Wadkin

IMAGE 150

PROFILE GRINDER

CE

MACHINE No.	
TEST No.	

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.

Wadkin

MANUFACTURERS E.C. DECLARATION OF CONFORMITY

The following machine has undergone "Conformity Assessment" and is "self" certificated in accordance with:-

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

COMPANY

WADKIN LTD
Green Lane Road
Leicester
LE5 4PF

RESPONSIBLE PERSON

Mr A Lott (Managing Director)

MACHINE DESCRIPTION

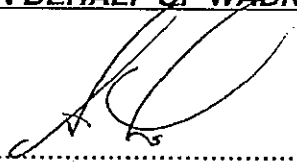
TYPE PROFILE GRINDER

MODEL NE

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 LTD



.....

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.

Manufactured by : WADKIN PLC
Green Lane Road
Leicester
LE5 4PF
England

Telephone No.: 0116 276 9111
Fax No. : 0116 259 8138

CE

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 ($L_{EP,d}$) of 85dB(A)

The second action level :-

a daily personal noise exposure ($L_{EP,d}$) 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.

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

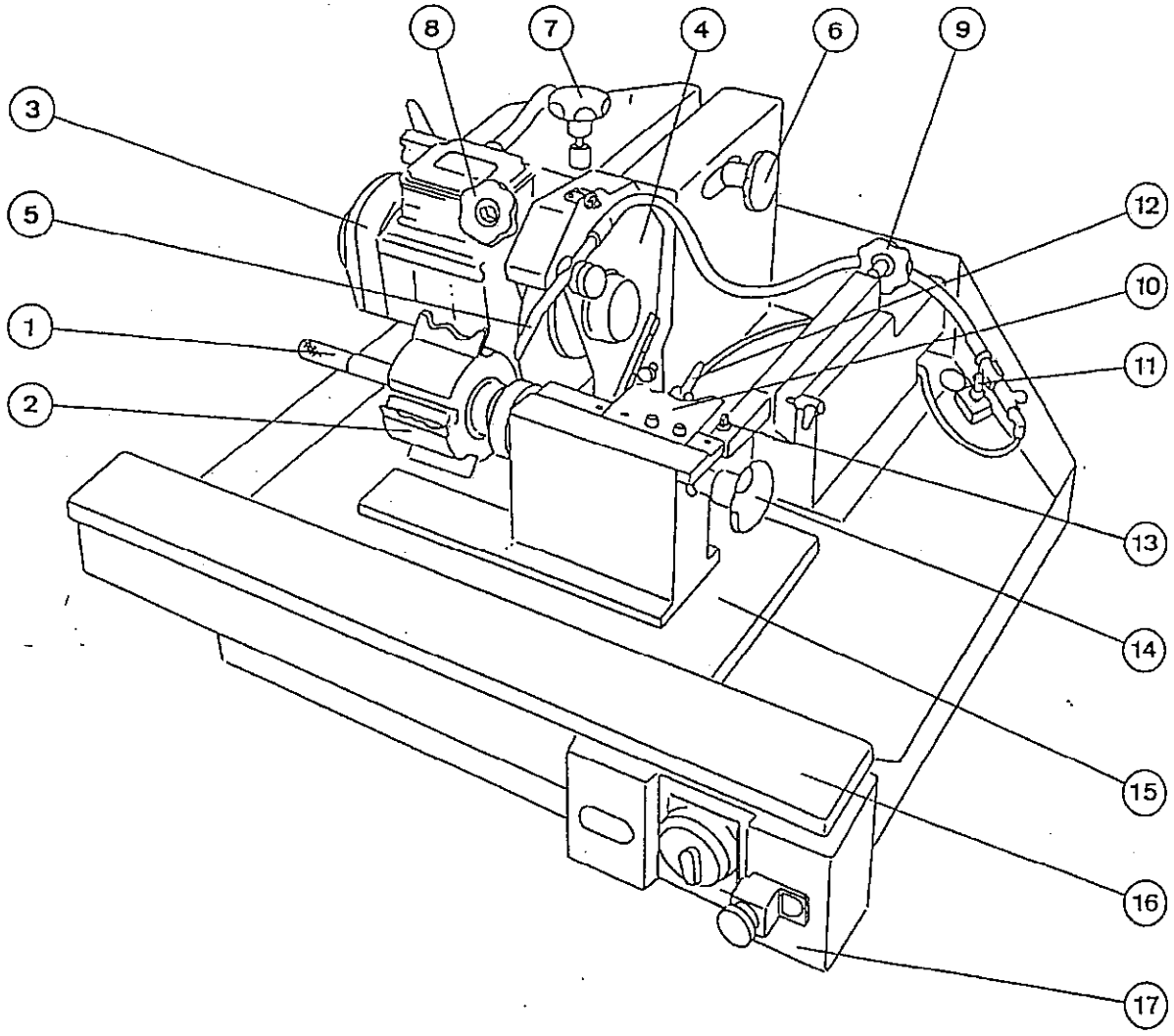


Fig. 1a

1	Arbor
2	Cutterhead
3	Head motor
4	Wheel guard
5	Coolant nozzle
6	Head tilt
7	Head rise and fall
8	Wheel adjustment
9	Stylus adjustment
10	Template
11	Coolant tap
12	Dresser lock
13	Stylus
14	Arbor handwheel
15	Carriage
16	Armrest
17	Controls

1.2 INTENDED USES

The Wadkin Image profile grinding machine type NE is a tool grinding machine designed for the grinding and re-grinding of various types of cutters used primarily in the woodworking industry.

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 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. A cutter rest and dresser are mounted off the grinding head in front of the wheel. A stylus is mounted 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.

A wet grinding coolant system is provided 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 CAPACITY		
Maximum length of cutter profile :	150 mm	(5.9")
Maximum cutting circle :	230 mm	(9")
Minimum cutting circle :	70 mm	(2.75")
Maximum depth of profile :	40 mm	(1.57")
GRINDING WHEELS		
Diameter	230 mm	(9")
Width	5 mm	(0.197")
Dressed width	4.7 mm	
Bore	31.75 mm	(1.25")
SPINDLE SPEED :		
With 50 Hz supply	3000 rpm max.	
With 60 Hz supply	3600 rpm max.	
MOTOR OUTPUTS		
Profile grinding spindle	1.5 Kw	(2 h.p.)
Coolant pump	0.06 Kw	(0.08 h.p.)
COOLANT SYSTEM		
Tank capacity - maximum	32 litre	(7 galls)
- minimum	16 litre	(3.5 galls)
MACHINE DIMENSIONS		
Height of machine	480 mm	(19")
Height Stand mounted.....	1340 mm	(53")
Width	800 mm	(32")
Depth	900 mm	(35")
Weight of machine (nett)	160 kg	(350 lbs)
Weight of stand (nett)	60 kg	(130 lbs)

NOISE EMISSION VALUES

MACHINE CRITERIA :

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

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

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.

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.

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

NOISE EMISSION CHART

MODEL :- *Image*
TYPE :- *NE 150* *50Hz* *415v*

DECLARED NOISE EMISSION VALUE in accordance with ISO 4871

	Idling	Operating
Declared A-weighted sound power level L_{WAd} ,in dB re 1 pW.	67	83
Declared A-weighted emission sound level (L_{pAd}) in dB re 20 µPa at the operator's position	55	71
Environmental correction factor (K)	3	

values determined according to specific test code ISO 3744

VIBRATION LEVEL

At arm rest ..... Less than 2.5 m/s²
At arbor support ..... Less than 2.5 m/s²

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^{o}, 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^{o} and 45^{o}. This necessitates the use of the cutter rest, to allow rotation of the cutterhead whilst grinding.

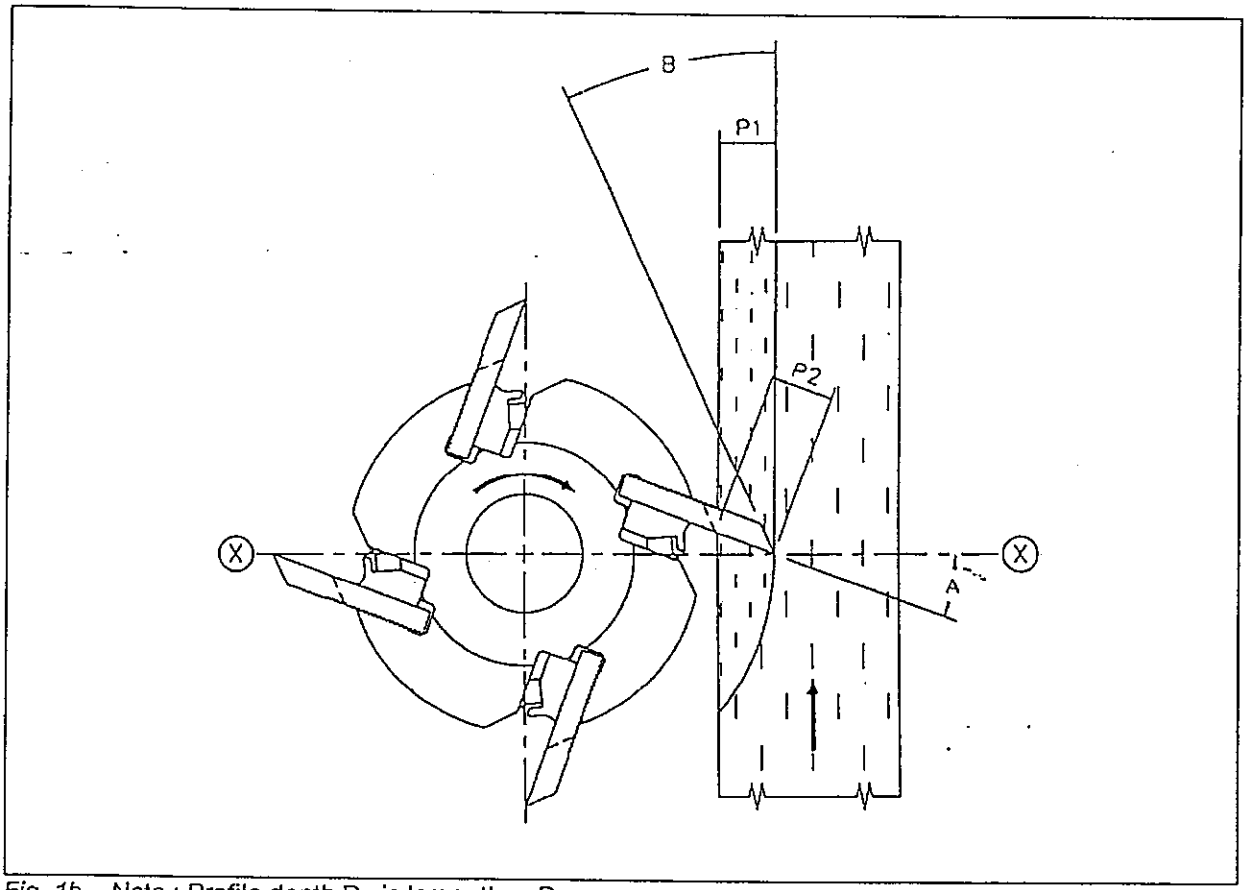


Fig. 1b Note : Profile depth P_2 is larger than P_1.

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.

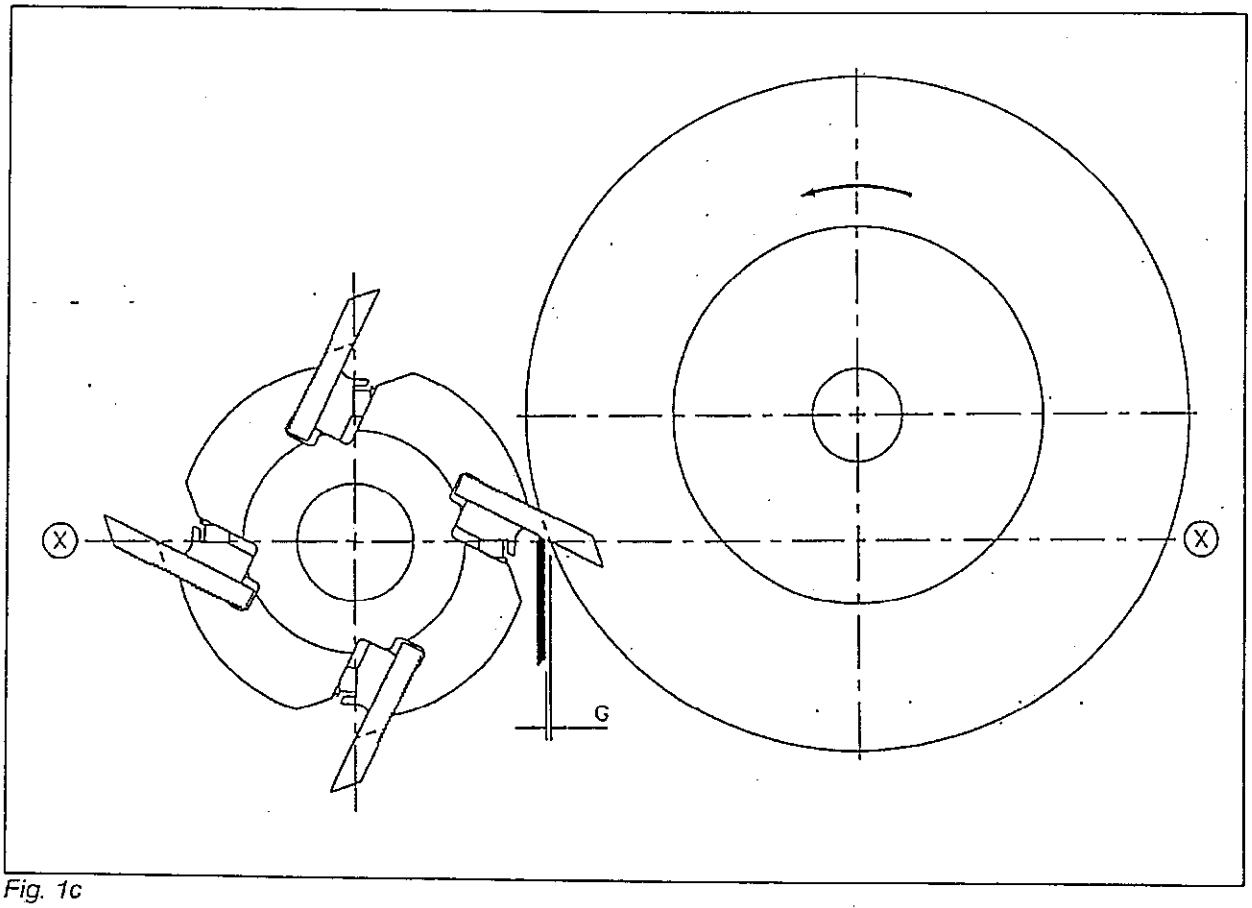


Fig. 1c

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.*

On the Image grinder, the gap (determined by the dresser position) is preset to achieve the best accuracy of profile shape and to allow sufficient 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^{O} is sufficient but can be increased up to as much as 10^{O} if required. Some profiles such as grooving cutters require both left and right side relief.

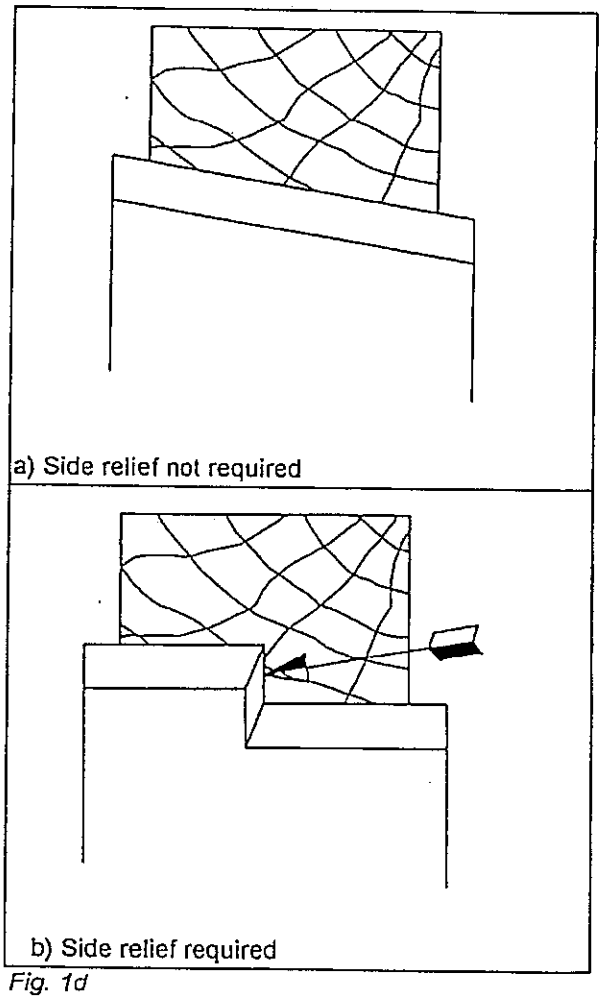


Fig. 1d

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.

The Image grinder is normally despatched from Wadkin packed on a pallet or case which can be moved using conventional fork lift equipment. If the machine is positioned close to its required location prior to unpacking it is possible to move it a short distance by hand to position it on a stand or bench. Four people are required, positioned one at each corner. The coolant tank and other loose items should be removed from the machine tray before lifting by hand.

Alternatively, lifting slings can be used. Three lifting points are provided as shown in *Fig. 2a*. Two 18 mm diameter holes [1&2] are provided behind the arm rest. Suitable shackles, or a 16 mm (5/8") diameter steel bar [4] should be used to attach.the slings. The third lifting point [3] is fitted with an eyebolt.
Note : Lifting using other parts of the machine can cause damage to the machine.

