INSTRUCTION BOOK

EMCO Unimat PC

Basic

Edition 91-1

Ref. No. EN1 722

Instruction book
UNIMAT PC
91-1 EN1 722

EMCO
Holz + Hobbymaschinen

Profi Heimwerkermaschinen Ges.m.b.H. – A-5082 GRÖDIG, Hauptstraße 31 – Telefon (00 43) 62 46/78 7 87 – Telefax 0 62 46/78 7 87-1

Foreword

This instruction manual contains a general description of the machine and its operating elements, a description of the accessories, working tips and safety instructions for the prevention of accidents.

Many of the working tips mentioned in this instruction manual actually exceed the usual contents of an instruction manual. We are of the opinion, however, that these working tips convey the necessary basic information to the aspiring professional and should thus bring optimal working results.

Read the instruction manual carefully before starting the machine. In this way, you can save yourself valuable time and frustration later.

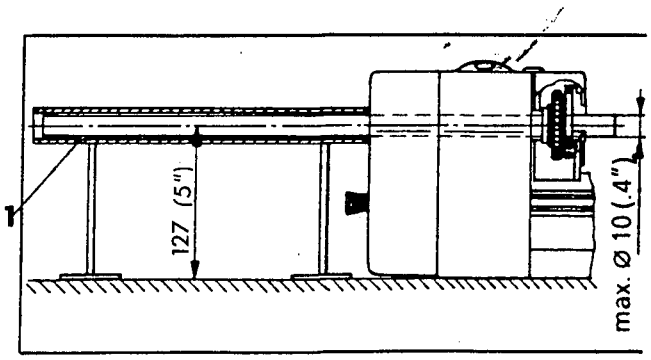
Emco Technical Documentation wishes you success.

emco
Technische Dokumentation

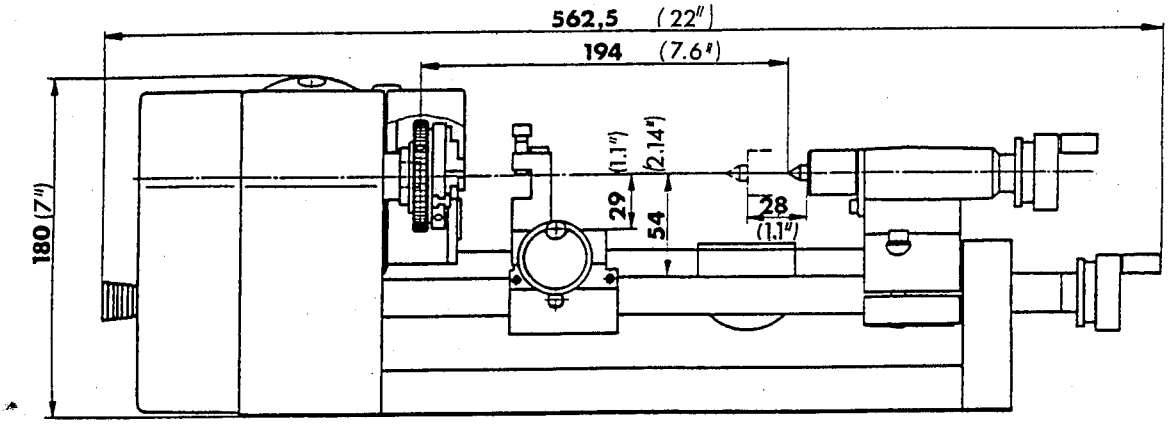
Index

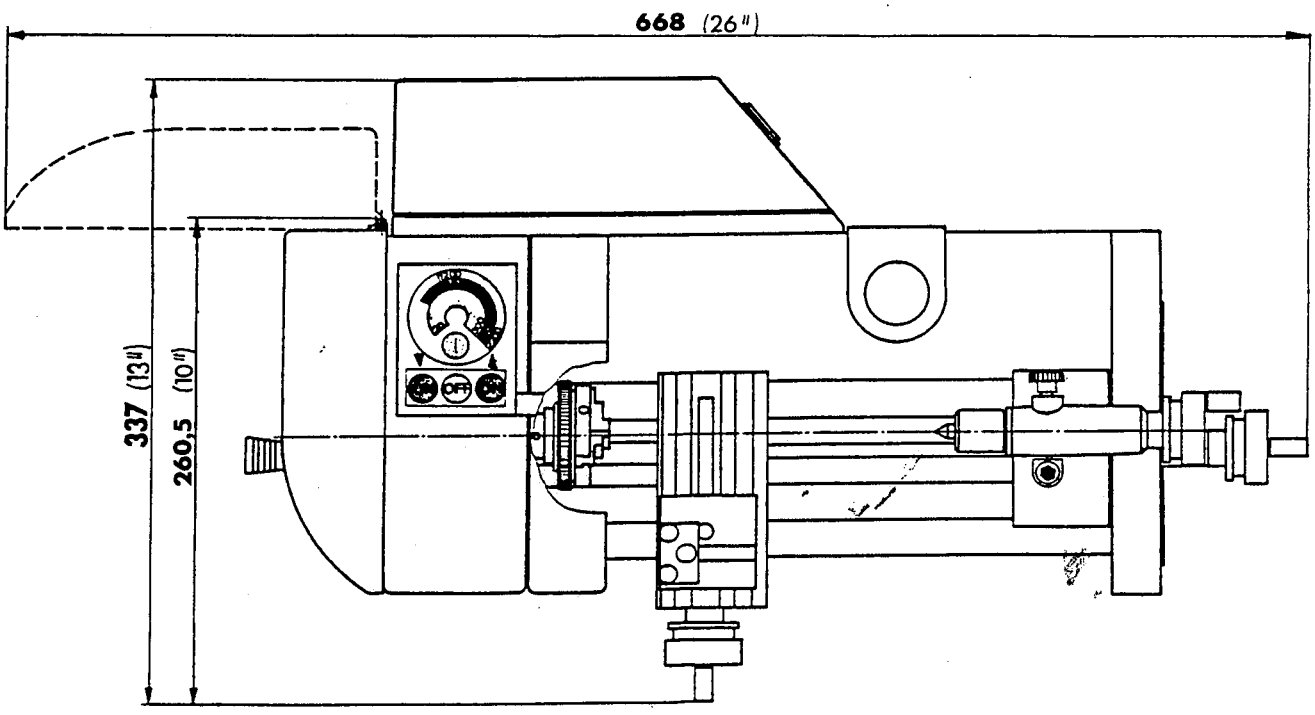
1. Safety instructions

- Read this documentation completely, before you start the machine.
- Remove especially long-chip chips from the machine with a brush or similar, so that they are not picked up by the chuck and thus cause injuries. (Chip removal is always carried out, when the machine is stationary.)
- Only connect the machine to an earthed socket.
- Always use the chuck guard for all work.
- Wear safety goggles.
- Wear hair protection.
- Do not wear clothing with loose sleeves.
- Never reach into the running machine.
- Only carry out clamping, measuring, re-adjustment, cleaning or mounting work, when the machine is stationary.
- Always remove braces, wrenches and similar after use.
- Never leave a running machine.
- Always keep work area clean.
- Always work with perfectly sharpened tools.
- Always clamp tools and workpieces securely.
- Secure the machine against an unauthorised start.
- Take note of the inspection and maintenance regulations.
- Never remove monitoring and protective equipment.
- Never exceed the clamping capacity of the lathe chuck.
- EMCO accepts no liability for parts, which are not supplied by EMCO.
  Always use original spare parts.
- For machining rods, pipes, etc., the rotating parts projecting above the headstock are to be surrounded over the complete length with a self-made, fixed guard (1).



Total dimensions of the machine





The technical data are subject to change without notice!

3. Putting the machine into operation

Unpacking and cleaning

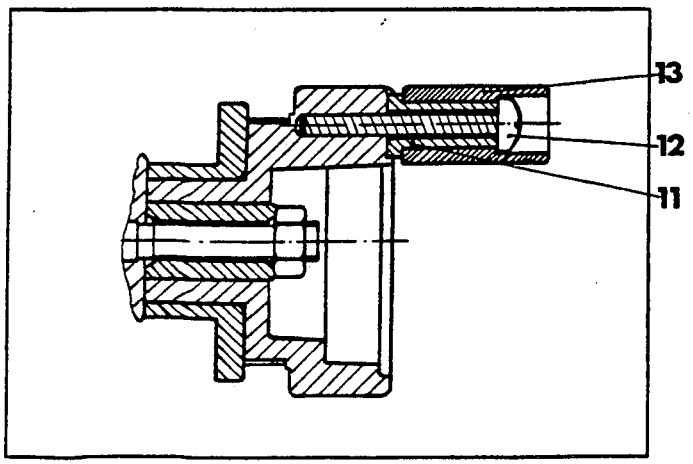
Check the machine for possible transport damage and for completeness of the delivered parts. - See delivery scope.
The blank surfaces of the machine are coated with a rust protective. Remove this substance with a cloth and then oil the cleaned parts with a light machine oil.

Delivery scope

- Basic machine with three-jaw chuck, revolving centre and toolpost
- Power supply
- Connection cable
- 2 items each of bearing journals, turning handles and sheet metal screws for longitudinal and cross slide hand wheel
- 2 items of plain pins for chuck mounting and workpiece clamping.
- 4 items of tool bases
- 2 items of shearing pins (spare part of overload protection of the lead screw)
- 1 item of an intermediate gear (for feed gear)
- 4 items of Allan keys
- 1 item of cross-headed screwdriver
- 3 items each of socket head screws M5x25 and the respective washers B5.3 (for fixing the power supply).
- Supporting ring 20x14x1.4 (only for drilling chuck mounting on tailstock sleeve).

