount of movement of the template slide.

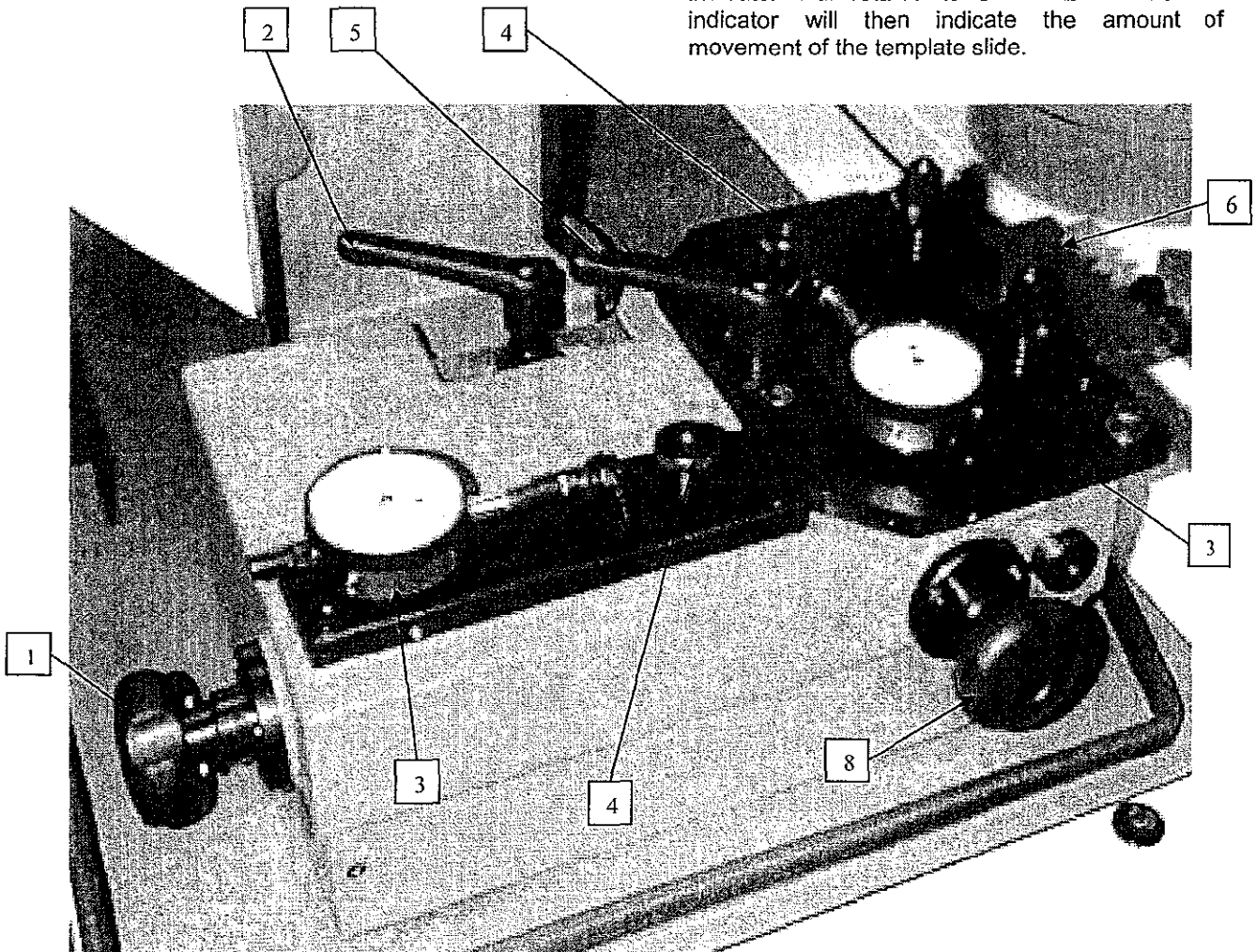


Fig. 4h

## HEAD ADJUSTMENT

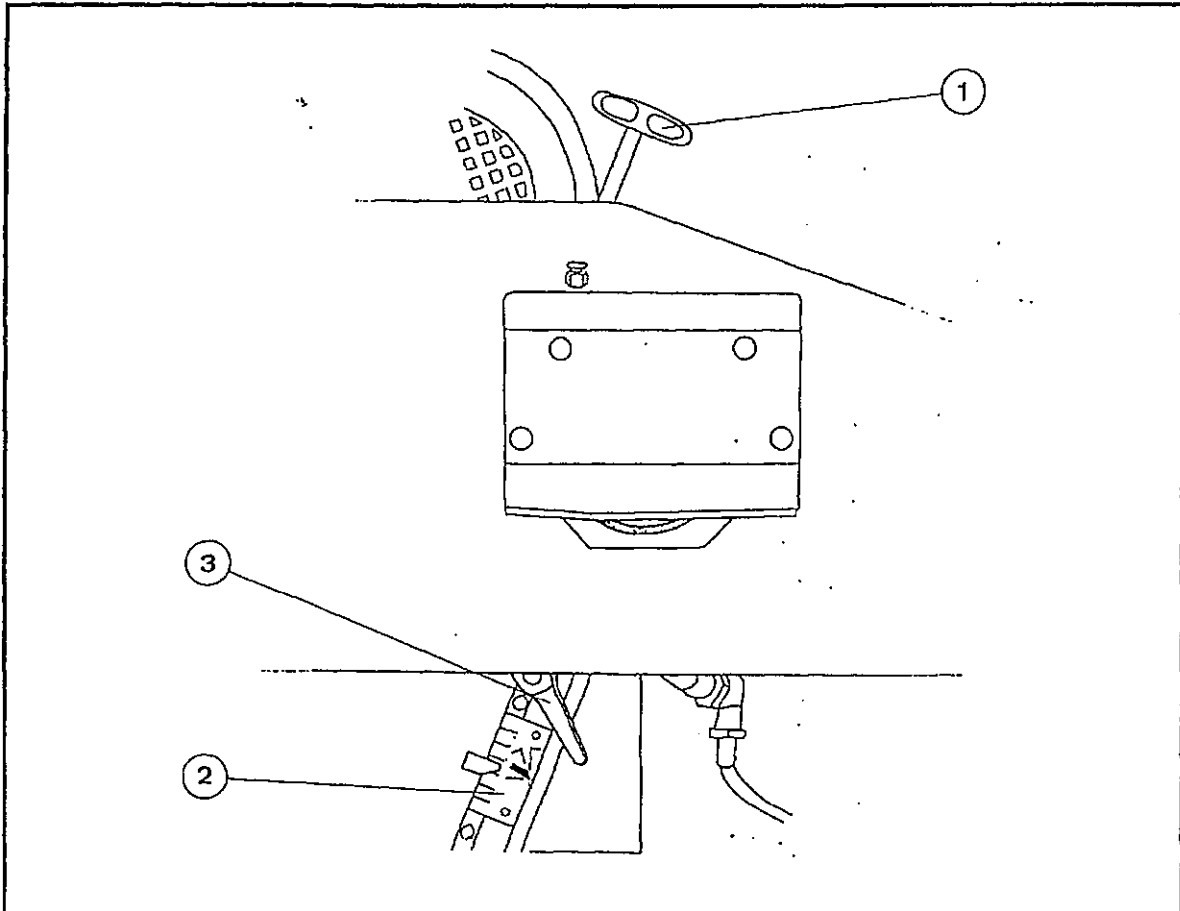


Fig. 4i

To set the cutter clearance angle, the grinding wheel is wound up or down in relation to the cutter rest. The rise and fall handwheel [1] is located at the top of the machine. (It is advisable to use the crank handle supplied with the machine when making this adjustment.) By winding the head up the clearance angle is increased and by lowering it is reduced. The lock for this movement is at position [3].

Whenever the cutter clearance angle is varied it will be necessary to re-dress the wheel to restore the automatic datum and cutter rest gap.

A scale [2] is fitted to indicate the clearance angle set. Due to the complex geometry of the headslide variations will occur as the wheel diameter is reduced. If an accurate clearance angle setting is required when using a reduced diameter wheel, a modified scale reading from Fig. 4j should be used.

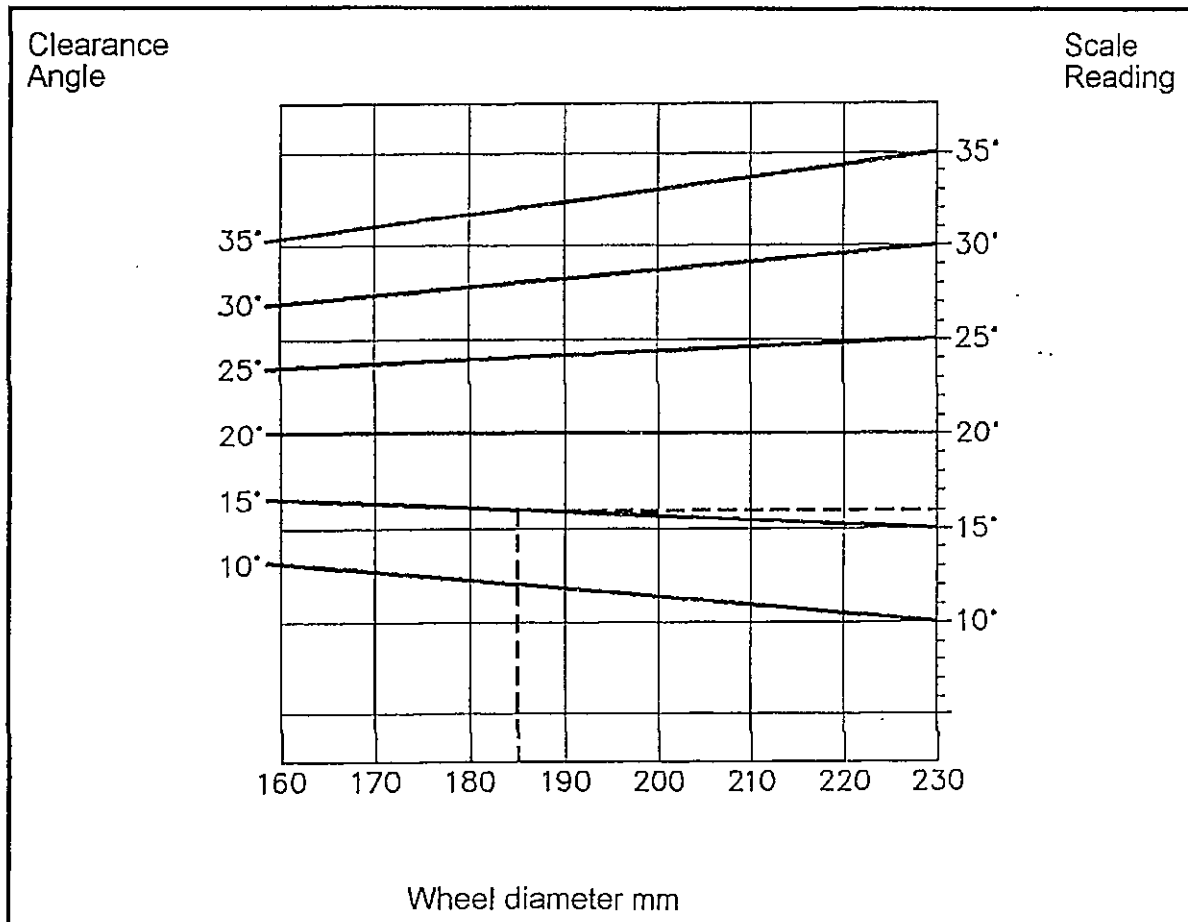


Fig. 4j

Example :

To set a clearance angle of 15° using a 185 mm diameter wheel, the head should be set to 16° on the scale.



## COOLANT APPLICATION

**IMPORTANT :** Coolant must always be used when grinding;

- a) It prevents overheating of the cutters which may lead to loss of hardness or even cracking of the cutting edges. If this should occur, cutters would need to be replaced.
- b) It washes away grinding dust and debris.
- c) It prevents the formation of airborne dust.

The flow of coolant to the twin nozzles above the cutter is controlled by taps mounted above the wheel guard. The flow to the underside of the cutter is not fitted with a tap. Both flows of coolant should be as large as possible and directed as close as possible to the grinding point.

Prolonged immersion of a stationary wheel can create an out of balance condition. Coolant should never be left to run onto a stationary wheel. When starting up :-

- 1) Start wheel
- 2) Start coolant

When stopping, the coolant should be shut off and the wheel allowed to run free for a few seconds until the coolant is removed.

## CARRIAGE CONTROL

The machine carriage may be moved around in order to reproduce the cutter profile to the depth allowed by the stylus and template. The rotation of the arbor must be controlled to keep the cutter in contact with the cutter rest. The best control may be achieved by keeping both elbows or forearms on the armrest and holding the arbor handwheel with one hand and the plain arbor handle with the other. Controlling the machine in this way will aid operator comfort by keeping hands away from the grinding area thereby reducing contact with the grinding coolant.

Once the cutter is firmly in contact with the cutter rest watch the template and stylus (NOT the cutter) so as to anticipate the carriage movements needed. Grinding progress can then be gauged by the sound and feel of grinding. Grinding pressure should be light enough to allow the grinding wheel to cut freely. If necessary let the cutter ride lightly on the grinding wheel, leaving a gap between the template and stylus, which is narrowed during repeated grinding passes until the cutter is ground away. Keep the cutter moving at all times and in the smoothest possible manner.

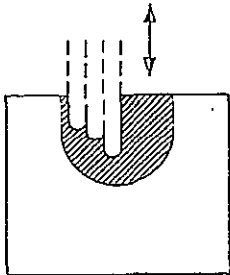
Side grinding should only be performed with wheels designed for the purpose. Grinding on the flat sides of wheels designed for peripheral grinding may be dangerous and cause broken wheels. This does not preclude their use for applications such as shoulder and form grinding where it is recognised that a limited amount of side grinding is performed. Extreme caution should be exercised not to use excessive pressure.

## ROUGH GRINDING

When a profile is first ground into a set of cutter blanks, it is necessary to 'rough out' in order to remove the majority of the material.

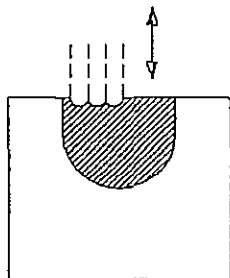
Always set the grinding wheel vertical when grinding out large amounts so that pressure is applied only to the rim of the grinding wheel.

When roughing out a nibbling action is adopted, i.e. a series of parallel plunging cuts directly into the grinding wheel, to form a series of close slots. Avoid unnecessary sideways movement as excessive side pressure can cause wheel breakage.

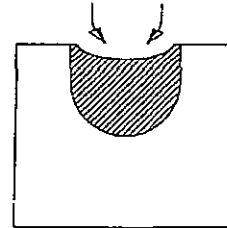


When grinding solid H.S.S. or T.C.T. cutters deep plunge grinding can cause excessive burning of the cutters. In addition, it can cause wear to the side of the wheel, causing it to become thinner than the stylus, resulting in insufficient material being ground off the cutters.

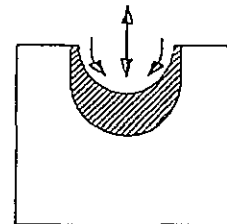
A combination of plunging and nibbling movements can therefore be used :



1) Shallow plunge grind.



2) Nibble across.



3) Continue with a combination of plunging and nibbling until the full profile depth is achieved.

For deep shoulder sections it is advisable to rough out the majority of the material before grinding the profile to its full width.

When first using the profile grinder it may be an advantage to set the template to small grinding depth (say 3mm). Grind this out, then step back the template by a further 3 mm to allow more grinding. Continue this procedure until the cutter is fully profiled. By using the template in this way a grind limiter is set, so allowing only a small amount to be ground off the cutter at any setting. This allows for more control so enabling confidence to be gained quickly.

Note : In cases where a cutterhead has several knives it is advantageous to 'rough out' all the knives at a single template setting. This procedure will necessitate frequent wheel dressing.

All the knives on the cutterhead should be roughed out and the wheel re-dressed to re-establish the fixed datum. A small amount is then ground from each knife without adjusting the template position to ensure that all the knives are ground equally prior to finish grinding.

The variable speed facility enables the optimum grinding speed to be found for any type of tool steel. By increasing the grind speed, a given composition of grinding wheel will seem to behave harder and be less likely to breakdown. This can be useful when grinding delicate profiles where good form retention by the grinding wheel is required. Similarly, by reducing the grind speed, the wheel will seem softer and breakdown more quickly, thereby being less prone to glazing.

As the wheel diameter reduces, the spindle speed can be increased to maintain a constant surface speed at the point of grind and so maintain constant cutting conditions.

## FINISH GRINDING

Once the rough grinding is completed on all of the cutters, the wheel should be dressed again to re-establish the datum. If desired, the template may be wound slightly back off the stylus to increase the amount to be ground off the cutters. The cutter can be finish ground using the soft roughing wheel (usually a 60 grit). As the finish cut is very small almost no wear will take place, therefore, all of the cutters are of the same shape and as near as possible in the same projection radially.

A finishing wheel (usually a 220 grit) is harder and less free cutting than a roughing wheel, however, they are less subject to wear and so retain their shape much longer. They are therefore ideally suited for producing very fine detail, or square corners, on the cutter.

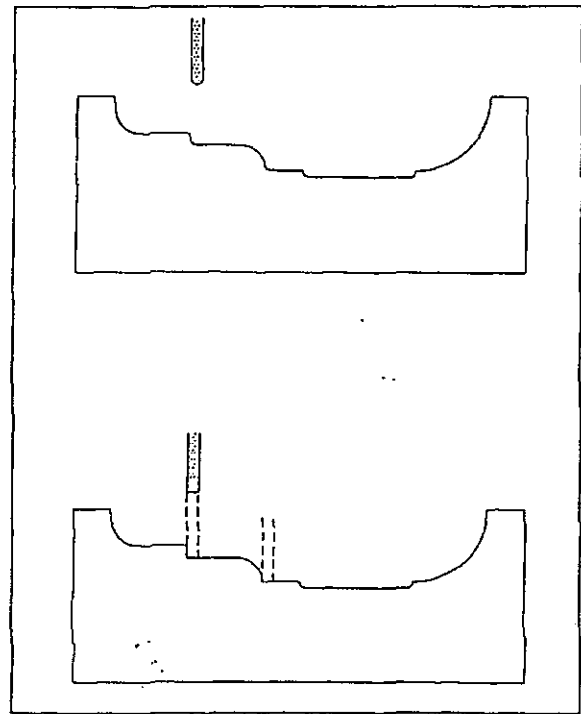


Fig.4k Finishing square corners

Generally, a round nosed shape will be used for grinding operations, however, any square corners which are required on the cutter will need the use of a squared off face on the stylus. The stylus is thus selected and the 60 grit wheel replaced with a 220 grit finishing wheel. By dressing the wheel square the fixed datum point is achieved, and this allows the stylus to be just touched into the square corners on the template, and the wheel only removes the small radii in the corner left by the round nosed wheel. By dressing the wheel the depth of cut is automatically aligned to the previous depth, so ensuring that neither a small step nor an undercut is left on the previously ground edge.

This procedure applies to all fine detailed work. The only point to remember is to ensure that the wheel is dressed to the exact shape and size of the stylus selected.

## SIDE RELIEF

The grinding of the cutters should now be complete except where side relief is required.

The head should be tilted, either to the left or the right, using the arrowed buttons on the control panel and set to the scale which is graduated from  $0^{\circ}$  to  $15^{\circ}$  in both directions.

The wheel should be dressed to suit the stylus shape and to restore the automatic datum.

Note : When dressing the wheel for side relief :

- a) A bull nose should be shaped BEFORE the wheel is tilted over to the left or right.
- b) A square face should be shaped AFTER tilting.

The areas requiring side relief should be located on the template and the back of the knife ground away without grinding deeper at the cutting edge. It will be found that the side relief will only be formed part way down the back of the knife. This is to prevent inadvertently removing material from the cutting edges. If side clearance is required to be generated right up to the cutting edges then this can be achieved by sideways adjustment of the template.

All knives are ground to give clearance on, say, the right hand side and then the whole operation is repeated with the wheel tilted to the left hand side. This ensures all areas of the profile at  $90^{\circ}$  to the cutting action are given the required relief.

The cutters should now be complete. Any grinding burr should be removed from the cutters to achieve the best cutting edge. The cutterhead, complete with profiled cutters, can now be mounted directly onto the moulding machine and run without further operation.

## CUTTER RESTS

A 25mm wide hardened steel cutter rest is ideal for most cutters. It is important to keep this in good condition as described in Section 1.4.

A tungsten carbide cutter rest is supplied on some machines to give an increased wear life.

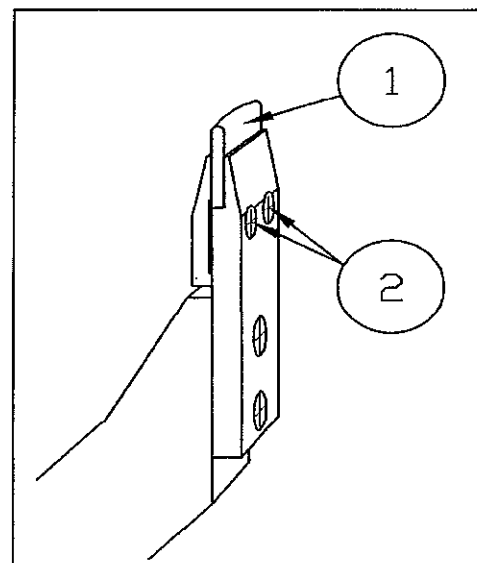


Fig.4ka Carbide Cutter Rest

Replacement carbide tips can be supplied by Ultracare. The tip [1] is released by loosening the two clamp screws [2]. Make sure that the seating is clean when fitting the new tip.

Other special cutter rests are available as described in Appendix A5.

#### 4.4 GRINDING SEGMENTAL TOOLING

Segmental and tena-disc tooling can be ground using the same method as that used for profile grinding.

In some cases the standard 25 mm wide cutter rest will be too wide for these types of cutterheads. Special narrow cutter rests are available from Wadkin to overcome this problem. See Appendix A5.

Some segmental blocks include overlapping profiles which cannot be ground in situ. In these cases a longer sleeve can be used with spacing collars [S] to make up the additional length. When grinding is carried out, the spacing collars are used to spread the block segments apart by a known amount thereby eliminating the overlap.

The template is made to suit [X+S] and may include undercuts as shown to allow square shoulders to be ground using the round nosed wheel.

#### 4.5 MEASURING

If measurement of the ground cutters is necessary with the cutterhead still on the machine, the carriage should be moved to a position well away from the grinding wheel. The machine should be switched off and the wheel allowed to come to a standstill before measuring is carried out.

It may be necessary to 'stone' the cutter to remove grinding burrs in order to achieve an accurate measurement.

Setting and measuring stands are available from Wadkin which are designed to accept the grinding machine arbor. This allows the cutterhead to be quickly transferred from machine to stand and visa-versa without removing the cutterhead from the arbor. Contact Wadkin for full details.

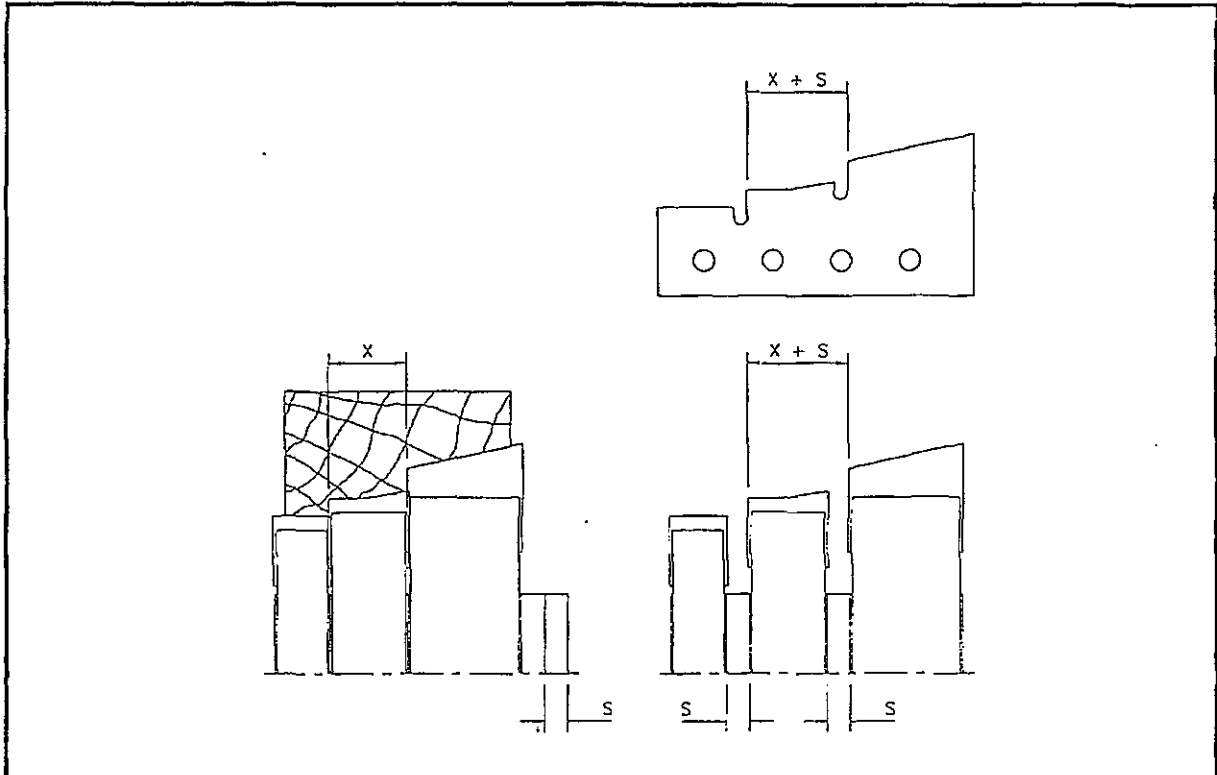


Fig. 4I



### 4.6 STRAIGHT KNIFE GRINDING

The straight knife grinding spindle should be set in the position as shown in Fig. 4m.