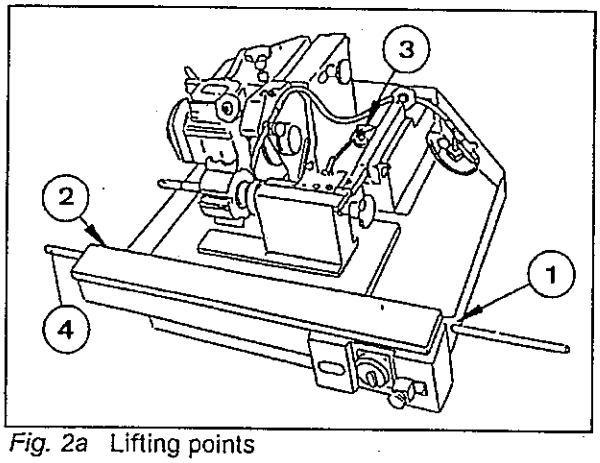


Fig. 2a Lifting points

When using lifting equipment ensure that the lifting slings are suitably arranged to enable the machine to be lifted with the body parallel to the floor and that no bending or distortion of the machine is caused by the slings.

Note: A transit clamp plate is 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. Ensure that the coolant tank is removed to prevent damage. The coolant pump is detachable from the tank and may be placed in the main machine tray. The coolant tank should preferably be moved separately.

If the machine is fitted to a stand, do not attempt to lift by hand. The lifting points (*Fig. 2a*) can be used to lift the machine and stand together after removal of the coolant tank and shelf contents.

2.2 BENCH MOUNTING

A standard work-shop bench should be used to support the machine. The bench top should be at least 800 mm (31 1/2") deep by 800 mm (31 1/2") long. If possible, a longer bench is preferable to allow a working area at the side of the machine.

The bench height is important as this will determine the height of the machine arm rest. For an average operator, a bench height of 820 mm (32 1/2") will give a comfortable arm rest height of about 1100 mm (43 1/2"). Heights can be varied to suit taller or shorter operators.

The bench must be sturdy to avoid unwanted movement of the machine during operation.

The machine should be positioned on the bench and levelled as described in section 2.4. Four M8 fixing points [6] (*Fig. 2b*) are provided in the machine tray which can be used to secure the machine to the bench. This will prevent the possibility of the machine moving and ensure that the levelling is maintained.

2.3 STAND MOUNTING (OPTIONAL EXTRA)

The stand is delivered in a 'flat-pack' form and requires assembling as follows (refer to *Fig. 2b*).

- a) Lay down the base [5] and fit 4 M12 jack-screws and locknuts for levelling (NOT supplied).
- b) Fit back panel [1] and two side panels [2 / 3] using 7 M8 screws and washers. Ensure that the screws are only ' finger tight' at this stage. Note : Ensure that the cut-outs are correctly positioned.
- c) Fit tool shelf [4] using 7 M8 screws, nuts and washers. Note : Shelf should be fitted with side lips to the top in order to retain tools.
- d) Lift grinding machine into top of the stand and fit 4 M8 screws and washers [6].
- e) Fully tighten all 18 stand assembly screws.
- f) Position coolant tank inside stand.
- g) Pass coolant pump and associated piping through the cut-out in the back panel and place in tank.

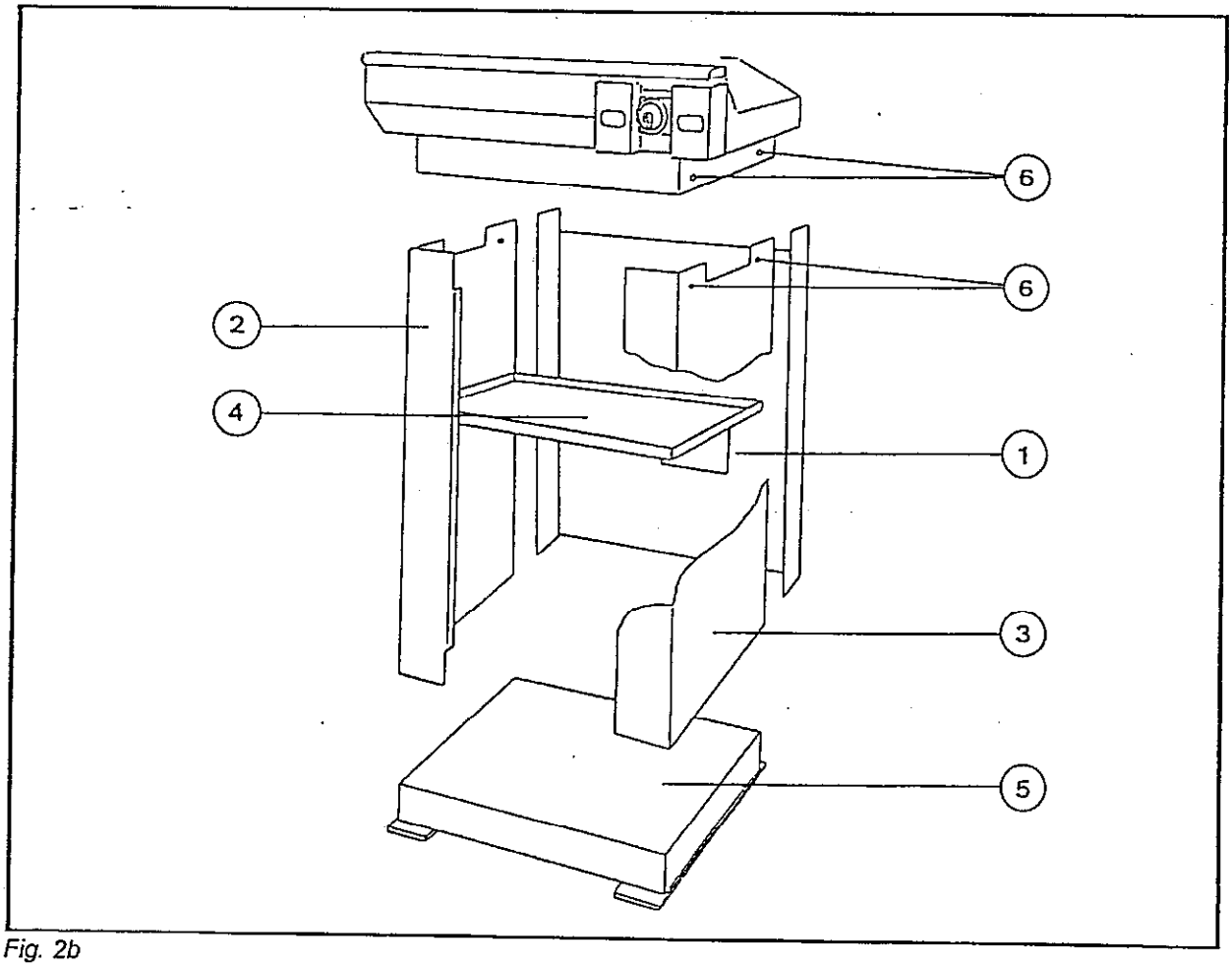


Fig. 2b

The foundation plan *Fig. 2c* shows minimum distances for positioning the stand mounted 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.

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.

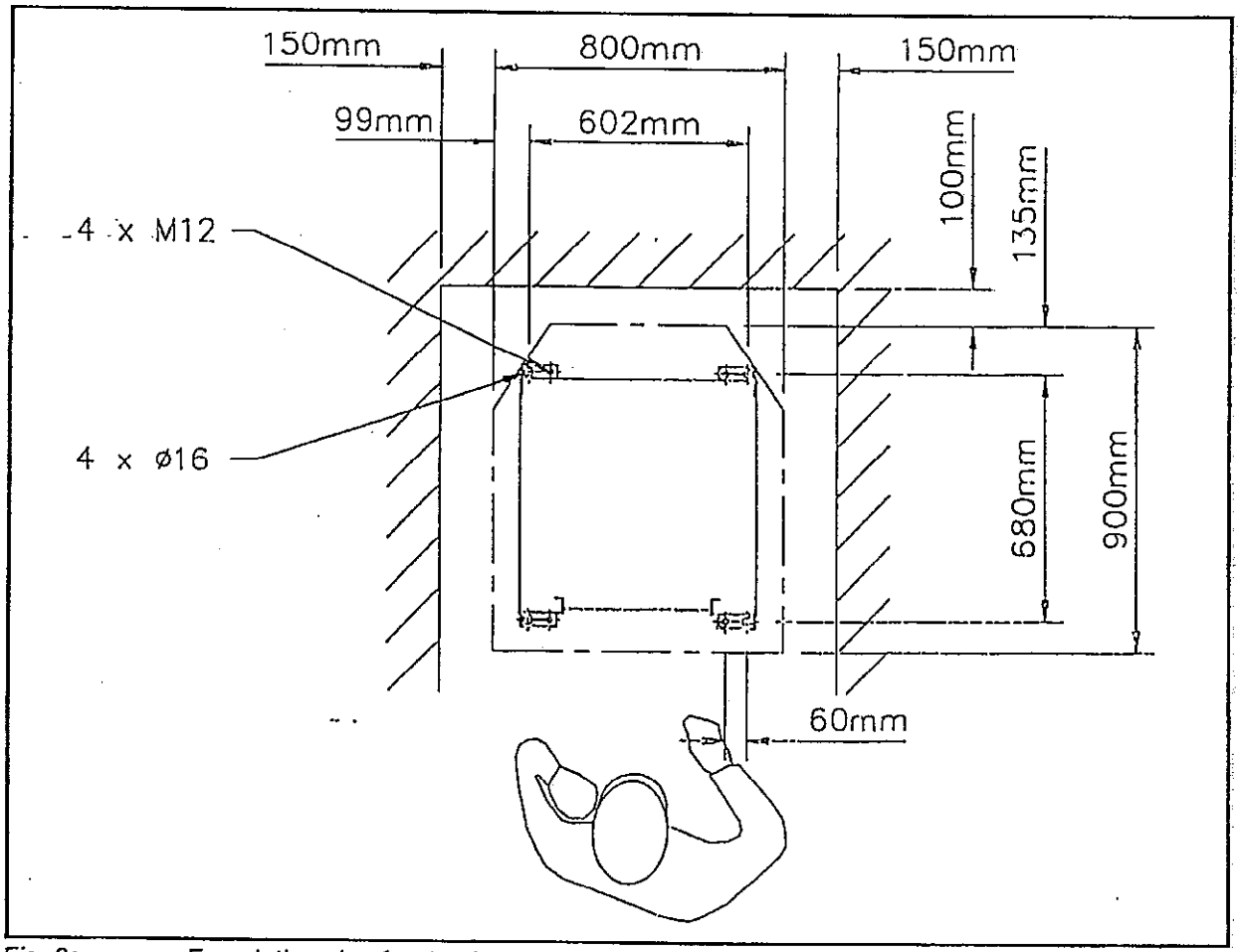


Fig. 2c Foundation plan for stand mounted machine

2.4 LEVELLING

IMPORTANT :
THIS MACHINE MUST BE CORRECTLY LEVELLED IRRESPECTIVE OF WHETHER BENCH OR STAND MOUNTED.

The machine should be set to a spirit level by adjusting the four levelling screws under the main tray, or, if stand mounted, the four levelling screws in the base. At this point the transit clamp plate 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. The coolant tray should have a slope from front to back to allow coolant to drain towards the outlet at the rear of the machine.

Levels should be re-checked when final bolting down is completed.

2.5 TRANSIT CLAMP PLATE

The transit clamp plate 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.

Refer to *Fig. 2d.*

- a) Remove the bolt [1] securing the clamp plate [3] to the stylus mounting bar.
- b) Remove the two screws [4] securing the clamp plate to the template mounting.
- c) Remove the stylus [2] from the clamp plate and re-assemble into the stylus mounting bar (position [1]).

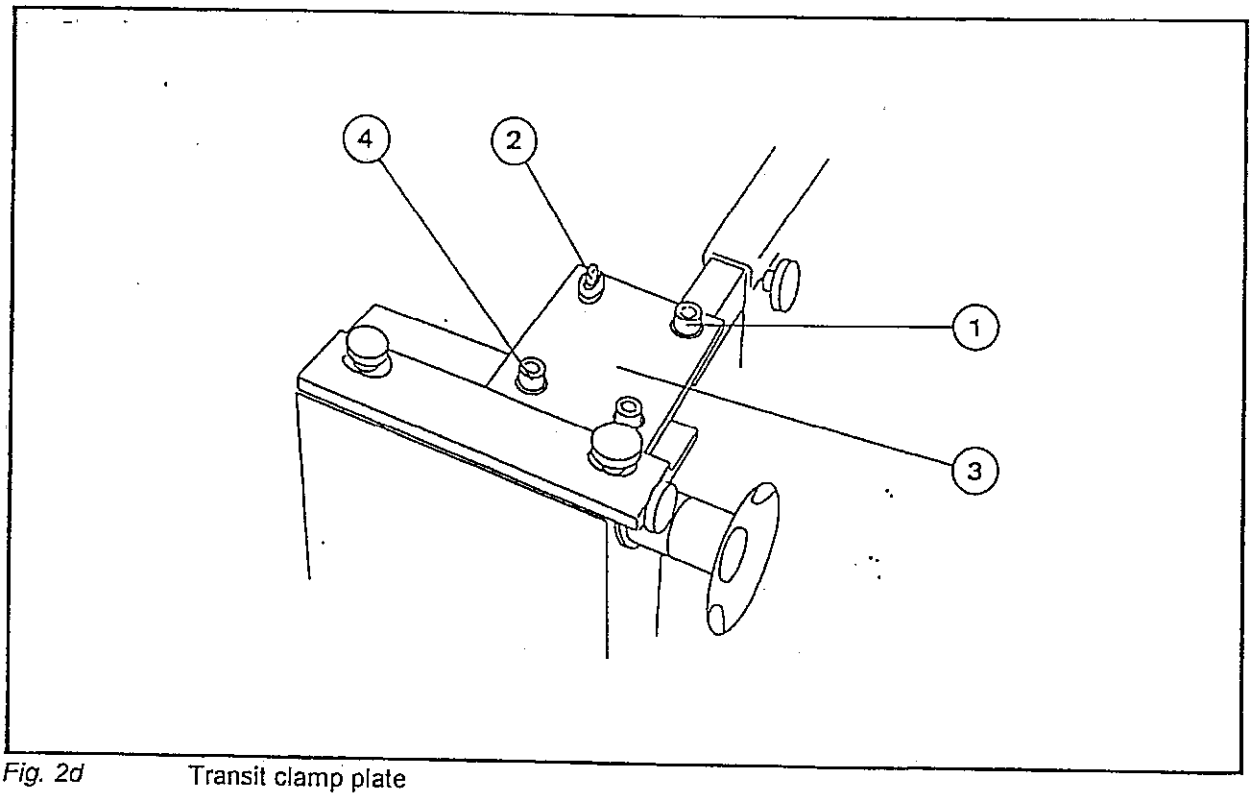


Fig. 2d Transit clamp plate

2.6 ELECTRICAL SUPPLY

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

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 on the front of the machine.

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 :

	GEC Spec.	Fuse Size
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

Adequate lighting is essential for safe operation of this machine. Ambient lighting of normal intensity should be provided for the machine and working area. The lighting should be positioned such that no areas of shadow are created to impair visibility during operation of the 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 aquainted 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' Part1 BS6854.

Personnel involved with the use of grinding wheels should be aquainted 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*

The coolant fluid supplied with the machine should be mixed in the tank according to instructions. The pump [2] is attached to a plate [6] which locates onto the lip of the tank. No fixing screws are required.

The tank should be positioned on the floor directly below the machine / bench. If stand mounted, the tank should be slid into the lower part of the stand.

The drain pipe [3] from the main coolant tray should be located in the pump plate [6] adjacent to the pump. The lid [4] should be located on the front section of the tank lip.

The metal filtration magnet [5] should be placed in the coolant tray close to the drain hole outlet. Take care to ensure that fingers are not 'nipped' - the magnet is very strong. (The magnet should not be placed in the tank.)