Mounting the turning handles

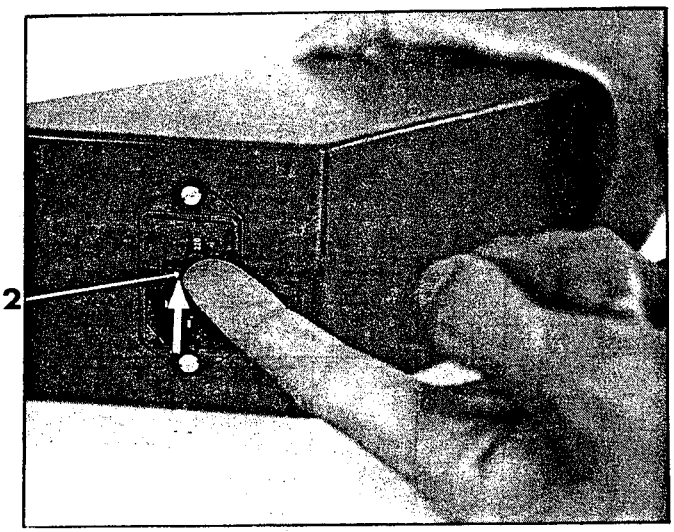
Mount the turning handles onto the handwheels of the lead screws and cross spindles as follows:
Push the turning handle (13) onto the bearing journal (11) and screw down this unit with the sheet metal screw (12) to the handwheel.

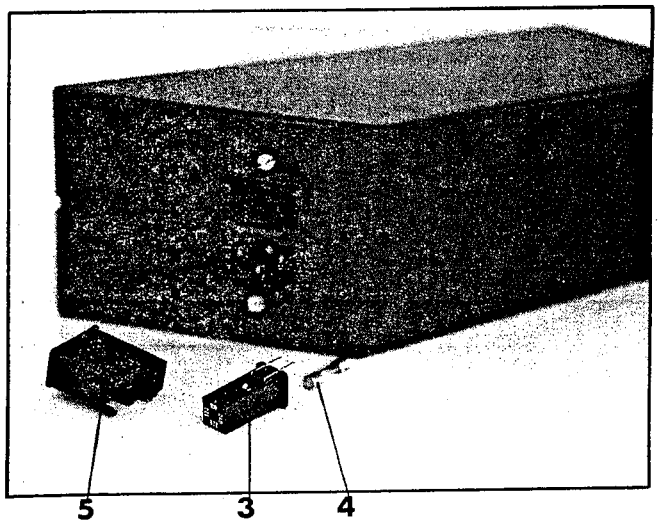


Electrical connection

1. Setting the required mains voltage:

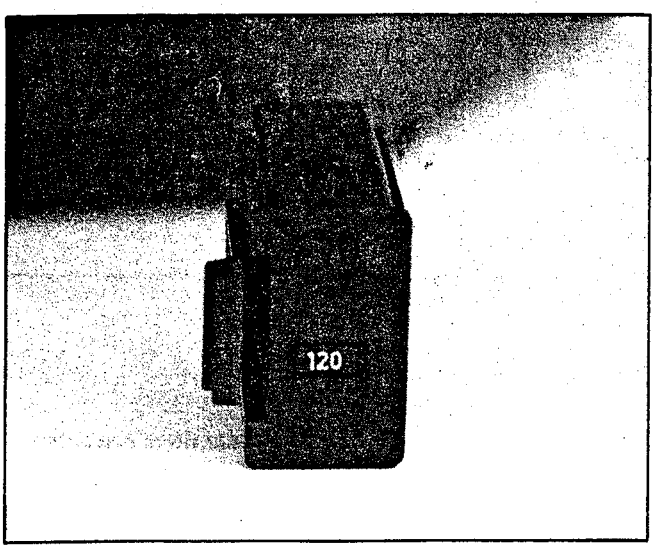
By pushing up the latch (2), the selector pin (3), the fuse (4) and the casing (5) can be removed (see next column).





Now plug in the selector plug into the casing in such a way that either:

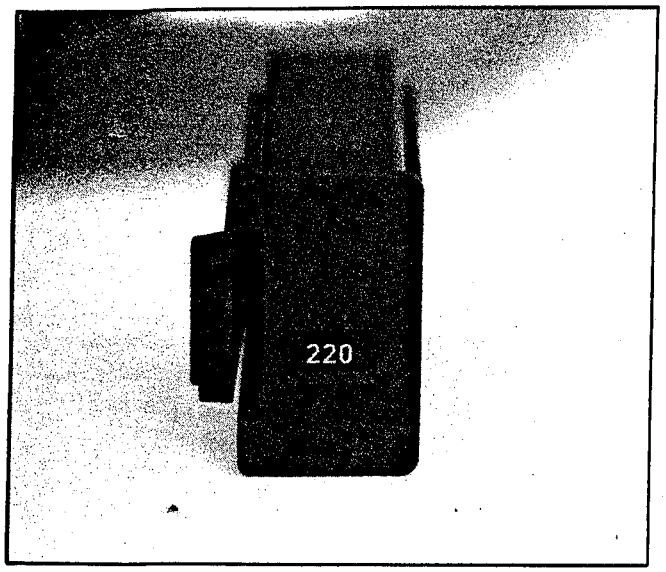
a) the number 120 appears in the window of the casing for 110 V mains voltage,



1 10 V mains voltage

or

b) the number 220 appears in the window of the casing for 220 V mains voltage.

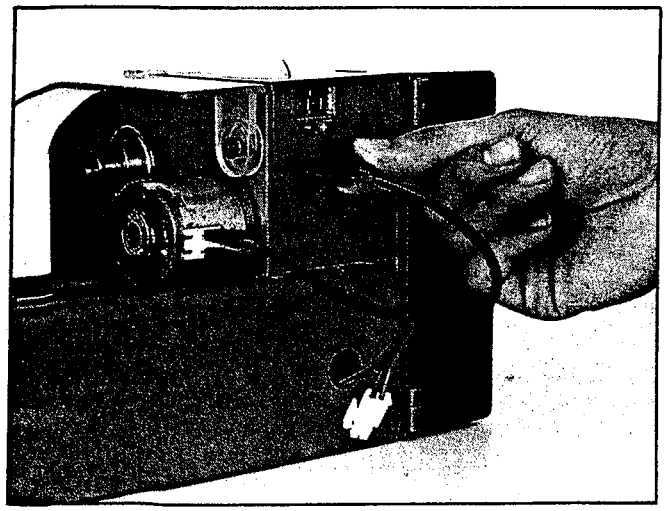


220 V mains voltage

Put the fuse into the selector plug and then put the whole unit into the receptacle.

2. Connector cable for the main drive control - main motor:

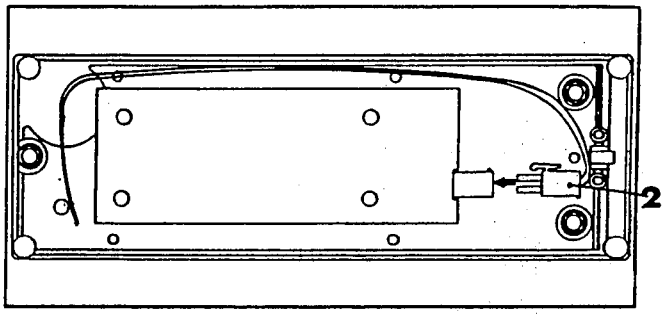
Connect the main motor to the main drive control as follows.
The plug on the blue wire to the negative poles (-) of the main motor and the main drive control (blue).
The plug on the red wire to the positive poles (+) from the main motor and the main drive control (red).



3. Power supply - lathe connection

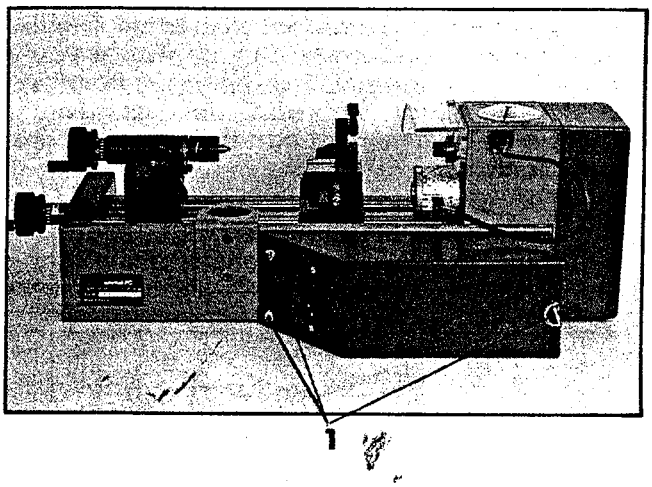
Pull out the cable with the plug (2) from the machine. Insert the plug (2) into the power supply as shown in the diagram.

Lay the cable as shown in the diagram.



4. Mounting the power supply to the lathe

Fix the power supply to the lathe with the 3 socket head screws M5x25 (1) and the respective washers.
Make sure that no cable is squashed in-between.



5. Connecting the mains cable

Plug in the mains cable into the receptacle of the power supply and connect the lathe to the mains.

Note:
Only connect the machine to a grounded socket.