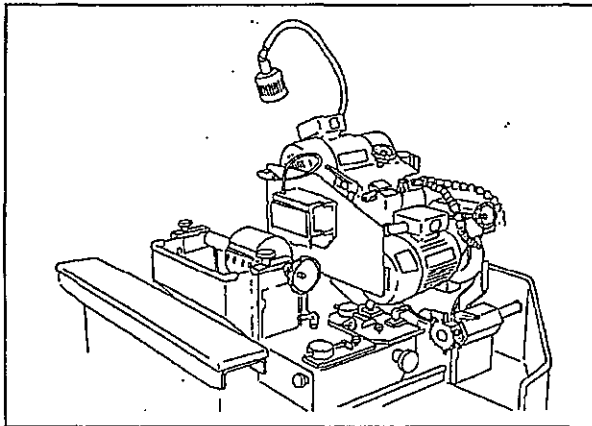


Fig. 4m Straight knife grinding position

### THE STRAIGHT KNIFE GRINDING WHEELS

The straight knife grinding spindle is designed to use C.B.N. (Borazon) or diamond type grinding wheels with a solid aluminium core.

#### CONVENTIONAL BONDED GRIT WHEELS MUST NOT BE USED

These wheels do not require dressing. The wheel [1] is mounted directly onto the spindle nose with a nut [3] and washer [2].

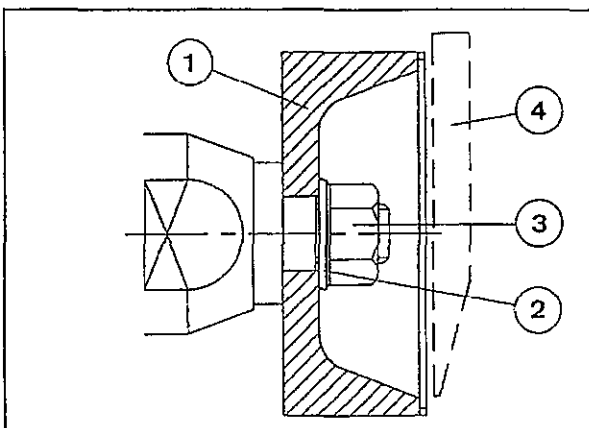


Fig. 4n Grinding wheel mounting

When mounting the grinding wheel the spindle should be electrically isolated to prevent unexpected start-up. Access to the wheel is obtained by removing the knife guide [4] which is secured by four M6 capscrews.

When mounting the wheel always inspect the bore for any dirt or damage. Clean any dirt from the bore. If there is any physical damage to the bore it is advisable that a new wheel is used, DO NOT attempt to salvage the wheel - damage suffered by the wheel may not be evident. If a grinding wheel is dropped, it should not be used.

If when mounting the wheel on the spindle nose any excessive play is felt between the shaft and the wheel bore the grinding wheel must be scrapped - DO NOT attempt to salvage.

Always use the special washer [2] supplied with the machine to clamp the grinding wheel onto the spindle.

Spanner flats are provided on the spindle nose for use during wheel tightening.

Note : The spindle nut [3] has a LEFT HAND thread and tightens by turning anti-clockwise. The correct wheel tightening torque required is 30 Nm (22 ft lbs).

A small amount of unevenness is not uncommon when these wheels are started up, but the wheel should quickly bed down as any high spots are worn down during grinding.

## KNIFE GUIDE SETTING

The knife guide is selected to match the thickness of knife to be ground. The machine is supplied with a knife guide to suit 3 mm and 4 mm thick knives. Optional knife guides are available to suit thicker knives, see Appendix A5.

The knife guide should be mounted onto the wheelguard ensuring the top edge is pushed up to the locating lip, and clamped using four M6 capscrews. Ensure that the face of the wheel is clear of the knife guide before the screws are tightened.

A 1mm thick setting gauge is supplied with the machine to enable the gap between wheel face and knife guide to be accurately set. The wheel is positioned by releasing lock [2] and turning the hexagon headed adjusting screw [1] using the wheel nut spanner.

With the gauge inserted in the gap the wheel is moved forward to lightly trap the gauge behind the knife guide. The gauge is then removed and the lock [2] secured.

As the wheel wears the gap should be checked and re-set from time to time.

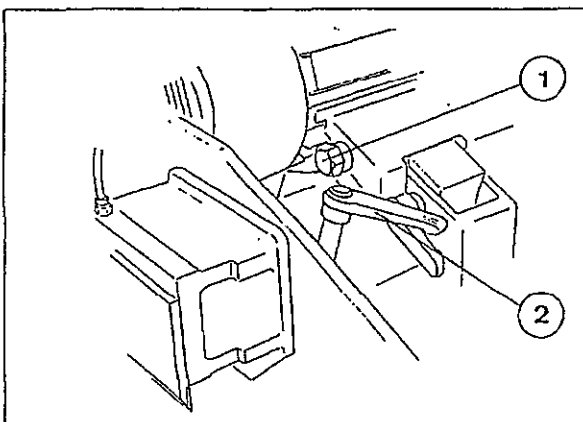


Fig. 4o

## MOUNTING THE PLANERHEAD

Knives are set into the planerhead 'off machine'. If this is done on a Wadkin setting stand the planerhead and arbor can be transferred directly to the grinding machine.

The planerheads are mounted on to the arbor as for profile cutterheads described in section 4.3 making sure that the knives are correctly orientated to suit the knife guide location.

## CARRIAGE LOCKS

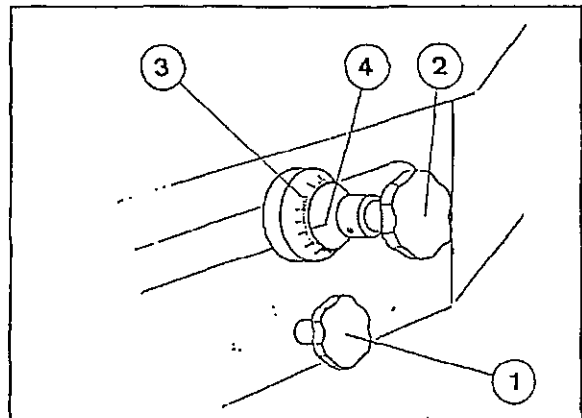


Fig. 4p

The lower carriage lock [1] is used to lock the left / right carriage movement. The upper carriage lock [2] is used to lock the in / out movement and is fitted with a graduated fine adjustment screw [3] and pointer [4].

When straight knife grinding is carried out the in / out movement is locked and progressive grinding cuts are made using the fine adjustment screw [3] (unlike profile grinding where cuts are made by moving the template slide).

When the machine is set up prior to grinding, the pointer [4] can be rotated to a suitable position by releasing the pointer locking screw using a 3 mm A/F allen key. Each graduation represents 0.02 mm (0.0008").

### GRINDING HEAD ADJUSTMENT

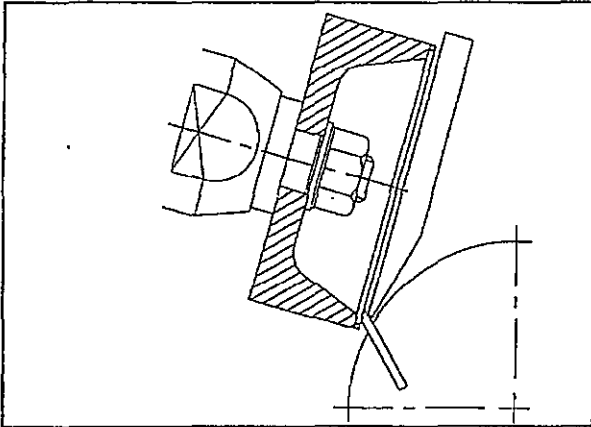


Fig. 4q

The grinding head position is set in conjunction with the carriage position and the knife location.

The grinding wheel height can be set using the top handwheel [1] (Fig. 4i) but it will probably be found to be more convenient to make this adjustment by using the arrowed buttons on the control panel.

The height of the head and the in / out position of the carriage are set such that the knife can be located under the knife guide as shown in Fig. 4q. The knife guide has a grinding point [1] and two angles along the bottom edge (Fig. 4r). The knife should be located on the grinding point when final setting is carried out.

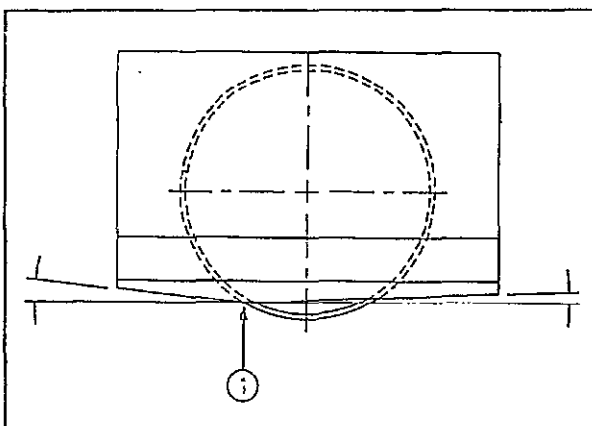


Fig. 4r

With the head height set, the carriage position can be locked and the final fine adjustment carried out using the fine adjustment screw [3] (Fig. 4p).

For most cutters the clearance angle can be set by eye i.e. by setting the back face of the knife parallel with the face of the wheel. If this is done the grinding operation will reproduce the same clearance angle. If more accurate setting and measuring of the clearance angle is required, an optional clearance angle gauge can be supplied by Wadkin. See Appendix A5.

The knife is set to lightly touch the face of the grinding wheel and then backed off one or two graduations on the fine adjustment screw such that the knife is free to pass across the face of the wheel. This position is best gauged when the wheel is rotated by hand.

### COOLANT APPLICATION

The coolant flow control tap is located to the left of the grinding spindle.

Ensure that it is in the open position by turning the tap handle to bring it in line with the coolant pipe.

Also ensure that the free end of the coolant pipe is located in the top of the wheel guard. Note : The free end of the coolant pipe locates in a push on fitting and can be released by pressing the collet of the fitting down whilst gently pulling the pipe away from the wheel guard.

Always use copious amounts of coolant when grinding with C.B.N. and diamond wheels. It has the effect of prolonging wheel life, improving finish and settles grinding dust.



## GRINDING THE PLANERHEAD

With one axis locked, the carriage is free to move in the left / right axis only. The carriage should be moved to the left beyond the knife guide location where the arbor is free to rotate.

The wheel speed should be set to suit the cutter to be ground. The 100 mm diameter straight knife C.B.N. wheel is normally run at 5500 - 6000 rpm.

Check that the wheel, guards, cutters etc. are correctly positioned and locked, and start the wheel and coolant. Adjust the coolant flow if required.

Control of the arbor rotation and carriage movement is carried out in the same way as for profile grinding described in section 4.3. The cutter should be moved to the right to locate the knife on the lead-in section of the knife guide. The arbor should be controlled to keep the knife in contact with the knife guide throughout the grinding pass.

The cutter is then moved to the right past the wheel. It is only necessary for the trailing edge of the knife to pass the grinding point - it does not need to leave the knife guide location on the right. The cutter is then moved to the left - back to the arbor rotation position. Note : slight rotation of the arbor will be felt as the knife moves along the lead-in and lead-out angles of the knife guide.

The arbor is then rotated and the second knife located and ground in the same way. Always grind all knives in the planerhead before altering the cut. When grinding a planerhead with freshly set knives it is advisable to check that all knives pass the wheel in case some knives have a larger projection than others.

The depth of cut is adjusted using the fine adjustment screw [3] (Fig. 4p). Each graduation represents 0.02 mm. When rough cutting a depth of cut of 0.04 mm (0.0015") is normally used. Do not attempt to take too much off in one pass - it is better to take a series of lighter cuts.

Roughing cuts are progressively taken until all knives are cleaned up and hence brought to a concentric cutting circle.

To finish off the planerhead a lighter finishing cut of 0.02 mm can be used. The speed at which the knife is moved past the wheel should be reduced to ensure that a good surface finish is produced on the ground knife. Note : A good surface finish on the back of the knife will produce a stronger, longer lasting cutting edge by eliminating microscopic irregularities on the cutting edge.

Additional accuracy can be achieved by sparking-out. This is carried out by passing the knives across the wheel again but with NO adjustment to the depth of cut.

The planerhead should then be complete. Any grinding burr should be removed by careful stoning to achieve the best cutting edge taking care not to alter the cutting edge itself.

#### 4.7 ARBOR COUNTER BALANCE (OPTIONAL EXTRA)

A counter balance can be supplied by Wadkin (see Appendix A5) for use with both profile and straight knife grinding.

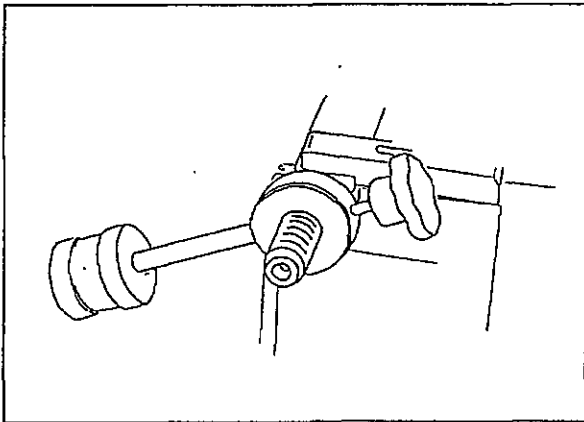


Fig. 4s

The counter balance is mounted onto the plain arbor handle. With the cutter located on the cutter rest / knife guide the counter balance is locked to the arbor handle to maintain the cutter in its located position. This allows the operator to control the carriage movement without having to control the arbor rotation as well.

For straight knife grinding in particular, the amount of pressure applied by the operator to the arbor rotation can vary from knife to knife. When exceptional concentric accuracy is required the arbor counter balance can be used to ensure a constant rotational pressure.

#### 4.8 SOLID PROFILE GRINDING (OPTIONAL EXTRA)

Grinding of solid profile cutters is carried out using the straight knife grinding spindle which should be set in the grinding position as shown in *Fig. 4m*.

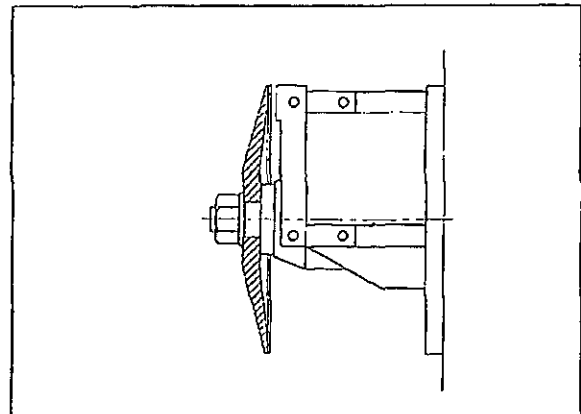
The equipment required for grinding solid profile cutters consists of :-

- a) Dished grinding wheel (C.B.N. or diamond).
- b) Wheel guard complete with philbus.
- c) Arbor rotation locking device.
- d) Dial indicator with magnetic base.
- e) Ratchet lever spanner for M16 nut.
- f) Cutting angle gauge (optional).

This equipment is available from Wadkin with a choice of three wheel diameters. The smallest diameter of wheel should be chosen in preference - the smaller wheels have less chance of deflecting during grinding. The larger wheels are only used where deep profiles form a deep throat face which cannot be covered by the smaller wheels. (See Appendix A5.)

#### SOLID PROFILE GRINDING WHEEL AND GUARD

Remove the knife guide and disconnect the coolant pipe from the straight knife wheel guard. The grinding spindle should be moved forward to its fullest extent using the hexagon headed adjusting screw [1] (*Fig. 4o*). It is important to rotate the wheel by hand during this movement to maintain tracking of the flat drive belt. This movement is best done using a ratchet lever spanner. The straight knife grinding wheel should then be removed.



*Fig. 4t* Solid profile wheel mounting

The C.B.N. (Borazon) or diamond type grinding wheel (with a solid aluminium core) should be mounted as shown with the grinding face to the rear. The mounting procedure should be carried out as described for straight knife grinding wheels in section 4.6.

CONVENTIONAL BONDED GRIT WHEELS  
MUST NOT BE USED

When the wheel is correctly mounted, the wheel guard [1] and the philbus [2] should be fitted to the mounting face on the right hand side of the knife guide mounting using four M6 capscrews. Ensure that the rear edge of the philbus is correctly seated on its rear location edge [3].

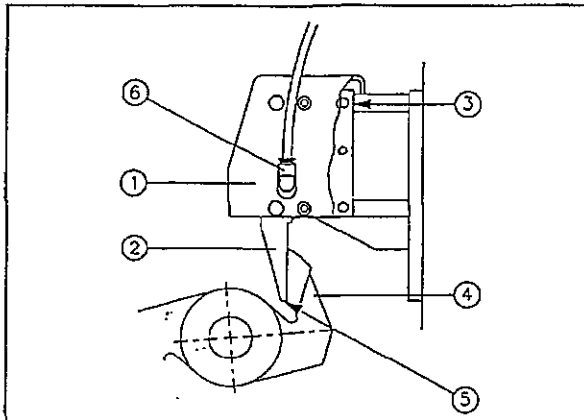


Fig. 4u Philbus and guard

The philbus [2] is approximately the same shape as the wheel when viewed from the side and is used for setting up, locating the cutter when indexing, and controlling the depth of cut. It is important that the correct philbus and guard are used to suit the wheel diameter. (The philbus tip [5] should be horizontally in line with the outside diameter of the wheel.)

The coolant feed pipe should be connected to the 'push-in' fitting [6] on the solid profile wheel guard.

### MOUNTING THE CUTTER

Solid profile cutters may be fitted to the arbor either sleeve mounted or direct onto the arbor. Mounting is carried out as for profile cutterheads described in section 4.3. Ensure that the cutter [4] is correctly orientated to suit the philbus location as shown in Fig. 4u.

When the arbor and cutter have been mounted on the machine, the arbor rotation lock should be fitted.

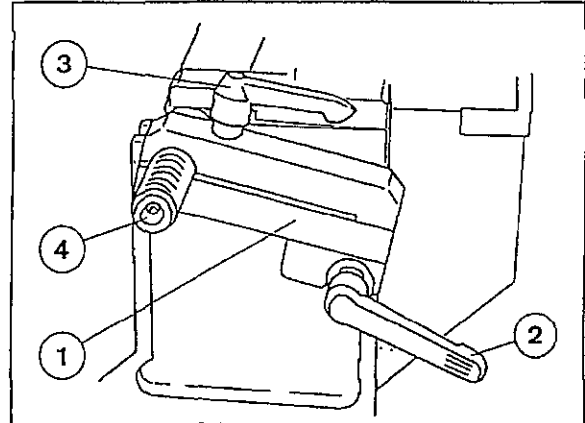


Fig. 4v

The lock [1] should be positioned and locked [3] onto the plain arbor handle [4] before it is pivoted down to locate behind the locking handle [2]. It should be locked in this position. Locking of the arbor rotation is then carried out using the locking lever [3].

### GRINDING HEAD ADJUSTMENT

The grinding head position is set in conjunction with the carriage position and arbor rotation such that the cutter face is located on the philbus as shown in Fig. 4u. The philbus should cover the full face to be ground and the cutter face should be in contact with the philbus at both the top and bottom of the face.

Final adjustment can be carried out with the carriage in / out movement locked using the fine adjustment screw [3] (Fig. 4p).

If correction of the cutting angle is necessary an optional cutting angle gauge can be supplied by Wadkin. See Appendix A5.

Note : For radial feed grinding the head height can be set using the arrowed buttons on the control panel. For straight feed grinding the procedure is slightly different. See 'Straight feed grinding'.



## DEPTH OF GRIND

The next stage is to align the face of the wheel with the face of the philbus. Note : Do not attempt to do this with a straight edge on the face of the wheel - the wheel is pitched relative to the carriage axis to ensure that it cuts on the leading edge.

The cutter should be rotated to locate on the philbus and the arbor rotation locked. The cutter face should be lightly touching the philbus such that the carriage is still free to move in the left / right axis.

Move the carriage to the left to line up the cutter face with the leading edge (right hand side) of the grinding wheel. The grinding spindle is then adjusted using the hexagon headed adjusting screw [1] (Fig. 4o) until the face of the wheel is lightly touching the cutter face. This position is best gauged when the wheel is rotated by hand.

At this point the wheel is in line with the philbus; i.e. with zero depth of grind.

The depth of grind should be set to suit the cutter to be ground. Solid profile cutters generally have a relatively large face to be ground. The larger the cutter face the more material there is to be removed at each pass, hence requiring a smaller depth of grind. It is generally better to take a series of light cuts rather than deep cuts which can cause wheel deflection.

Initially a cut of 0.02 / 0.10 mm (0.001 / 0.005") should be set by moving the grinding wheel towards the cutter face (after moving the cutter clear). For radial feed grinding the depth of grind can be estimated if preferred, but for straight feed grinding should be set more accurately - see 'Straight feed grinding'.

## RADIAL FEED GRINDING

The cutter face should be lightly located on the philbus and the arbor rotation locked.

The wheel speed should be selected to suit the wheel diameter and type, and the cutter type. For C.B.N. (Borazon) wheels and H.S.S. cutters the following speeds are normally used.

150 dia. wheel	4000 rpm approx.
175 dia. wheel	3430 rpm approx.
200 dia. wheel	3000 rpm approx.

Check that the wheel, guards, cutter etc. are correctly positioned and locked, start the wheel and coolant. Adjust the coolant flow if required.

The carriage should be moved to the left slowly moving the cutter past the wheel. The cutter face is ground by the leading edge (right hand side) of the wheel. The cutter is then moved back to the philbus position.

If the arbor rotation lock is released and the cutter face re-located on the philbus, a second cut can be made. Several successive cuts may be required to clean up the whole cutter face.

When radial feed grinding, it is quite acceptable to take several cuts off one cutter face before moving on to the next. (This is not the case for straight feed grinding.) Care should be taken to avoid grinding large amounts off one cutter face at this stage - this could result in a lot of grinding being required to correct the tracking.

Note : If wheel deflection occurs, moving the cutter face past the wheel a second time at the same setting will cause more material to be ground off; either reduce the depth of grind, or make several passes for each cut.

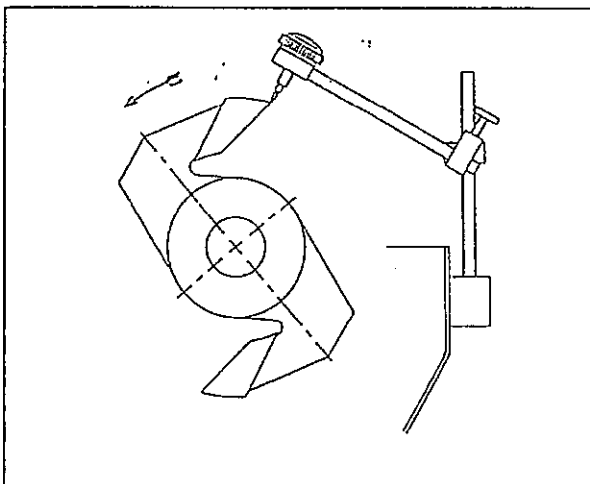


## TRACKING

When all the cutter faces have been cleaned up (not necessarily over the whole cutter face) the tracking should be checked.

With a marker pen number each of the cutter wings. Set up the dial indicator (*Fig. 4w*) and rotate the cutter, noting the amount of variation at each of the cutting edges. Any difference in the readings taken at each edge indicates that different amounts will be needed to be ground off each cutter face.