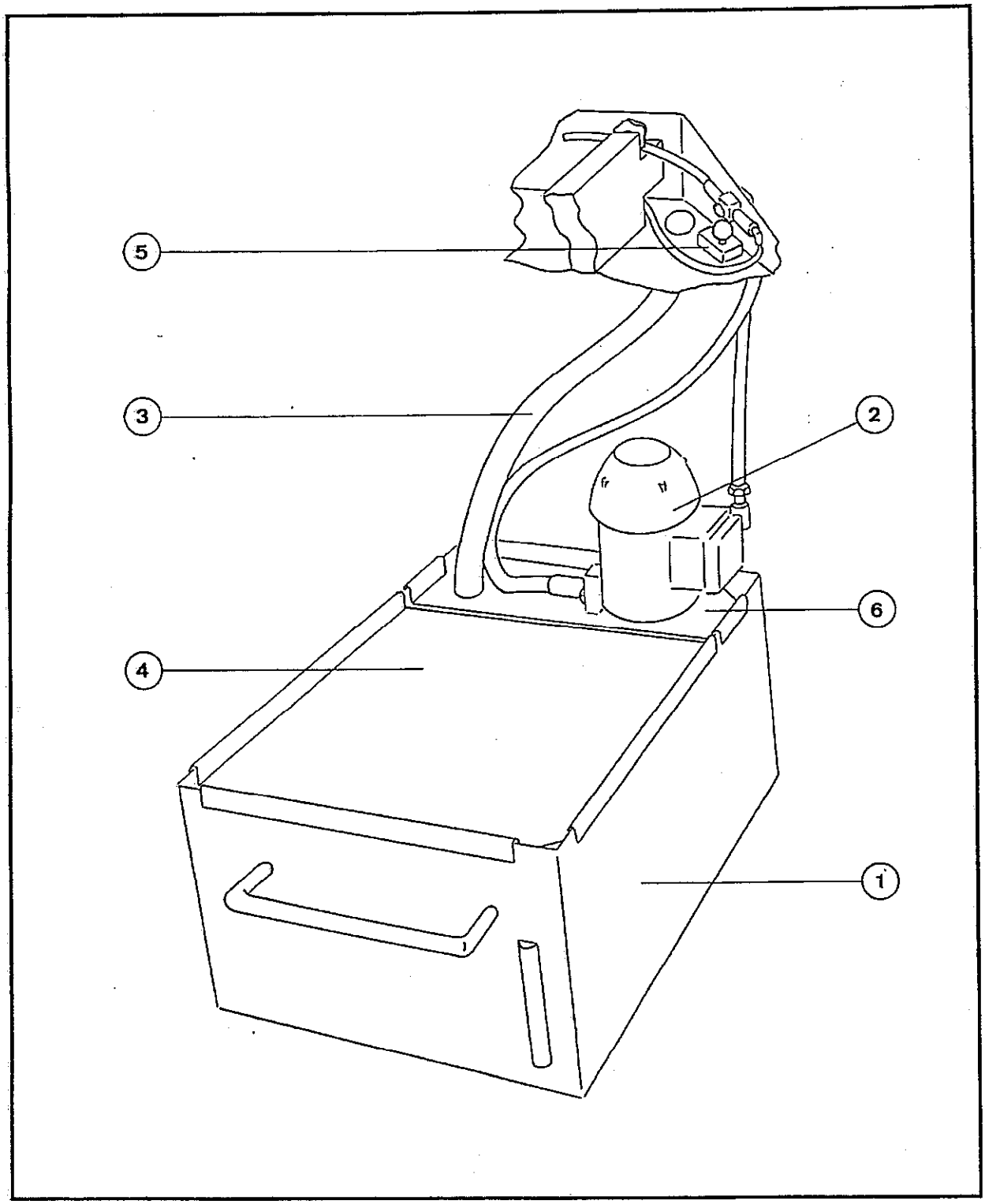
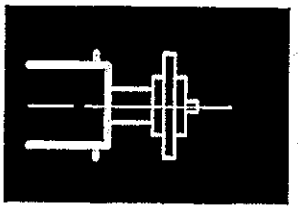


Fig. 3a Coolant system

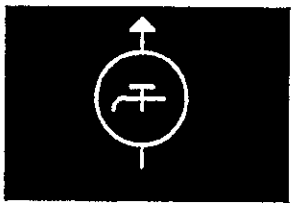
3.3 CONTROLS

The operator should be familiar with the electrical controls before the machine is used. The main controls are positioned at the front of the machine (see *Fig. 1a*).

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



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



The Isolator (disconnect) switch is mounted with the start / stop controls.

3.4 TESTING THE MACHINE

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

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

Ensure that there are no loose items on the grinding spindle. Start and stop the grinding spindle and check the direction of rotation. The spindle should rotate anti-clockwise when viewed from the right hand side of the machine. If the rotation is wrong, any two of the line lead connections at the incoming supply should be reversed by a competent electrician.

Start the coolant pump and ensure that there is a good flow of coolant. (Do not run coolant on to a stationary wheel.) The flow control tap is located in the main coolant tray to the right of the stylus. Check that the coolant drains to the outlet at the rear of the main tray.

3.5 TEMPLATE MAKING

Both steel templates made by hand and plastic templates made by machine are suitable for use on this grinding machine. (Contact Wadkin for full details of template making machines.)

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.

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.

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).

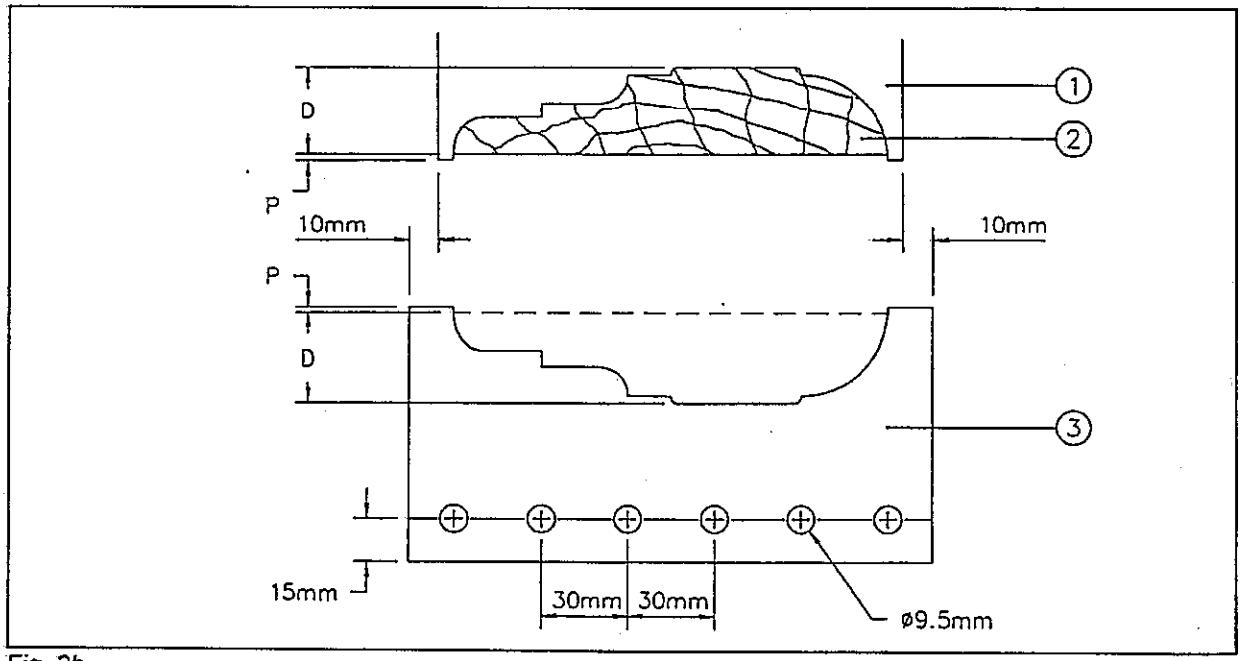


Fig. 3b

3.6 WORKING HEIGHT

A comfortable posture should be adopted when operating the machine. Short operators may require a duckboard to stand on to avoid excessive reaching.

The stand mounted machine has been designed to suit operators of average height. The working height of a bench mounted machine is determined by the height of the bench - see section 2.2.

3.7 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 should be stored carefully to avoid damage.

A shelf area for tools etc. is provided in the optional extra mounting stand.

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.

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 THE 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.

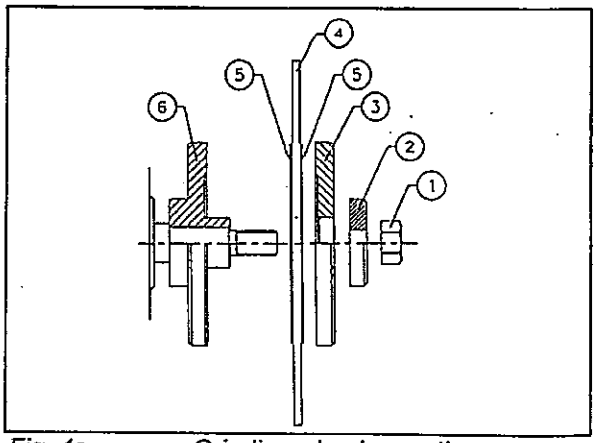


Fig. 4a Grinding wheel mounting

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.

4.3 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 dresser and cutter rest are mounted together directly below the grinding wheel. To engage the dresser, the lock [3] should be released and the cutter rest / dresser unit rotated through 90^0 to bring the dresser to the wheel. A stop [2] is provided to align the dresser to the centre of the wheel. Note : The locknuts fitted to stop screws [2] and [4] are factory set to align the dresser to the wheel and should not be interfered with.

A rotary movement about a vertical axis is provided for dressing a radius on the periphery of the wheel and is controlled using the finger grip wings [5]. A lock [6] is provided for the movement.

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 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.

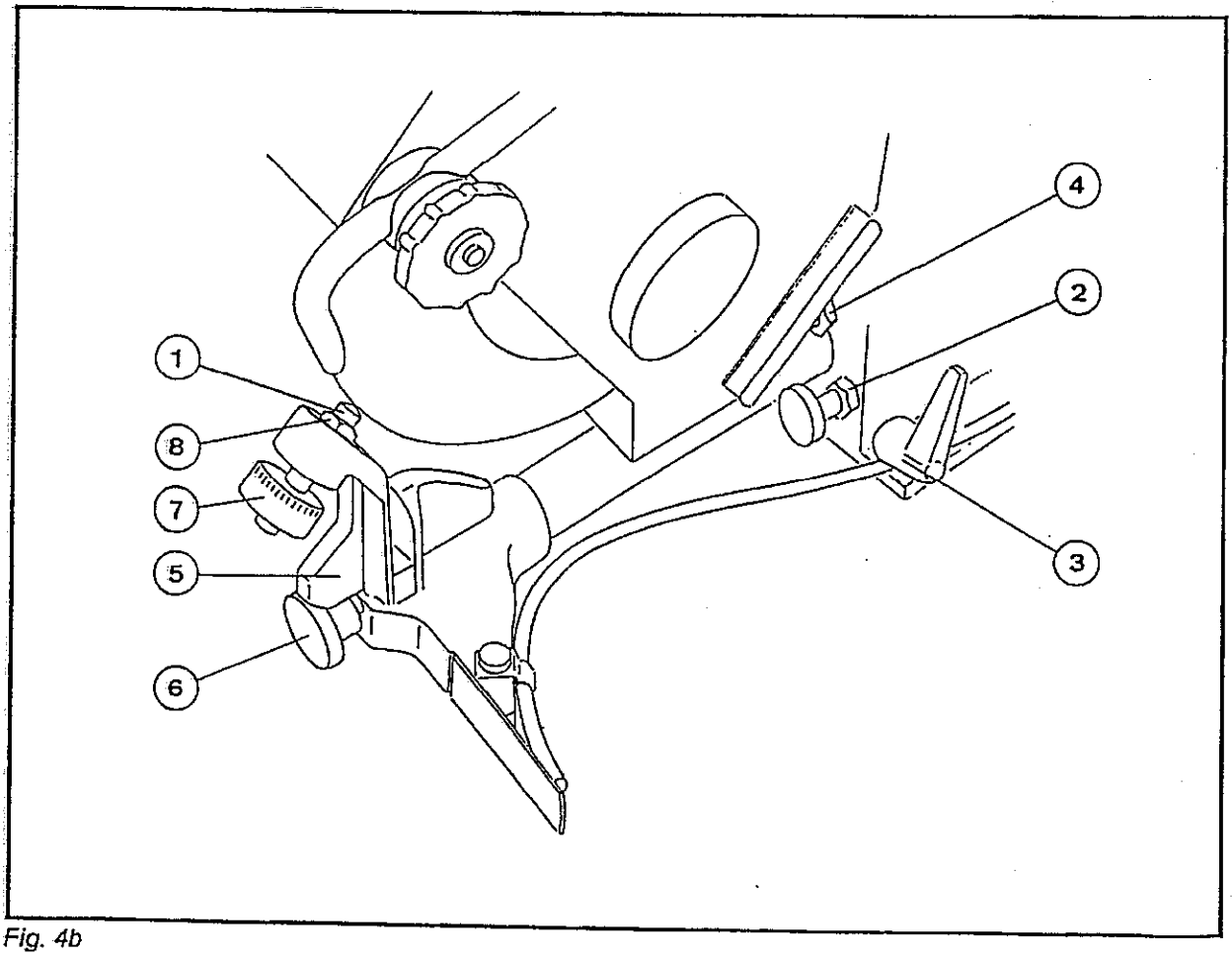


Fig. 4b

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.

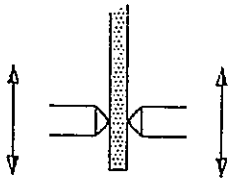
Eye protection must be used.

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).



Ensure that stop screw [2] is screwed fully in before moving the dresser to the dressing position. Secure the lock [3].

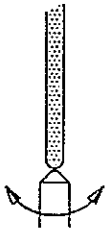
Release the locking screw [6] and rotate the dresser to either the left or right hand side of the wheel. Secure locking screw [6].

The dressing diamond [1] should be screwed in until it touches the side of the wheel and the locknut [8] locked. The wheel and coolant are then started and the side of the wheel dressed by moving the wheel forward past the dresser. This is done using the handwheel [3] (*Fig. 4e*) at the top of the wheelguard. The crank handle supplied with the machine can be used for this movement. The wheel is then moved back to clear the dresser, the dresser is rotated through 180^{0}, locked, and the opposite side of the wheel dressed.

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 [7] 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

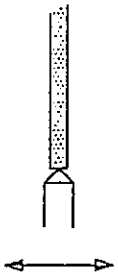


Ensure that stop screw [2] is screwed fully in before moving the dresser to the dressing position. Secure the lock [3].

The locking screw [6] should be released and the dresser rotated back and forth through 180^{O} to form the radius on the wheel. Successive cuts are taken by moving the wheel towards the dresser.

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 should be set with the diamond square to the periphery of the wheel and the rotation locked [6].

The locking handle [3] should be released and the stop screw [2] backed off far enough to allow the diamond to clear both sides of the wheel. Note : Do not move locknut on stop screw [2].

The wheel is dressed (taking a series of small cuts) by moving the dresser from side to side across the running wheel to form the square edge.

4.4 MOUNTING THE CUTTERHEAD

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

The Image 150 utilises a unique arbor assembly which allows it to cater for various cutterhead bore sizes at limited expense. This entails the use of a pair of arbor bushes [1] placed into the cutterhead [2] (one at each end) and the cutterhead, complete with bushes, being loaded onto the arbor, which is an integral part of the carriage assembly.

The cutterhead should be positioned onto the arbor with one edge placed against the adjusting ring [3] nearest the template carrier.

The clamp collar [4] should be fitted and clamped to the arbor. The cutterhead is locked in position by tightening the adjusting / locking ring [3] using the tommy bar provided.

The position of the cutterhead along the arbor can be adjusted using the ring [3] if the clamp collar [4] is released.

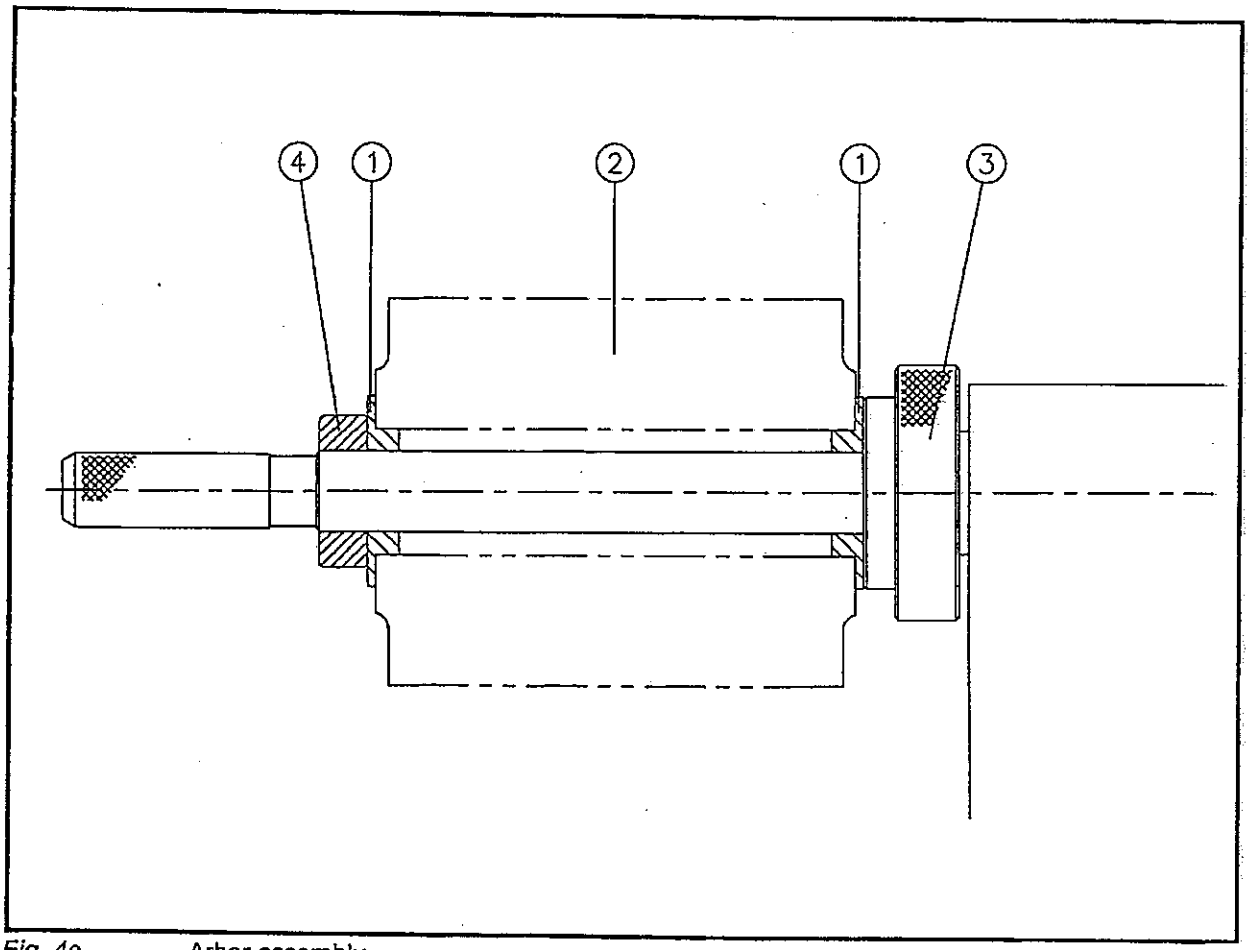


Fig. 4c Arbor assembly

4.5 STYLUS

The standard stylus [1] supplied with the machine 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.

Before using the 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 from below.