Important information for switching on the lathe

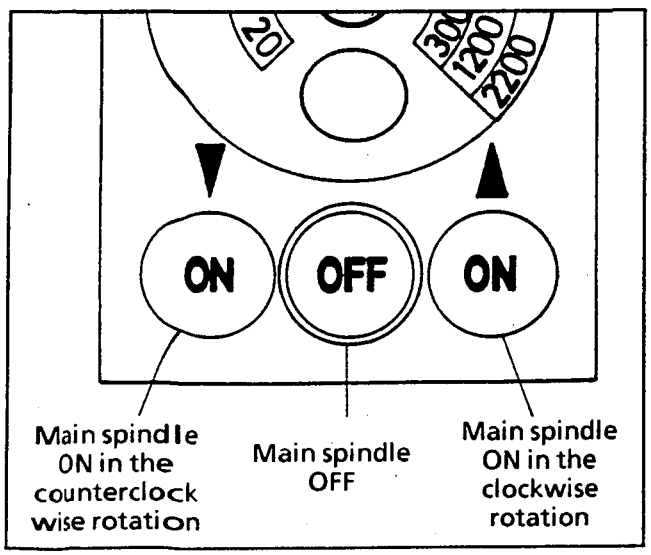
The UNIMAT PC is a precision machine tool. Thorough care of the machine is a pre-requisite for the long-lasting precision and efficiency.

- Oil or coat spindles, mounting threads, slide guides and machine surfaces regularly with a light machine oil.

Attention:
Due to an incorrect machine operation or through collisions, it is possible that the shearing pin of the lead screw breaks. Read through the chapter "Maintenance, care and servicing" in connection with this.

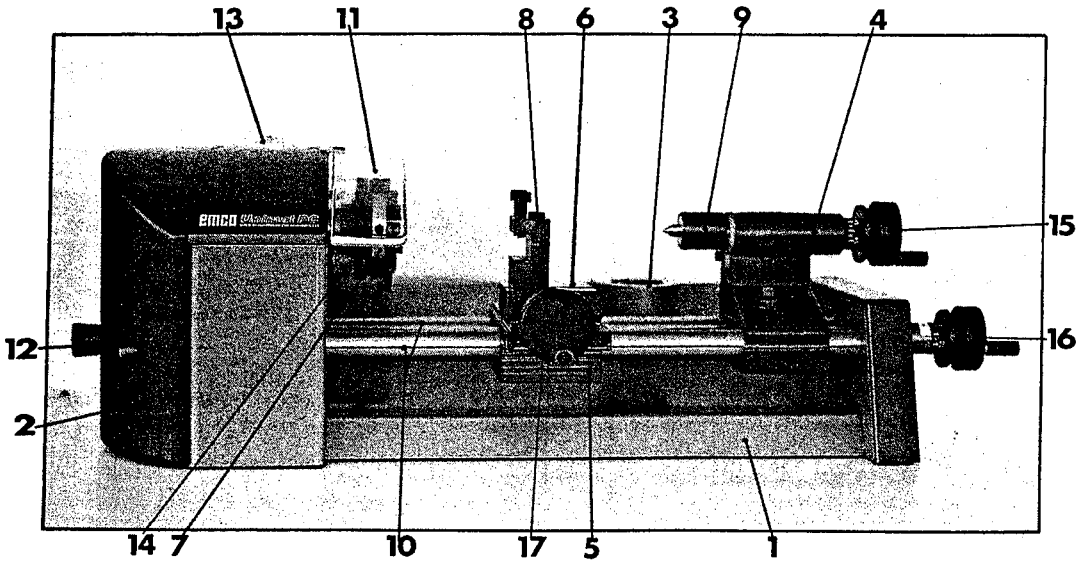
Switching the machine on or off

The main spindle can be switched on or off in the counterclockwise or clockwise rotation with the following buttons. Switching from counterclockwise to clockwise rotation is required, e.g., when cutting threads with automatic feed.



4. Description of the machine

Machine components



1 .... Machine bed with headstock
2 .... Cover
3 .... Mounting for vertical unit
4 .... Tailstock
5 .... Longitudinal slide
6 .... Cross slide
7 .... Main spindle with three-jaw chuck
8 .... Toolpost
9 .... Revolving centre
10 .... Guide columns
11 .... Chuck guard
12 .... Sleeve (switch-on lead screw)
13 .... Adjusting knob (fine adjustment of the speed)
14 .... Main motor
15 .... Tailstock handwheel
16 .... Longitudinal slide handwheel
17 .... Cross slide handwheel

Note:
For detailed descriptions of the machine elements see the spare parts list.

The lathe bed

The lathe bed is a steel sheet welded construction with an integrated headstock casing and mounting for the vertical unit.
The guide columns are mounted on the machine bed. The tailstock and the tool slide are mounted on the guide columns.
The lead screw is fixed between the guide columns.
The power supply is located at the rear of the lathe bed.

The main spindle

The main spindle is supported by two ball bearings in the headstock housing.
The ball bearings are completely enclosed and lubricated for life (lubrication-free).
The clamping devices for workpieces or tools are mounted onto the main spindle nose.

Handwheels with graduated rings

The handwheels for the longitudinal slide, cross slide and tailstock each have an adjustable graduated ring.
The division on the graduated rings amounts to 0.05 mm (.002").
If you turn the handwheel by one division, the slide or the tailstock move by 0.05 mm (.002").
Attention:
For infeeding the cross slide by, e.g., 0.05 mm (.002"), the diameter of the workpiece is reduced by twice as much, by 0.1 mm (.004"), therefore.
The graduated rings on the handwheels are also adjustable. You can set each graduated ring to 0 without altering the position of the slides or of the tailstock sleeve. This saves you calculation work when feeding the turning tool or the tailstock sleeve.

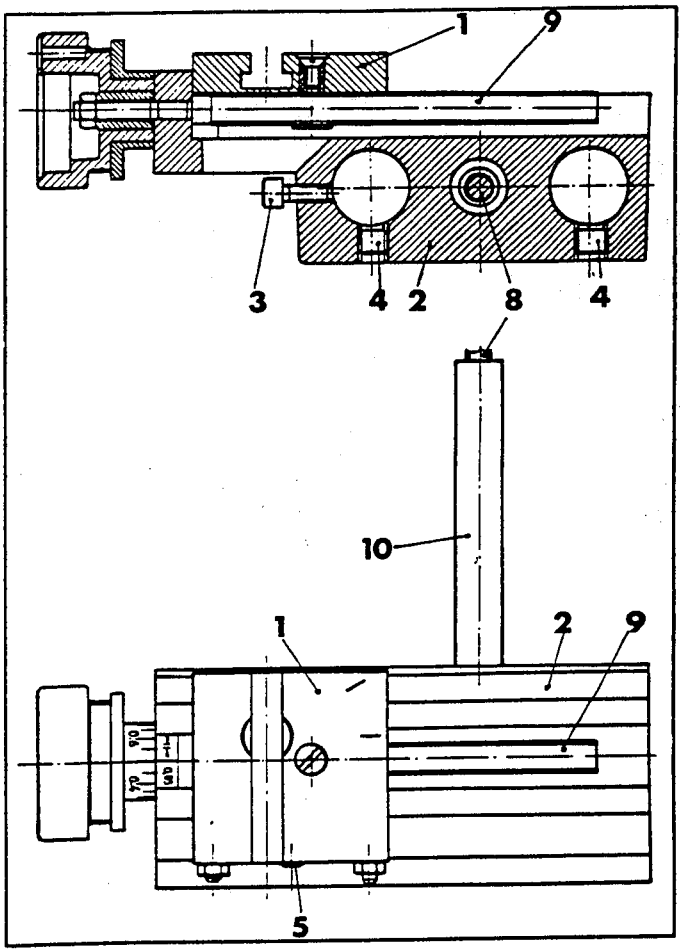
Slide clearance:
When turning the handwheel to the other side, the handwheel can be turned slightly, without the slide or the tailstock sleeve moving ("clearance, lost motion"). Take this clearance into account when reversing the respective handwheel.

The tool slide

The tool slide comprises a cross slide (1) and a longitudinal slide (2).
The longitudinal slide runs play-free on the ground guide columns of the lathe and can be fixed with the clamping screw (3) in any position. (With mounted stepping motor, this must first be dismounted.)
The slide clearance of the longitudinal slide can be set with the two set screws (4).

The cross slide (1) runs in the dovetail guideway of the longitudinal slide.
It can be adjusted play-free with a setting strip and can be fixed with the clamping screw (5) in any position, just like the longitudinal slide.

Note:
Never switch on the automatic feed, when the slide is clamped. The shearing pin of the lead screw can break in this way.



The longitudinal or cross slides are moved by turning the handwheels via the lead screw (8) or the cross spindle (9).

The handwheel is either turned by hand or via the stepping motors, according to the lathe equipment.