Irrespective of whether radial feed or straight feed grinding, a correctly ground cutter should track within 0.025 mm (0.001"). However, because the grinding cut is taken off the cutter face and not the outer circumference of the solid profile cutter, the amount needed to be ground off a cutter face to correct the tracking will not be the difference in the readings obtained from the dial indicator. It is therefore recommended that small grinding cuts be taken off the cutter face(s) out of tracking and the dial indicator set up again to re-check the readings. Knowing the differences from the initial readings it is now possible to discern the amount needed to be ground off the cutter faces to correct the tracking.



*Fig. 4w* Tracking

## STRAIGHT FEED GRINDING

Most solid profile cutters are designed to be ground using radial feed. There are some however which require straight feed. The difference is in the way in which successive grinding cuts are taken - radial feed cuts are taken by rotating the cutter - straight feed cuts are taken by moving the carriage position.

The machine should be set-up generally as described in the previous sections, but with the following differences.

The grinding head adjustment is carried out generally as described but the grinding wheel must be vertical.

The arrowed buttons on the control panel are used only to set the wheel vertical (i.e. 0° on the side relief scale). The height of the head must then be set using the top handwheel [1] (*Fig. 4i*).

The depth of grind should be set to a known figure. This is done, having lined up the wheel face with the philbus, by adjusting the carriage position using the fine adjustment screw [3] (*Fig. 4p*). The cutter face is moved away from the face of the wheel by an amount equal to the depth of grind using the fine adjustment screw graduations. The grinding spindle can then be reset until the wheel face is once again lightly touching the cutter face. When set, the carriage should be reset to its original position with the cutter face touching the philbus.

When straight feed grinding it is advisable to number the cutter wings with a marker pen before starting to grind.

Cutter face No.1 is located on the philbus and ground. **DO NOT** reset and take a second cut off this face. Cutter face No.2 should be located and ground. When the last face has been ground the carriage position is moved using the fine adjustment screw graduations by an amount equal to the depth of cut. This should bring the ground face into contact with the philbus once again. This procedure is repeated until grinding is complete - always taking just one cut off each face and then moving the carriage position.

If the tracking needs to be corrected the same procedure is continued but as the wings become correctly tracked they are eliminated from the grinding sequence.



### 4.9 CARE OF THE MACHINE

The machine should be cleaned down when grinding is finished. The abrasive dust produced by the grinding operation can cause damage to moving parts and slideways if cleaning is not carried out correctly.

#### COMPRESSED AIR SHOULD NOT BE USED

to assist cleaning. It can cause abrasive dust and coolant to be forced into slides, screws and bearing surfaces. It can also be dangerous to other people.

A flow of coolant can be used to wash the machine but ONLY ON THE AREAS WHERE COOLANT NORMALLY FLOWS during grinding. If a coolant flow is used, the following guidelines must be observed :-

- Coolant must not be sprayed onto electric motors. These are splashproof but are not designed to withstand constant jets of coolant.
- Coolant must not be sprayed under covers or into slides, screws, bearings etc.
- Coolant should not be used to simply wash all the grinding debris down into the tank - this only leads to more frequent cleaning of the tank.

The coolant compartment at the front of the machine contains a coiled pipe [6] (Fig. 3a) which is provided for draining the tank. This pipe can also be used for washing down the machine by turning the tap [5] (Fig. 3a).

Accumulations of grinding debris should be scooped out of the coolant trays. It is a matter of personal choice as to whether this is better done with the debris wet or dry.

If the metal filtration magnets are correctly placed in the coolant tray, they should be visible to the operator. They should be cleaned when necessary.

The level of coolant in the system should be 'topped up' as necessary. (See Appendix A2.) A level indicator is fitted to the coolant tank. The coolant should be allowed time to drain into the tank before the reading is taken. Note : Different types of coolant fluid should not be mixed together, see maintenance section 5.



## SECTION 5 : MAINTENANCE

### 5.1 SAFETY

The machine should always be electrically isolated when maintenance is carried out unless specifically required otherwise.

Maintenance personnel should be familiar with the Health and Safety precautions for handling coolant fluids. See Appendices A2 and A3.

Maintenance personnel should not mount grinding wheels unless specifically trained to do so.

### 5.2 CLEANING THE MACHINE

Cleaning should be carried out on a regular basis as part of the normal operation of the machine (see section 4.9). During machine maintenance any shortcomings should be made good by thorough cleaning.

#### COMPRESSED AIR SHOULD NOT BE USED ...

for cleaning the machine. It can cause the abrasive dust and grit produced during grinding to be forced into slides, screws and bearings etc. A flow of coolant can be used to wash the machine but ONLY ON THE AREAS WHERE COOLANT NORMALLY FLOWS. (See section 4.9).

### 5.3 LUBRICATION

The machine is designed to require minimum lubrication. The grinding spindles, motors, coolant pump and carriage slideways are fitted with sealed bearings which require no additional lubrication. Note : The carriage slideway bearings are fitted with lubrication points. These are not intended to be regularly lubricated. If the carriage is dismantled at any time, these bearings can be lightly re-greased.

If too much grease is applied, the carriage movement can become very stiff, making the machine difficult to operate.

All bushes employed are of the 'bronze oil retaining type'. Slides and screws should be examined periodically with careful attention paid to any moving parts that become stiff.

Accessible slides, screws, bushes etc. should be lubricated weekly with Wadkin grade L4 oil. A list of approved lubricants is given in Appendix A1.

On a monthly basis, one shot of grease (Wadkin L6) should be applied to the head tilt screw/nut lubrication point which is located towards the rear of the main head support (see Fig 6l, item 16)

### 5.4 WHEEL MOUNTINGS AND GUARDS

It is essential for the safe operation of this machine that the wheel mountings and wheel guards are maintained in good condition. The grinding spindle ends should run true and be free from burrs. The wheel flanges should be flat and free from burrs. The spindle nuts should be in good condition.

The wheel guards must be intact with no cracked welds. The profile guard door including the hinge and latch should be in good condition and the fixing of the guards should be solid.

These items should be checked whenever wheels are mounted but particularly if a wheel should disintegrate. If any of these items are worn or damaged they should be replaced.



## 5.5 COOLANT SYSTEM

Topping up of the coolant system and evaporation over a period of time can affect the dilution of the mixture. This should be checked using a refractometer, which can be supplied by Wadkin (see Appendix A5). As a general guide the mixture should be checked and corrected if necessary every 1 to 2 months.

The useful life of the coolant mixture is dependent on various factors such as the amount of use, type of wheels used, cleaning down practice etc. As a general guide the coolant should be replaced every 4 to 6 months.

The machine should be thoroughly cleaned down and drained of coolant. A pump out facility is provided for emptying the coolant tank. Located in the coolant compartment (*Fig 3a*) is a coiled pipe [6], the end of which should be placed in a bucket or other suitable container. With the tap [5] switched over, the coolant pump can be started to pump the fluid out of the tank. The tank can be withdrawn and tilted to pump out lower levels, but take care not to pump sediment. The coolant should be disposed of as per Appendix A2.

The system should be cleansed with an anti-bacterial cleaning fluid when required. Details of the anti-bacterial solution supplied by Wadkin are given in Appendix A3.

**Important :** If coolant fluids are used other than those supplied by Wadkin, the Health and Safety recommendations supplied with the fluid should be strictly followed.

Different types of coolant fluid should not be mixed together. When changing supply, the system should be thoroughly drained and cleaned before refilling with the new coolant.

## 5.6 ELECTRICAL SYSTEM

All electrical maintenance work should be carried out by a competent electrician.

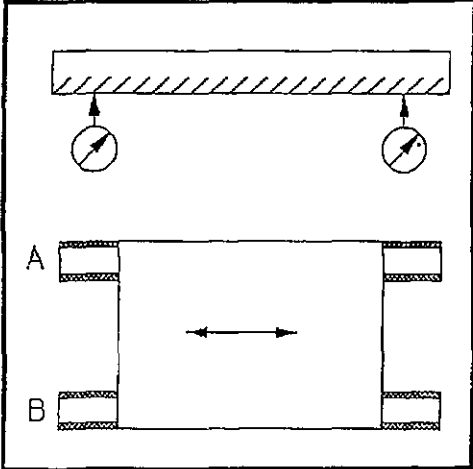
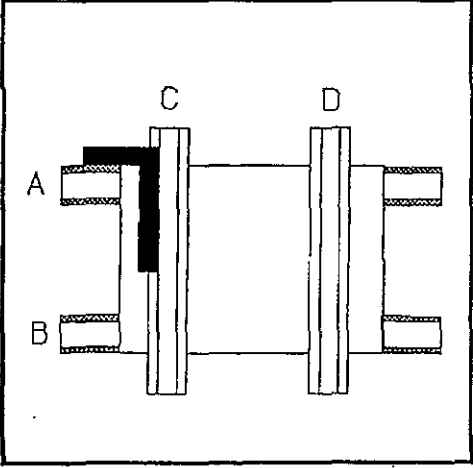
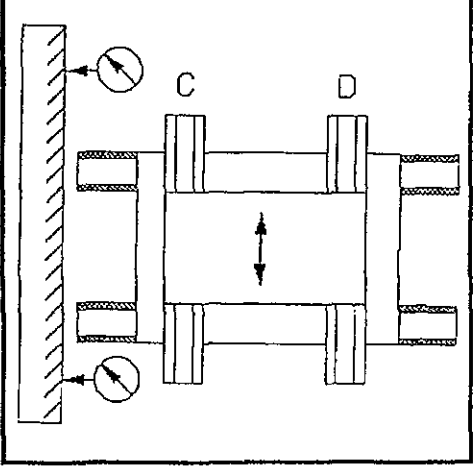
The electrical circuit diagram is included at the end of this manual - see Appendix A7. A copy of the circuit diagram for the machine together with a separate instruction manual and wiring diagram for the inverter (variable speed unit) should be enclosed with the machine documentation inside the electrical control cabinet.

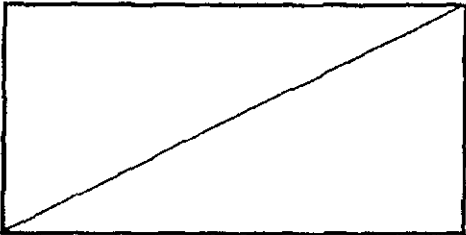
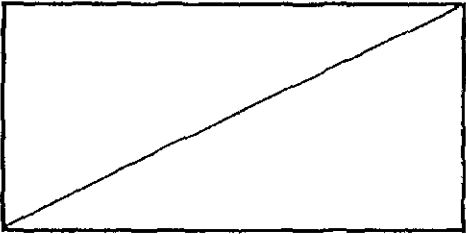
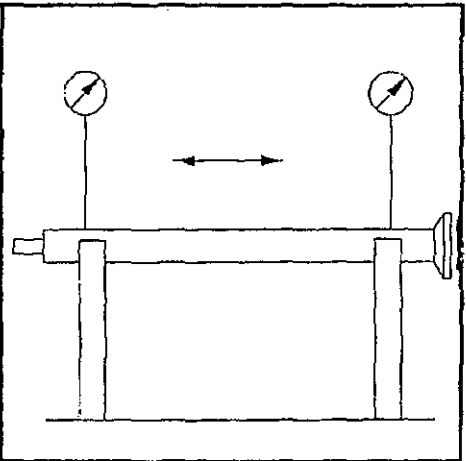
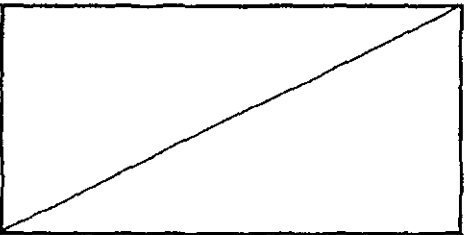
Routine maintenance of the electrical system is not necessary other than to check the condition of the controls and worklamp. Any damaged control buttons etc. or defective bulbs should be replaced.

## 5.7 MACHINE ALIGNMENTS

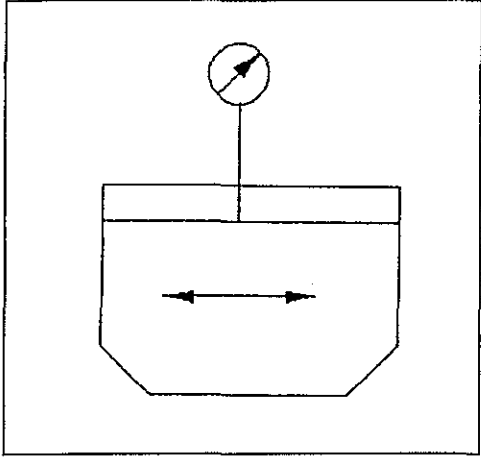
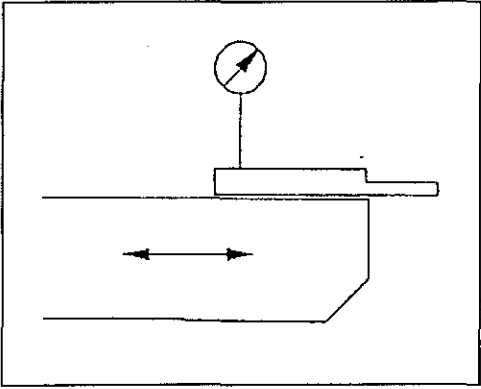
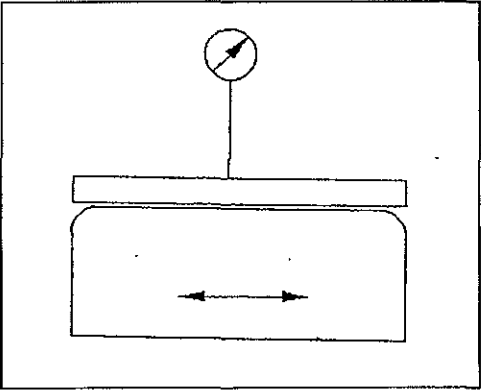
There are a number of alignments and checks which are built into the machine from new and **MUST** be re-set whenever parts are dismantled and re-built. The following alignments should be set by a competent engineer.

### CARRIAGE

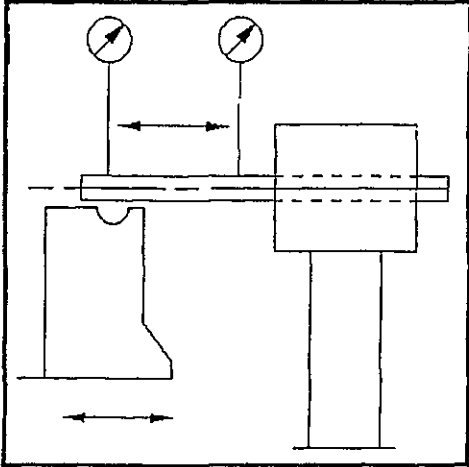
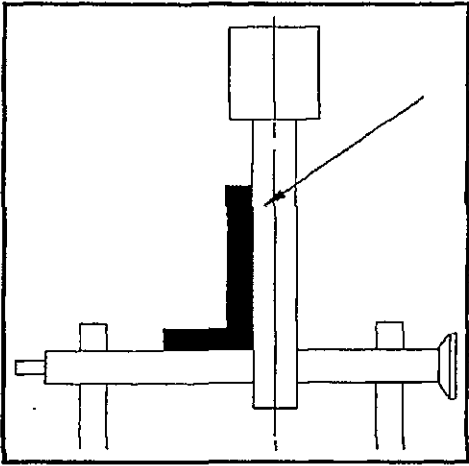
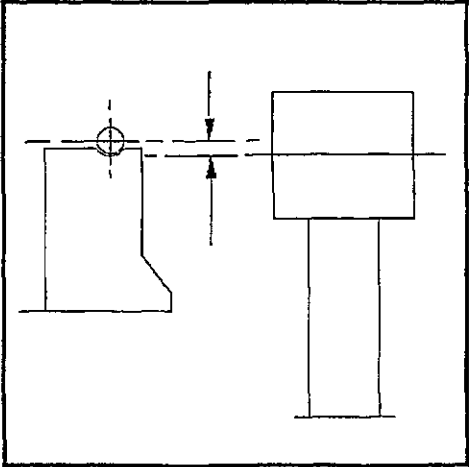
Test No.	Test diagram	Test	Permissible Error mm   inch
1		<p>Set rail A parallel to straight edge using carriage movement.</p> <p>Set rail B parallel to rail A.</p>	<p>0.01   0.0004</p> <p>0.01   0.0004</p>
2		<p>Set rail C square using engineers square.</p>	<p>0.04   0.0015</p>
3		<p>Set rail C parallel to straight edge using carriage movement.</p> <p>Set rail D parallel to rail C.</p>	<p>0.01   0.0004</p> <p>0.01   0.0004</p>

Test No.	Test diagram	Test	Permissible Error mm   inch
4		Carriage in / out lock assembly. End float in screw adjustment.	0.007   0.0003
5		Check smooth running of carriage bearings.	--   --
<b>ARBOR</b>			
6		Parallelism of arbor to carriage left / right movement.	
		Top of arbor	0.01   0.0004
		Side of arbor	0.01   0.0004
7		Test arbor should be feeler tight in arbor supports.  Bed in.	--   --

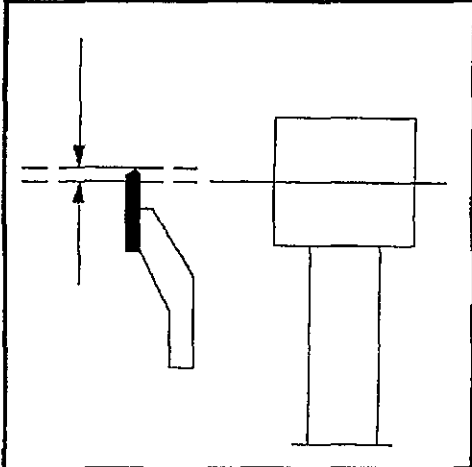
TEMPLATE SLIDE

Test No.	Test diagram	Test	Permissible Error mm   inch
8		<p>Parallelism of template location edge to carriage left / right movement.</p>	<p>0.013   0.0005</p>
9		<p>Parallelism of template slide to carriage in / out movement.</p>	<p>0.13   0.005</p>
10		<p>Parallelism of template location to carriage left / right movement.</p>	<p>0.13   0.005</p>

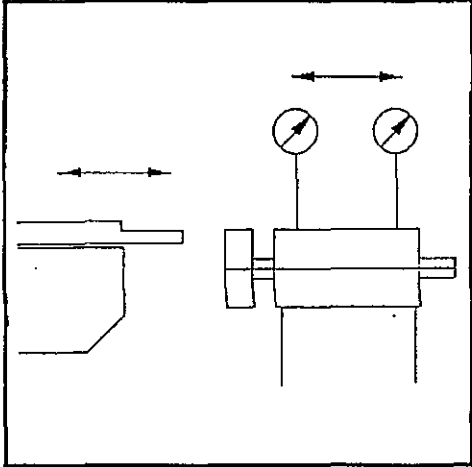
### HEAD PIVOT AND CUTTER REST

Test No.	Test diagram	Test	Permissible Error mm   inch
11		<p>Parallelism of pivot axis to carriage in / out movement.</p> <p>Check using test bar and dial indicator at front and back positions</p>	<p>0.13   0.005</p>
12		<p>Squareness of pivot axis to arbor</p> <p>Check using test bar, engineer's square mounted off arbor and feeler gauge.</p>	<p>0.04   0.0015</p>
13		<p>Arbor centre-line to be 0.20 mm above pivot axis.</p> <p>Check using test bar and height gauge.</p>	<p>0.13   0.005</p>

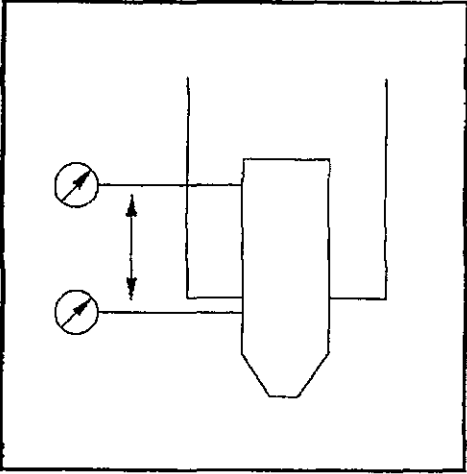
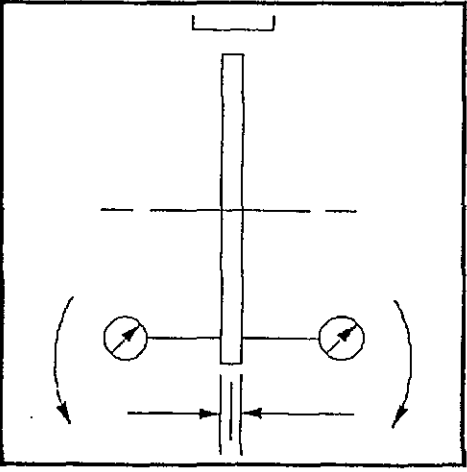
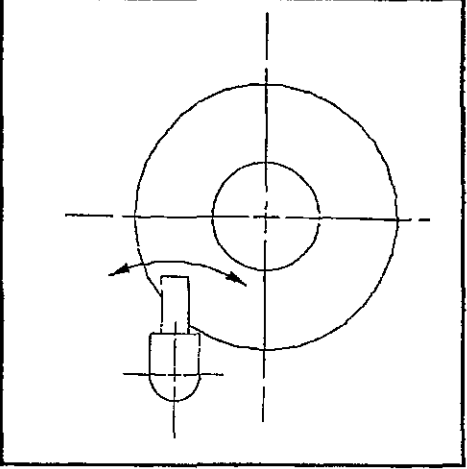


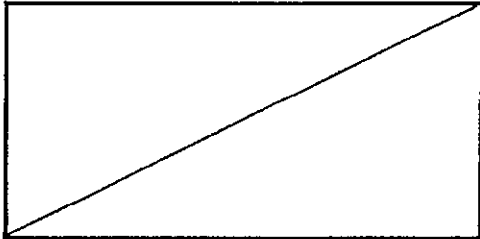
Test No.	Test diagram	Test	Permissible Error mm   inch
14		<p>Cutter rest to be 0.7 mm above pivot axis.</p> <p>Check using test bar and height guage.</p>	0.05   0.002

### STYLUS MOUNT

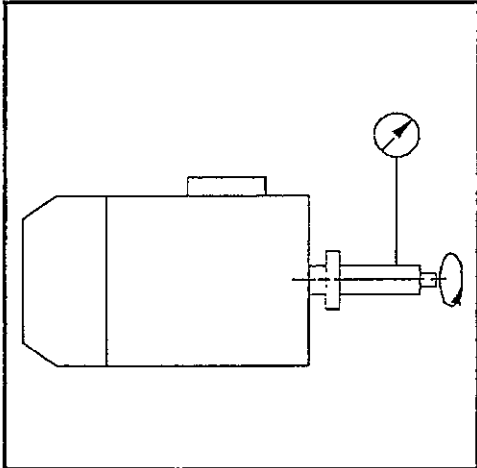
15		<p>Parallelism of stylus mount to carriage in / out movement.</p>	
		Top	0.13   0.005
		Side	0.13   0.005

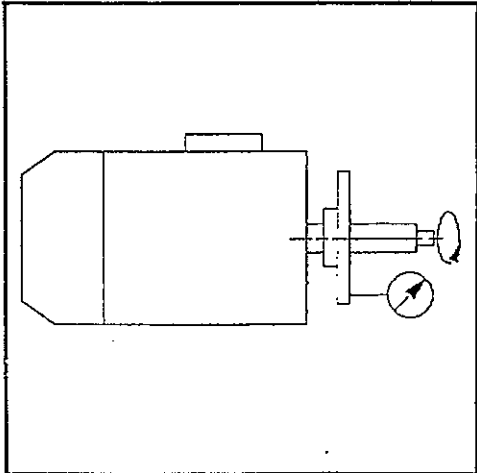
### DRESSER

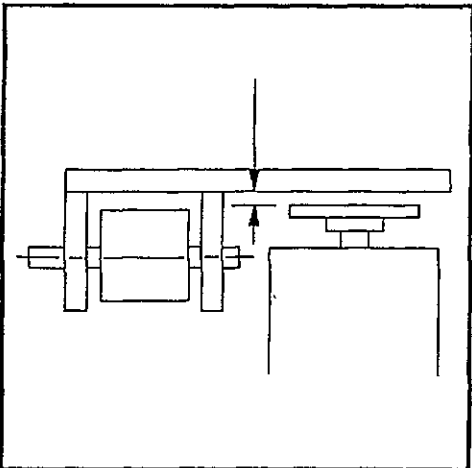
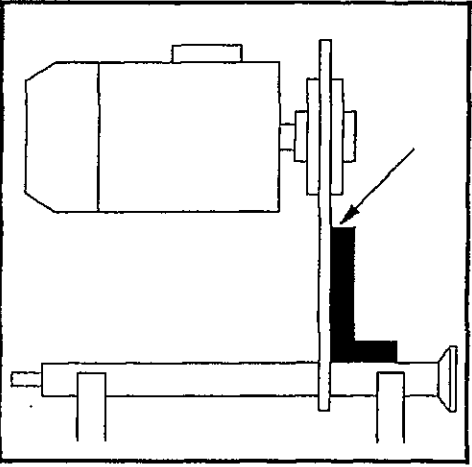
Test No.	Test diagram	Test	Permissible Error mm   inch
16		<p>Squareness of dresser anchor point to carriage in / out movement.</p>	<p>0.04   0.0015</p>
17		<p>Check set-screw on dresser anchor bracket locates dresser rotary axis about pivot axis.</p> <p>Check using steel test wheel and dial indicator mounted off diamond dresser.</p>	<p>0.025   0.001</p>
18		<p>Check dresser 180° rotation stop screw positions using steel test wheel and dial indicator mounted off diamond dresser.</p> <p>At 180° positions swivel dial indicator across sides of test wheel.</p>	<p>0.025   0.001</p>