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

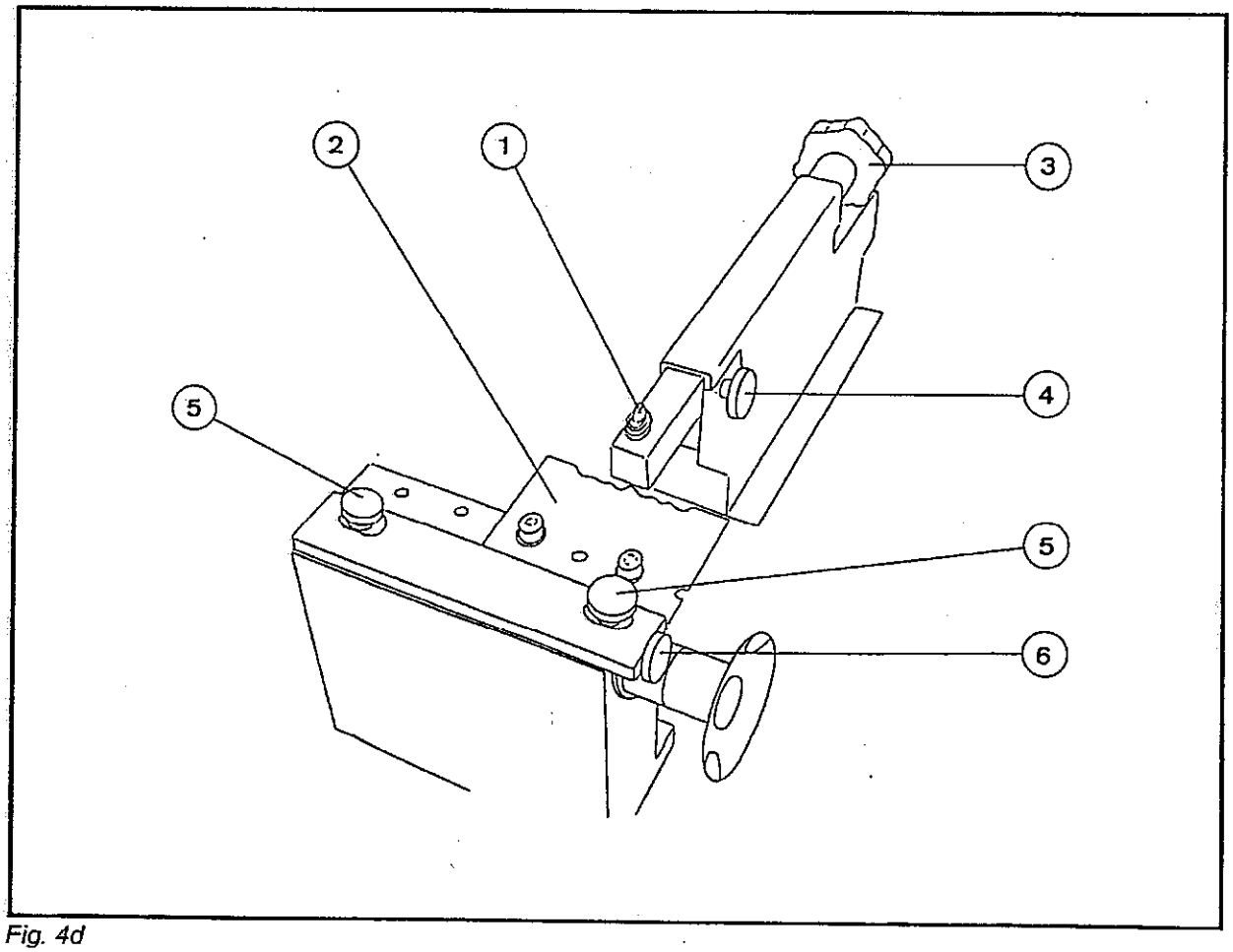


Fig. 4d

4.6 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 [2] on the carrier using two M8 screws in the tapped holes provided. Ensure that the template seats correctly.

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

The stylus [1] position is adjusted by releasing lock [4] and adjusting handwheel [3] at the rear of the stylus assembly. The stylus should be just touching the template when the cutter is approximately 1 mm (1/16") clear of the grinding wheel.

The axial (left / right) position of the template is adjusted by releasing locks [5] and adjusting knob [6]. It may be necessary to make repeated adjustments of the stylus position and template slide before the template is positioned sufficiently accurately relative to the cutter when regrinding existing profiles. Note : If there is insufficient adjustment on the axial template slide, the position of the cutterhead on the arbor should be adjusted as described in section 4.4.

When grinding, the depth of cut is controlled by movement of the stylus using the handwheel [3]. Locks [4] and [5] should always be secure when grinding.

4.7 HEAD ADJUSTMENT

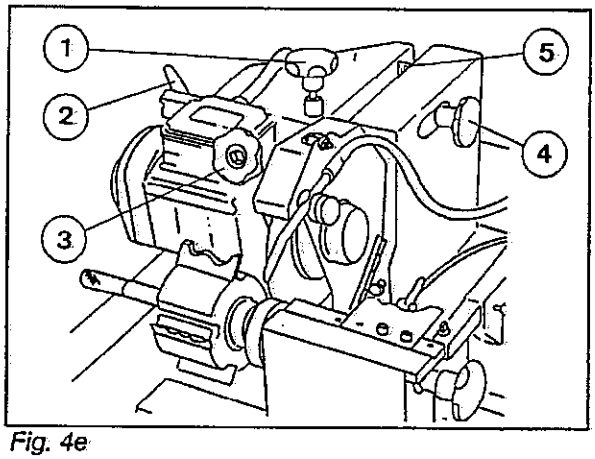


Fig. 4e

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. By winding the head up the clearance angle is increased and by lowering it is reduced. The lock for this movement is at position [2].

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.

4.8 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 nozzle above the cutter is controlled by the tap mounted to the right of the stylus. 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.

4.9 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.

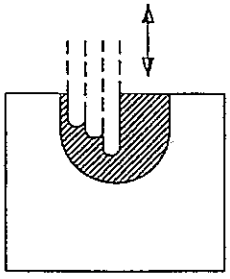
Side grinding should only be performed with wheels designed for the purpose. Grinding on the flat sides of wheels designed for peripheral grinding may be dangerous and cause broken wheels. This does not preclude their use for applications such as shoulder and form grinding where it is recognised that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

4.10 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.

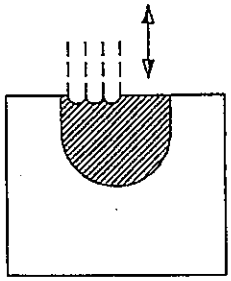
Always set the grinding wheel vertical when grinding out large amounts so that pressure is applied only to the rim of the grinding wheel.

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.

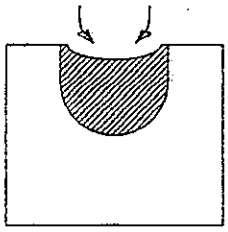


When grinding solid H.S.S. or T.C.T. cutters deep plunge grinding can cause excessive burning of the cutters. In addition, it can cause wear to the side of the wheel, causing it to become thinner than the stylus, resulting in insufficient material being ground off the cutters.

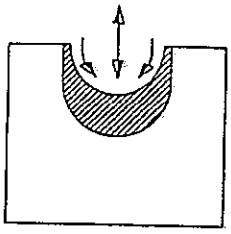
A combination of plunging and nibbling movements can therefore be used :



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.

4.11 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 stylus may be wound slightly back off the template 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.

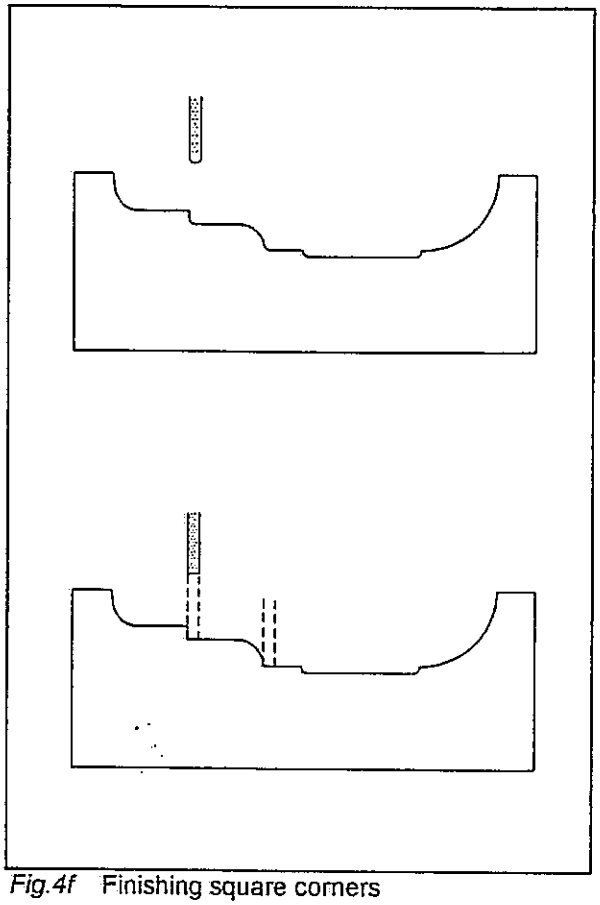


Fig.4f Finishing square corners

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 reset 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.

4.12 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 handwheel [4] (*Fig. 4e*) to the right of the head, and set to the scale [5] which is graduated from 0^{o} to 10^{o} 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^{o} 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.

4.13 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. Contact Wadkin for full details.

4.14 GRINDING PLANERHEADS

Straight knife grinding of planerheads can be carried out on the Image profile grinder. The method used is exactly the same as that used for profile grinding, except that in this case, the template profile is straight.

4.15 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.

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

If the metal filtration magnet is correctly placed in the coolant tray, it should be visible to the operator. It 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 4.15). 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 4.15).

5.3 LUBRICATION

The machine is designed to require minimum lubrication. The grinding spindle, motor, coolant pump and carriage slideways are fitted with sealed bearings which require no additional lubrication.

All bushes employed are of the 'bronze oil retaining type'. Slides and screws etc. 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.

5.4 WHEEL MOUNTINGS AND GUARD

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

The wheel guard must be intact with no cracked welds. The guard door including the hinge and latch should be in good condition and the fixing of the guard 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. The tank should be emptied and the coolant 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.

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

5.7 MACHINE ALIGNMENTS

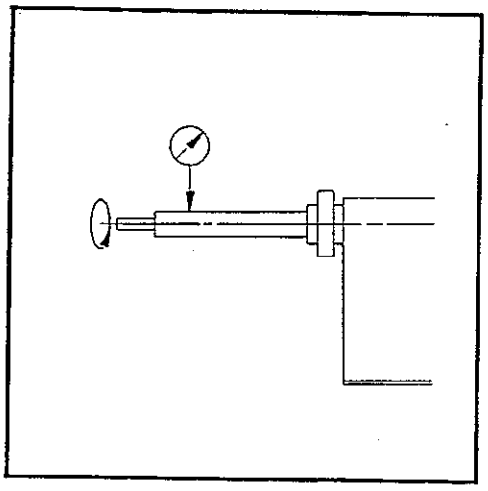
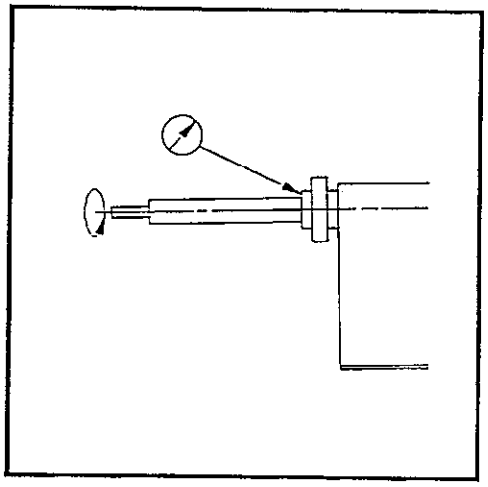
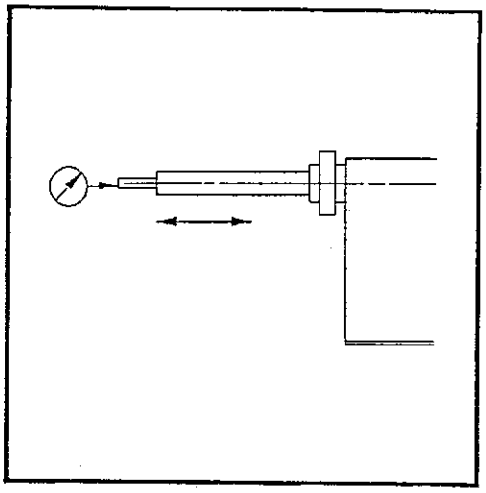
There are a number of alignments and checks which are built into the machine from new and MUST be re-set whenever parts are dismantled and re-built.

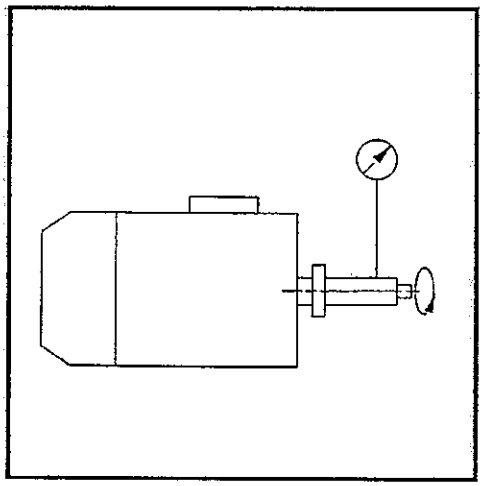
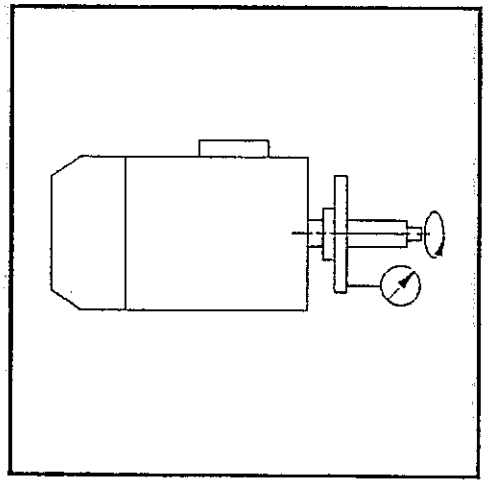
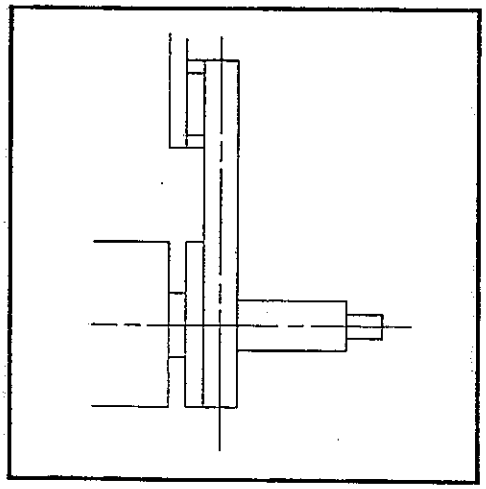
The Image grinder is initially built on an assembly jig which establishes various datums and relationships between the various assemblies on the machine. To avoid losing these datums it is important that only part of the machine is worked on at any time, and that it is re-aligned before any other part of the machine is worked on. The following alignments should be set by a competent engineer.

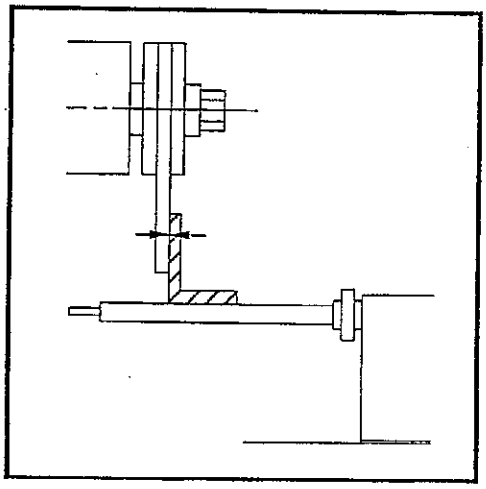
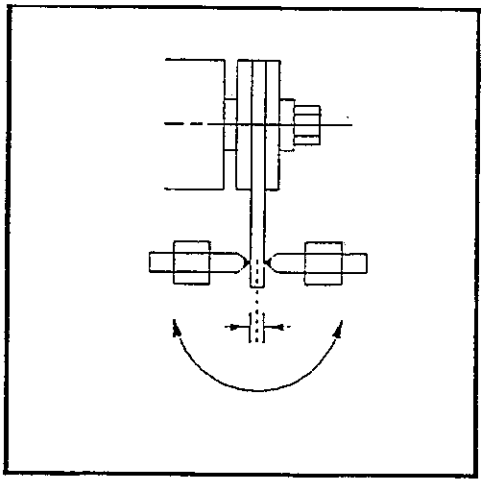
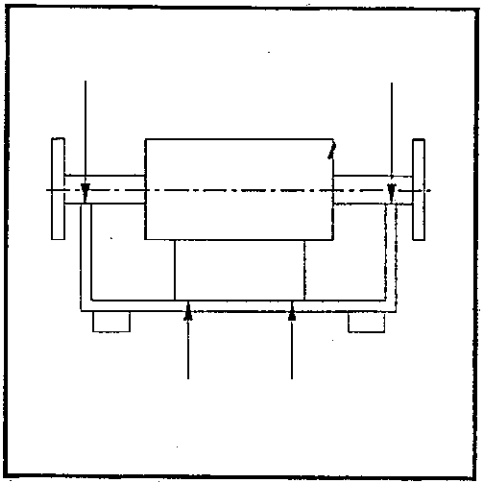
TEST EQUIPMENT

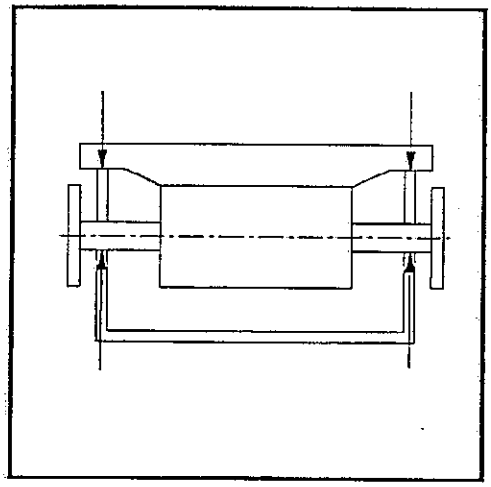
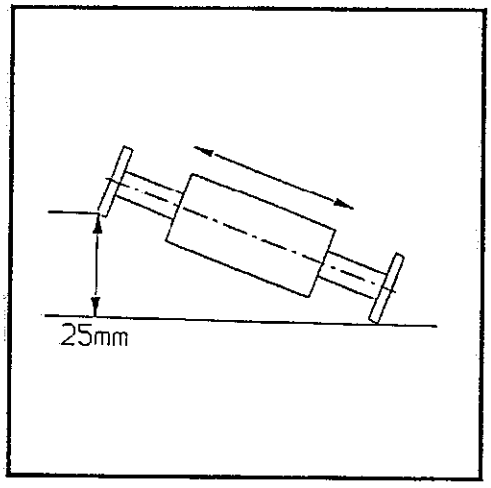
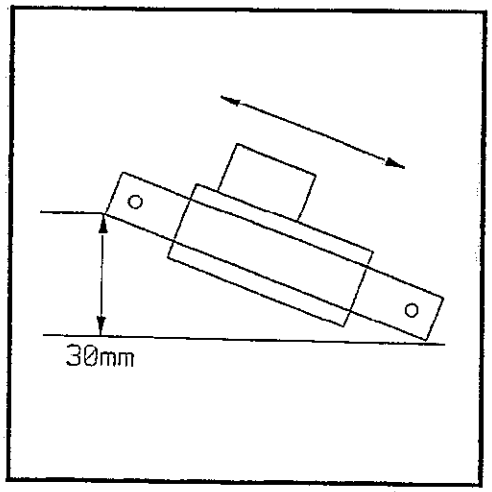
Some of the tests involve the use of special test equipment which can be supplied by Wadkin if required.