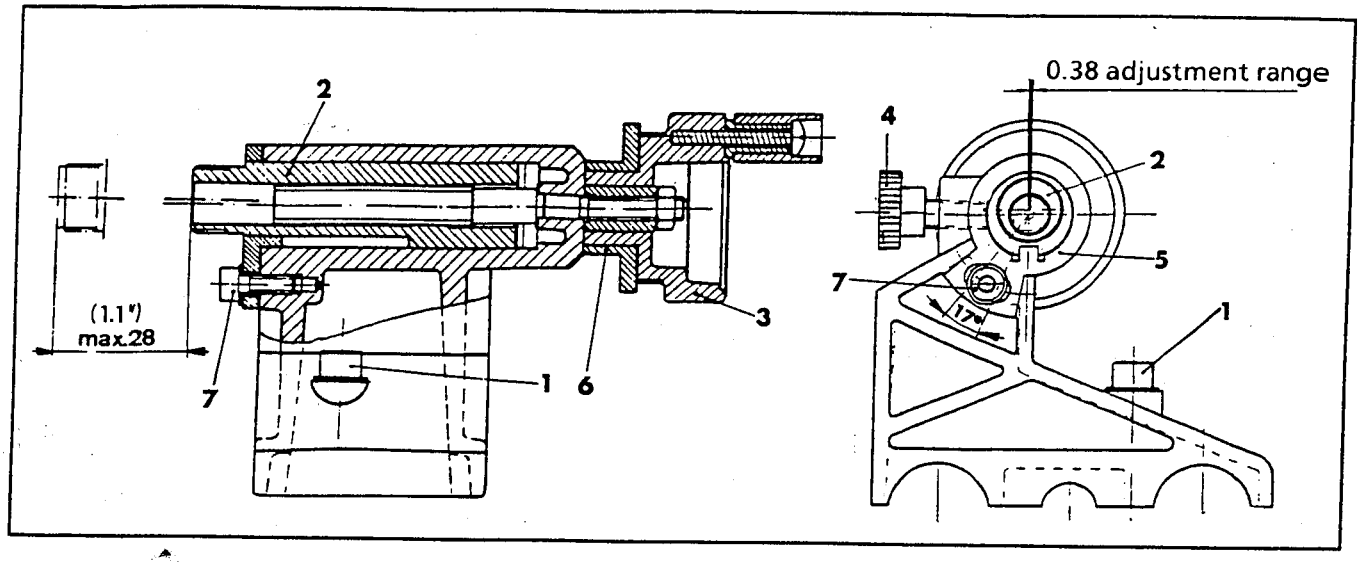
One complete rotation of the handwheel causes the slide to move by one millimeter.
(Shifting the slide = feed movement)

The graduated ring is divided every
0.05 mm (.002"). If you turn the handwheel by one division marking, the affected slide is moved by 0.05 mm (.002").

The toolpost is clamped on the cross slide with a T-nut and a socket head screw.
The lead screw is protected from chips by the protective tube (10).

The tailstock

The ribbed tailstock housing is made of aluminium dye casting.



Function:

The tailstock serves for holding long workpieces. For this purpose, the revolving centre, included in the basic equipment and already mounted, is used.

After loosening the clamping screw (1), the tailstock can be moved on the lathe bed and clamped again at any desired position.

The tailstock sleeve (2) can be adjusted by turning the handwheel by a maximum of 28 mm (1.1") and is to be fixed with the knurled screw (4).

A graduated ring (6) is attached to the handwheel (3).
If you turn the handwheel by one pitch, the sleeve is then moved by 0.05 mm (.002").

The sleeve nose serves for mounting the revolving centre or the three-jaw chuck.

The mounting threads on the sleeve nose, main spindle and vertical unit, are the same size in order to facilitate variations during tool clamping.

The sleeve nose is fixed to the sleeve in an off-centre way.

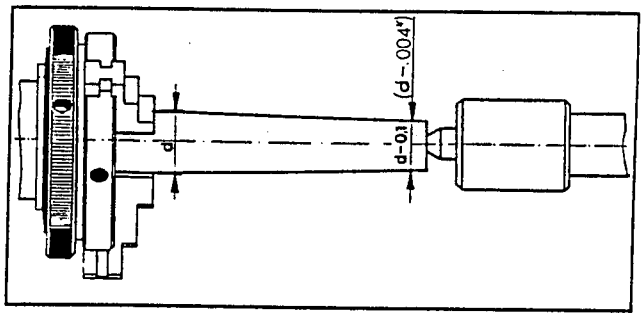
It can be adjusted by means of the adjustable eccentric cam (5) by 0.38 mm (.015") parallel to the slide level.

Loosen the socket head screw (7) beforehand for this purpose. In this way, the sleeve and the main spindle can be aligned exactly.

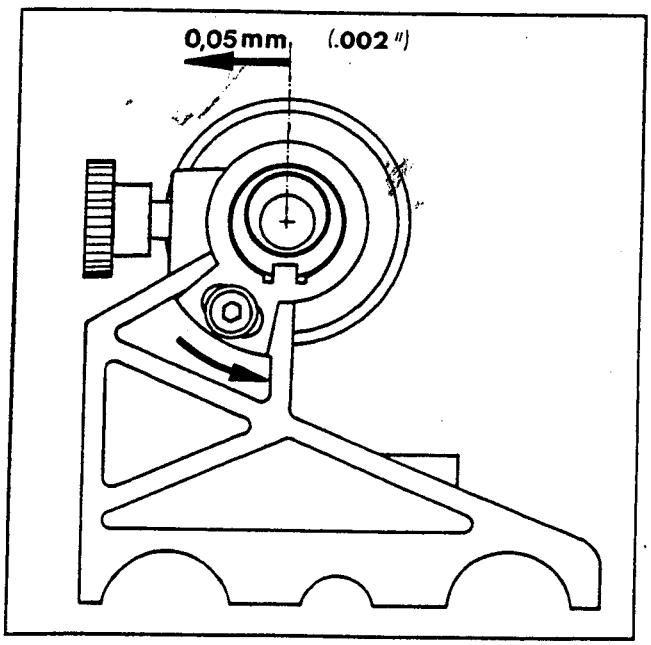
The eccentric cam has an adjustment range of 17°.

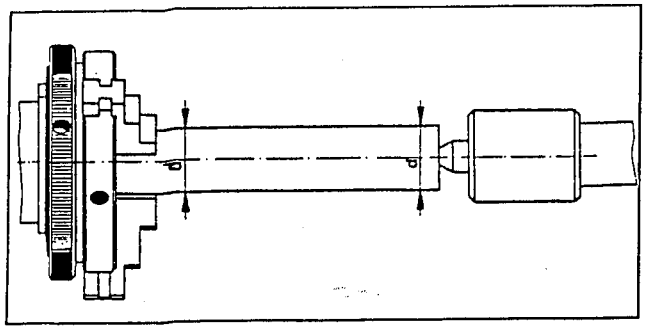
Example of eccentric adjustment:

You notice a deviation of 0.1 mm (.004") in the diameter during longitudinal turning of a shaft. (Conical workpiece)



Now, turn the eccentric cam, until the tip of the tailstock is 0.05 mm (.002") further to the rear (measure with dial gauge).





The workpiece can then be turned cylindrically again.

Note:

- When adjusting the tailstock centre to the workpiece, turn the handwheel (3) with care, so that the end support is not too strong.
- When fixing the tailstock to the guide columns, do not tighten the socket head screws (1) too tightly, either.
- Only allow the tailstock sleeve (2) to protrude as little as possible from the tailstock in every case.
  In this way, a stable end support is guaranteed.
- Always clamp the workpiece into the chuck up to the stop, if possible.

The revolving centre

The revolving centre included in the basic equipment is already mounted to the tailstock.
Together with the tailstock, it serves as an end support for long workpieces.
The rotating centre is screwed onto or unscrewed from the tailstock sleeve by hand.

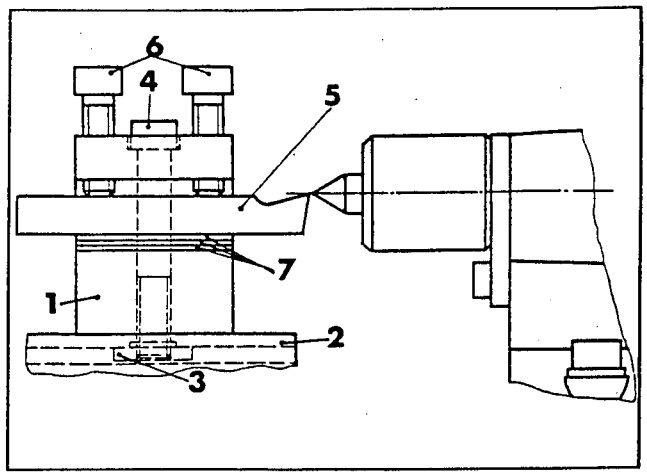
Counterclockwise rotation of the revolving centre = unscrewing the revolving centre

Clockwise rotation of the revolving centre = screwing on the revolving centre

The revolving centre is lubricated for life.

The toolpost

The toolpost (1) is fixed on the cross slide (2) with a T-nut (3) and a socket head screw (4).
Various turning tools (5) are clamped in the toolpost with the two allen screws (6) according to the type of machining. Always clamp your turning tools in the toolpost, so that they protrude as little as possible.
A turning tool, which protrudes too far, vibrates, causes chattering and a rough workpiece surface.
The turning tools must be clamped in such a way that the main cutting edge is exactly at the height of the centres.
Thus, if required, put steel spacers (7) under the turning tool.



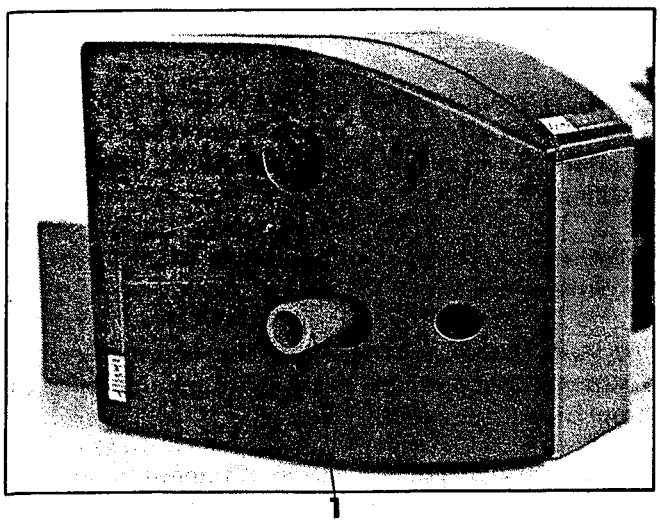
The main motor

The main motor can be reversed (necessary for thread cutting).
The main spindle is driven by the main motor and the drive for the lead screw is also carried out by the main motor via the change gear box.

The lead screw

The lathe can automatically carry out feed movements in the longitudinal axis with the switch-on lead screw.