Test No.	Test diagram	Test	Permissible Error mm   inch
19		<p>Check dresser rotation scale set at zero degrees when square to grinding wheel.</p>	. --   --

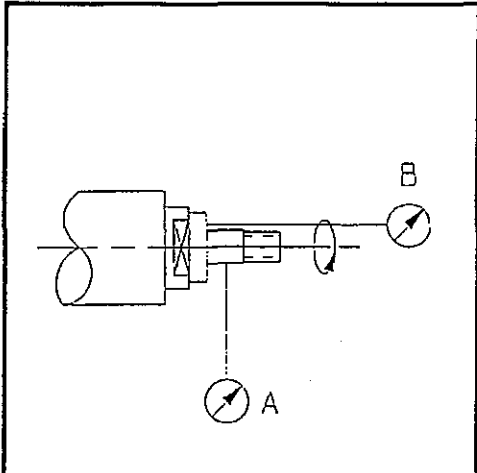
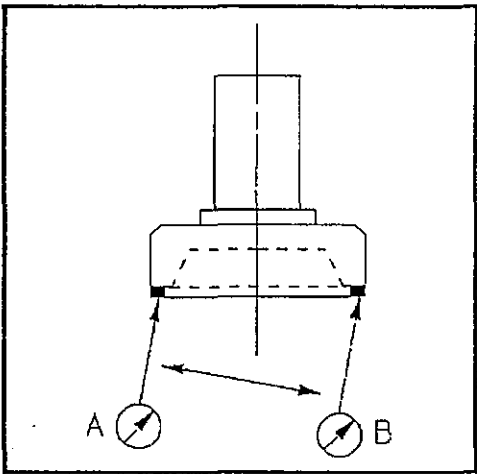
PROFILE GRINDING SPINDLE

20		<p>Run-out of grinding motor spindle.</p>	0.013   0.0005
----	---	---	----------------

21		<p>Run-out of grinding wheel flange at maximum radius.</p>	0.04   0.0015
----	---	--	---------------

Test No.	Test diagram	Test	Permissible Error mm   inch
22		<p>Parallelism of grinding wheel flange to pivot axis.</p> <p>Distance from grinding wheel flange to centre-line of pivot axis to be 3 mm.</p>	<p>0.04   0.0015</p> <p>0.05   0.002</p>
23		<p>Squareness of grinding wheel flanges to arbor using test plate clamped in flanges, engineer's square mounted off arbor and feeler gauge : Set tilt scale.</p>	<p>0.04   0.0015</p>

### STRAIGHT KNIFE SPINDLE

Test No.	Test diagram	Test	Permissible Error mm   inch
24		Check spindle run-out At A At B	0.013   0.0005 0.013   0.0005
25		Set spindle pitching to carriage movement. (To cut at point A.) A = 0 B = -0.25 mm	0.05   0.002

### TEST EQUIPMENT

Some of the tests involve the use of special test equipment which can be supplied by Wadkin if required.

Part No.	Description	For test no.
MPG 201	Steel test wheel (230 dia. x 6)	17,18.
MPG 202	Setting plate	23.
T3005334	Ground bar (25 dia. x 470)	11,12,13,14,22
FIT 241	Wylie plate	22

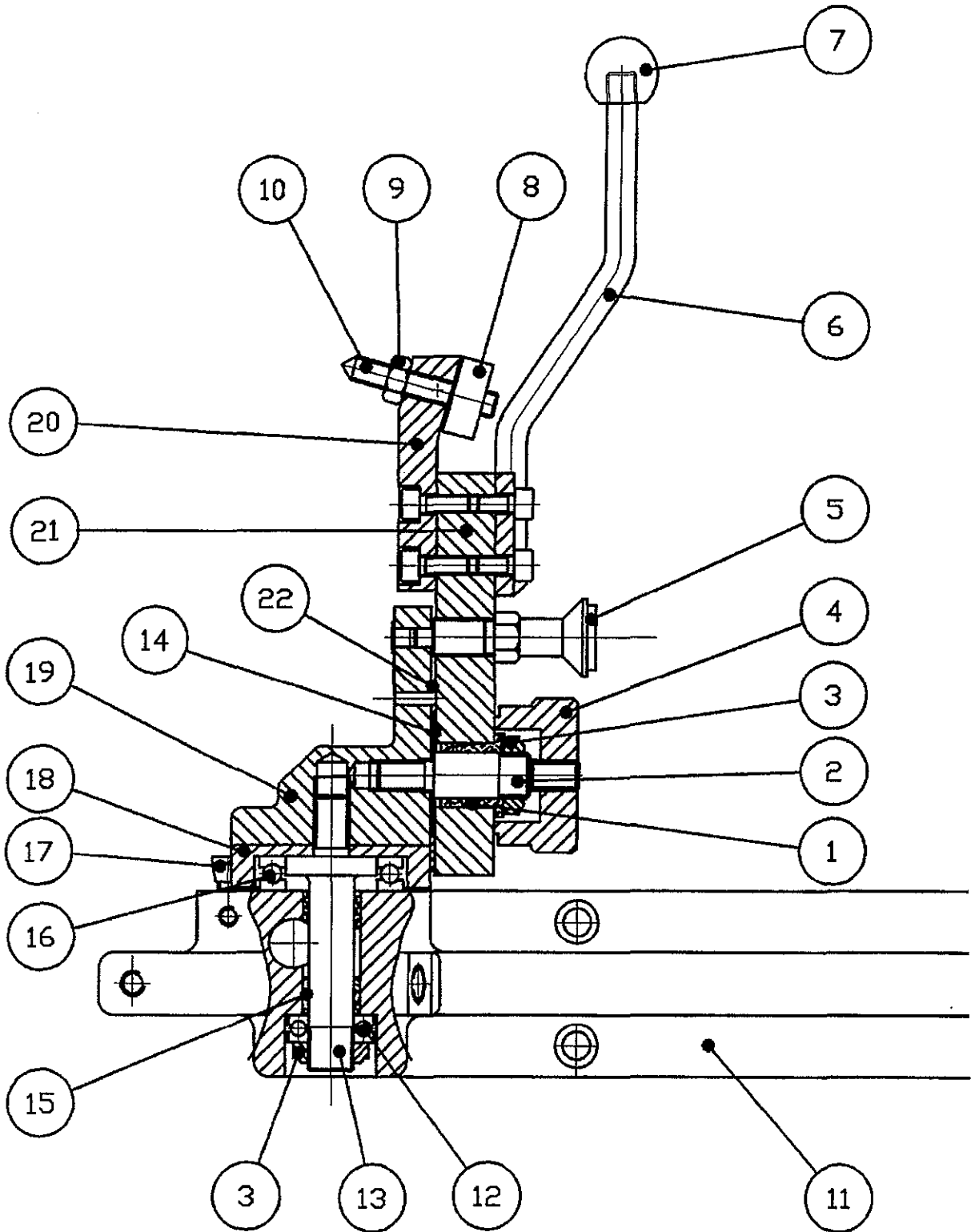


## SECTION 6 : ILLUSTRATED PARTS LIST

Should it become necessary to replace worn or damaged parts of the machine, it is essential that the work is carried out by a competent engineer in order to maintain the grinding accuracy of the machine. Alignments MUST be re-set as described in section 5.7.

Always quote the Machine No. and Test No. when ordering spare parts from Wadkin. This information is marked on the machine nameplate.

Fig. 6a Dresser





# PARTS LISTS

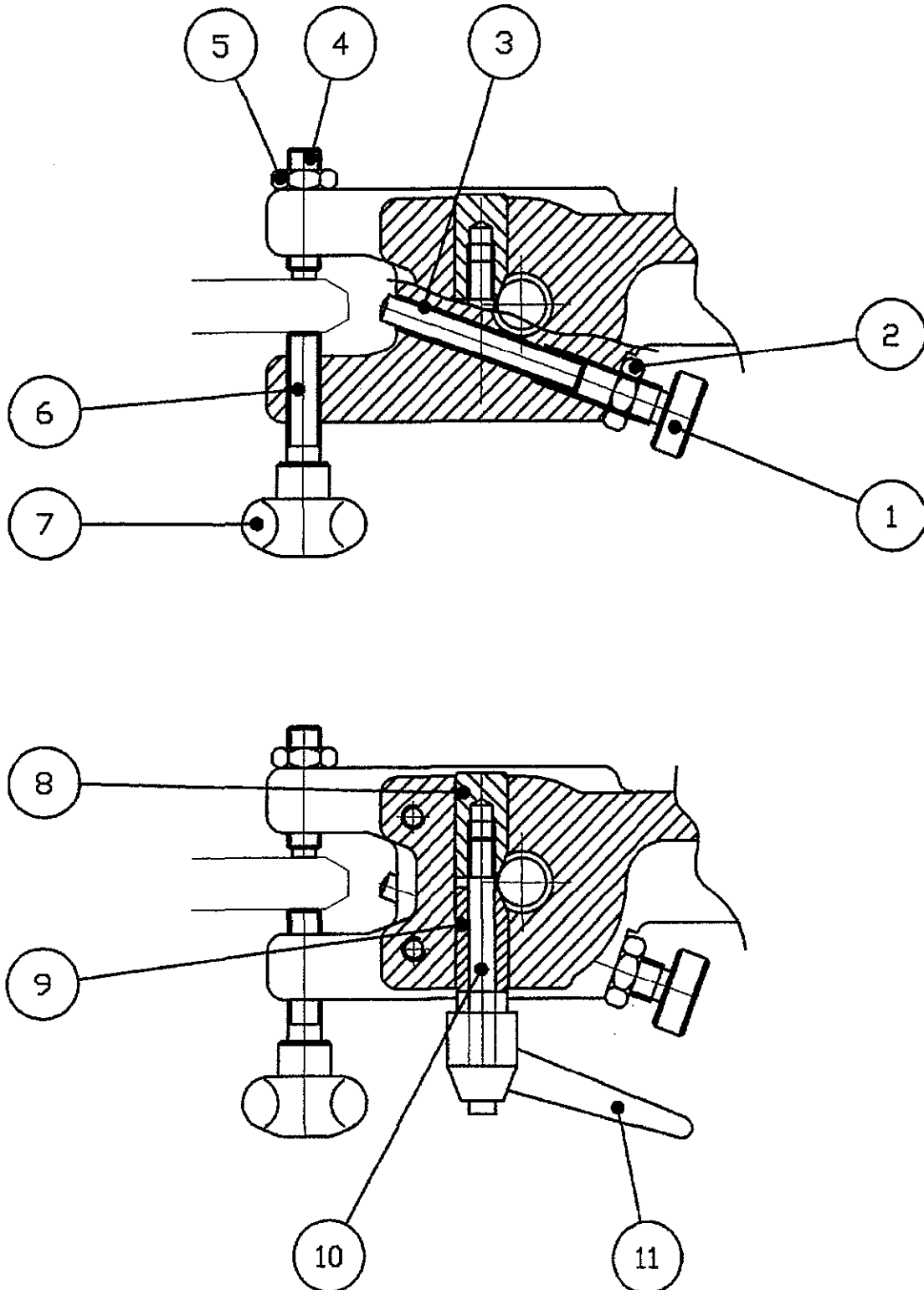
## SECTION 6

### DRESSER (Fig. 6a)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	T3005120	Bush
2	1	NN 332	Pivot Pin
3	2	T3053109	M15 locknut
4	1	NN 337	Locking knob
5	1	K3005681	Spring plunger unit
6	1	NN 336	Dresser handle
7	1	T3041252	Ball knob
8	1	NXU 523	Graduated dial
9	1	K0527102	M8 nut
10	1	NXU 522	Diamond dresser
11	1	NN 327	Mounting
12	1	K0604142	Thrust bearing 51102
13	1	NN 335	Pivot pin
14	1	NN 331	Location disc
15	2	K3005163	Bush
16	1	K0604138	Thrust bearing 51106
17	4	TBO 350	M7 tapered capscrew
18	1	NN 140	Dresser scale
19	1	NN 334	Pivot bracket
20	1	NN 148	Arm extension
21	1	NN 333	Dresser arm
22	1	T3005341	Thrust washer



Fig. 6b Dresser Location/Lock





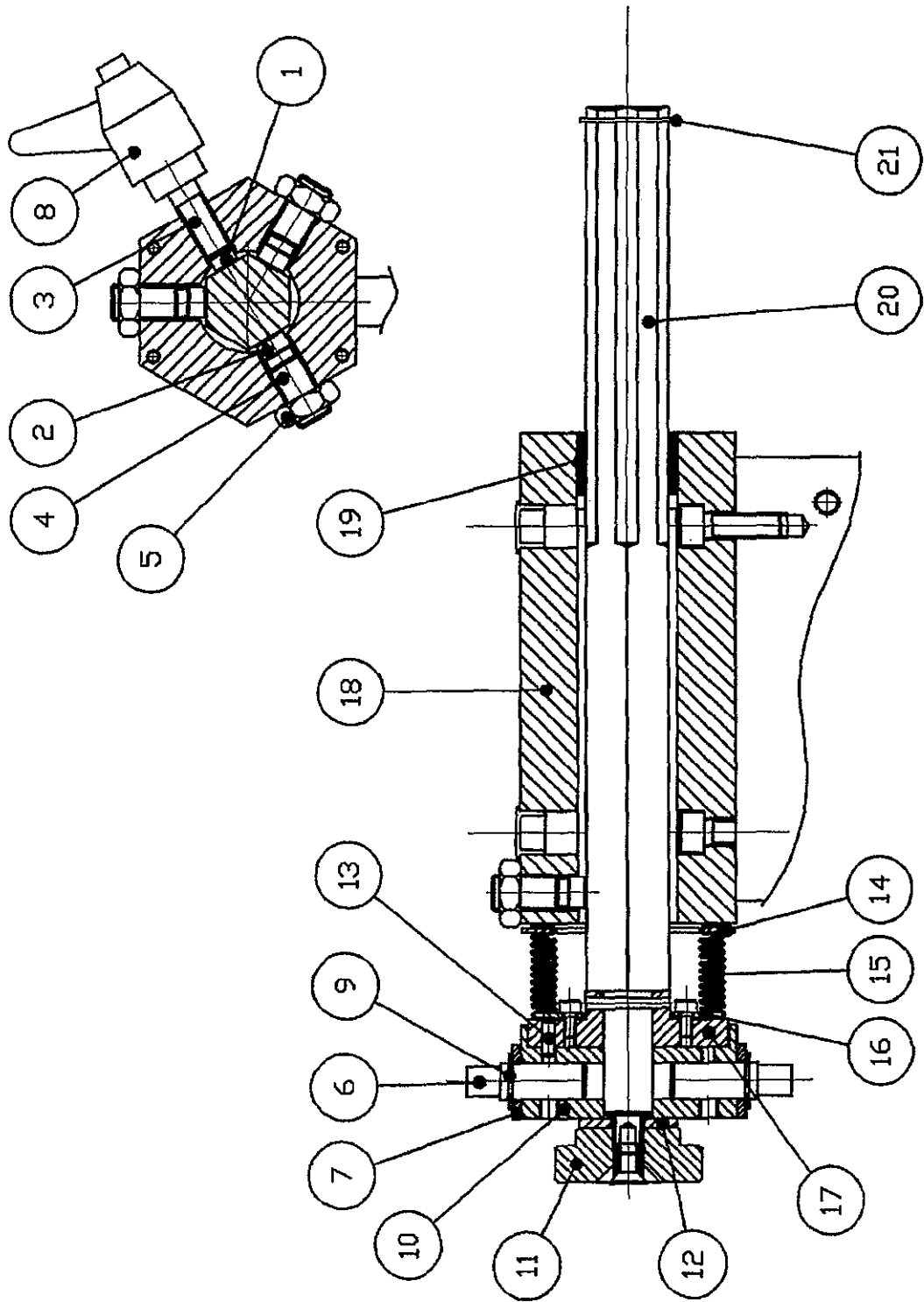
# PARTS LISTS

## SECTION 6

### DRESSER LOCATION/LOCK (Fig. 6b)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 328	End stop screw
2	1	K0527111	M12 locknut
3	1	K3005104	Bush
4	1	K0526541	M10 x 40 dog screw
5	1	K0527110	M10 locknut
6	1	K0526268	M10 x 55 stud
7	1	K5127139	Knob
8	1	NN 329	Threaded lock
9	1	NN 330	Plain lock
10	1	K0526240	M8 x 60 stud
11	1	K5127197	Handlever

Fig. 6c Stylus Turret Assembly





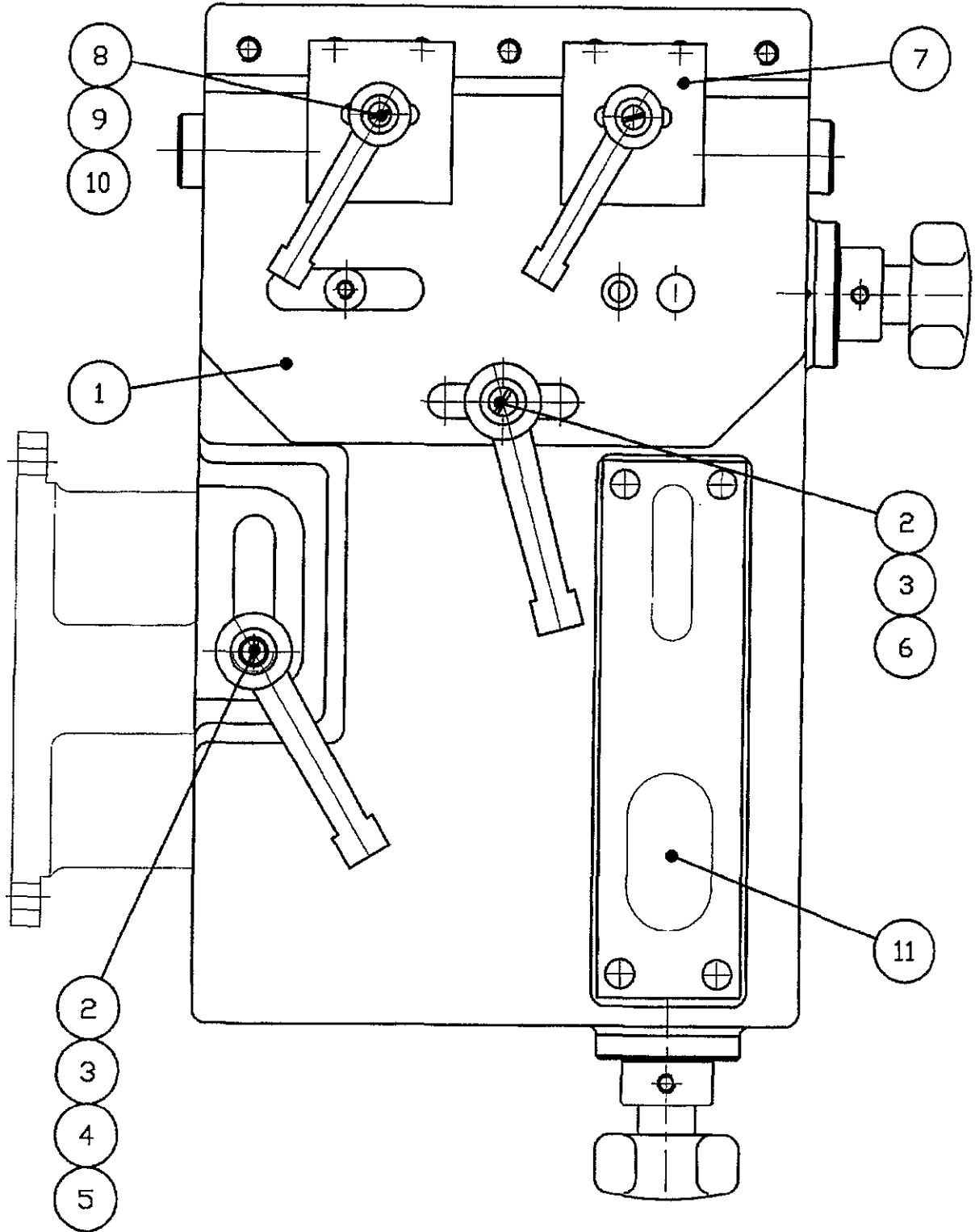
# PARTS LISTS

## SECTION 6

### STYLUS TURRET ASSEMBLY (Fig. 6c).

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	K0525472	Brass pad
2	3	K0525473	Brass pad
3	1	K0526265	M10 Stud
4	3	K0526489	M12 dog screw
5	3	K0527111	M12 locknut
6	1	NX 40	Stylus – 4.7mm wide Rad & Square
6	1	NX 110	Stylus – 7.4 mm x 90 deg. point
6	1	NX 111	Stylus – 4.7mm x 30 deg. RH
6	1	NX 112	Stylus – 4.7mm x 30 deg. LH
6	1	NX 131	Stylus – 4.7mm x 45 deg. LH & RH
6	1	NX 133	Stylus – 3.0mm wide Rad & Square
7	6	K0528105	M12 washer
8	1	K5127198	M10 handlever
9	6	K3009931	'E' retainer
10	1	NN 313	Stylus turret
11	1	NN 315	Turret nut
12	1	K0528113	M10 washer
13	1	K0529102	Pin
14	1	NN 318	Bellows retainer
15	1	MPG 129	Bellows
16	1	NN 317	Inner bellows retainer
17	1	NN 316	Flange
18	1	NN 314	Housing
19	1	K3005165	Bush
20	1	NN 312	Stylus bar
21	1	K3010162	Circlip

Fig. 6d Template slide





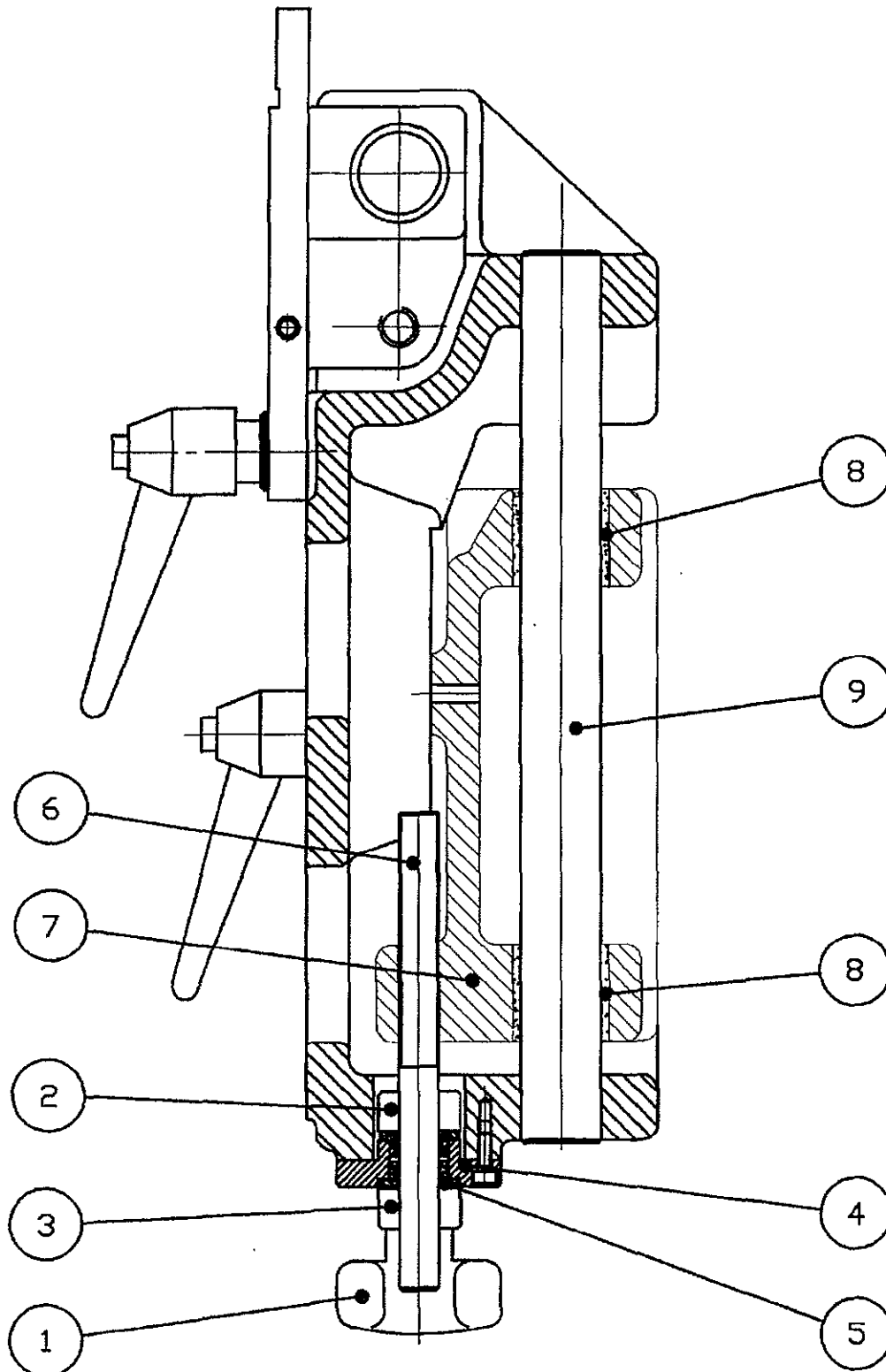
# PARTS LISTS

## SECTION 6

### TEMPLATE SLIDE *(Fig. 6d)*

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 341	Template mounting plate
2	2	K5127198	M10 handlever
3	2	K0528113	M10 washer
4	1	K0528205	M10 collar
5	1	K0526269	M10 x 60 stud
6	1	K0526265	M10 x 40 stud
7	2	NN 346	Template clamp
8	2	K5127197	M8 handlever
9	2	K0526235	M8 x 35 stud
10	2	K0528103	M8 washer
11	NOTE:	If the plate [11] is moved, access can be gained for lubrication of the adjusting screw and slide shaft.	