Part No.	Description	For test no.
MPG 201	Steel test wheel (230 dia. x 6)	8.
MPG 202	Setting plate	7.
FIT 232-14	Setting bar	6.
FIT 233	Shor-Twylie plate	6.
FIT 234	Carriage assembly jig	9,10.

Test No.	Test diagram	Test	Permissible Error mm / inch
1		Run out of arbor.	0.10 / 0.004
2		Run out of locking ring (Worst case)	0.08 / 0.003
3		End float of arbor	0.013 / 0.0005

Test No.	Test diagram	Test	Permissible Error mm / inch
4		Run out of grinding motor spindle.	0.013 / 0.0005
5		Run out of wheel flange at maximum radius.	0.04 / 0.0015
6		Parallelism of wheel flange to pivot axis.	0.04 / 0.0015
		Distance from wheel flange to centre line of pivot axis to be 3.0 mm. (Use jig : FIT 233)	0.05 / 0.002

Test No.	Test diagram	Test	Permissible Error mm / inch
7		Squareness of wheel flanges to arbor. Use test plate clamped in flanges, and engineer's square mounted off arbor. Check with feeler gauge Pointer / scale should be set to 0 degree at this position.	0.04 / 0.0015
8		Set dresser stop screw to position dresser central to steel test wheel.	0.025 / 0.001
9		Assembly jig location for short carriage axis. To be feeler tight at pad location and four bar location points.	0.04 / 0.0015

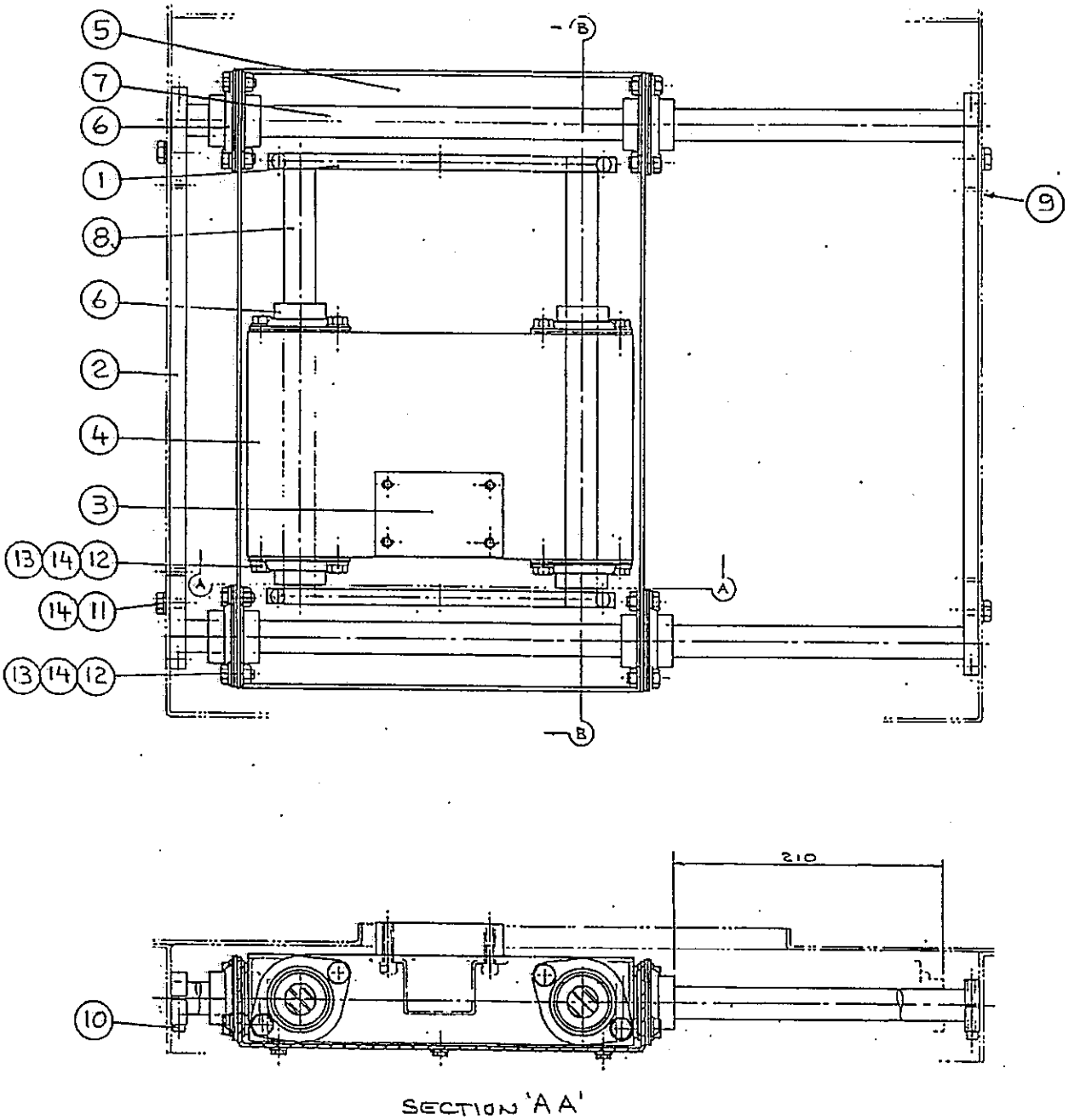
Test No.	Test diagram	Test	Permissible Error mm / inch
10		Assembly jig location for long carriage axis. To be feeler tight at pad location and four bar location points	0.04 / 0.0015
11		Carriage movement long axis Carriage to move freely under its own weight over full traverse. Test from both ends.	--- / ---
12		Carriage movement short axis. Carriage to move freely under its own weight over full traverse. Test from both ends.	--- / ---

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.

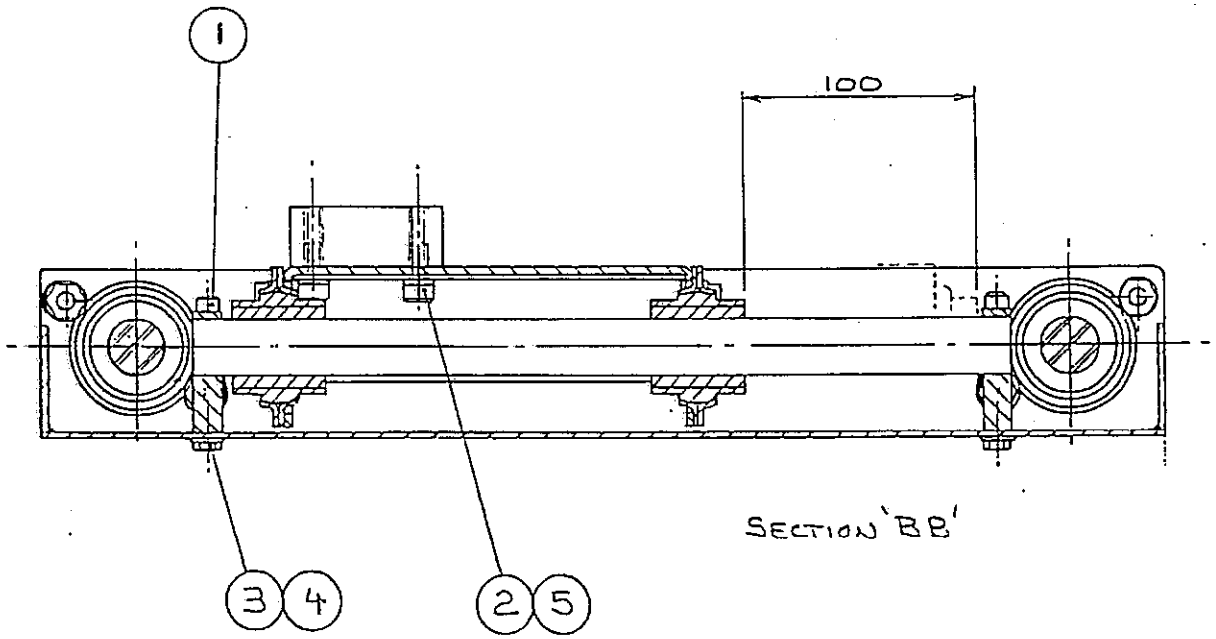
Fig. 6a Carriage



CARRIAGE *(Fig. 6a)*

ITEM	QTY	PART No.	DESCRIPTION
1	2	NE 4	Short rail clamp
2	2	NE 5	Long rail clamp
3	1	NE 6	Spacing plate
4	1	NE 83	Top carriage
5	1	NE 84	Bottom carriage
6	8	T30 05372	Linear bearing housing
7	2	T30 05373	INA bearing shaft
8	2	T30 05374	INA bearing shaft
9	4	K05 20520	Tension pin M6 x 16 mm
10	4	K05 25168	Hex skt capscrew M6 x 30 mm
11	4	K05 25515	Hex hd screw M8 x 16 mm
12	16	K05 25516	Hex hd screw M8 x 20 mm
13	16	K05 27102	Hex full nut 8 mm
14	36	K05 28103	Washer 8 mm

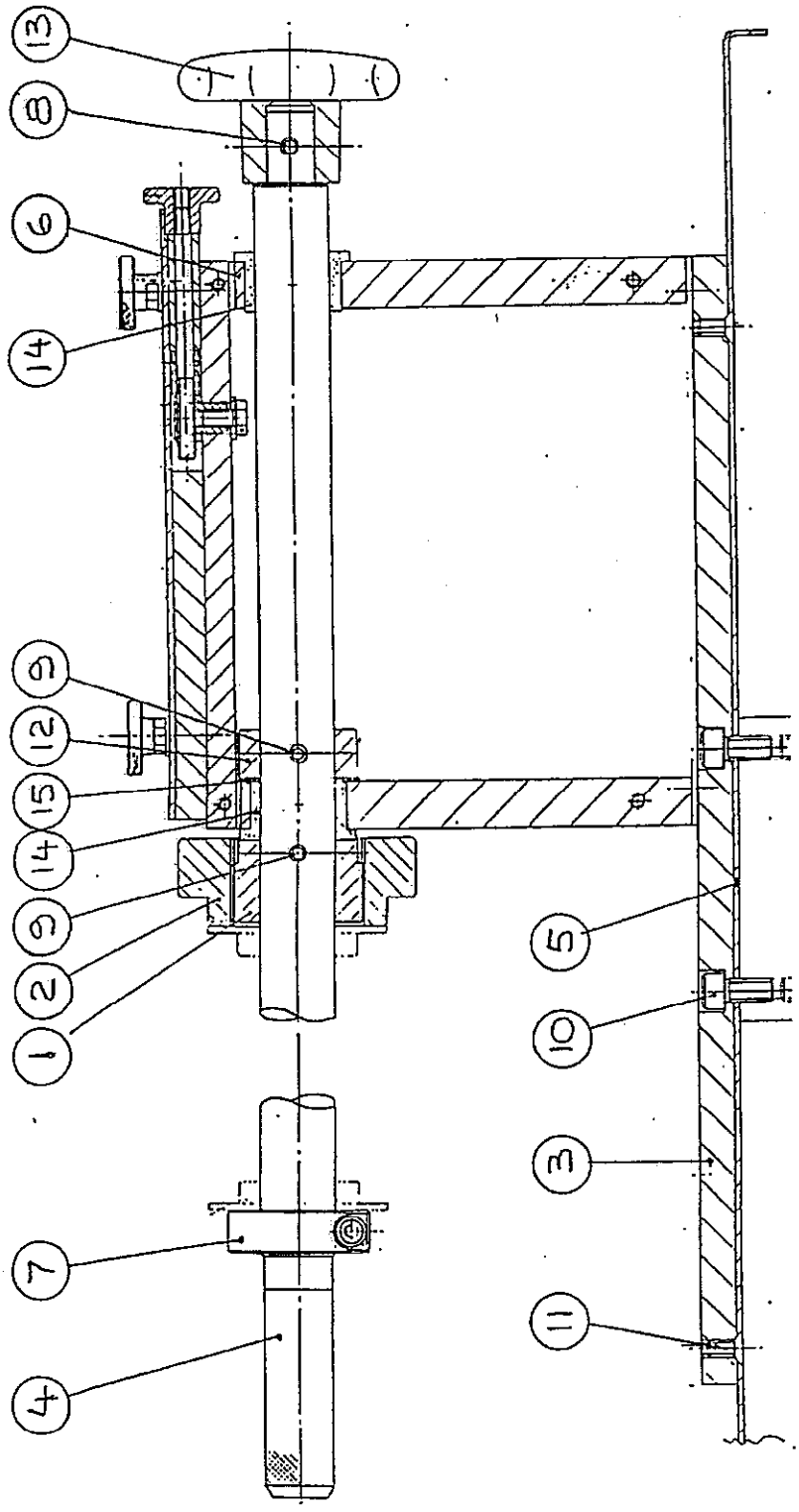
Fig. 6b Carriage



CARRIAGE *(Fig. 6b)*

ITEM	QTY	PART No.	DESCRIPTION
1	4	K05 25167	Hex skt capscrew M6 x 25 mm
2	4	K05 25186	Hex skt capscrew M8 x 16 mm
3	6	K05 25501	Hex hd screw M6 x 12 mm
4	6	K05 28102	Washer 6 mm
5	4	K05 28154	Spring washer 8 mm