This function is used for thread cutting or for work with the automatic feed.
The lead screw can be switched on by pulling out the sleeve (1).
When the lead screw is "switched off", the infeed in the longitudinal axis is carried out via the handwheel attached to the lead screw.
The machine is secured against overloading by a shear pin integrated in the lead screw. (See "Maintenance, care and servicing".)

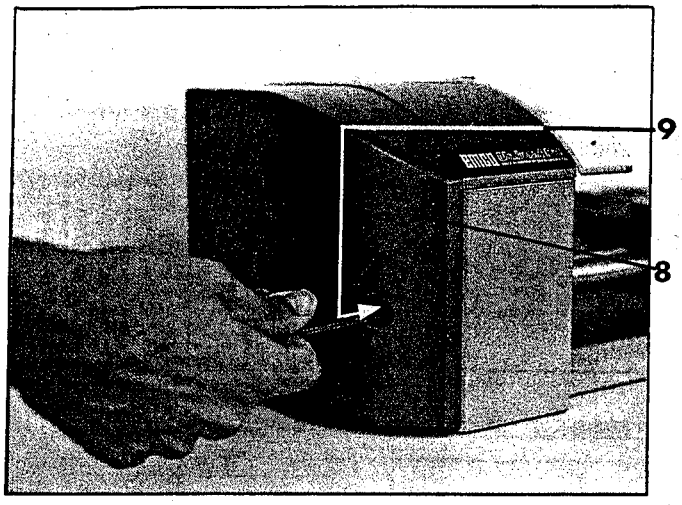


The speed and feed setting is described in the following.

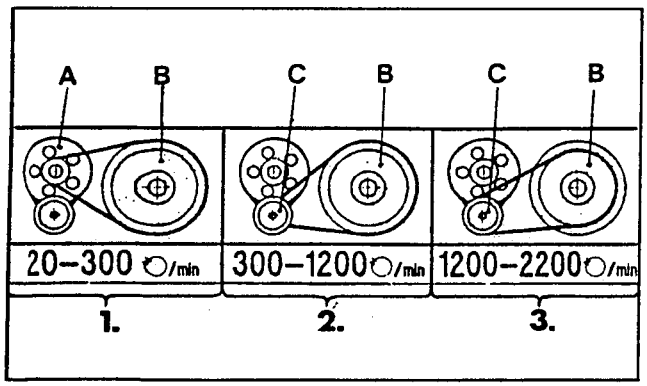
The cutting speed - feed table

a) Speed of the main spindle [rpm]

The speed of the main spindle can basically be set into three speed ranges (see cutting speed - feed chart on the inner side of the cover).



For this purpose, open the cover (8) by turning the socket head screw (9) by 90° to the left.



1. Cutting speed range from 20 - 300 rpm (red)

   The toothed belt is positioned on the countershaft pulley (A) and at the large diameter of the pulley (B).

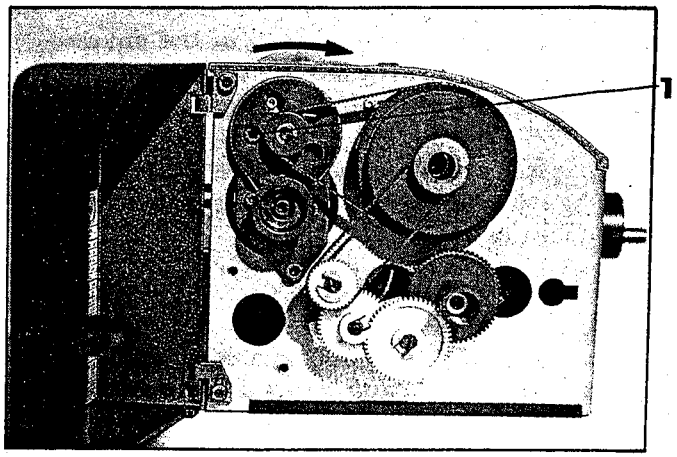
2. Cutting speed range from 300 - 1200 rpm (green)

   The toothed belt is positioned at the small diameter of the motor pulley (C) and the large diameter of the pulley (B).

3) Cutting speed range from 1200 - 2200 rpm (blue)

   The toothed belt is positioned at the large diameter of the motor pulley (C) and the small diameter of the pulley (B).

Shifting the toothed belt:



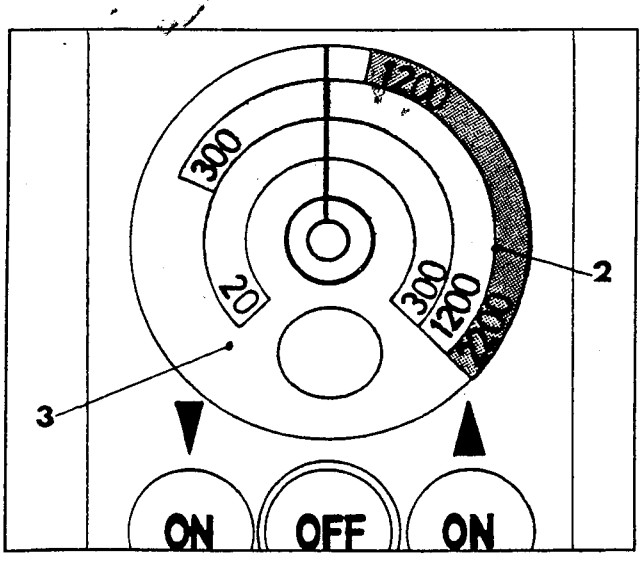
- Loosen the socket head screw (1) and swivel the countershaft pulley in the direction of the arrow.
- Shift the toothed belt.
- Push the countershaft pulley in the opposite direction to the arrow and tighten the socket head screw (1) again.

Note:
If the toothed belt slips off during the machining (clicking noise), it should be tensioned somewhat more tightly or the cutting depth or the feed should be reduced.

If the drive belt is tensioned too tightly, its working life is shortened.
After setting the cutting speed range, close the cover again.

In the 1st cutting speed range (20 - 300 rpm), the belt must be tensioned stronger than, e.g., in the 3rd cutting speed range (1200 - 2200 rpm) due to the larger speed reduction.

Fine adjustment of the cutting speed



The exact speed in the respective cutting speed range can be adjusted via the adjusting knob (3). The label on the front (2) shows three differently coloured speed ranges.
According to the set cutting speed of the drive unit, the respective scale of the front label is used for the exact setting of the cutting speed.

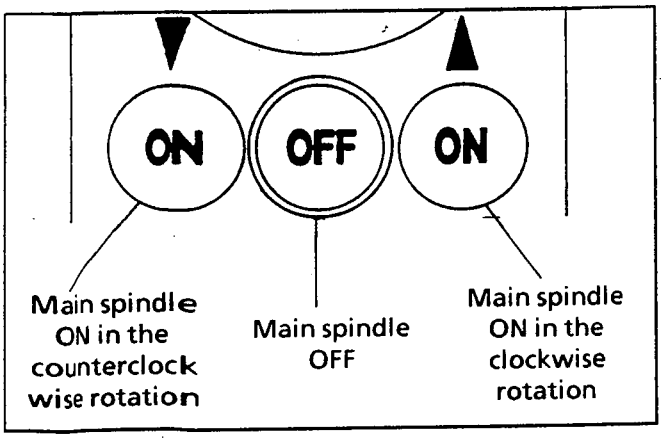
The cutting speed development in the respective cutting speed ranges (red, green, blue) is approximately linear.

Example:
The cutting speed setting 750 rpm is located in the middle of the 2nd cutting speed range (300 - 1200 rpm).

Attention:
Never regulate the cutting speed of the main spindle below the respective coloured cutting speed range. It may happen that the required torque is no longer achieved.

Switching on the main spindle

The main motor can be reversed.
The main spindle can be switched on or off in the counterclockwise or clockwise rotation with the following keys and the slide feed direction can be switched over during automatic feed or during thread cutting.

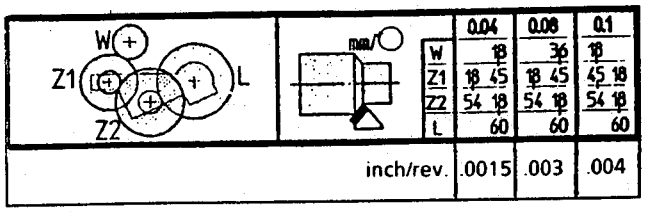


Note:
Before switching on the lathe, read at all costs the chapter "Maintenance, care and servicing".

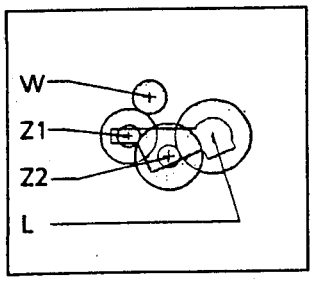
b) Automatic feed of the longitudinal slide [mm/rev.]

You receive a very clean and uniform workpiece surface by turning with the automatic feed. The cranking by hand for the longitudinal feed no longer applies.
The gear combinations for three feeds (0.04, 0.08 and 0.1 mm/rev.) (.0015, .003, .004 inch/rev.) are shown in the cutting speed feed chart (on the inner side of the cover).

The desired feed for the longitudinal slide can be set according to the mounting of the gear combinations.
The gears for the mentioned feeds are already mounted in the basic equipment.



Mounting the gears:



Designation of the axes, on which the gears are mounted. Axes Z1 and Z2 can be moved on the quadrant.

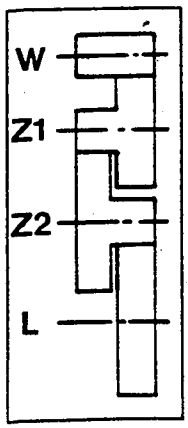
Axes	Desired feed 0.04
W	18
Z1	18 45
Z2	54 18
L	60

Gear with 18 teeth positioned on axis W

This vertical line means that the gear 18 meshes with the gear 45.