Fig. 6e Template slide





# PARTS LISTS

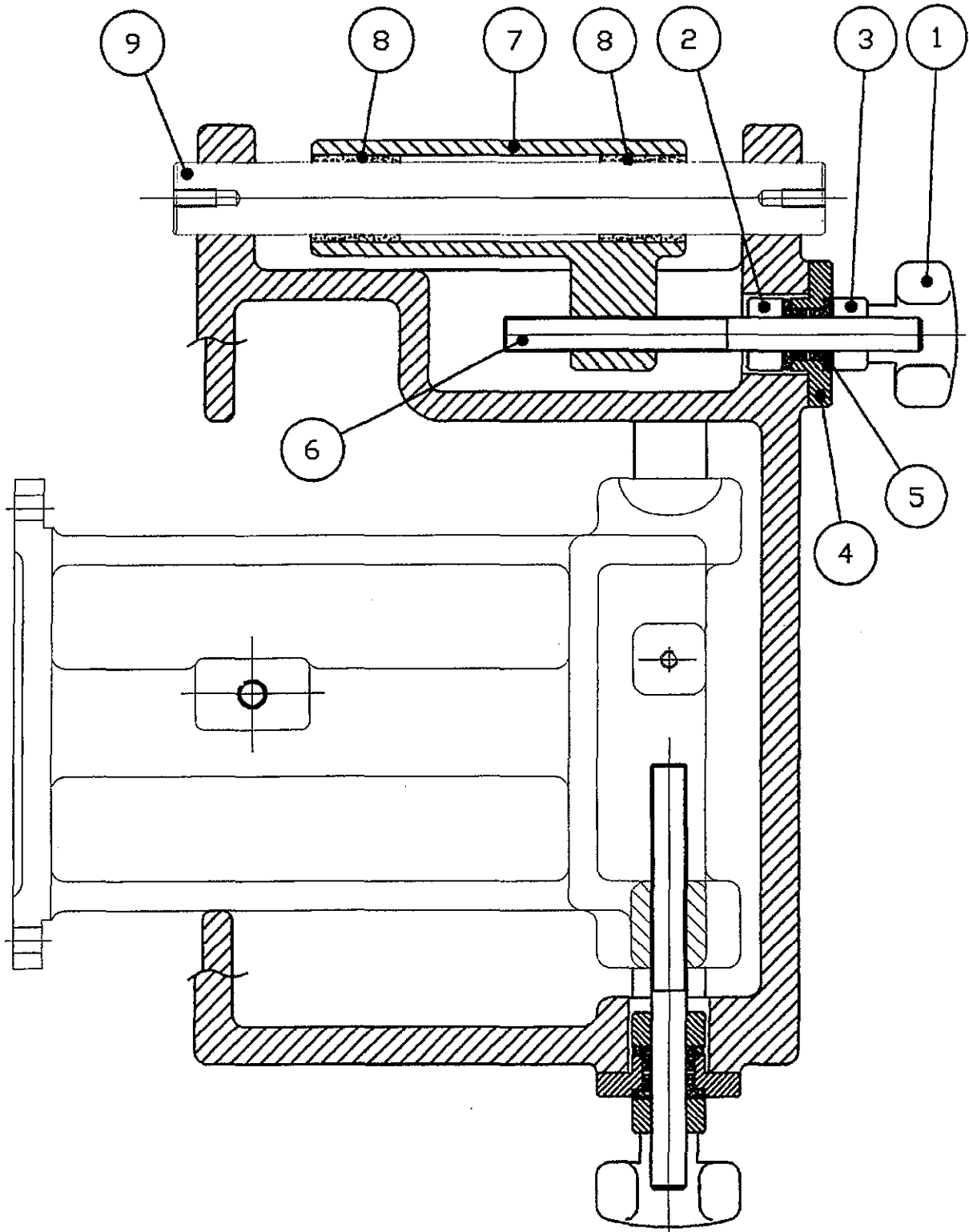
## SECTION 6

### TEMPLATE SLIDE *(Fig. 6e)*

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	K0530257	Handwheel
2	1	K0528205	Plain collar
3	1	K0528205	Plain collar
4	1	NN 343	Screw mounting
5	2	K0531302	Bush
6	1	NN 325	Adjusting screw
7	1	NN 338	Mounting
8	2	K0531589	Bush
9	1	NN 342	Slide shaft



Fig. 6f Template Crossslide





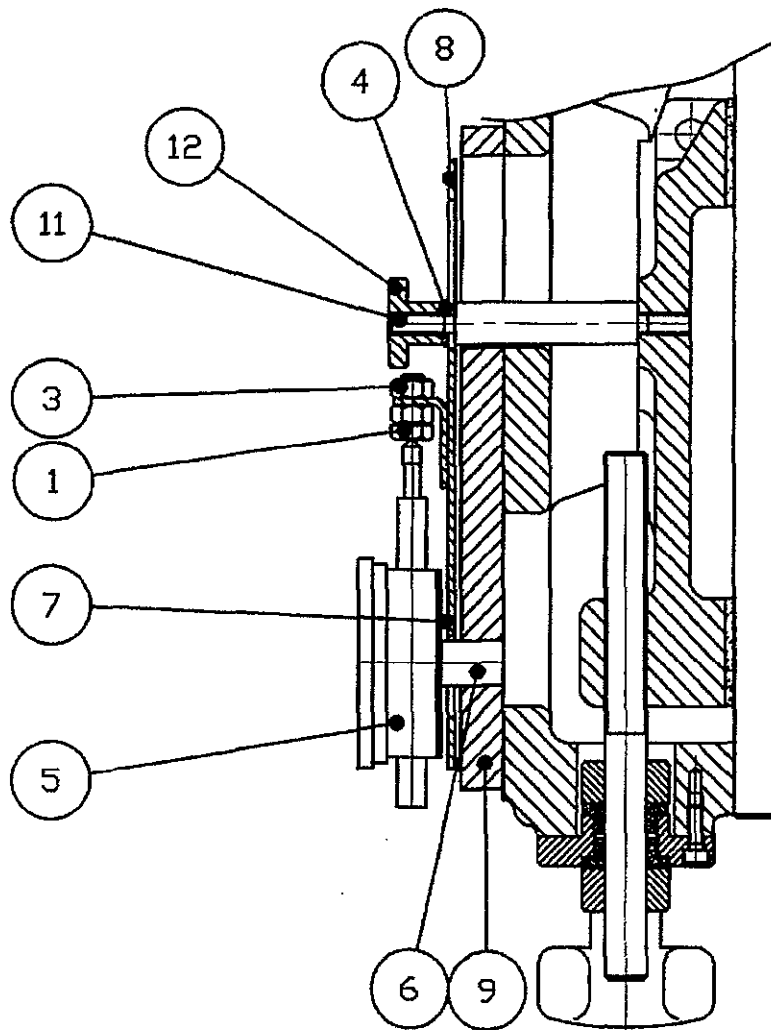
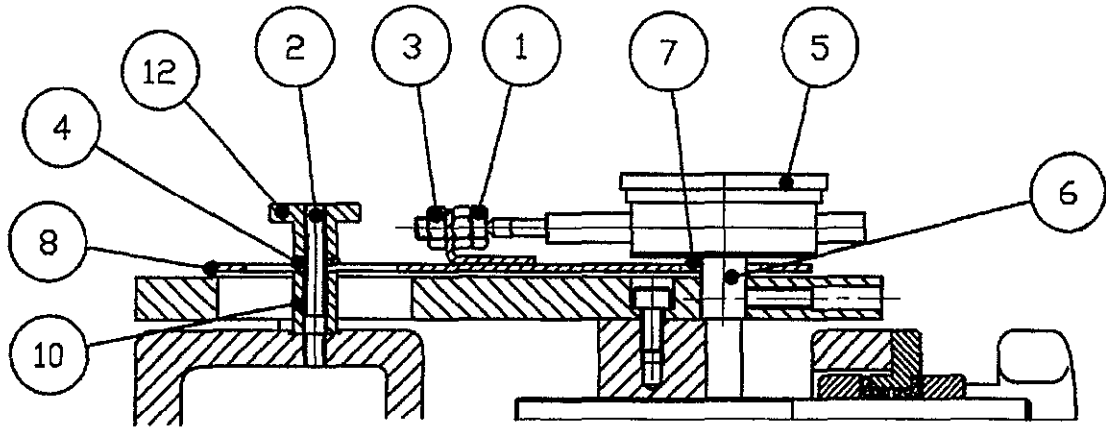
# PARTS LISTS

## SECTION 6

### TEMPLATE CROSSLIDE (Fig. 6f)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	K0530257	Handwheel
2	1	K0528205	Plain collar
3	1	K0528205	Plain collar
4	1	NN 343	Screw mounting
5	2	K0531302	Bush
6	1	NN 325	Adjusting screw
7	1	NN 340	Crossslide
8	2	K0531589	Bush
9	1	NN 120	Crossslide

Fig. 6g Dial Indicators





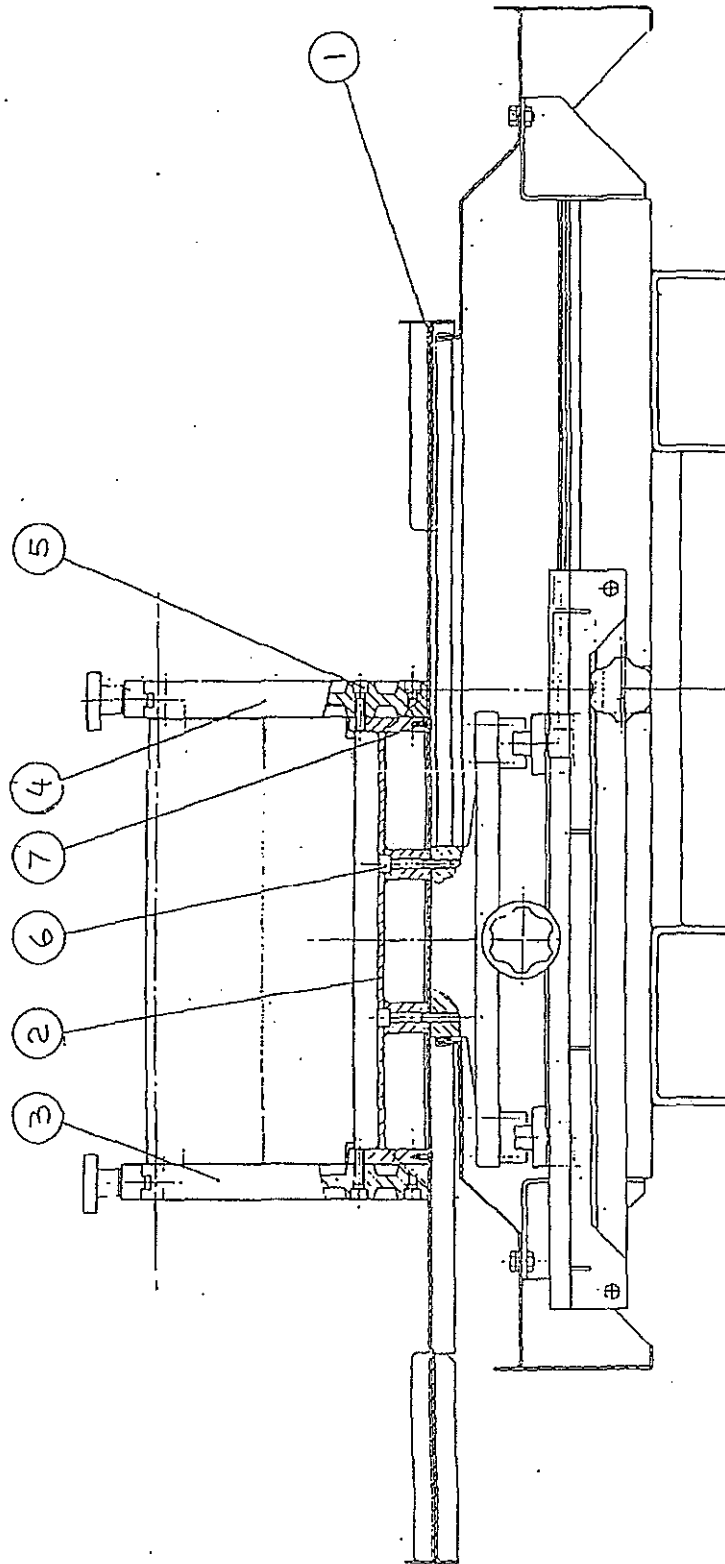
## PARTS LISTS

### SECTION 6

#### DIAL INDICATORS (Fig. 6g)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	2	K0525502	Hex hd screw M6 x 16
2	1	K0526208	Stud M6 x 45
3	4	K0527108	hex lock nut M6
4	2	K0528102	Washer M6
5	2	K3025455	Dial Indicator (Metric) OR
	2	K3025513	Dial Indicator (Imperial)
6	2	K3025456	Post back for dial indicator
7	4	K3089202	M12 thin washer
8	2	NN 155	D.T.I. actuator
9	1	NN 344	Plate for D.T.I.
10	1	NN 347	Spacer for D.T.I. lock
11	1	NN 348	Stud for D.T.I. lock
12	2	T3053101	M6 thumb screw

Fig. 6h Carriage





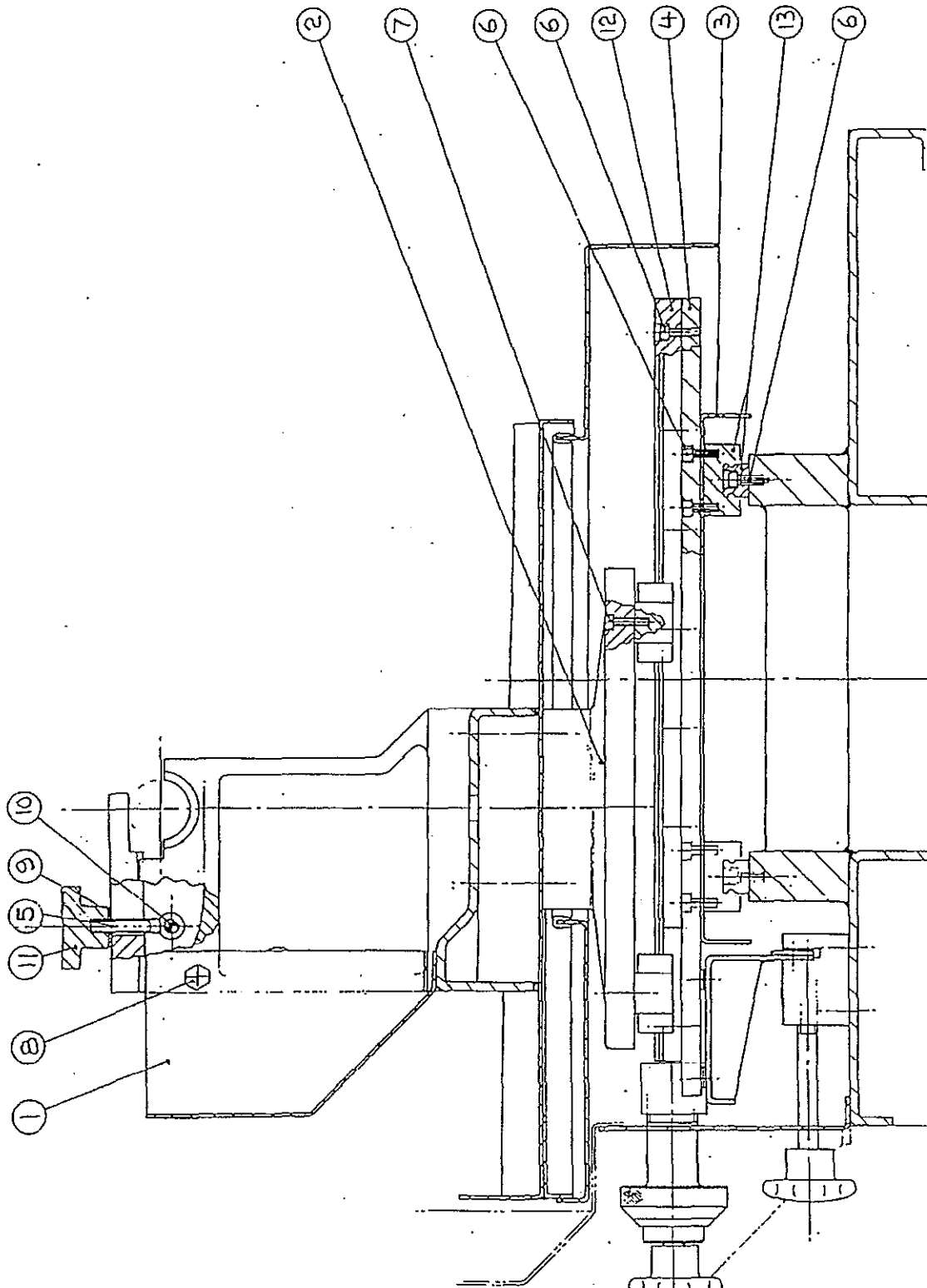
# PARTS LISTS

## SECTION 6

### CARRIAGE (Fig.6h)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 52	Carriage tray
2	1	NN 109	Arbor support base
3	1	NN 128	Arbor post LH
4	1	NN 129	Arbor post RH
5	6	K0525190	Hex skt capscrew m8 x 35 mm
6	4	K0525193	Hex skt capscrew m8 x 50 mm
7	4	K0525323	Hex skt countersunk screw m6 x 10 mm

Fig. 6j Carriage





# PARTS LISTS

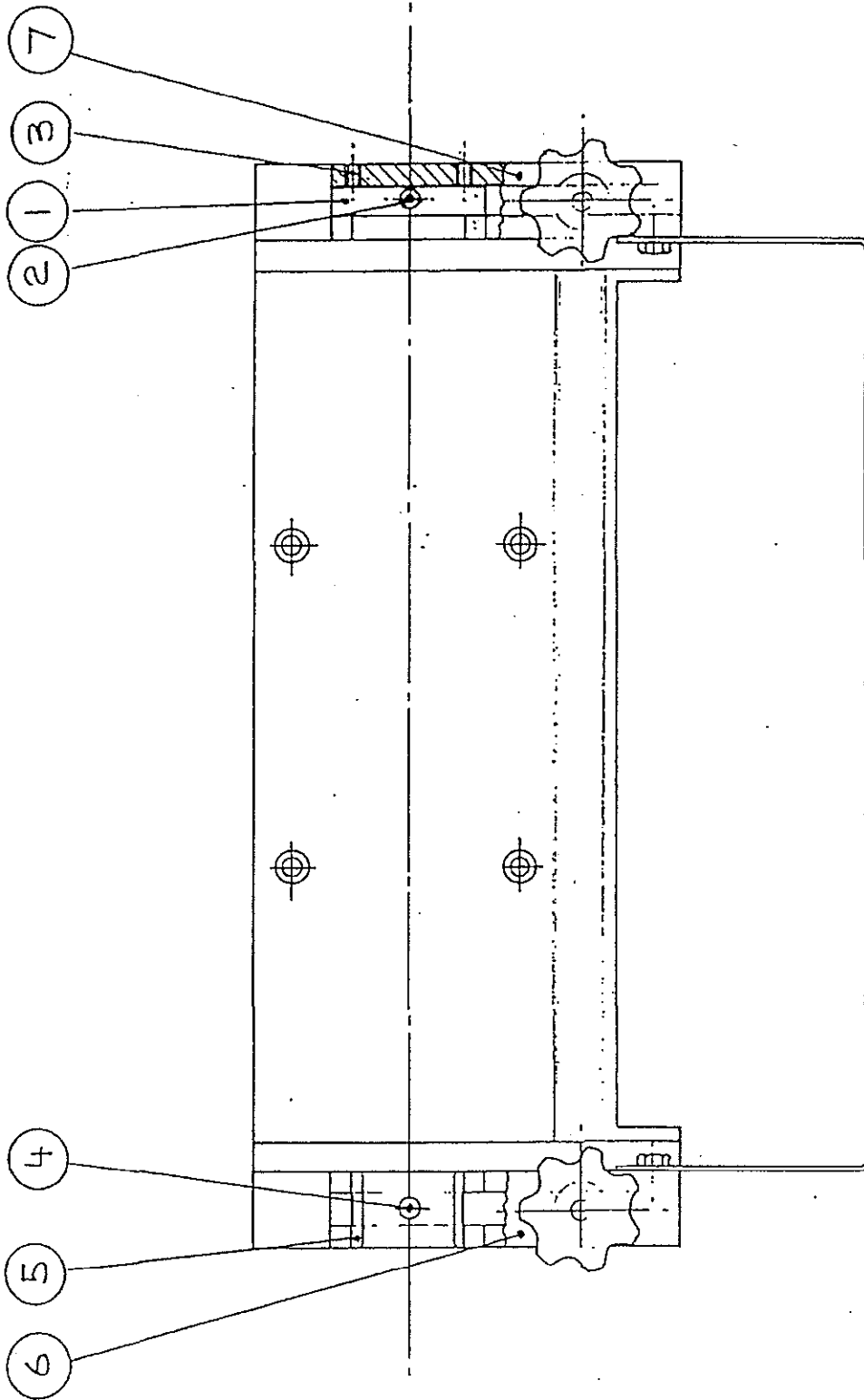
## SECTION 6

### CARRIAGE (Fig. 6i)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 9	Splash guard
2	1	NN 39	Carraige plate
3	1	NN 40	Carraige mid plate
4	2	NN 41	Carraige bearing strip
5	2	T3005653	Swing bolt m8 x 50 mm x 8 bore
6	52	K0525144	Hex hd capscrew m5 x 16mm
7	8	K0525145	Hex hd capscrew m5 x 20mm
8	2	K0525514	Hex hd screw m8 x 12mm
9	2	K0528103	wasker 8 mm
10	2	K0529145	Plain dowel 8 mm x 30 mm
11	2	K0530320	Handwheel 50 mm thread 8 mm No 141
12	2	K0607180	Linear bearing assembly. 460 lg
13	2	K0607181	Linear bearing assembly. 820 lg