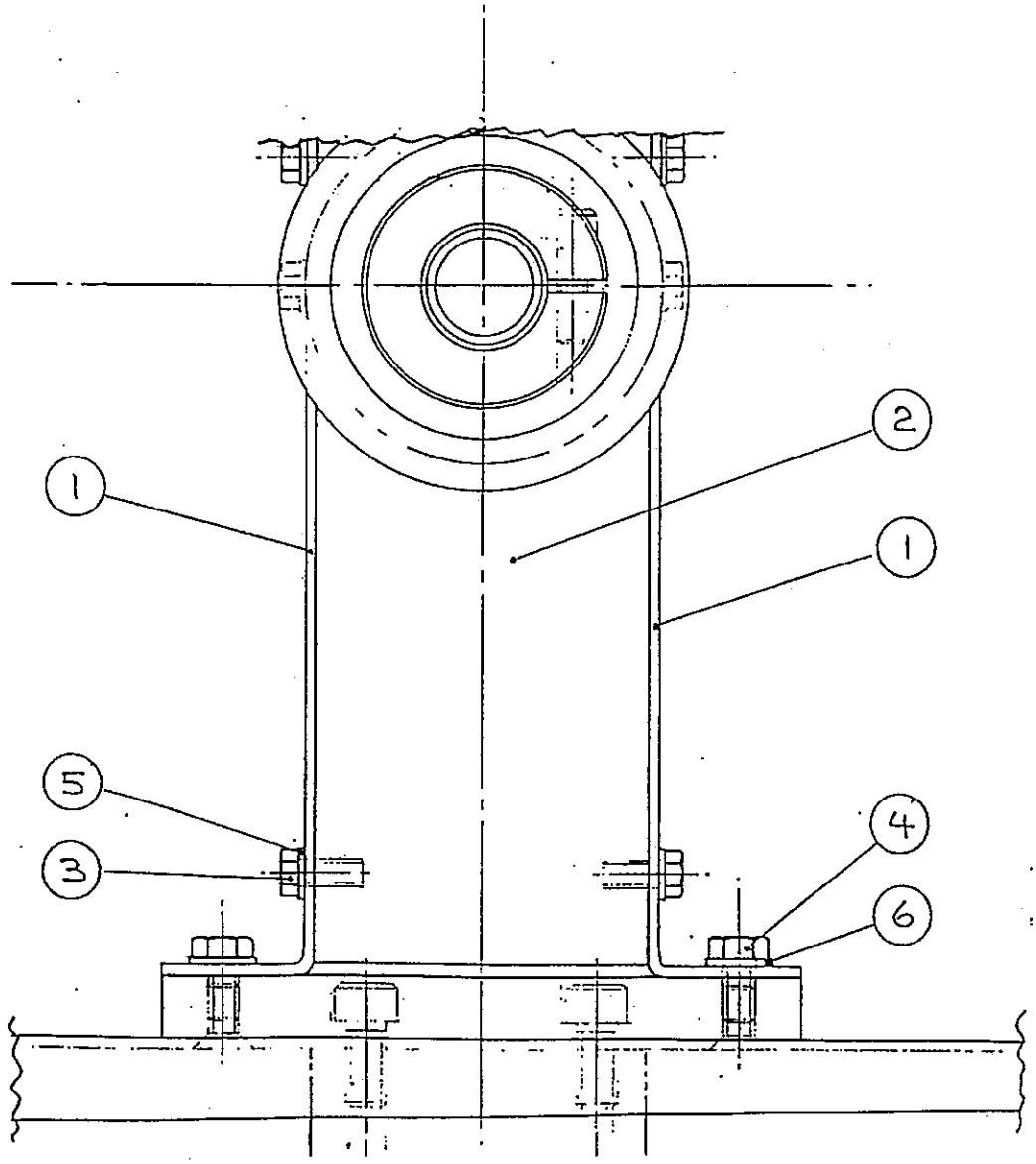
Fig. 6c Arbor assembly



ARBOR ASSEMBLY *(Fig. 6c)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 7	Arbor shoulder
2	1	NE 8	Adjusting ring
3	1	NE 10	Carriage top plate
4	1	NE 12	Arbor
5	1	NE 13	Carriage cover
6	2	NE 15	Arbor support
7	1	T30 09769	Clamptite collar - 25 bore
8	1	K05 20526	Tension pin 6 mm x 32 mm
9	2	K05 20527	Tension pin 6 mm x 40 mm
10	4	K05 25186	Hex skt capscrew M8 x 16 mm
11	4	K05 25324	Hex skt csk screw M6 x 12 mm
12	1	K05 28208	Loose collar 25 mm
13	1	K05 30224	Handwheel 16 bore, blind
14	2	K05 31350	39 Fl. bush, 25 B x 32 OD x 20 lg
15	1	K06 10254	AS-2542 INA thrust washer

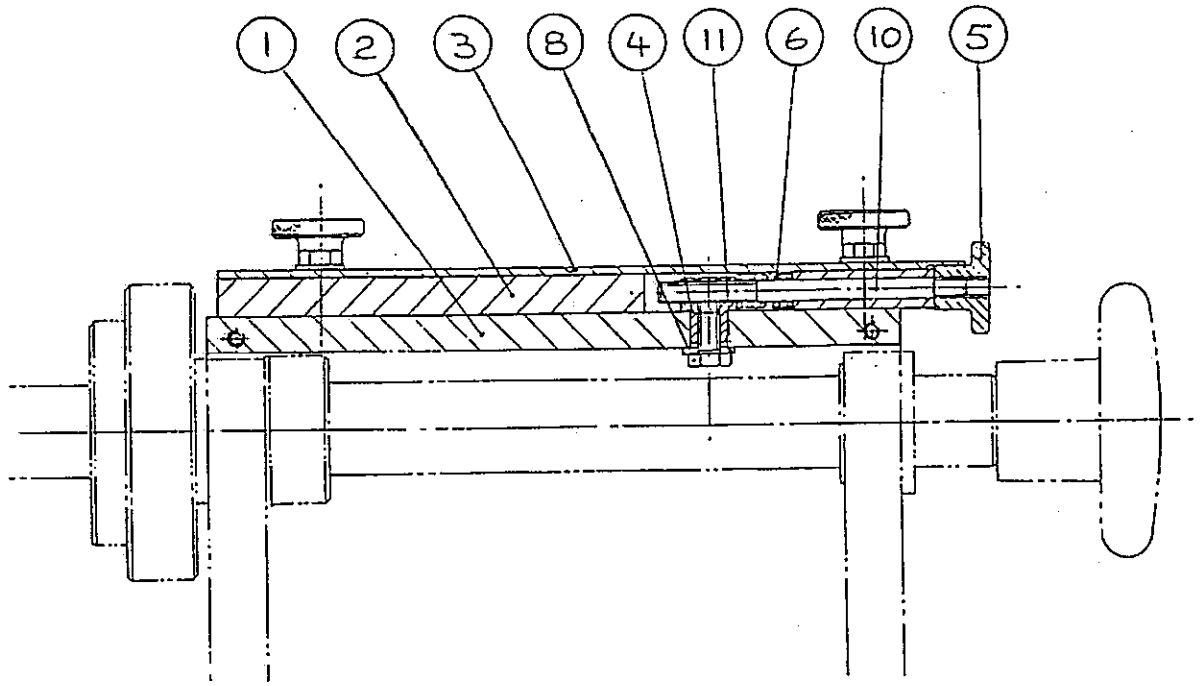
Fig. 6d Arbor assembly

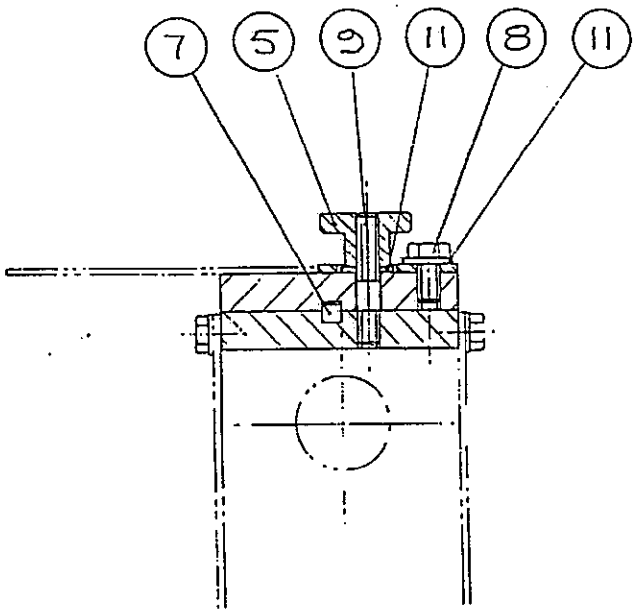


ARBOR ASSEMBLY *(Fig. 6d).*

ITEM	QTY	PART No.	DESCRIPTION
1	2	NE 11	Side plates
2	1	NE 15	Arbor support
3	12	K05 25142	Cap head screw M5 x 10 mm
4	4	K05 25501	Hex hd screw M6 x 12 mm
5	12	K05 28101	Washer 5 mm
6	4	K05 28102	Washer 6 mm

Fig. 6e Template slide

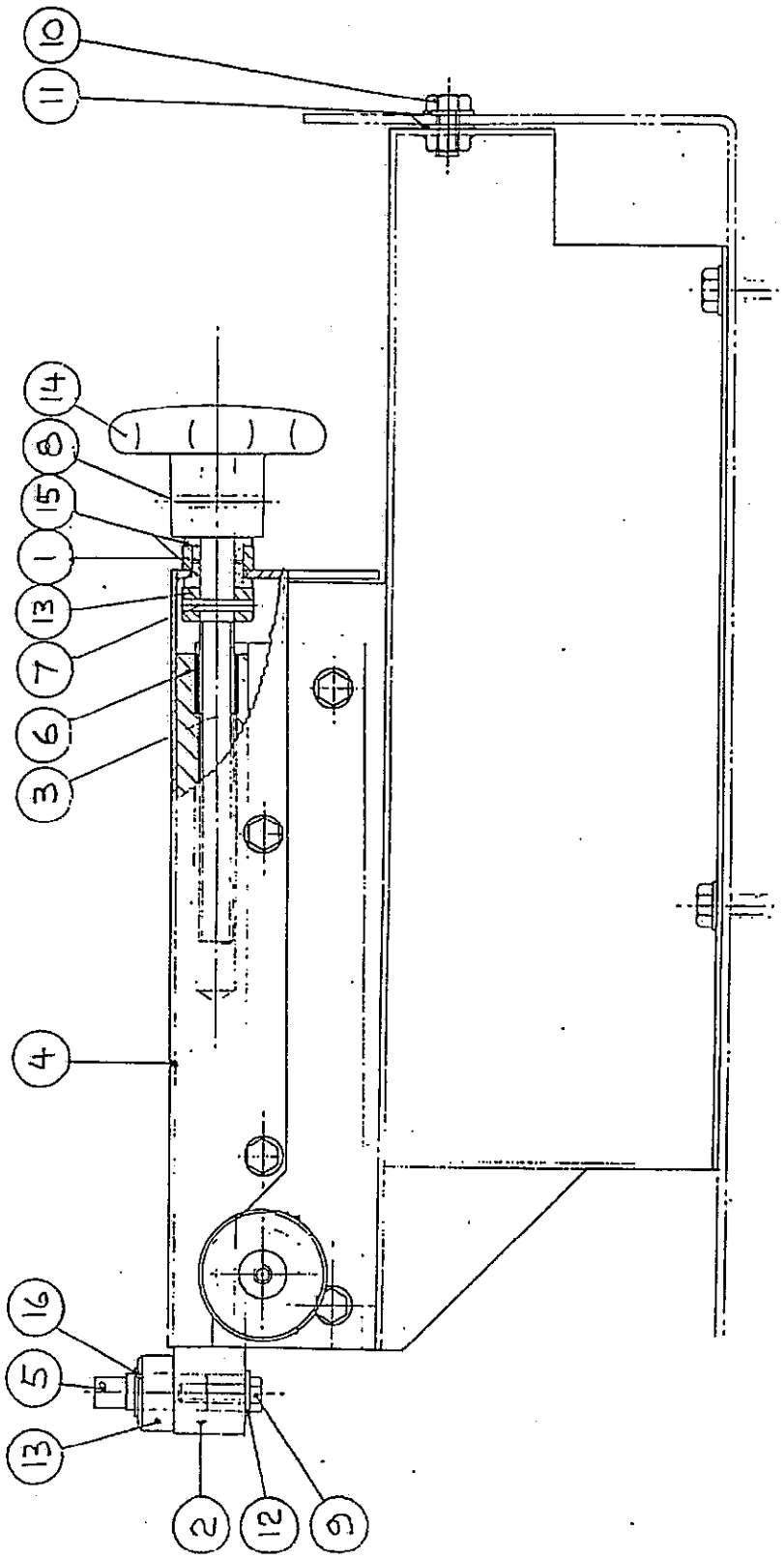




TEMPLATE SLIDE *(Fig. 6e)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 86	Bottom slide
2	1	NE 87	Slide plate
3	1	NE 88	Scale
4	1	NE 89	Nut
5	3	T30 53101	WDS 520-203, M6 thumb nut
6	1	T30 73805	Coil spring 9 mm x 25 mm
7	2	K05 23110	Key 5 x 5 x 20 lg
8	3	K05 25501	Hex hd screw M6 x 12 mm
9	2	K05 26206	Screwed stud 6 mm x 35 mm
10	1	K05 26216	M6 x 85 lg stud
11	5	K05 28102	Washer 6 mm

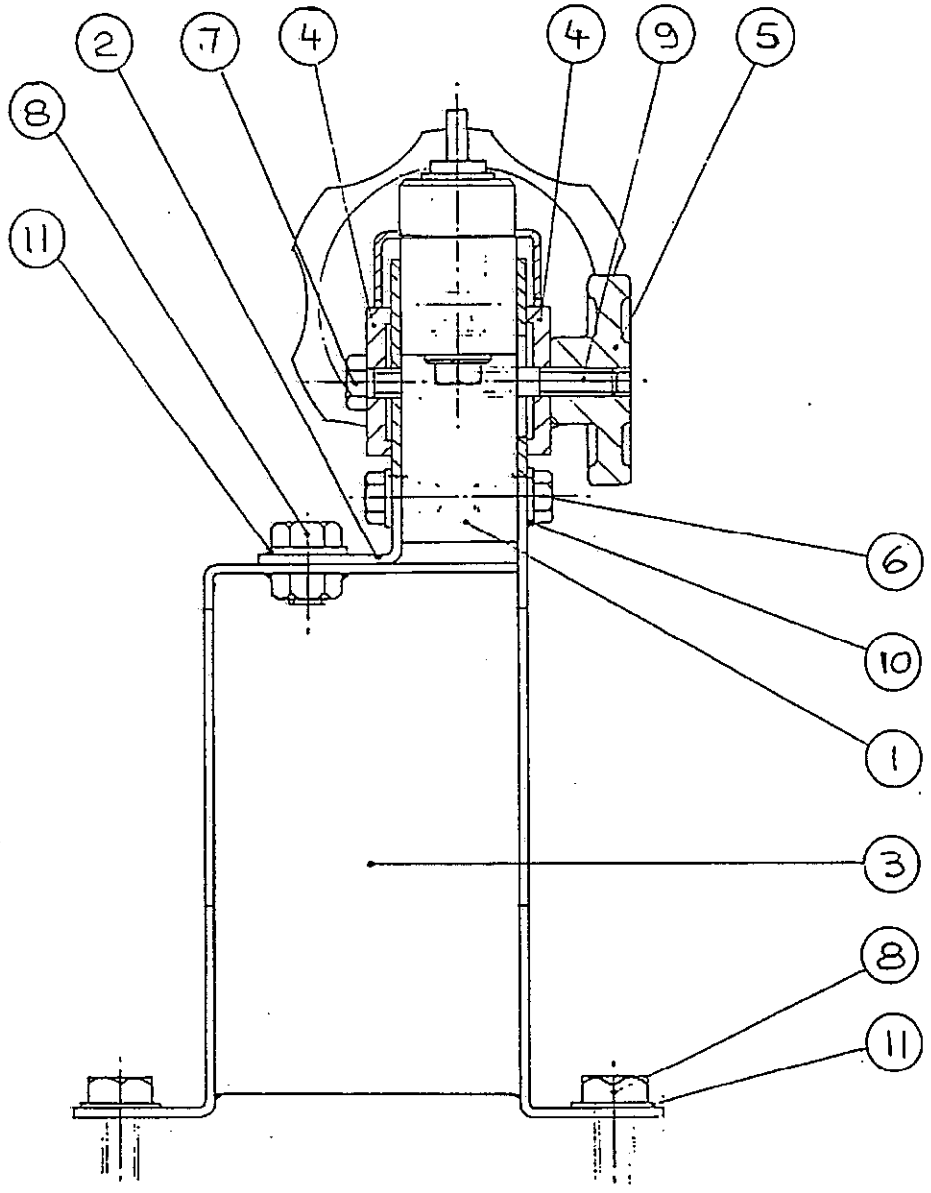
Fig. 6f Stylus mount



STYLUS MOUNT (Fig. 6f)

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 26	Bearing spacer
2	1	NE 56	Stylus mounting bar
3	1	NE 59	Stylus adj. screw
4	1	NE 63	Stylus mount cover
5	1	NX 40	Stylus 4.7 mm wide radius and square
6	1	T30 33103	M12 x 1.75p x 1.5 D Helicoil
7	1	K05 20484	Tension pin 4 mm x 26 mm
8	1	K05 20485	Tension pin 4 mm x 32 mm
9	1	K05 25504	Hex hd screw M6 x 25 mm
10	1	K05 25515	Hex hd screw M8 x 16 mm
11	2	K05 28103	Washer 8 mm
12	1	K05 28111	Washer 6 mm large diameter
13	2	K05 28207	Collar 12 mm diameter
14	1	K05 30223	Handwheel 12 bore, blind
15	2	K05 31302	24 Fl. bush, 12 B x 18 OD x 8 lg
16	1	K30 09931	'E' retainer 7133-090 9 mm

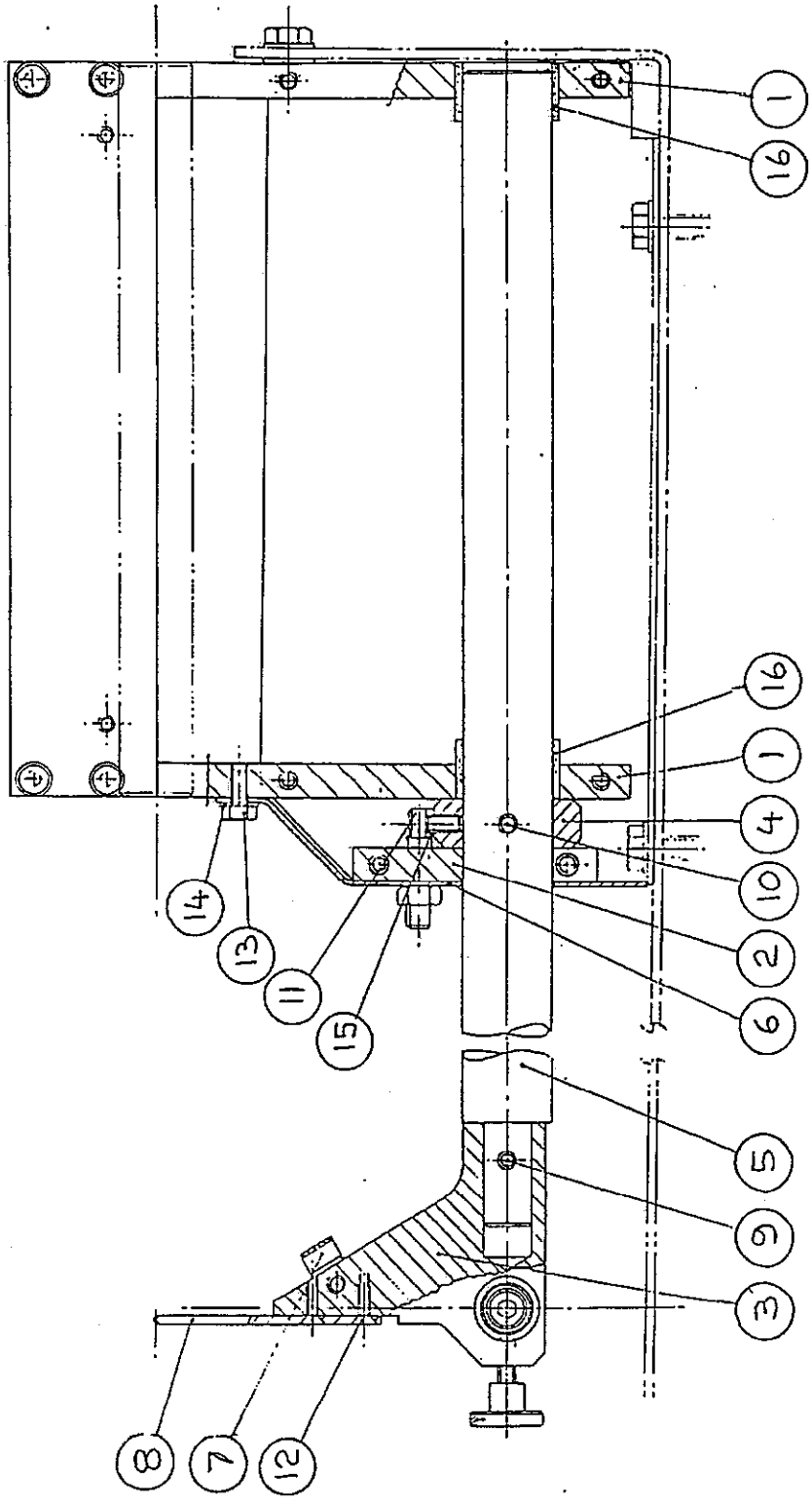
Fig. 6g Stylus mount



STYLUS MOUNT (*Fig. 6g*)