Double gear with 45 and 18 teeth

The gears on the right-hand side of this table are positioned on the side pointing to the lathe (right).

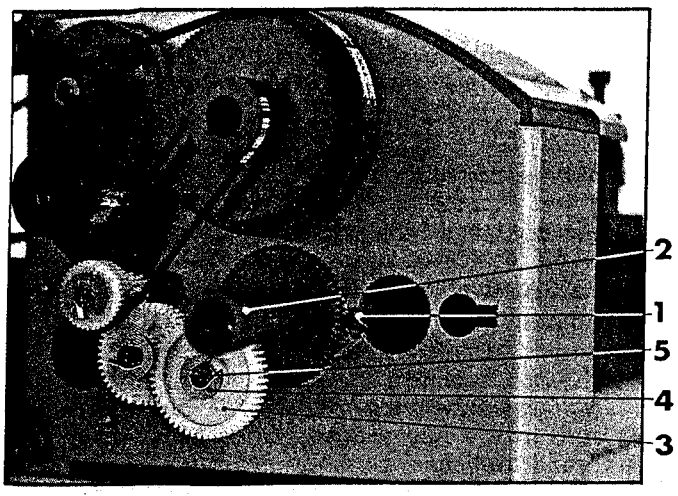


This diagram shows which gears are meshing.

Note:
- When mounting the change gears, always start from the lead screw.

Example:

Desired feed rate 0.04 mm/rev. (.0015").



1. Loosen the socket head screw (1) and swivel the quadrant downwards. The gear 60 is mounted on the lead screw (axis L).

2. Pull out the sleeve (2). (In this way, the feed of the longitudinal slide is switched on.)

3. Mounting the gear 54 18 (3) on axis Z2:

   - Allow the gears to mesh, so that a toothed flank play of approx 0.1 mm is given.

   - A flank play must be present, otherwise the wear of the gears is considerably increased. The flank play reduces in no way the pitch accuracy during thread cutting or the feed.

   - Put the bayonet washer (4) on axis Z2 and tighten the countersunk screw (5).

   This procedure is to be used for all meshing gears.

4. Mount gear 18 45 on axis Z1.

5. Mount the wide gear 18 on axis W.

6. Swivel the quadrant upwards and clamp it with the socket head screw (1).

7. Close the cover.

8. Push in the sleeve (2). (In this way, the longitudinal slide cannot move by accident, when the lathe is switched on.)

Recommended feed rates depending on the material to be machined:

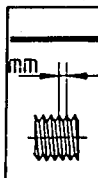
Material	Feed [mm/rev.]	[inch/rev.]
Steel	0,04	.0015
Aluminium	0,08	.003
Plastic	0,1	.004

c) Thread pitches - gear combinations

It is possible to cut threads with the following thread pitches with the change gears supplied in the basic equipment: 0.2; 0.3; 0.6; 0.75; 1.5 mm.

The other pitches listed in the tables can only be achieved by means of the accessorial metric gear set or the inch gear set.

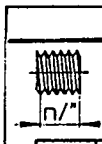
Thread pitches for metric threads [mm]



mm	0.125	0.2	0.225	0.25	0.3	0.35	0.4	0.45
W	18	36	18	36	18	18	18	36
Z1	45 18	45 18	45 18	45 18	18 54	45 18	45 18	45 18
Z2	48 20	54 18	32 24	48 20	45 18	24 28	24 32	32 24
L	60	60	60	60	60	60	60	60

mm	0.5	0.6	0.7	0.75	0.8	1.0	1.25	1.5
W	18	36	36	18	36	36	36	36
Z1	45 18	18 54	45 18	54 18	45 18	45 18	54 18	54 18
Z2	18 30	45 18	24 28	18 45	24 32	18 30	24 50	18 45
L	60	60	60	60	60	60	60	60

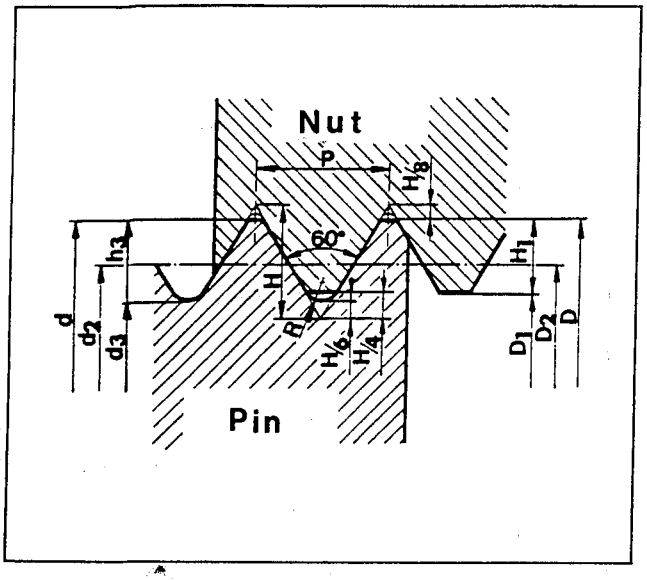
Inch threads [rev./inch]



n/"	16	18	20	24	32	36	40	48	56	64
W	36	36	36	36	18	18	18	18	36	18
Z1	54 18	54 18	45 18	45 18	54 18	54 18	45 18	45 18	45 18	45 18
Z2	17 45	17 40	17 36	17 30	17 45	17 40	17 36	17 30	41 31	31 41
L	60	60	60	60	60	60	60	60	60	60

The mounting of the individual gear combinations and the switching on of the feed are carried out in a similar way to the feed for the longitudinal slide (see point b).

Dimensions of metric ISO threads (Standard thread)

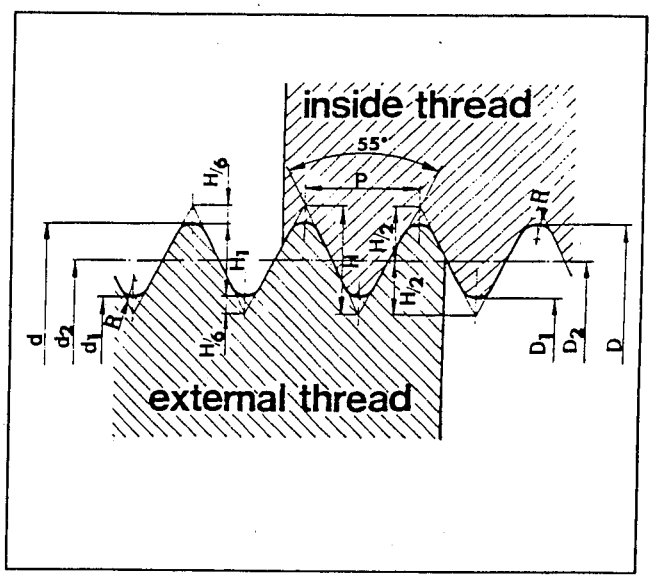


$D = d$	=	Thread nominal diameter
P	=	Thread pitch
$H = 0.866\ P$	=	Height of triangle
$h_3 = 0.6134\ P$	=	Thread depth of the pin
$H_1 = 0.5413\ P$	=	Thread depth of the nut
$R = 0.1443\ P$	=	Rounding
$D_2 = d_2 = d - 0.6495\ P$	=	Flank diameter
$d_3 = d - 1.2269\ P$	=	Core diameter of the pin
$D_1 = d - 1.0825\ P$	=	Core diameter of the nut
60°	=	Flank angle

Some thread sizes:

Thread nominal diameter d = D mm	Thread pitch P mm	Flanks ⌀ $d_2 = D_2$ mm	Core diameter		Thread depth	
			Pin d_3 mm	Nut D_1 mm	Pin h_3 mm	Nut H_1 mm
M3	0.5	2.675	2.387	2.495	0.307	0.271
M4	0.7	3.545	3.141	3.242	0.429	0.379
M5	0.8	4.480	4.019	4.134	0.491	0.433
M6	1	5.350	4.773	4.917	0.613	0.541
M8	1.25	7.188	6.466	6.647	0.767	0.677
M10	1.5	9.026	8.160	8.376	0.920	0.812

Measurements - British Standard Whitworth



$P = \frac{1}{n}$	=	Pitch
$R = 0.137329\ P$	=	Radius
$H = 0.960491\ P$	=	Triangular Height
$H_1 = 0.640327\ P$	=	Depth of Thread
$e = 0.0739176\ P$	=	Depth of Rounding

Some thread sizes:

Nominal Size Inches	Threads per Inch	Pitch Inches	Depth of Thread. Inches	Major Diameter, Inches
3/8	16	0.06250	0.0400	0.3750
5/16	18	0.05556	0.0356	0.3125
1/4	20	0.05000	0.0320	0.2500
3/16	24	0.4167	0.0267	0.1875
3/16	32	0.03125	0.200	0.1875
1/8	40	0.02500	0.0160	0.1250

Nominal Size Inches	Effective Diameter, Inches	Minor Diameter, Inches	Area at Bottom of Thread, Square in.	Tap. Drill. Diam.
3/8	0.3350	0.2950	0.0683	5/16 in.
5/16	0.2769	0.2413	0.0457	6.50 mm
1/4	0.2180	0.1860	0.0272	5.10 mm
3/16	0.1608	0.1341	0.0141	3.70 mm
3/16	0.1675	0.1475	0.0171	5/32 in.
1/8	0.1090	0.0930	0.0068	2.55 mm

5. Technical data

The feed (s)

The feed size (s) is the path of the turning tools during one workpiece revolution [mm/rev.] [inch/rev.] or during a minute [mm/min.] [inch/min.].