Fig. 6j Carriage - arbor location





## PARTS LISTS

### SECTION 6

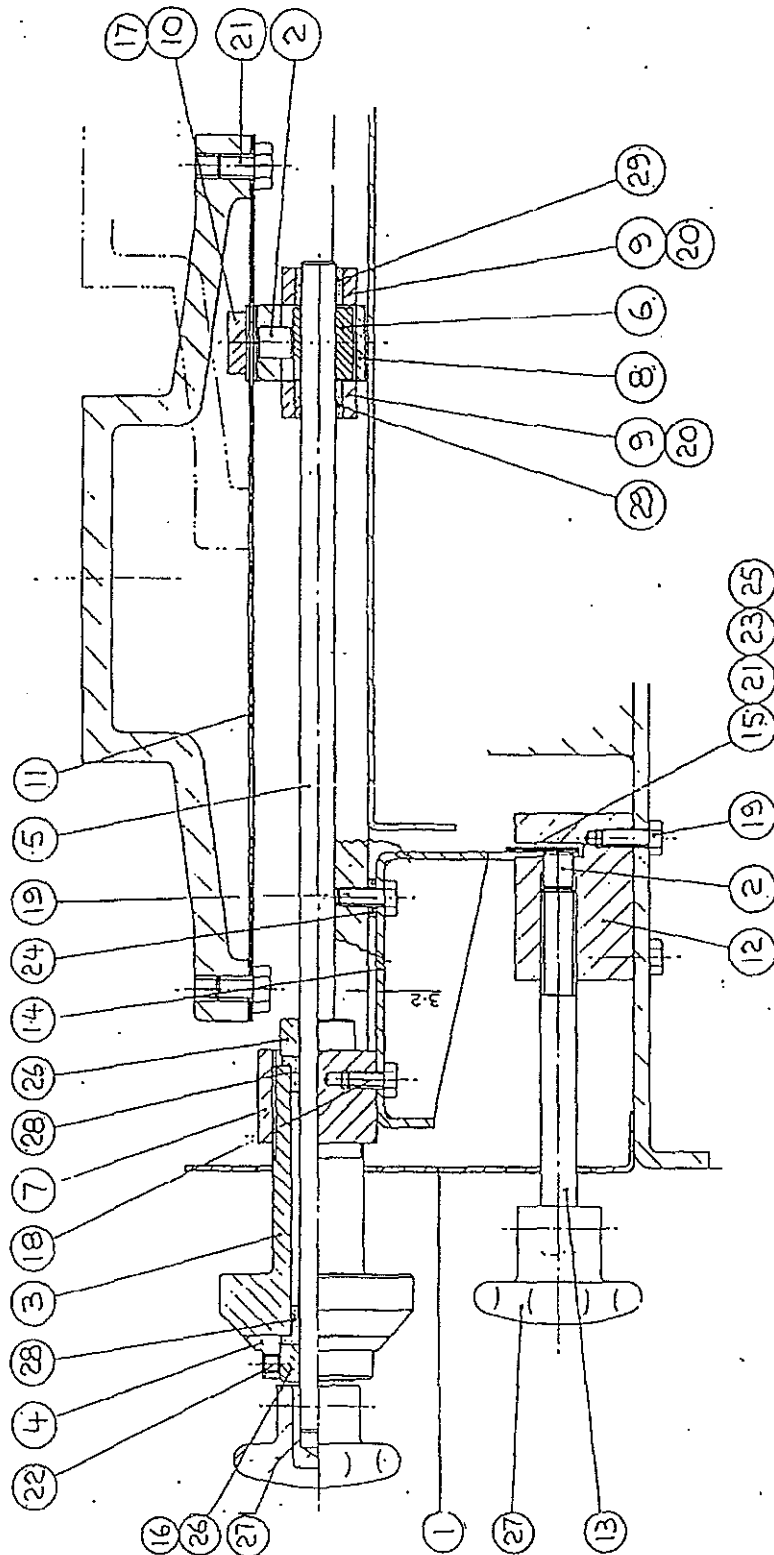
#### CARRIAGE - ARBOR LOCATION (Fig. 6i)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 133	Arbor location key
2	1	K0525122	Hex skt capscrew M4 x 12 mm
3	2	K0526144	Grubscrew M6 x 10 mm
4	1	K0525310	Hex skt csk screw M4 x 12 mm
5	1	NHP 346	Arbor shell
6	1	NN 131	Arbor clamp (37 dia.)
7	1	NN 130	Arbor clamp (47 dia.)

Alternative parts to suit 28 dia. arbor bearings :-

4	1	K0525122	Hex skt capscrew M4 x 12 mm
5	1	NXU 189	Shell
6	1	NN 132	Arbor clamp (28 dia.)

Fig. 6k Carriage locks





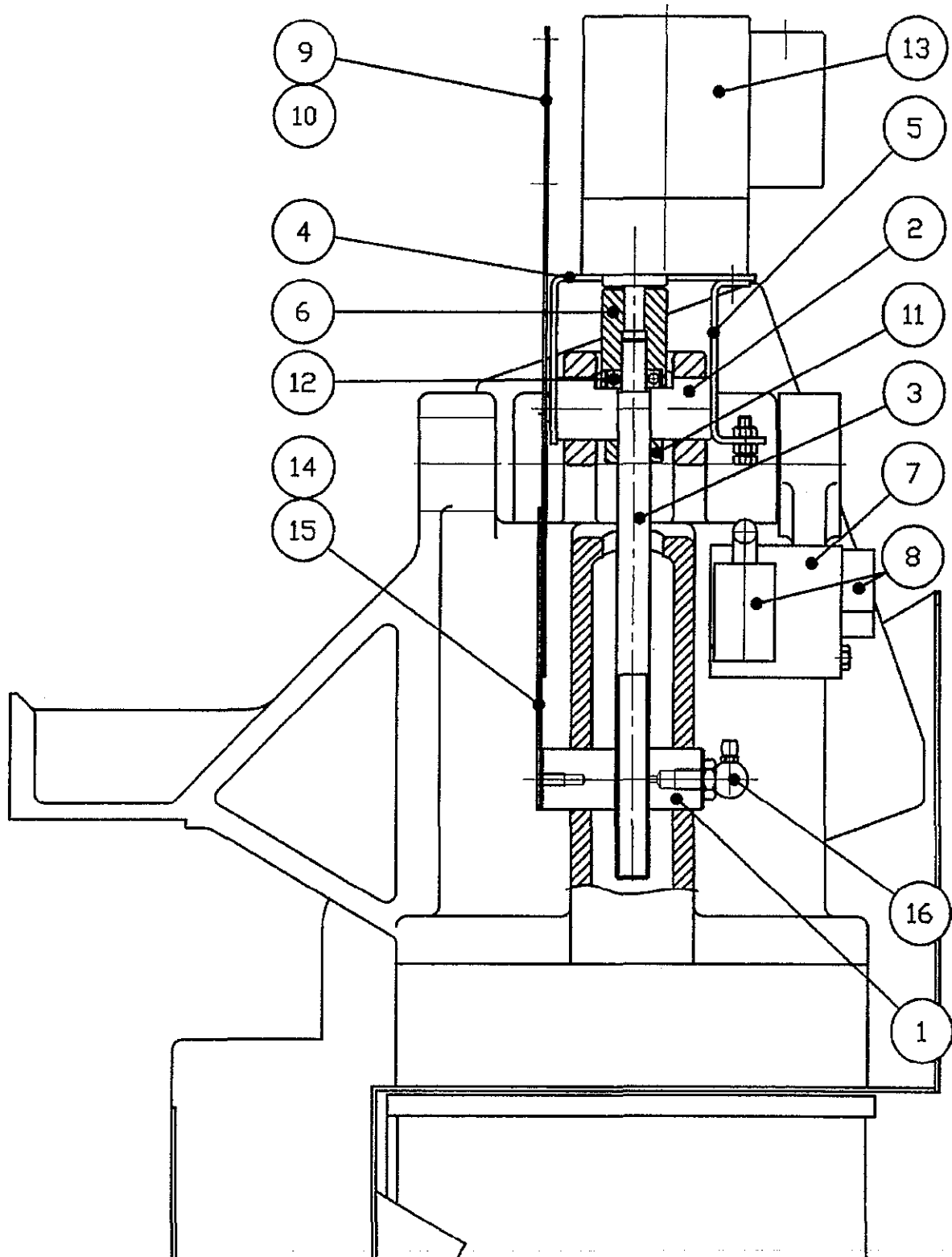
## PARTS LISTS

### SECTION 6

#### CARRIAGE LOCKS *(Fig. 6k)*

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 11	Cover plate (carriage locks)
2	2	NN 18	Locking pad
3	1	NN 25	Graduated cut adjuster
4	1	NN 26	Scale pointer ring
5	1	NN 27	Lock shaft
6	1	NN 28	Eccentric lock
7	1	NN 29	Lock adjusting block
8	1	NN 30	Lock block
9	2	NN 31	Shaft support plate
10	1	NN 32	Lock plate
11	1	NN 33	Short lock strip
12	1	NN 34	Locking block
13	1	NN 35	Lock screw
14	1	NN 37	Carriage lock bracket
15	1	NXU 186	Lower slide lock strip
16	5	K0520504	Taper pin No1 11/64 x 1 1/4
17	2	K0525324	Hex skt csk screw M6 x 12 mm
18	6	K0525501	Hex hd screw M6 x 12 mm
19	7	K0525502	Hex hd screw M6 x 16 mm
20	4	K0525504	Hex hd screw M6 x 25 mm
21	4	K0525514	Hex hd screw M8 x 12 mm
22	1	K0526112	Hex skt M6 x 6 mm
23	2	K0527102	Hex full nut 8 mm
24	8	K0528102	Washer 6 mm
25	4	K0528103	Washer 8 mm
26	2	K0528207	Collar 12 mm dia.
27	2	K0530257	Handwheel 55 mm x 12 bore
28	2	K0531320	24 Fl.Bush 12 B x 18 OD x 12 lg
29	2	K0531526	Bush 12 x 16 x 12

Fig. 61 Powered Head Tilt Assembly





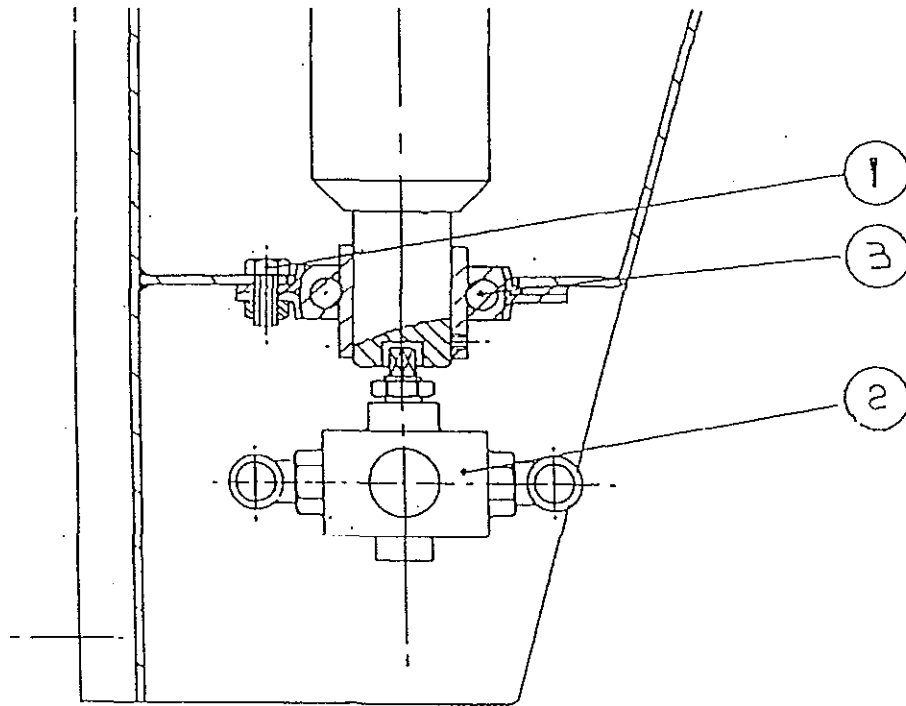
# PARTS LISTS

## SECTION 6

### POWERED HEAD TILT ASSEMBLY (Fig. 6f)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 217	Adj. nut for head cant
2	1	NN 218	Adj. screw mount for cant
3	1	NN 223	Cant adjusting screw
4	1	NN 262	Bracket for cant motor
5	1	NN 263	Bracket for cant motor
6	1	NN 264	Coupling for cant motor
7	1	NN 272	Bracket for limit switch
8	4	NXUS0033	Limit switch
9	1	NN 276	Scale mounting
10	1	NN 275	Cant scale
11	1	K0528209	Collar
12	1	k0604133	Thrust bearing
13	1	K1314346	Geared motor (380 - 440v) - CHECK VOLTAGE
14	1	NN 277	Pointer mounting
15	1	NN 288	Pointer for scale
16	1	K0950105	Nipple

Fig.6m Head mount tail bearing and valve





# PARTS LISTS

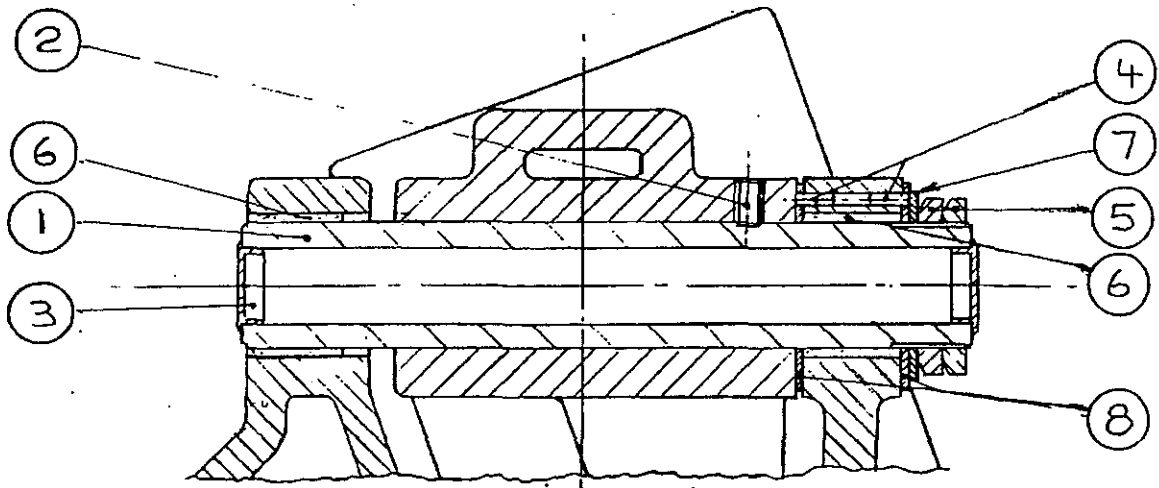
## SECTION 6

### HEAD MOUNT TAIL BEARING AND VALVE (Fig. 6m)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	3	K05 25 516	Hex hd screw M8 x 20 mm
2	1	K30 62 728	ABS -- RB 3400 3/8" Ball valve
3	1	K06 07 178	RHP.SLFE 35 Flange bearing



Fig. 6n Head Main Pivot Shaft





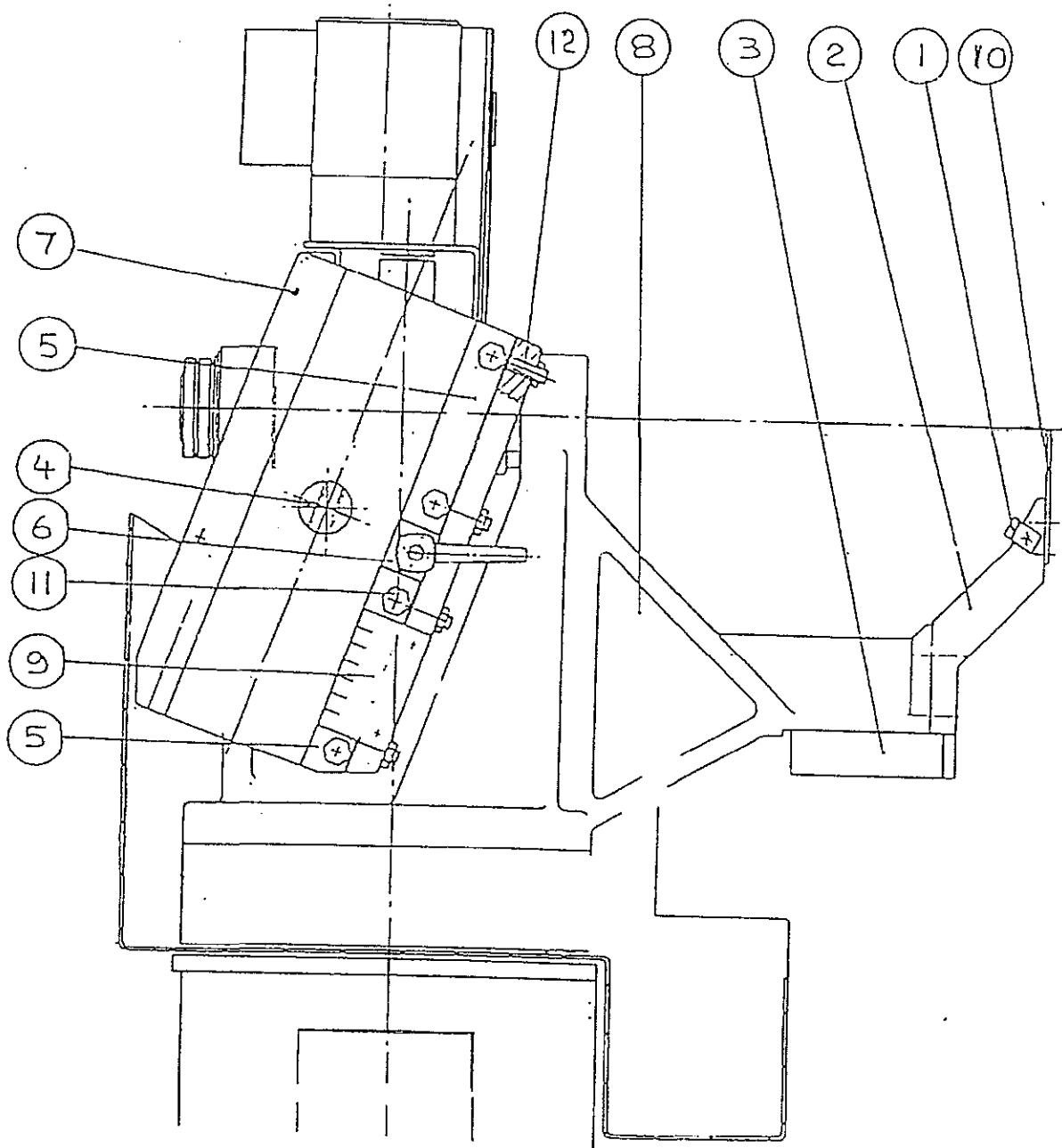
# PARTS LISTS

## SECTION 6

### HEAD MAIN PIVOT SHAFT (Fig. 6n)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 226	Pivot shaft for head
2	1	K0526149	Grubscrew M12 x 16
3	2	T3062303	Nylon hole plug 25.5 mm
4	2	K0520480	Tension pin 4 x 12
5	2	K0527209	Notch nut M40 x 1.5
6	2	K0531592	Bush 40 x 46 x 30
7	1	K0610256	AS-4060 INA Thrust washer
8	2	K3005328	SKF GLYPX G426601.5 bearing

Fig. 6p Head slide and cutter rest





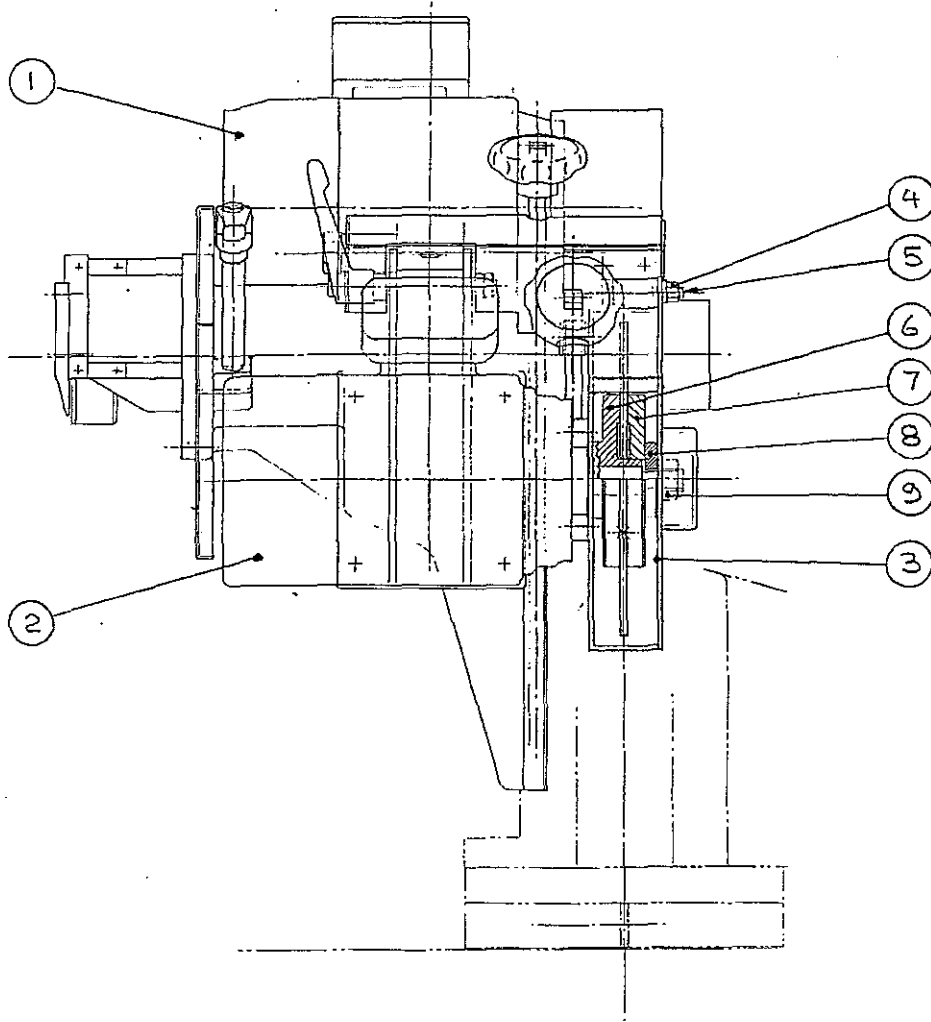
## PARTS LISTS

### SECTION 6

#### HEAD SLIDE AND CUTTER REST (Fig. 6p)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NE 79	Coolant pipe clip
2	1	NN 215	Tool rest mounting
3	1	NN 216	Dresser location
4	1	NN 225	Head vertical adj. nut
5	2	NN 227	Slide strip
6	1	NN 228	Slide lock strip
7	1	NN 268	Main pivot slide
8	1	NN 270	Main head mount
9	1	NN 286	Clearance angle scale
10	1		Cutter rest (see appendix A5)
11	4	K0525518	Hex hd screw M8 x 30 mm
12	4	K0526128	Skt set screw M8 x 20 mm cup