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 54	Stylus support bar
2	1	NE 55	Stylus mount side plate
3	1	NE 81	Stylus mounting
4	2	T30 09770	WDS clamping pads
5	1	T30 29102	Plastic handwheel 45 diameter x M6
6	8	K05 25501	Hex hd screw M6 x 12 mm
7	1	K05 25502	Hex hd screw M6 x 16 mm
8	6	K05 25515	Hex hd screw M8 x 16 mm
9	1	K05 26205	Screwed stud M6 x 30 mm
10	12	K05 28102	Washer 6 mm
11	6	K05 28103	Washer 8 mm

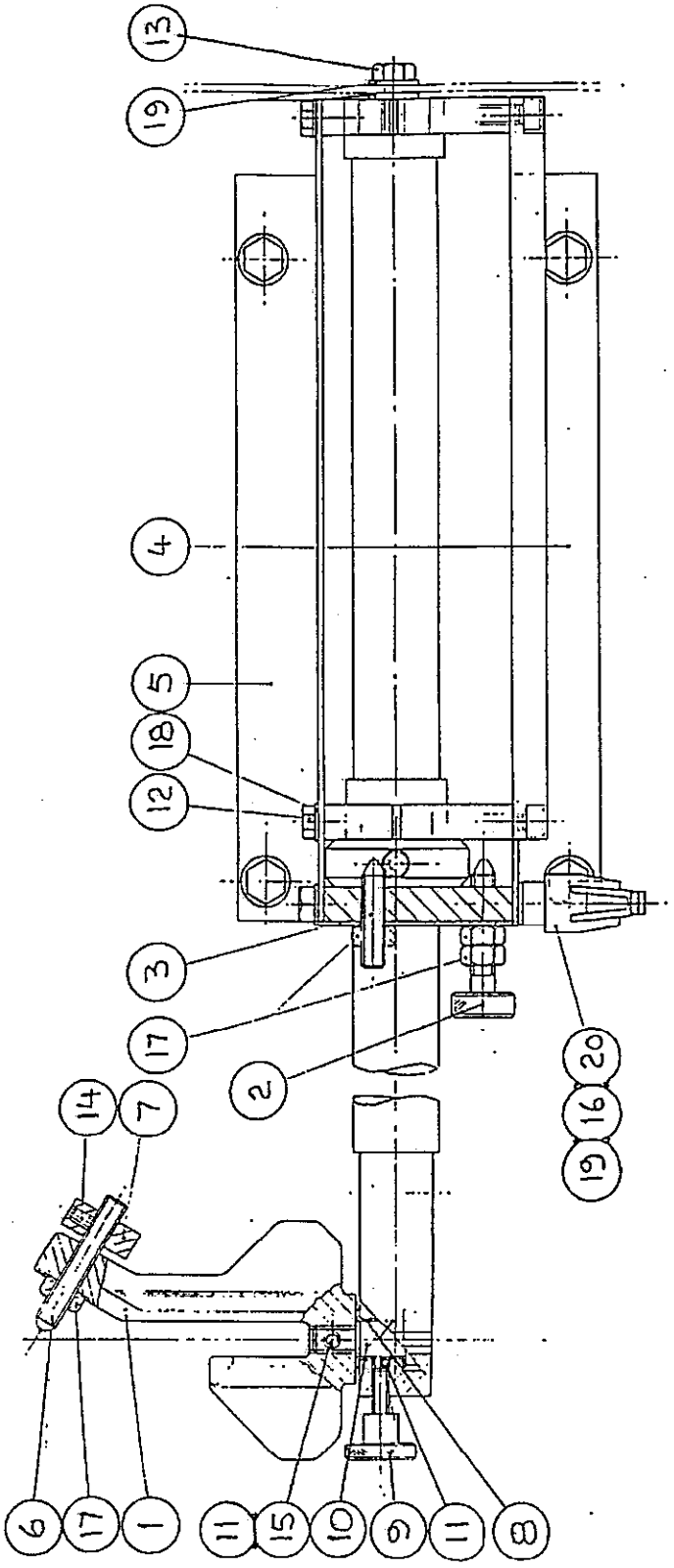
Fig. 6h Dresser / Cutter rest



DRESSER / CUTTER REST *(Fig.6h)*

ITEM	QTY	PART No.	DESCRIPTION
1	2	NE 18	Hd / tool rest mount plate
2	1	NE 19	Lock / stop plate
3	1	NE 20	Toolrest / dresser mount
4	1	NE 21	Stop collar
5	1	NE 22	Mounting bar
6	1	NE 32	Cover for stops
7	1	NE 79	Coolant pipe clip
8	1	NX 454	25 mm wide cutter rest
9	1	K05 20524	Heavy duty tension pin 6 mm x 24 mm
10	1	K05 20529	Tension pin 6 mm x 50 mm
11	1	K05 25184	Hex skt capscrew M8 x 10 mm
12	2	K05 25309	Hex skt capscrew M4 x 10 mm
13	2	K05 25501	Hex hd screw M6 x 12 mm
14	2	K05 28102	Washer 6 mm
15	1	K05 28154	Spring washer 8 mm
16	2	K05 31566	Bush 30 mm x 35 mm x 20 mm lg

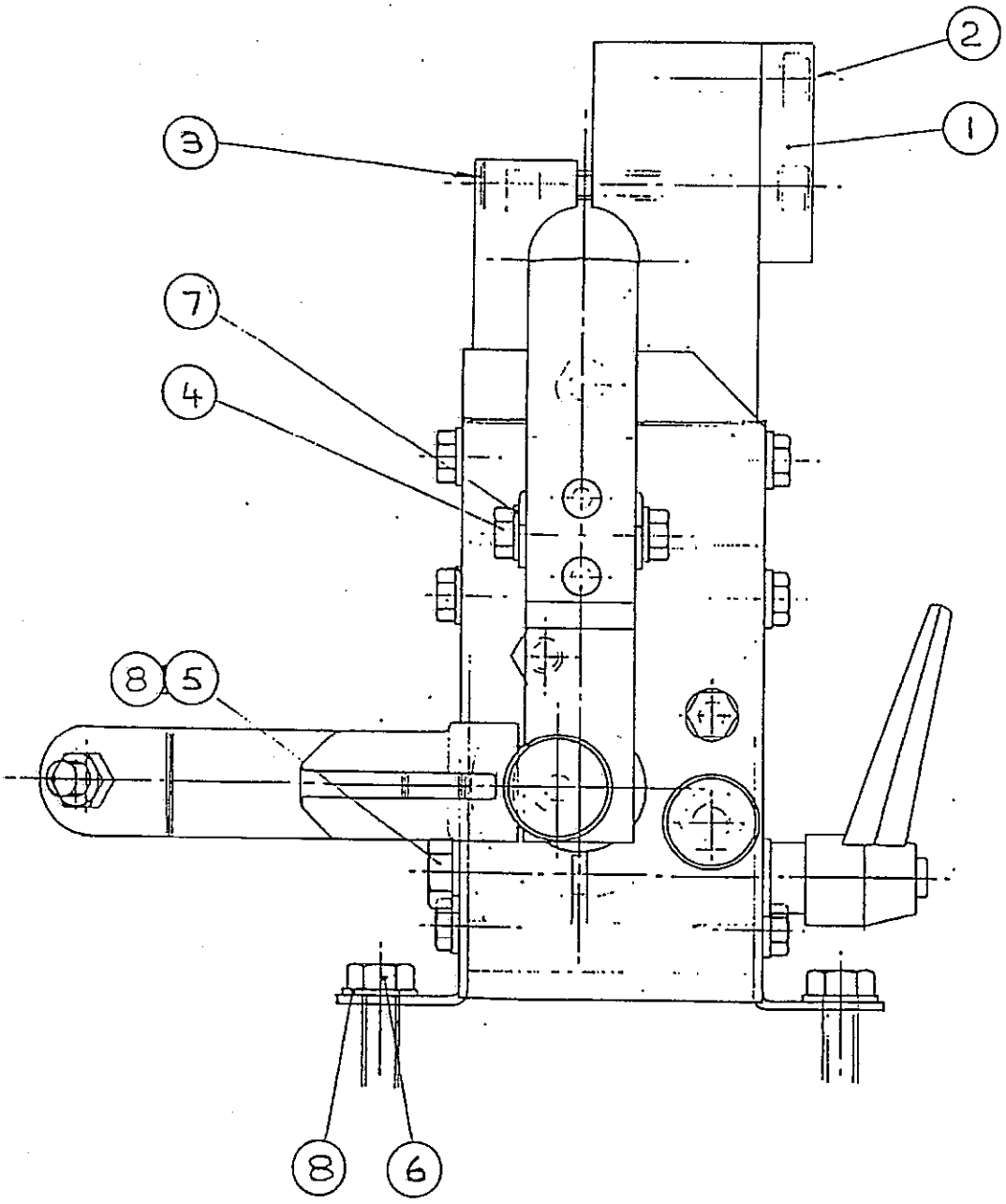
Fig. 6i Dresser / Cutter rest



DRESSER / CUTTER REST *(Fig. 6)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 23	Dresser
2	1	NE 24	Dresser setting screw
3	1	NE 25	Toolrest stop screw
4	1	NE 33	Side plate (RH)
5	1	NE 34	Side plate (LH)
6	1	NXU 522	Diamond dresser
7	1	NXU 523	Graduated dial - dresser
8	2	T30 05131	Glycodur bush 12 mm dia. x 7 mm lg
9	1	T30 73152	Knurled locking screw
10	1	T30 73162	M10 x 16 mm lg shoulder screw
11	2	K05 25470	Brass pad 4.5 dia x 4
12	10	K05 25501	Hex hd screw M6 x 12 mm
13	1	K05 25515	Hex hd screw M8 x 16 mm
14	1	K05 26103	Hex skt set screw M5 x 10 mm
15	1	K05 26112	Hex skt screw M6 x 6 mm
16	1	K05 26242	Screwed stud 8 mm x 70 mm
17	4	K05 27109	Hex lock nut 8 mm
18	10	K05 28102	Washer 6 mm
19	3	K05 28103	Washer 8 mm
20	1	K05 30241	Rachet l/handle M8 x 12.5

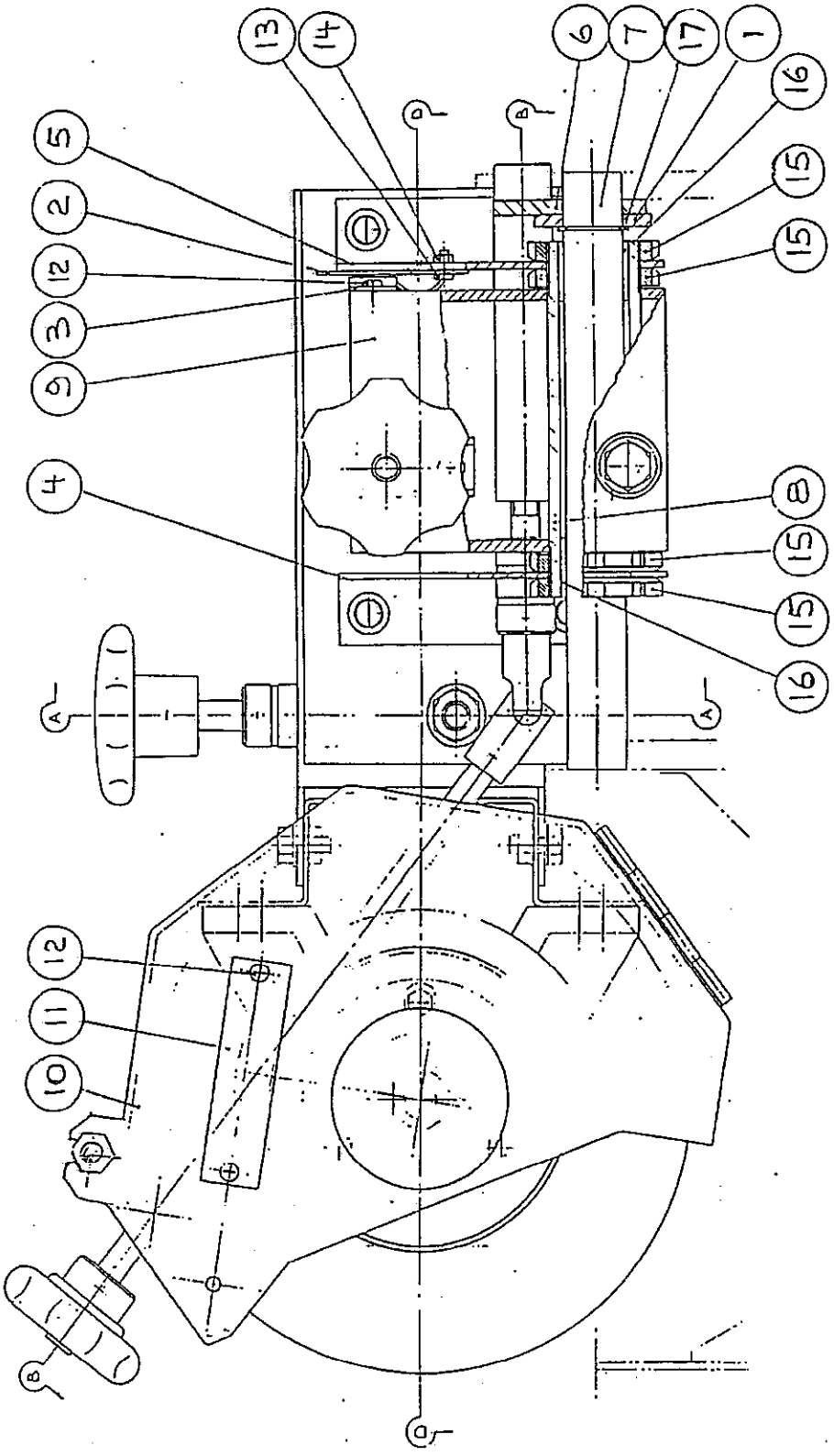
Fig. 6j Dresser / cutter rest



DRESSER / CUTTER REST *(Fig. 6i)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 47	Cross bar
2	4	K05 25164	Hex skt capscrew M6 x 12 mm
3	2	K05 25168	Hex skt capscrew M6 x 30 mm
4	2	K05 25501	Hex hd screw M6 x 12 mm
5	1	K05 25514	Hex hd screw M8 x 12 mm
6	4	K05 25515	Hex hd screw M8 x 16 mm
7	2	K05 28102	Washer 6 mm
8	5	K05 28103	Washer 8 mm