The feed of the turning tool can -

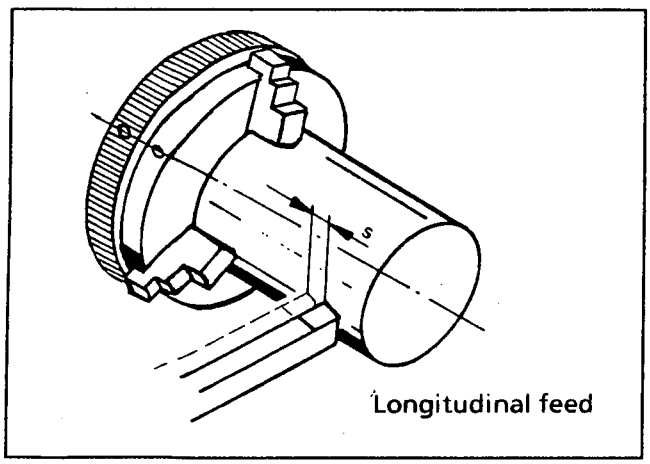
1. be carried out by hand: By activating the longitudinal, cross or top slide handwheel;

2. be carried out automatically via lathe feed (see cutting speed - feed chart) or via the stepping motors (control via PC).

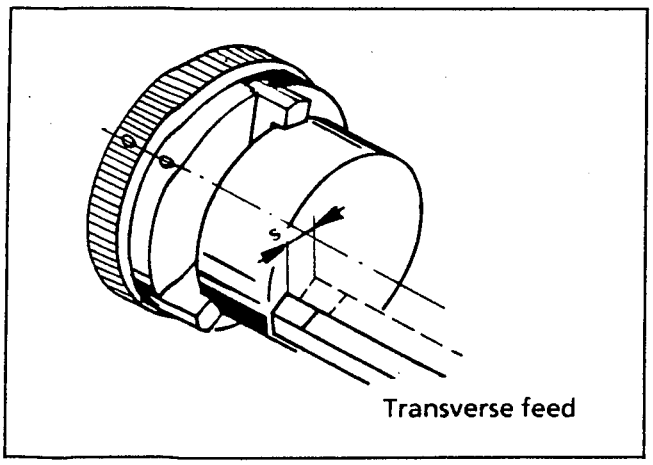
The two main types of feed:

A) Longitudinal feed:
The turning tools are guided exactly parallel to the rotary axis of the workpiece.

B) Cross feed (transverse feed):
Guidance of the turning tools exactly at right angles to the rotary axis.



Longitudinal feed



Transverse feed

Why the different feed sizes?

Coarse (large) feed:
- For roughing cuts
- If much material should be cut off in as short a time as possible
- If the surface quality is not of great importance (rough surface).

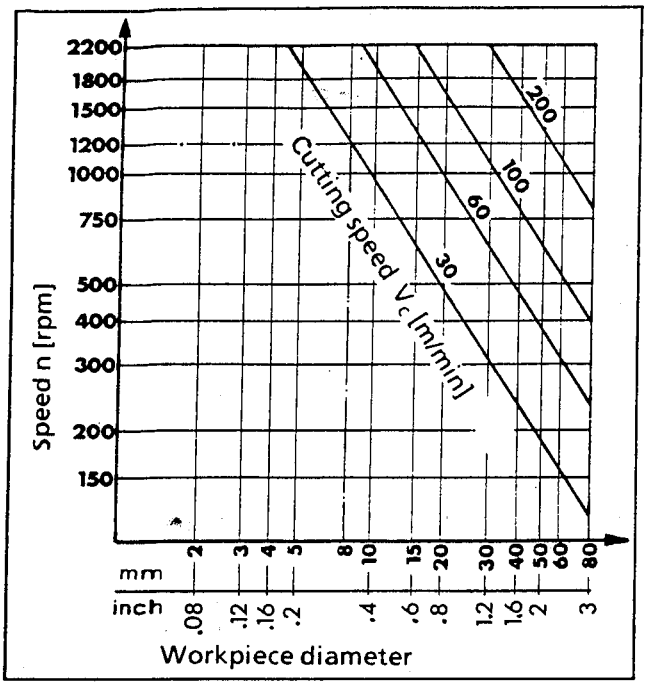
Fine (small) feed:
- When fine surfaces are desired or for finishing cuts.

Recommended feed rates depending on the material to be machined:

Material	Feed [mm/rev.]	[inch/rev.]
Steel	0,04	.0015
Aluminium	0,08	.003
Plastic	0,1	.004

Selectin g the cutting speed:

It is possible to determine the respective cutting speed according to the machining technology from the following table.



Recommended cutting speed V_c m/min	ft/min	Tool used	Workpiece material
30	100	HSS - turning tool	Steel
60	200	HSS - turning tool	Aluminium
100	330	HM - insert plate	Steel
200	660	HM - insert plate	Aluminium

Example:

Tool: HSS turning tool
Workpiece: Steel
Workpiece diameter: 8 mm (.3") } V_c = 30 m/min (100 ft/min)

↓

Cutting speed = 1200 rpm

Selecting the maximum cutting depth for the given workpiece diameter and the known cutting speed:

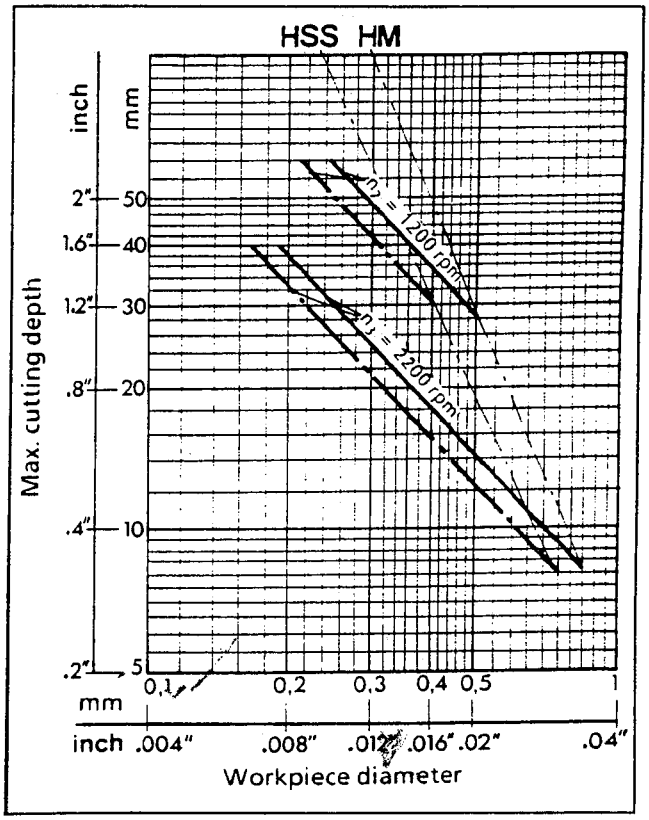
The following diagram is valid for the following technical data:

1. Machining material: Aluminium Torradur B
   Feed: 0.08 mm/rev.
2. Machining material: Steel 9S20
   Feed: 0.04 mm/rev.

The characteristic curves (n_2 = 1200 rpm, n_3 = 2200 rpm) shown in this diagram cover the cutting depths, for which good surface qualities of the workpieces are obtained.

If cutting depths are used, which are larger than the cutting depths covered by the characteristic curves, the surface quality of your workpiece will not be satisfactory. Thus, you should only work with cutting depths, which are covered by the characteristic curves.

The characteristic curves for the covered cutting depths end at the limit lines (HSS, HM) according to the cutting speed.



Tool → Hard metal: ——————
Tool → HSS: —— . —— . ——

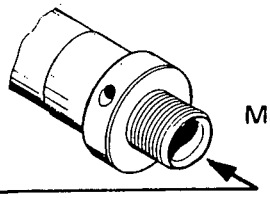
Explanatory example:
Workpiece diameter 20 mm (.8"); tool HSS; aluminium workpiece; cutting speed 1000 rpm (put this characteristic curve into your diagram accordingly.) These values would result in a cutting depth of 0.7 mm with an extended characteristic curve. The ideal cutting depth should not exceed 0.35 mm (.015"), however, for this cutting speed.

6. Accessories - working tips

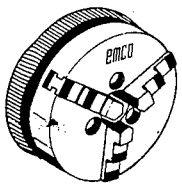
Clamping devices of the main spindle

In accordance with the type of workpiece and the type of machining, the workpiece is clamped into the various clamping devices. The clamping devices are first screwed onto the spindle nose and tightened (clockwise). To support them during the tightening, you can use the clamping pin. The clamping pin is put into the cross bore of the main spindle for this purpose. The thread from the spindle nose and clamping tool must always be free from contamination.

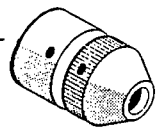
Overview



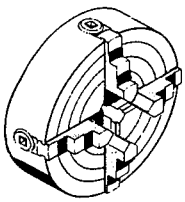
Main spindle



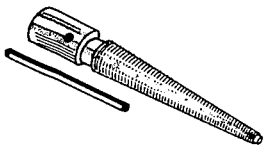
Three-jaw chuck Ø 55 mm (Ø 2.2")
This serves for central clamping of round or hexagonal material.



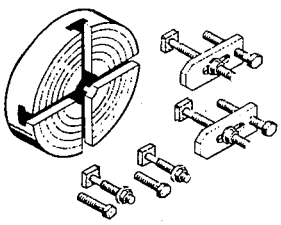
Collet chuck attachment ESX 16
Highest rotary accuracy for drills, milling cutters and short workpieces.