Fig. 6r Head assembly





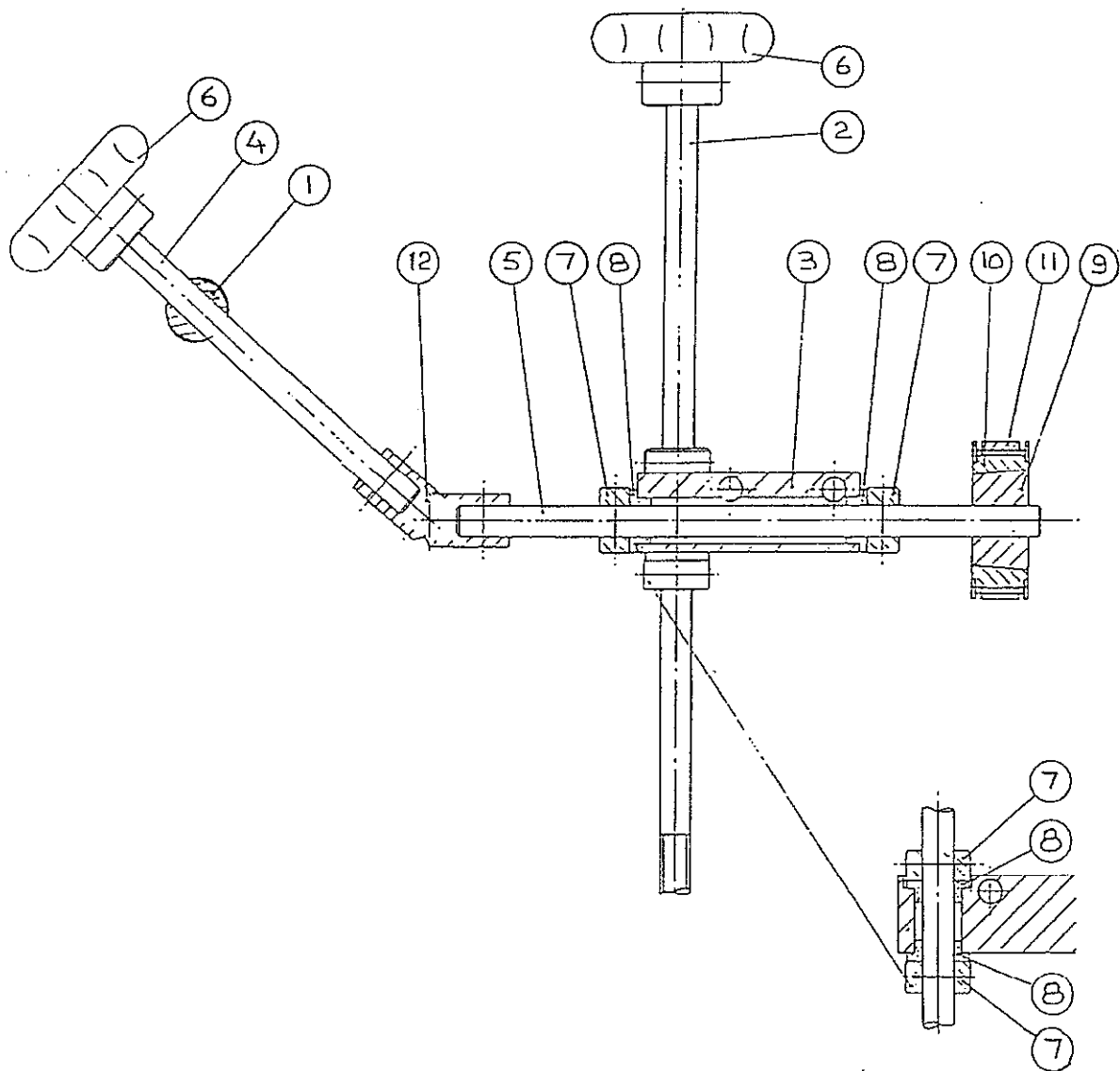
## PARTS LISTS

### SECTION 6

#### HEAD ASSEMBLY *(Fig. 6g)*

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NXS0202	Motor for straight knife spindle
2	1	K1304129	Profile spindle motor
3	1	NE 90	Wheel guard (profile)
4	1	K3053264	M8 Collar nut
5	1	T3005653	M8 Swing bolt
6	1	NN 290	Fixed wheel flange
7	1	NN 291	Front wheel flange
8	1	NXU 341	Locking washer
9	1	K0527105	M16 Spindle nut

Fig. 6r Head Adjustment Screws





## PARTS LISTS

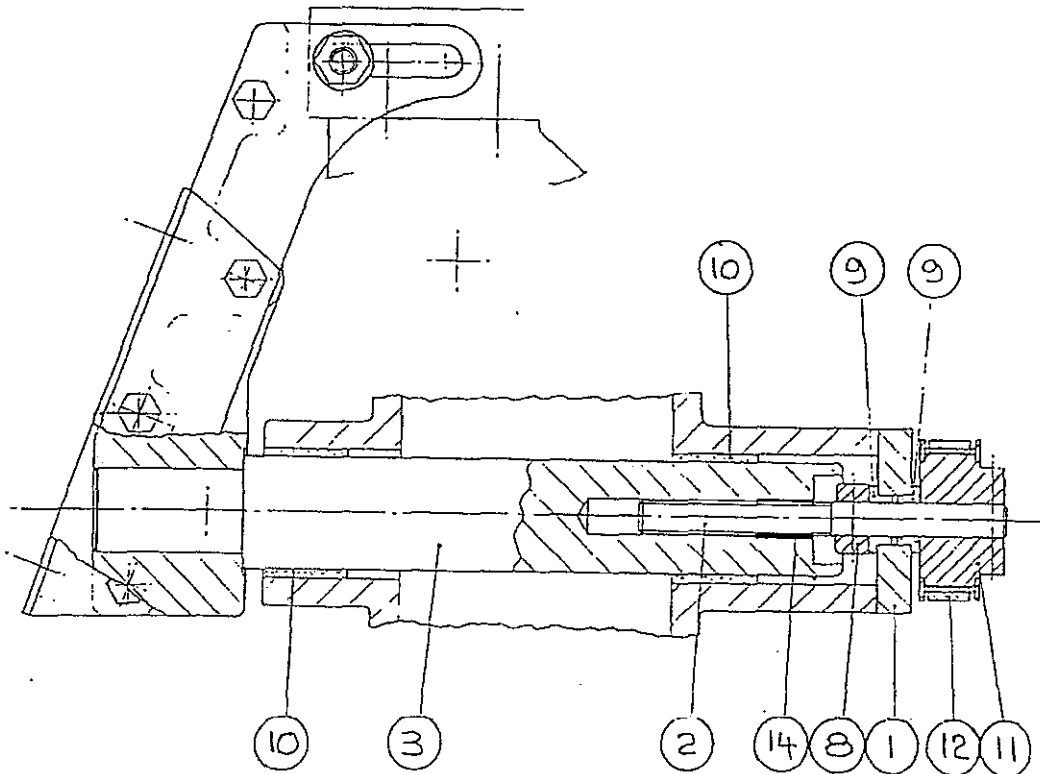
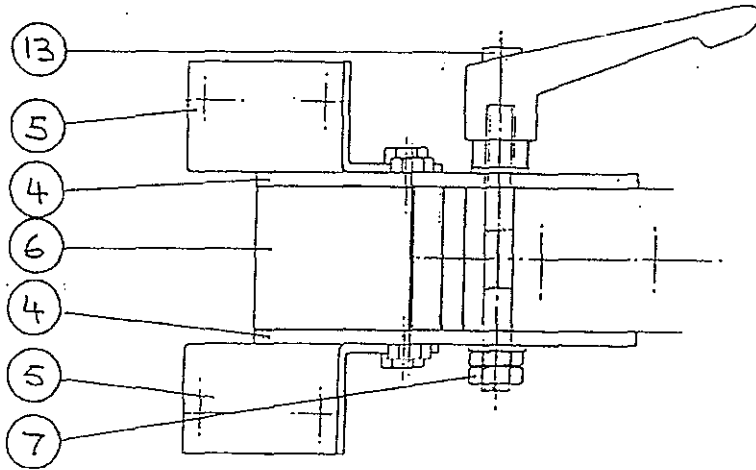
### SECTION 6

#### HEAD ADJUSTMENT SCREWS (Fig. 6r)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NE 29	Handwheel support
2	1	NN 224	Rise and fall screw
3	1	NN 229	Mounting block
4	1	NN 236	Shaft - Handwheel to universal joint
5	1	NN 237	Shaft - universal joint to pulley
6	2	NXU 424	Handwheel
7	4	K0528207	Loose collar
8	4	K0531302	Flanged bush
9	1	K3078774	Taper lock bush
10	1	K3078776	Pulley
11	1	K3078777	Timing belt
12	1	T3009772	Universal joint



Fig. 6s Profile Head Adjustment





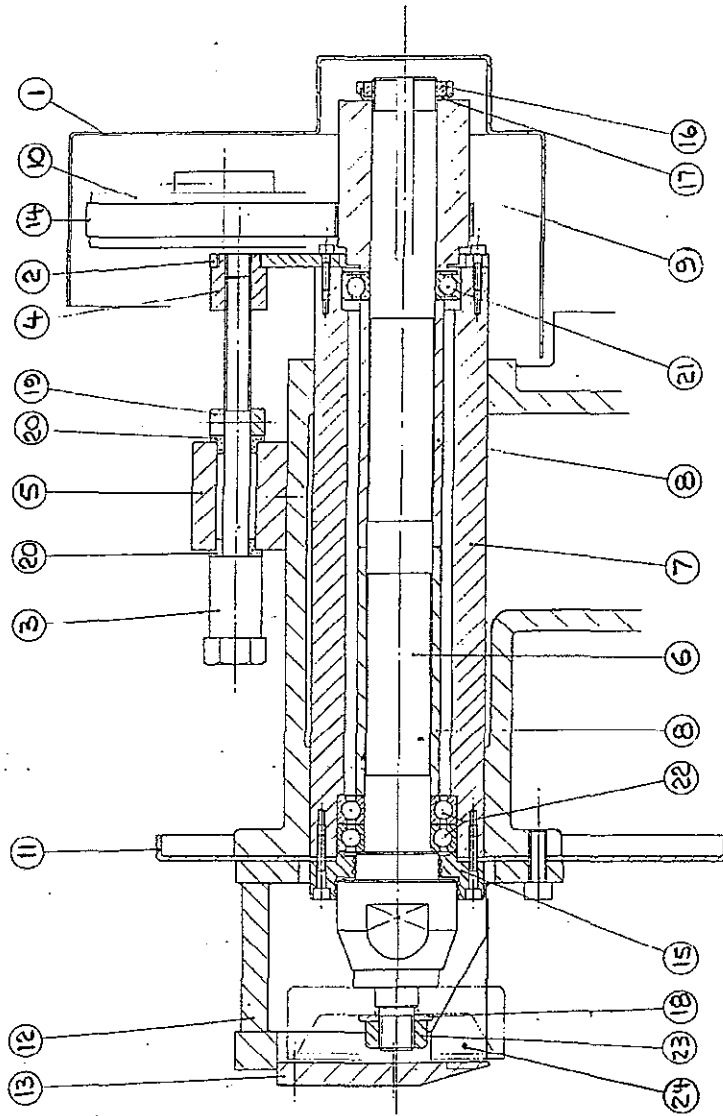
## PARTS LISTS

## SECTION 6

### PROFILE HEAD ADJUSTMENT (Fig. 6s)

<u>ITEM</u>	<u>QTY</u>	<u>PART No.</u>	<u>DESCRIPTION</u>
1	1	NN 230	Screw plate
2	1	NN 238	Adjusting screw
3	1	NN 239	Mounting shaft
4	2	NN 240	Locking plate
5	2	NN 241	Motor mounting bracket
6	1	NN 242	Profile head mount
7	2	K0527110	M10 Locknut
8	1	K0528207	Loose collar
9	2	K0531302	Flanged bush
10	2	K0531592	Bush 40 x 46 x 30
11	1	K3078775	Pulley
12	1	K3078777	Timing belt
13	1	K5127198	M10 Locking handle
14	1	T3033103	M12 Thread insert

Fig.6t Straight Knife Spindle





## PARTS LISTS

### SECTION 6

#### STRAIGHT KNIFE SPINDLE (Fig.6f)

<u>ITEM</u>	<u>QTY</u>	<u>PART No</u>	<u>DESCRIPTION</u>
1	1	NN 231	Belt guard
2	1	NN 232	Adjusting plate
3	1	NN 233	Adjusting screw
4	1	NN 234	Adjusting nut
5	1	NN 235	Top lock block
6	1	NN 244	Spindle
7	1	NN 245	Spindle barrel
8	2	NN 246	Bearing spacer
9	1	NN 247	Spindle pulley
10	1	NN 248	Motor pulley
11	1	NN 250	Splash plate
12	1	NN 251	Knife guide mounting
13	1	NHP 140	Knife guide *
14	1	NXU 322	Flat drive belt
15	1	NXU 325	Spindle end cap
16	1	K0527207	M30 locknut
17	1	K0527256	Tab locking washer
18	1	K0528106	M16 washer
19	1	K0528207	Loose collar
20	2	K0531302	Flanged bush
21	1	K0601126	Deep groove bearing
22	1	T3005305	Pair A/C bearings
23	1	T3053104	M16 LH nut
24	1	NN 278	Rubber splash flap

\* See Appendix A5 for options

APPROVED LUBRICANTS

Wadkin	B.P.	Caltex	Castrol	Esso	Gulf	Mobil	Shell
L1	Energol HLP 32	Rando	Hyspin AWS 32	Nuto H32 43 AW	Harmony Oil HDA	DTE oil Light 24	Tellus 37
L2	Energol HP 150	URSA P40	Alpha ZN 150	Spartan EP 150 Heavy	Service 13	Vactra Extra	Vitrea 150 or CS 150
L4	Energol HP 68	URSA P20	Magna 68	Nurray 68 Heavy Medium	Service 51	Vactral Oil	Vitrea 68 or CS 68
L6	Energol LS 3	Regal Startak Premium 3	Spheerol AP3	Beacon 3	Gulfcrown Grease No. 3	Mobilplex Grease No. 48	Alvania Grease No. 3

- L1 Oil                      Hydraulic oil with anti-corrosion, anti-oxidation, anti-wear, anti-foam performance.
- L2 Oil                      Gear oil (viscosity 150 centi-stokes at 40 degrees C).
- L3 Oil                      Plain mineral oil (viscosity 68 centi-stokes at 40 degrees C.)
- L6 Grease                 Grease NLG1 No.3 consistency lithium bearing grease.



## NXT 138 GRINDING COOLANT

**IMPORTANT :** The following information is reproduced for reference only. When handling coolant from ANY supplier ALWAYS use the data sheets provided with the product.

### APPLICATION.

The recommended dilution for use on this machine is 2% by volume (i.e. 50 : 1 water to coolant ratio).

Measure (do not guess) the required volume of water into a clean coolant tank or other suitable container.

Calculate the volume of coolant concentrate required. For example 30 litres of water would require 0.6 litres of coolant concentrate.

Always mix the emulsion by introducing the concentrate gradually to water. Continuously paddle the emulsion during mixing, circulating the fluid from bottom to top. Care should be taken to ensure that the emulsion is properly formed. Failure to do so may result in an emulsion of water in oil rather than oil in water. If an emulsion of water in oil is formed then it will have none of the properties normally expected of the coolant, and will lead to rapid rusting.

### POINTS TO REMEMBER :-

- Always add the coolant to water - NEVER vice versa.
- DON'T prepare coolant mixtures by guesswork - measure all quantities.
- NEVER pour the coolant concentrate into the water too quickly. It must be mixed in at a steady rate to achieve a stable emulsion.
- DON'T use dirty, saline, or hard water. Rain water is only acceptable if clean and free from debris.
- DON'T use dirty, rusted, galvanised or "old-oil" contaminated buckets etc.
- NEVER try to mix the coolant using the coolant pump.



TYPICAL PHYSICAL CHARACTERISTICS		
Concentrate :		
Appearance	-	Amber
Relative density at 20° C	-	1.002 gm/cm <sup>3</sup>
Emulsion :		
Appearance	-	Translucent / white liquid.
pH at 3% concentration	-	9.1 - 9.4
Refractometer Factor	-	1.4

#### TOPPING UP

If it is found necessary to 'top up' the coolant tank at a later stage, allowance should be made for water evaporation. This is necessary to prevent a gradual increase in fluid concentration. An approximate dilution of 1% by volume when 'topping up' will normally achieve this.

**NEVER ADD NEAT COOLANT TO STRENGTHEN, OR JUST WATER TO WEAKEN, EMULSIONS THAT ARE ALREADY IN USE IN THE MACHINE.**

Incorrect coolant strength MUST ALWAYS be compensated for by adding either a stronger or weaker EMULSION to the existing mix. Failure to observe this criteria is the cause of most aspects of poor coolant performance.

Remember to multiply direct refractometer readings by the refractive index of the product to gain the true coolant concentration figure.

NOTE : If the concentration should become too high, above a maximum of 10%, not only will the emulsion become unstable, but there is also the possibility of skin complaints among operators.

NOTE : Wadkin Plc reserve the right to change the type of cutting fluid supplied to our customers at any time. However, any changes of supply will be accompanied by the necessary safety data sheets.



# APPENDIX

A2



Castrol (U.K.) Limited

The Leading Lubricant Specialist



## SAFETY DATA SHEET

### 1: IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name: **Hysol G** Code: **7040-UK**  
 Application: Metalworking fluid - Soluble  
 Company: Castrol (U.K.) Limited  
 Address: Burmah Castrol House, Pipers Way, Swindon, Wiltshire, SN3 1RE  
 Telephone (24 hours): 0793 512712 Fax: 0793 432872

### 2: COMPOSITION/INFORMATION ON INGREDIENTS

Composition: Highly refined mineral oil, emulsifiers and additives

Hazardous Ingredient(s)	Symbol	Risk Phrases	Other Information	%
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This product contains ingredients classified as hazardous. However, they are NOT present in sufficient quantities to warrant classifying the product as hazardous

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of New Chemical Substances) or are exempt.

Refer to Section 8 for Occupational Exposure Limits.

### 3: HAZARDS IDENTIFICATION

This product is NOT classified as hazardous

### 4: FIRST AID MEASURES

Eyes: Irrigate immediately with copious quantities of water for several minutes. Obtain medical attention if irritation persists

Skin: Wash thoroughly with soap and water or suitable skin cleanser as soon as possible

Inhalation: Remove from exposure

Ingestion: Obtain medical attention urgently. Do NOT induce vomiting. Wash out mouth with water.

### 5: FIRE FIGHTING MEASURES

Suitable Extinguishing Media: Carbon dioxide, powder, foam or water fog - Do not use water jets

Special Exposure Hazards: Nitrogen compounds

Special Protective Equipment: Self-contained breathing apparatus

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**6: ACCIDENTAL RELEASE MEASURES**

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Personal Precautions: Spilt product presents a significant slip hazard  
Environmental Precautions: Prevent entry into drains, sewers and water courses  
Decontamination Procedures: Soak up with inert absorbent or contain and remove by best available means

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**7: HANDLING AND STORAGE**

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Handling: To avoid the possibility of skin disorders, repeated or prolonged contact with products of this type must be avoided. It is essential to maintain a high standard of personal hygiene  
Avoid breathing spray mist  
Storage: Protect from frost. Store out of direct sunlight. Store between (°C): 5-50

---

**8: EXPOSURE CONTROLS/PERSONAL PROTECTION**

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**Occupational Exposure Limits:-**

Substance	8 Hr.TWA	STEL	Source/Other Information
Mineral oil (see Oil mist, mineral)	5mg/m <sup>3</sup>	10mg/m <sup>3</sup>	EH40

---

Engineering Control Measures: Local exhaust ventilation is recommended. Mechanical methods to minimise exposure must take precedence over personal protective measures.

Personal Protective Equipment: Safety glasses. Plastic apron. Wear impervious gloves (eg of PVC), in case of repeated or prolonged contact.  
Change contaminated clothing and clean before re-use

---

**9: PHYSICAL AND CHEMICAL PROPERTIES**

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Physical State:	Liquid
Colour:	Amber
Odour:	Mild
pH(concentrate):	Not applicable
pH(working dilution):	9 (5%)
Boiling Point/Range (°C):	Above 100
Flash Point (closed, °C):	Above 100
Autoignition (°C):	Not determined
Relative Density (at 20°C):	Below 1.0
Water Solubility:	Emulsifiable
Fat Solubility:	Not determined

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**10: STABILITY AND REACTIVITY**

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Stability: Stable, will not polymerise

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Conditions to Avoid: Temperatures (°C) above 60  
Materials to Avoid: Strong oxidising agents. Strong acids.  
Hazardous Decomposition Products: Nitrogen compounds

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### 11: TOXICOLOGICAL INFORMATION

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The following toxicological assessment is based on a knowledge of the toxicity of the product's components.  
Expected oral LD<sub>50</sub>, rat > 2g/kg. Expected dermal LD<sub>50</sub>, rabbit > 2g/kg.  
Not classified as an eye or skin irritant

#### Health Effects

On Eyes: May cause transient irritation  
On Skin: May defat the skin  
By Inhalation: Mist and vapours may cause irritation to nose and respiratory tract  
By Ingestion: May cause nausea, vomiting and diarrhoea  
Chronic: Repeated and prolonged skin contact may lead to skin disorders  
Other: None known

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### 12: ECOLOGICAL INFORMATION

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Environmental Assessment: May cause significant ecological damage in aquatic systems and must be used and disposed of in accordance with the recommendations made in this safety data sheet  
Mobility: Mobile liquid. Emulsifiable in water.  
Persistence and Degradability: Not readily biodegradable  
Bioaccumulative Potential: Not determined  
Ecotoxicity: Not determined

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### 13: DISPOSAL CONSIDERATIONS

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Disposal must be in accordance with local and national legislation.  
Unused Product: Dispose of through an authorised waste contractor to a licensed site  
Used/Contaminated Product: Diluted product may be separated by chemical means before removal by an authorised waste contractor  
For further information see Section 16  
Packaging: Must be disposed of through an authorised waste contractor  
May be steam cleaned and recycled

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### 14: TRANSPORT INFORMATION

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This product is NOT classified as dangerous for transport

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### 15: REGULATORY INFORMATION

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#### Hazard Label Data:-

This product is NOT classified as dangerous for supply in the UK

EC Directives: Framework Waste Directive, 91/156/EEC  
Waste Oil Directive, 87/101/EEC

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Statutory Instruments:	Health & Safety at Work, etc. Act 1974 Consumer Protection Act 1987 Environmental Protection Act 1990
Codes of Practice:	Waste Management. The Duty of Care
Guidance Notes:	Occupational skin diseases: health and safety precautions (EH 26) Occupational exposure limits (EH 40) Carcinogenicity of mineral oils (EH 58) Metalworking fluids - health precautions (EH 62) Skin cancer caused by oil [MS(B)5] Save your skin! - Occupational Contact Dermatitis [MS(B)6] Dermatitis - cautionary notice [SHW 367] Effects of mineral oil on the skin [SHW 397]

The above publications are available from HMSO or HSE

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### 16: OTHER INFORMATION

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Castrol publication: Talking about Cutting Fluids  
Castrol Advice Sheet: The Disposal of Used Metalworking Fluids  
Castrol publication: Talking About Health and Safety - Lubricants and Allied Products

The data and advice given apply when the product is sold for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. You should not use the product other than for the stated application or applications without seeking advice from us.

If you have purchased the product for supply to a third party for use at work, it is your duty to take all necessary steps to secure that any person handling or using the product is provided with the information in this sheet.

If you are an employer, it is your duty to tell your employees and others who may be affected of any hazards described in this sheet and of any precautions which should be taken.

Further copies of this Safety Data Sheet may be obtained from Castrol (U.K.) Limited.

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## NXT 145 ANTI-BACTERIAL SOLUTION

**IMPORTANT :** The following information is reproduced for reference only. When handling anti-bacterial solutions from ANY supplier ALWAYS use the data sheets provided with the product.

The solution normally supplied by Wadkin is a nitrite-free, medium to heavy duty machine tool cleaner / steriliser based on a powerful detergent. It has been specially formulated to deal with a wide variety of machine tool contaminants and is easy to use, being added directly to the coolant system whilst still in operation.

- Cleans machine tool systems of a wide range of contaminants including fatty build up in pipelines and floor ducts.
- Kills bacteria and emulsifies floating tramp oil.
- Particularly useful in areas of hard water where greater amounts of insoluble material are likely to occur.
- Minimises maintenance downtime.
- Can be used whilst machines are operating normally.
- Helps keep machine tools in a clean and efficient condition.

### APPLICATION

- 1) An addition of 0.5% - 2% of System Cleaner is recommended. The amount added depends on the general condition of the coolant system (1% is usually adequate).
- 2) Introduce System Cleaner where there is good coolant movement, e.g. in the main coolant tray near to the drain hole position. This ensures complete mixing with the cutting fluid.
- 3) Add System Cleaner on the day before the coolant is programmed to be discarded. The machine should then be operated normally for a minimum of eight hours.
- 4) Following this period of circulation, empty the entire coolant system and machine, and dispose of the coolant in accordance with local authority regulations.

### TECHNICAL DATA

Alkalinity	Medium (contains a small amount of free caustic)
Density @ 20 <sup>o</sup> C	1.080
pH (1% solution)	11.25
Surface tension (1% solution at 20 <sup>o</sup> C)	34mN/m
Appearance	Blue liquid, moderately viscous

**NOTE :** Wadkin Plc reserve the right to change the type of anti-bacterial solution supplied to our customers at any time. However, any changes of supply will be accompanied by the necessary safety data sheets.



# APPENDIX

A3



Castrol (U.K.) Limited

*The Leading Lubricant Specialist*

## SAFETY DATA SHEET



### 1: IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name: **System Cleaner** Code: **7949-UK**  
Application: Machine tool coolant system cleaning  
Company: Castrol (U.K.) Limited  
Address: Burmah Castrol House, Pipers Way, Swindon, Wiltshire, SN3 1RE  
Telephone (24 hours): 0793 512712 Fax: 0793 432872

### 2: COMPOSITION/INFORMATION ON INGREDIENTS

Composition: Aqueous solution of alkalis, surfactants and additives

Hazardous Ingredient(s)	Symbol	Risk Phrases	Other Information	%
Sodium hydroxide	C	R35	CAS No 1310-72-2	0.5 - 2
1,3,5-Tris- (2-hydroxyethyl)-1,3,5-hexahydrotriazine	Xi	R22, 36/38	CAS No 4719-04-4	< 20

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of New Chemical Substances) or are exempt.

Refer to Section 8 for Occupational Exposure Limits.