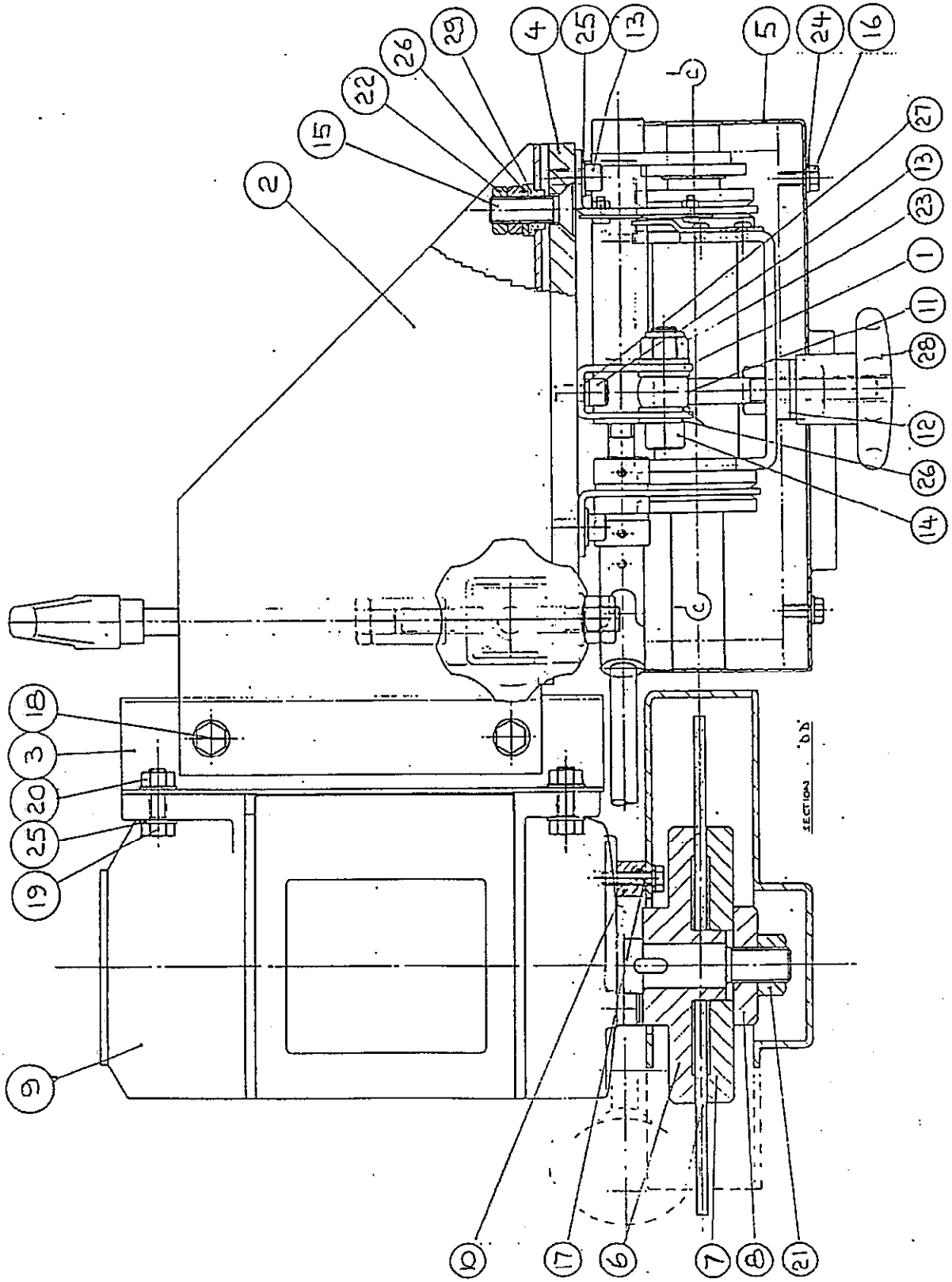
Fig. 6k Head



HEAD (Fig. 6k)

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 27	Thrust washer
2	1	NE 30	Head cant scale
3	1	NE 31	Pointer for head cant
4	1	NE 38	Head mounting bracket - LH
5	1	NE 39	Head mounting bracket - RH
6	1	NE 45	Horizontal adj. plate
7	1	NE 52	Pivot shaft
8	1	NE 53	Head pivot
9	1	NE 74	Head cant bracket
10	1	NE D03	Wheel guard complete
11	1	MPG 163	Speed plate
12	4	K05 25401	Pan head screw M4 x 5 mm
13	2	K05 25816	Pan head screw M4 x 10 mm
14	2	K05 27115	Hex full nut 4 mm
15	4	K05 27209	Notch nut M40 x 1.5
16	2	K05 31577	Bush 25 ID x 30 OD x 25 lg
17	1	K30 09145	External circlip 25 mm

Fig. 6l Head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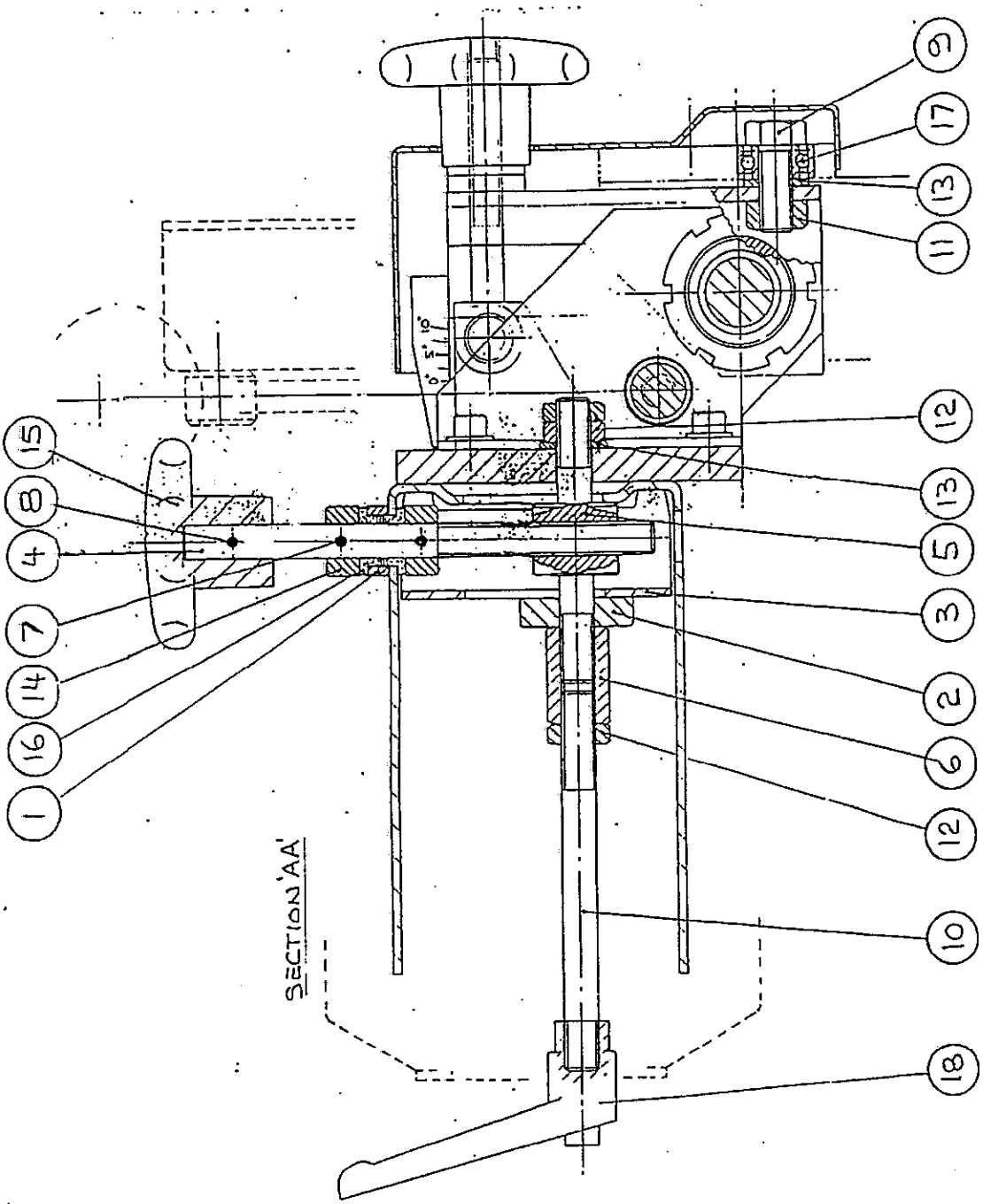
SECTION 'D-D'

HEAD *(Fig. 6I)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 40	Eyebolt bracket
2	1	NE 42	Rise / fall arm
3	1	NE 43	Motor plate
4	1	NE 44	Head mounting plate
5	1	NE 75	Cover for head mount
6	1	NN 290	Fixed wheel flange
7	1	NN 291	Front wheel flange
8	1	NXU 341	Locking washer
9	1	NV S0202	Motor / spindle unit
10	3	NN 20	Spacer for wheel guard
11	1	T30 09773	Heavy duty eyebolt
12	1	T30 89104	Spherical seating washer
13	5	K05 25186	Hex skt capscrew M8 x 16 mm
14	1	K05 25234	Hex skt capscrew M12 x 45 mm
15	1	K05 25355	Hex skt csk screw M12 x 40 mm
16	2	K05 25501	Hex hd screw M6 x 12 mm
17	3	K05 25504	Hex hd screw M6 x 25 mm
18	4	K05 25515	Hex hd screw M8 x 16 mm
19	4	K05 25517	Hex hd screw M8 x 25 mm
20	4	K05 27102	Hex full nut 8 mm
21	1	K05 27105	Hex full nut 16 mm
22	2	K05 27111	Hex lock nut 12 mm
23	1	K05 27147	Self locking nut 12 mm
24	2	K05 28102	Washer 6 mm
25	16	K05 28103	Washer 8 mm
26	5	K05 28105	Washer 12 mm
27	2	K05 28154	Spring washer 8 mm
28	1	K05 30225	Handwheel 75 dia x M12 through
29	1	K05 31302	24 Fl.bush, 12 B x 18 OD x 8 lg

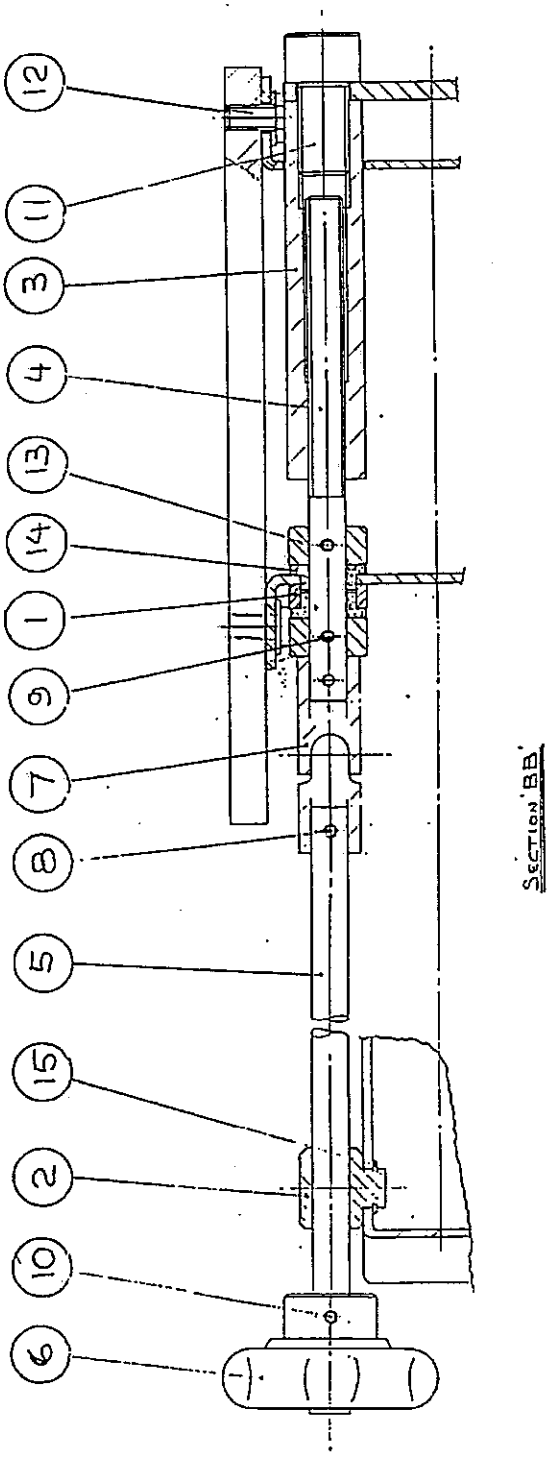
Fig. 6m Head



HEAD *(Fig. 6m)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 26	Bearing spacer
2	1	NE 28	Lock washer
3	1	NE 41	Rise / fall lock plate
4	1	NE 48	Rise / fall screw
5	1	NE 49	Rise / fall nut / lock
6	1	T30 09771	M12 coupling nut
7	2	K05 20484	Tension pin 4 mm x 26 mm
8	1	K05 20485	Tension pin 4 mm x 32 mm
9	1	K05 25544	Hex hd screw M12 x 30 mm
10	1	K05 26309	Screwed stud 12 mm x 135 mm
11	1	K05 27104	Hex full nut 12 mm
12	3	K05 27111	Hex lock nut 12 mm
13	2	K05 28105	Washer 12 mm
14	2	K05 28207	Collar 12 mm dia.
15	1	K05 30223	Handwheel 12 bore, blind
16	2	K05 31302	24 Fl.bush 12 mm x 18 mm x 8 lg
17	1	K06 01316	SKF 63001-2rs bearing
18	1	K30 29904	Bristol handle M12 female

Fig. 6n Head adjustment



HEAD ADJUSTMENT *(Fig. 6n)*

ITEM	QTY	PART No.	DESCRIPTION
1	1	NE 26	Bearing spacer
2	1	NE 29	Handwheel support
3	1	NE 46	Horizontal adj. nut
4	1	NE 50	Horizontal adj. screw
5	1	NE 51	Horizontal adj. shaft
6	1	NXU 424	Handwheel plastic 13 mm square
7	1	T30 09772	Universal joint
8	2	K05 20482	Tension pin 4 mm x 20 mm
9	2	K05 20484	Tension pin 4 mm x 26 mm
10	1	K05 20485	Tension pin 4 mm x 32 mm
11	1	K05 25252	Hex skt capscrew M16 x 30 mm
12	1	K05 25515	Hex hd screw M8 x 16 m
13	2	K05 28207	Collar 12 mm dia.
14	2	K05 31302	24 Fl.bush 12 mm x 18 mm x 8 lg
15	1	K30 09931	'E' retainer 7133-090 9 mm

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	Energrease 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^3
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.

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	%
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

6: ACCIDENTAL RELEASE MEASURES

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

7: HANDLING AND STORAGE

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

Occupational Exposure Limits:-

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

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

10: STABILITY AND REACTIVITY

Stability: Stable, will not polymerise

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

11: TOXICOLOGICAL INFORMATION

The following toxicological assessment is based on a knowledge of the toxicity of the product's components.
Expected oral LD_{50}, rat > 2g/kg. Expected dermal LD_{50}, 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

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. Emulsifiable in water.
Persistence and Degradability:	Not readily 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:	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

14: TRANSPORT INFORMATION

This product is NOT classified as dangerous for transport

15: REGULATORY INFORMATION

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

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

16: OTHER INFORMATION

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.

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^{0} C	1.080
pH (1% solution)	11.25
Surface tension (1% solution at 20^{0} 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.

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

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^3	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

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

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

16: OTHER INFORMATION

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 IMAGE

Qty	Part No.	Description
1	GW 203	Grinding wheel 230 x 5 x 1 1/4" coarse
1	K30 41144	Allen key 6 mm A/F
1	K30 73781	D/ended spanner 8 x 10 A/F
1	K30 73785	D/ended spanner 24 x 27 A/F
1	NXT 6	Template blank 330 mm long
1	NXT 138	Grinding coolant conc. 5 litres
1	T30 29105	Crank handle - 13 mm square
1	T30 41110	5mm A/F handled Allen key
2	NXT 853	40 mm diameter arbor bushes

Note : An alternative diameter of arbor bush will be supplied in lieu of 40 mm if specified on order.

ACCESSORIES FOR IMAGE GRINDING MACHINES

GRINDING WHEELS

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

GW	203	Standard roughing wheel, 5 mm thick, 60 grit, 3000 rpm maximum
GW	202	Finishing wheel, 5 mm thick, 220 grit, 3000 rpm maximum
GW	294	Specially formulated hard wheel for solid H.S.S., 5 mm thick, 3000 rpm max.
GW	295	Specially formulated wheel for 3600 rpm spindles, 5 mm thick

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 with a 31.75 mm (1.25") bore and suitable for running at 3600 rpm. except where specified otherwise.

ARBOR BUSHES

NXT	851	30 mm diameter
NXT	852	35 mm diameter
NXT	853	40 mm diameter
NXT	854	45 mm diameter
NXT	871	1 1/8" diameter
NXT	872	1 1/4" diameter
NXT	873	1 3/8" diameter
NXT	874	1 1/2" diameter

Note : 40 mm diameter arbor bushes are supplied with the machine unless specified otherwise.

ALTERNATIVE STYLII

NX	110	Stylus 4.7 mm wide 90^{0} point
NX	111	Stylus 4.7 mm wide 30^{0} right hand
NX	112	Stylus 4.7 mm wide 30^{0} left hand
NX	131	Stylus 4.7 mm wide 45^{0} chamfer right and left hand
NX	133	Stylus 3 mm wide radius and square

Other profiles are available upon request.

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.

COOLANT SYSTEM

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.

SETTING AND MEASURING

Setting stands, computer aided setting systems, and optical setting and measuring systems. Contact Wadkin for full details.

SUGGESTED SPARES FOR IMAGE GRINDING MACHINES

CONSUMABLE MACHINE PARTS

NX	454	Cutter rest 25 mm
NXU	522	Diamond dresser
NX	40	Stylus 4.7 mm wide radius and square

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

SERVICE PARTS

Qty	Part No.	Description
Carriage		
8	T30 05372	Linear bearing / housing
Arbor assembly		
2	K05 31350	Flanged bush 25 x 32 x 20 long
1	K06 10254	Thrust washer
Template Slide		
1	NE 88	Scale
1	NE 89	Nut
1	K05 26216	M6 x 85 long stud
Stylus mount		
1	NE 59	Adjusting screw
2	K05 31302	Flanged bush 12 x 18 x 8 long

Dresser and cutter rest assembly

2	T30	05131	Glyco Fl.bush 12 x 7 long
2	K05	25470	Brass pad
2	K05	31566	Bush 30 mm x 35 mm x 20 long

Head

1	NE	46	Horizontal adj. nut
1	NE	48	Rise and fall screw
1	NE	49	Rise and fall nut
1	NE	50	Horizontal adj. screw
1	NE	D03	Wheel guard
1	NN	290	Fixed wheel flange
1	NN	291	Front wheel flange
1	T30	09772	Universal joint
1	T30	09773	Eyebolt
1	K05	30225	Handwheel
5	K05	31302	Flanged bush 12 x 18 x 8 long
2	K05	31577	Bush 25 x 30 x 25 long

Coolant system

1	T30	49205	Magnet
1	NE	78	Coolant nozzle

ELECTRICAL CIRCUIT DIAGRAM