### 3: HAZARDS IDENTIFICATION

Irritating to eyes and skin



IRRITANT

### 4: FIRST AID MEASURES

Eyes: Irrigate immediately with copious quantities of water for several minutes  
Obtain medical attention urgently

Skin: Wash immediately with soap and water or suitable skin cleanser  
Obtain medical attention if irritation persists

Inhalation: Remove from exposure

Ingestion: Obtain medical attention. Do NOT induce vomiting. Wash out mouth with water.

### 5: FIRE FIGHTING MEASURES

Suitable Extinguishing Media: Carbon dioxide, powder, foam or water

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Special Exposure Hazards: Nitrogen compounds  
Special Protective Equipment: Self-contained breathing apparatus

## 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions: Spilt product presents a significant slip hazard  
Wear rubber boots in addition to the recommended protective clothing

Environmental Precautions: Prevent entry into drains, sewers and water courses

Decontamination Procedures: Soak up with inert absorbent or contain and remove by best available means. Clean contaminated area with water.

## 7: HANDLING AND STORAGE

Handling: Handle and open containers with care. Avoid skin and eye contact. Avoid breathing spray mist.  
Storage: Protect from frost. Store only in hazard labelled containers.

## 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits:-

Substance	8 Hr.TWA	STEL	Source/Other Information
Sodium hydroxide	-	2mg/m <sup>3</sup>	EH40
Formaldehyde (formed in solution)	2ppm (MEL)	2ppm (MEL)	EH40

Engineering Control Measures: Local exhaust ventilation is recommended. Mechanical methods to minimise exposure must take precedence over personal protective measures.

Personal Protective Equipment: Goggles. Impervious gloves (eg PVC). Plastic apron.  
Change contaminated clothing immediately and clean before re-use.  
An eye wash station must be available.

## 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Colour:	Blue
Odour:	Sharp
pH(concentrate):	13.3
pH(working dilution):	11.3 (1%)
Boiling Point/Range (°C):	Above 100
Melting Point/Range (°C):	Below 0
Flash Point (closed, °C):	None, as supplied
Relative Density (at 20°C):	Above 1.0
Water Solubility:	Soluble
Fat Solubility:	Not determined

## 10: STABILITY AND REACTIVITY

Stability: Stable, will not polymerise  
Conditions to Avoid: Temperatures (°C) above 60

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Materials to Avoid: Strong acids  
Hazardous Decomposition Products: Irritant fumes. Formaldehyde. Nitrogen compounds.

## 11: TOXICOLOGICAL INFORMATION

The following toxicological assessment is based on a knowledge of the toxicity of the product's components  
Classified as an eye and skin irritant. Recommended working concentrations are not classified as eye or skin irritants.

### Health Effects

On Eyes: Irritating and may injure eye tissue if not removed promptly  
On Skin: Irritation  
By Inhalation: Mist and vapours may cause irritation to nose and respiratory tract  
By Ingestion: May cause irritation of mouth, throat and digestive tract  
Chronic: None known  
Other: None known

## 12: ECOLOGICAL INFORMATION

Environmental Assessment: May cause significant ecological damage in aquatic systems and must be used and disposed of in accordance with the recommendations made in this safety data sheet  
Mobility: Mobile liquid. Soluble in water.  
Persistence and Degradability: Inherently biodegradable  
Bioaccumulative Potential: Not determined  
Ecotoxicity: Not determined

## 13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.  
Unused Product: Dispose of through an authorised waste contractor to a licensed site  
Used/Contaminated Product: As for Unused Product  
Diluted product may be separated by chemical means or reverse osmosis  
Packaging: Contains hazardous residues, must be disposed of through an authorised waste contractor. May be steam cleaned and recycled.

## 14: TRANSPORT INFORMATION

This product is NOT classified as dangerous for transport

## 15: REGULATORY INFORMATION

### Hazard Label Data:-

Named Ingredients: Sodium hydroxide 0.5-2.0%  
Symbol(s): Xi  
Risk Phrases: Irritating to eyes and skin

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Safety Phrases:	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice After contact with skin, wash immediately with plenty of soap and water Wear suitable protective clothing, gloves and eye/face protection
EC Directives:	Dangerous Preparations Directive, 88/379/EEC Safety Data Sheets Directive, 91/155/EEC Framework Waste Directive, 91/156/EEC
Statutory Instruments:	Health & Safety at Work, etc. Act 1974 Chemicals (Hazard Information and Packaging) Regs. 1993 (SI 1746) Consumer Protection Act 1987 Control of Substances Hazardous to Health Regs. 1988 (SI 1657) Environmental Protection Act 1990
Codes of Practice:	Classification & labelling of substances dangerous for supply (COP 22) Waste Management. The Duty of Care
Guidance Notes:	Storage of packaged dangerous substances [CS 17 / HS(G)71] Occupational exposure limits (EH 40) Occupational skin diseases: health and safety precautions (EH 26) Classification, Packaging & Labelling of Dangerous Substances Regs. 1984 [HS(R)22] Save your skin! - Occupational Contact Dermatitis [MS(B)6] Dermatitis - cautionary notice [SHW 367]

The above publications are available from HMSO or HSE

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#### 16: OTHER INFORMATION

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Information approved for the classification, packaging and labelling of dangerous substances for supply and conveyance by road (Third Edition)

Castrol publication: Talking About Health and Safety - Lubricants and Allied Products

The data and advice given apply when the product is sold for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. You should not use the product other than for the stated application or applications without seeking advice from us.

If you have purchased the product for supply to a third party for use at work, it is your duty to take all necessary steps to secure that any person handling or using the product is provided with the information in this sheet.

If you are an employer, it is your duty to tell your employees and others who may be affected of any hazards described in this sheet and of any precautions which should be taken.

Further copies of this Safety Data Sheet may be obtained from Castrol (U.K.) Limited.



TOOLS AND ACCESSORIES SUPPLIED WITH THE SILHOUETTE

<u>Qty</u>	<u>Part No.</u>	<u>Description</u>
5	GW 202	Grinding wheel 230 x 5 x 1 1/4" finish
5	GW 203	Grinding wheel 230 x 5 x 1 1/4" coarse
1	GW 301	Borazon wheel
1	K30 41140	Allen key 2.5 mm A/F
1	K30 41141	Allen key 3 mm A/F
1	K30 41142	Allen key 4 mm A/F
1	K30 41143	Allen key 5 mm A/F
1	K30 41144	Allen key 6 mm A/F
1	K30 41145	Allen key 8 mm A/F
1	K30 41146	Allen key 10 mm A/F
1	K30 73724	Locknut spanner 46 mm A/F
1	K30 73738	D/ended spanner 17 x 19 A/F
1	K30 73782	D/ended spanner 11 x 13 A/F
1	K30 73785	D/ended spanner 24 x 27 A/F
1	NHP 112	Setting gauge
3	NXT 6	Template blank 330 mm long
1	NXT 138	Grinding coolant conc. 5 litres
1	T30 29105	Crank handle - 13 mm square
1	NNT 122	40 mm dia. Heavy duty arbor
1	NXT 301	40 mm bore locking collar
1	NXT 302	40 mm bore threaded collar
1	NXT 303	Clamping nut for collar
1	NXT 304	Tommy bar
1	T30 41110	5mm A/F handled Allen key
4	WA 149	Levelling Plate

Note : 40 mm diameter arbor and locking collars are supplied unless specified otherwise.



## ACCESSORIES FOR SILHOUETTE MACHINES

### WHEELS FOR PROFILE GRINDING

For solid H.S.S. and H.S.S. on iron :-

GW	203	Standard roughing wheel, 5 mm thick, 60 grit
GW	202	Finishing wheel, 5 mm thick, 220 grit

For Tungsten Carbide (T.C.T.) :-

GW	209	4.7 mm thick square edge diamond grinding wheel
GW	210	4.7 mm thick round edge diamond grinding wheel
GW	211	3.0 mm thick round edge diamond grinding wheel
GW	212	3.0 mm thick square edge diamond grinding wheel

Other profiles are available on request.

Note : All profile grinding wheels are 230 mm diameter and suitable for running at 3000 rpm.  
The bore size is 31.75 mm (1.25").

### PRE MOUNT WHEEL FLANGES

NN	D13	Pre-mount wheel flange unit to allow interchangeability whilst retaining the profile Grinding wheel in its originally dressed position.
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Note : Straight knife grinding wheels are 100 mm diameter, 20 mm bore, and are designed for face grinding at up to 6000 rpm.

### WHEELS FOR SOLID PROFILE CUTTER GRINDING

GW	304	150 mm diameter Borazon wheel for H.S.S.
GW	305	175 mm diameter Borazon wheel for H.S.S.
GW	306	200 mm diameter Borazon wheel for H.S.S.
GW	307	150 mm diameter diamond wheel for T.C.T.
GW	308	175 mm diameter diamond wheel for T.C.T.
GW	309	200 mm diameter diamond wheel for T.C.T.

Note : Solid profile cutter grinding wheels have a 20 mm bore, and are designed for face grinding.

HEAVY DUTY ARBORS

NNT	122	40 mm diameter
NNT	127	45 mm diameter
NNT	132	50 mm diameter
NNT	137	60 mm diameter
NNT	172	1 1/2" diameter
NNT	177	1 5/8" diameter
NNT	182	1 3/4" diameter
NNT	187	1 13/16" diameter
NNT	192	2 1/8" diameter

Note : Each arbor includes one set of locking collars. Heavy duty arbors have a 37 mm O.D. support bearing. The standard arbor supplied with the machine is NNT 122 unless specified otherwise.

SMALLER ARBOR SIZES

NNT	102	30 mm diameter
NNT	107	35 mm diameter
NNT	112	40 mm diameter
NNT	152	1 1/8" diameter
NNT	157	1 1/4" diameter
NNT	162	1 3/8" diameter

Note : Each arbor includes one set of locking collars. The smaller arbors have a 28 mm O.D. support bearing. If these arbors are used, the following clamp assembly is also required.

NN	C04	Arbor clamp and shell for smaller arbors. (28 mm dia bearing.)
NN	J01	Counter balance for arbor
NXT	140	Dummy cutterhead for grinding a pair of square or scribing cutter cartridges as used on the Wadkin SET machine. Mounts direct to standard 40 mm arbor.

PROFILE GRINDING – CUTTER RESTS

NX	134	Narrow tool rest (12 mm wide)
NN	D06	Curved narrow tool rest (6 mm wide) for Tena Disc or narrow segmental type circular cutterheads
NN	D14	Carbide tool rest (25mm wide)
NN	354	Spare carbide tip for above

STRAIGHT KNIFE GRINDING – KNIFE GUIDES

NN	E04	No. 6 Knife guide for 6 mm thick knives
NN	E05	No.8 Knife guide for 8 mm thick knives
NN	E06	No. 9 Knife guide for 3/8" thick knives
NN	E07	No. 11 Knife guide for 7/16" thick knives

Note : The No. 4 knife guide supplied with the machine is suitable for 3 mm and 4 mm thick knives.

SOLID PROFILE CUTTER GRINDING

NN	M05	Solid profile attachment complete with 150 mm diameter Borazon wheel (Maximum throat depth 55 mm (2.16"))
NN	M06	Solid profile attachment complete with 175 mm diameter Borazon wheel (Maximum throat depth 67 mm (2.63"))
NN	M07	Solid profile attachment complete with 200 mm diameter Borazon wheel (Maximum throat depth 80 mm (3.15"))

Note : The smallest wheel diameter should be chosen in preference. The larger wheels are only used where deep profiles form a deep throat face which cannot be covered by the smaller wheels. The above attachments include wheels, guards, arbor rotation lock, D.T.I. with magnetic base, and a ratchet spanner for head adjustment. If a wheel diameter other than that supplied with the attachment is to be used, an additional guard and philbus will be required :

NN	M02	150 mm diameter wheel guard and philbus
NN	M03	175 mm diameter wheel guard and philbus
NN	M04	200 mm diameter wheel guard and philbus

TEMPLATE MAKING

NXT	6	Template steel 330 mm (13") length
TBO	650	Template making toolkit

Note : The template making toolkit includes ; toolbox with instructions, template steel, and a selection of hand tools required for template making.

NXT	5100	Wadkin UltraCare Mirage 2-axis NC template making machine.
NXT	5200	Wadkin UltraCare Outline 3-axis NC template making machine.

Contact Wadkin UltraCare Limited for full details

COOLANT SYSTEM

NN	H08	Additional filter tray
K30	21153	Filtration paper for above
NXT	138	Semi-synthetic grinding fluid in concentrate form. Supplied in 5 litre containers Note : To be diluted at 50 : 1 ratio
NXT	145	Anti-bacterial solution concentrate for cleansing coolant system when replacing grinding fluid. Supplied in 5 litre containers

FULL HEALTH AND SAFETY DATA SHEETS ARE AVAILABLE FOR NXT 138 / 145 FLUIDS.

T30	49102	Hand held refractometer for measuring concentration of grinding fluid.
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SETTING AND MEASURING

MSS	300	Setting stands, computer aided setting systems, and optical setting and measuring systems. Contact Wadkin for full details.
MSS	G06	Set of arbor shells (37 mm dia.). Note : used to adapt existing MSS stands to accept NNT heavy duty type arbors.
NN	J03	Cutting and clearance angle measuring and setting gauge

## SUGGESTED SPARES FOR SILHOUETTE MACHINES

CONSUMABLE MACHINE PARTS

NX	454	Cutter rest 25 mm
NHP	140	Knife guide No.4
NXU	522	Diamond dresser
NX	40	Stylus 4.7 mm wide radius and square
NX	110	Stylus 4.7 mm wide 90 <sup>0</sup> point
NX	111	Stylus 4.7 mm wide 30 <sup>0</sup> right hand
NX	112	Stylus 4.7 mm wide 30 <sup>0</sup> left hand
NX	131	Stylus 4.7 mm wide 45 <sup>0</sup> chamfer right and left hand
NX	133	Stylus 3 mm wide radius and square
K12	03418A	Bulb for worklamp

Note : Consumable items such as grinding wheels, template blanks, and coolant fluids are included in Appendix A5.

SERVICE PARTS

<u>Qty</u>	<u>Part No.</u>	<u>Description</u>
<u>Template slide</u>		
2	NN 153	Adjusting nut
2	NN 238	Adjusting screw
4	K05 31302	Flanged bush 12 x 18 x 8 long
4	K05 31589	Bush 25 x 30 x 30 long
2	K30 25455	Dial indicator
<u>Carriage</u>		
2	K06 07180	Linear bearing assembly 460 long
2	K06 07181	Linear bearing assembly 820 long
<u>Carriage locks</u>		
2	NN 18	Locking pads
2	K05 31320	Flanged bush 12 x 18 x 12 long
2	K05 31526	Bush 12 x 16 x 12 long
<u>Arbor supports</u>		
1	NN 133	Location key
1	NHP 346	Arbor shell
<u>Main Head mounting</u>		
1	NN 217	Nut for head tilt
1	NN 218	Tilt screw mounting
1	NN 223	Tilt adjusting screw
1	NN 224	Vertical adjusting screw
1	NN 225	Vertical adjusting nut
1	NN 233	Adjusting screw for spindle
1	NN 216	Dresser location
1	K06 07178	Flanged deep groove bearing
1	K06 10228	Main thrust bearings
2	K06 10268	Main thrust washer
2	K30 05328	Glyco thrust washer
1	K06 04133	Thrust bearing
6	K05 31302	Flanged bush 12 x 18 x 8 long
4	K05 31592	Bush 40 x 46 x 30 long

Profile grinding spindle

1	NN	238	Adjusting screw
1	NN	D09	Wheel guard
1	NN	291	Front wheel flange
1	NN	290	Fixed wheel flange
1	NE	29	Handwheel support
1	T3009772		Universal joint
1	K3078777		Toothed belt
2	K0531302		Flanged bush 12 x 18 x 8 long

Straight knife spindle

1	NN	234	Adjusting nut
1	NN	247	Spindle pulley
1	T3005305		Pair A/C bearings
1	K0601126		Deep groove bearing
1	NN	248	Motor pulley
1	NXU	322	Drive belt

Dresser

1	T3005341		Glyco thrust washer
1	K0604138		Thrust race 30 diameter
1	K0604142		Thrust race 15 diameter
1	K3005163		Bush 15 x 19 x 16 long
1	K0531549		Bush 10 x 14 x 16 long

Stylus mount

1	K3005165		Bush 28 x 33 x 20 long
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Coolant system



Coolant system

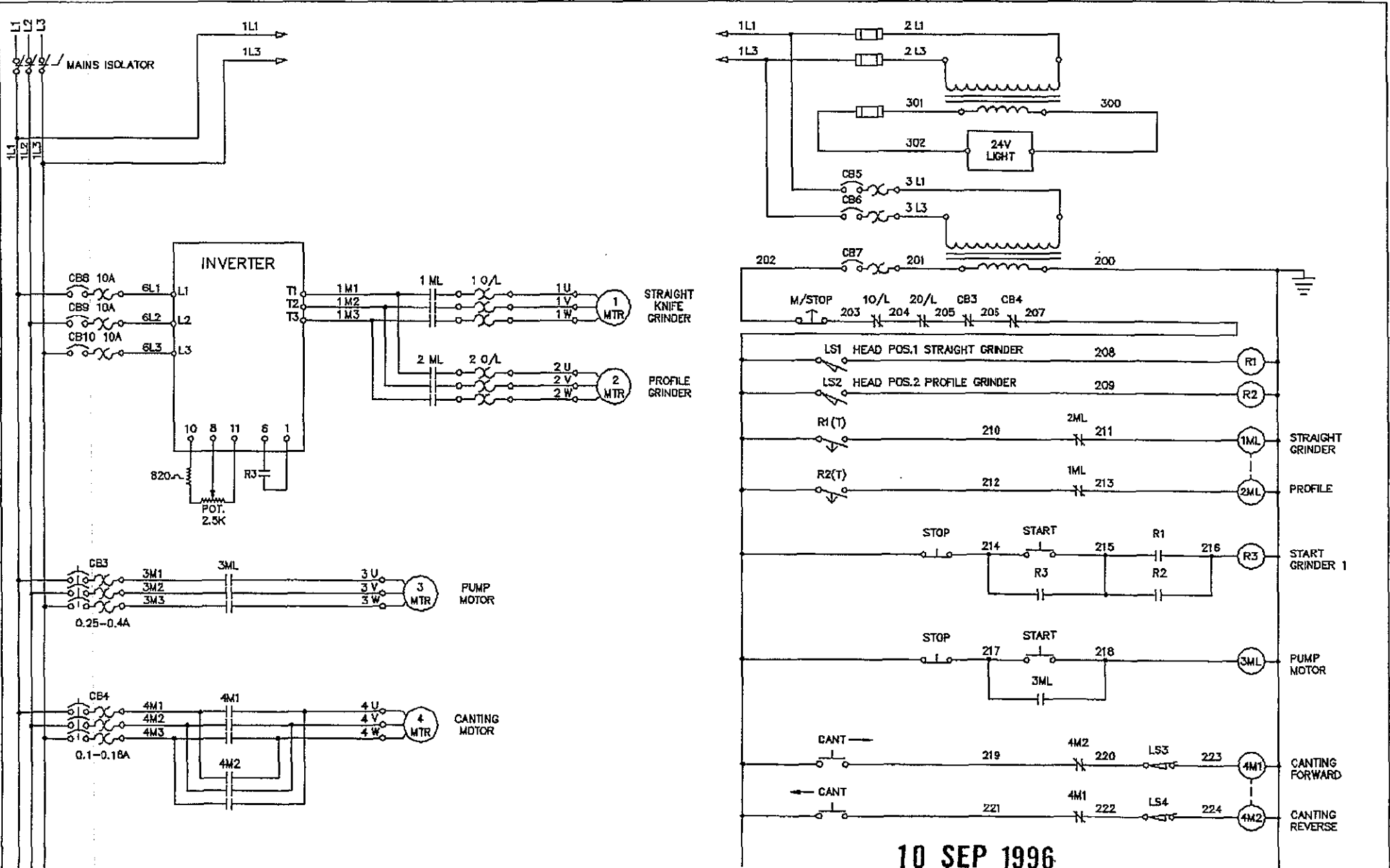
1	T30 49205	Magnet
4	K30 62759	Coolant nozzle
2	K30 77999	Segmental tubes
2	K30 62758	Spigot for above

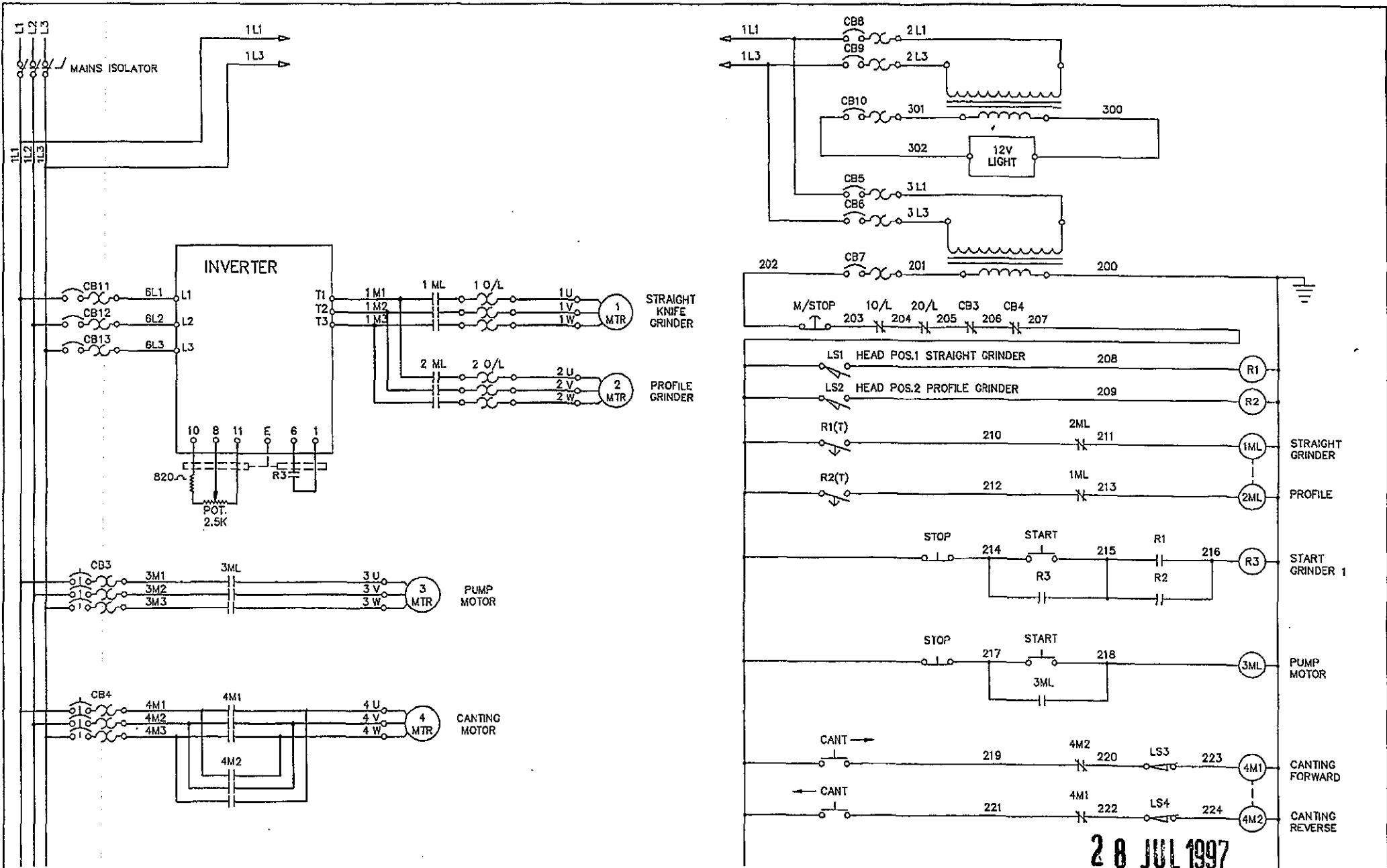
Electrical system

1	K12 01690-10	Start / stop button
1	K12 01690-3	Emergency stop button
1	K12 01690-8	Tilt button
1	K12 16431	Potentiometer
1	K12 16434	}
1	K12 16435	} Knob for potentiometer
1	K12 16436	}
2	K12 06190	Limit switch
1	T30 17231	Work lamp



ELECTRICAL CIRCUIT DIAGRAM





28 JUL 1997

	<b>LEICESTER WOODWORKING DIVISION</b>	Date	Sig.	C	Date	Sig.	B	Date	Sig.	A	Description	<b>WADKIN USA</b>	Drawn K.MOBBS	Drawing No. <b>D7029</b>
													Approved R.PATEL	
											CAD Location N:\ACAD\DR\ELECTRO\ELECSYD\ESTD2121	W.O. No		