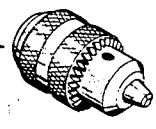
Independent chuck Ø 55 mm (Ø 2.2")
Each jaw is individually adjustable and reversible. The independent chuck enables the clamping of unsymmetrical and differently profiled workpieces.



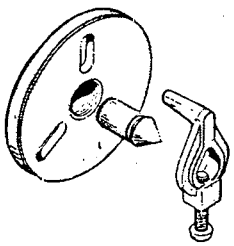
Dentist spindle
For the input of felt discs, cloth discs, round brushes, etc.



Clamping plate
The workpiece is clamped onto the clamping plate with clamping shoes. Large workpieces, which can no longer be clamped with the three-jaw chuck or the independent chuck, can be fixed.



Three-jaw drill chuck
This is screwed directly onto the main spindle. For this purpose, push the supporting ring 20x14x1.4 supplied in the basic equipment onto the mounting thread of the sleeve. (The main use of the three-jaw drill chuck is, however, on the tailstock.) It is also suitable, however, for the mounting of twist drills, combined drills, milling cutters, core drills, etc., and of workpieces with a diameter of up to 8 mm (.3").



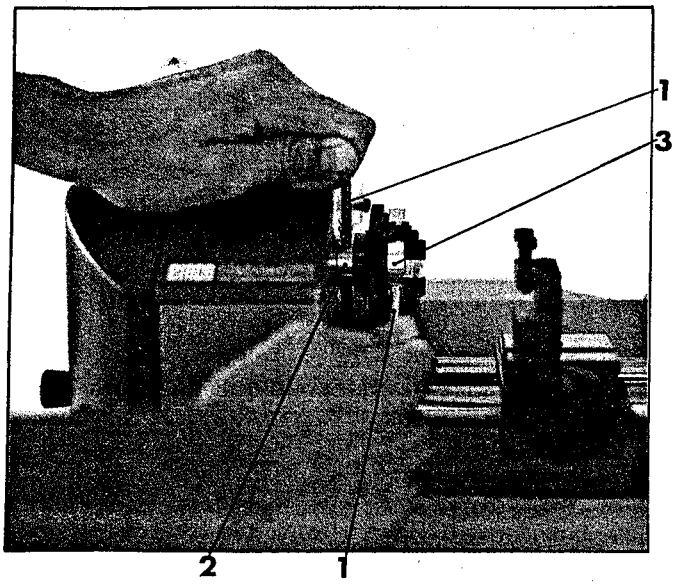
Turning equipment between the centres
This guarantees the highest rotation accuracy even if the workpiece is clamped and unclamped several times. Use for long workpieces with tailstock support.

The three-jaw chuck

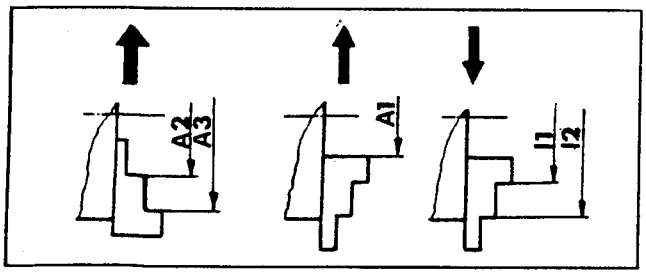
The three-jaw chuck is the clamping tool, which is most often used. The workpiece is automatically centred during the clamping in the three-jaw chuck.

Mounting the three-jaw chuck

Screw on the three-jaw chuck clockwise onto the main spindle nose and tighten it.
Use a plain pin (1) for counter holding during the tightening.
For this purpose, put a plain pin each into the cross bore of the main spindle (2) and into the chuck housing (3).
The thread of the main spindle nose and the three-jaw chuck must always be free from contamination.



Clamping capacities of the chuck

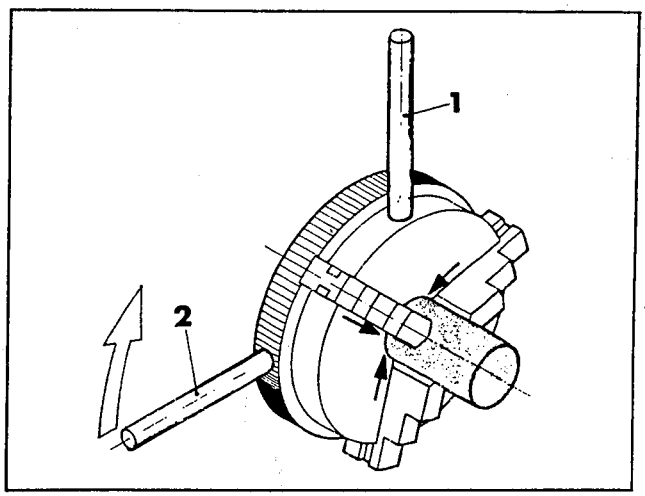


Workpiece clamped on the outer diameter		Workpiece clamped on the inner diameter	
Measure-ment	Maximum clamping diameter	Measure-ment	Maximum clamping diameter
A1	22 mm (.86")	I1	36 mm (1.4")
A2	32 mm (1.26")	I2	54 mm (2.1")
A3	50 mm (2")		

Never exceed the clamping capacities!
This could cause the chuck teeth to break - the jaws and the workpiece would be thrown out and could cause severe injuries.

Clamping procedure:

If a workpiece is clamped on the inner diameter, the clamping is carried out counterclockwise.
The jaws are stepped outside for this purpose.

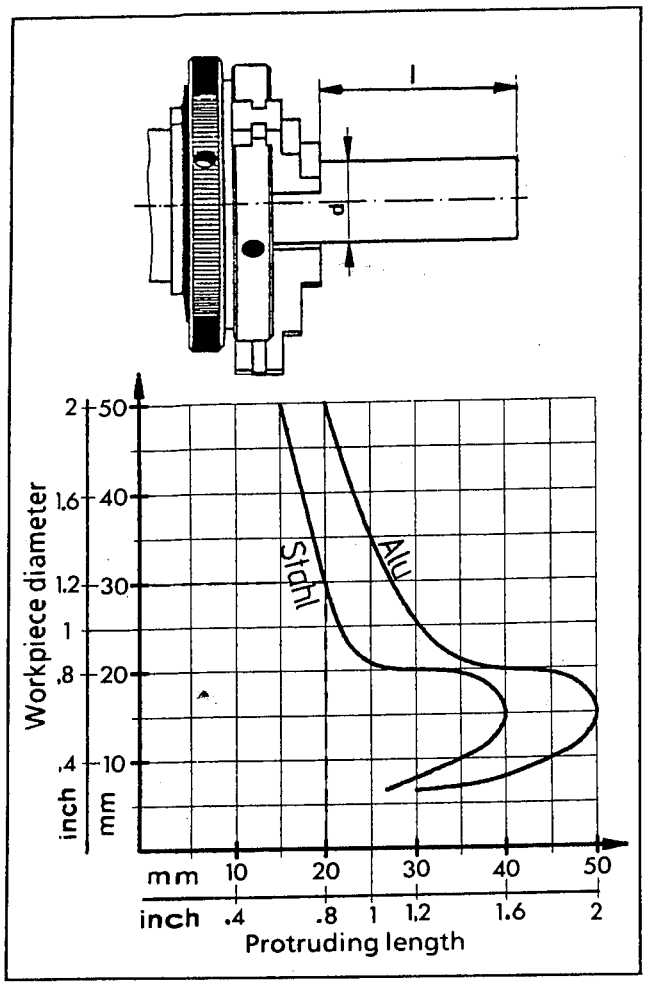


Hold the housing tight with the plain pin (1) and turn the independent chuck with the pin (2).

Note:

- Always clamp your workpieces into the chuck up to the stop, if possible.
  Only in this way can the clamping be guaranteed as tight and secure.
- If required, cover the finished surface of the workpiece with a paper strip before clamping it into the three-jaw chuck, so that the surface is not damaged.
- For rapid machining, the workpiece may only protrude a certain protruding length l out of the chuck in order to guarantee a secure clamping.

  The protruding length l also depends on the material, which is clamped.
  Use the following diagram for determining the protruding length l.



Example:
Workpiece diameter: 30 mm (1.2")
Material: Steel

↓

Maximum protruding length 20 mm (.8")

If longer workpieces are machined, you can use the revolving centre at the tailstock sleeve as an end support.
For this purpose, a centre bore is drilled into the workpiece beforehand.

Drilling a centre bore into the front side of the workpiece:

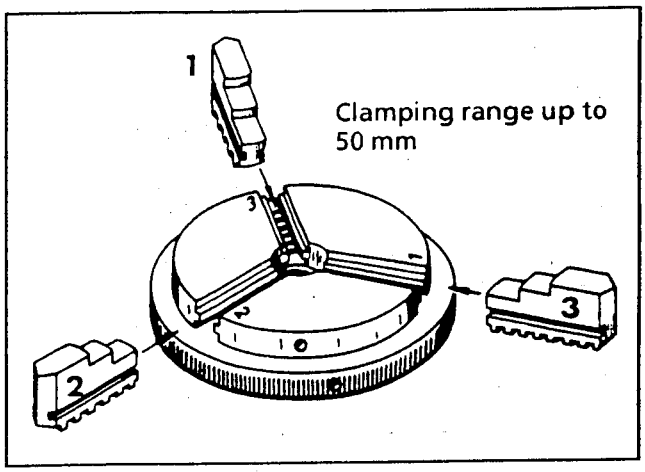
The workpiece is clamped in the three-jaw chuck and turns.
(Speed = approx. 1.500 rpm.)
Drill chuck with centre drill is moved in the direction of the workpiece by turning the handwheel. The tailstock is clamped.

When centring longer workpieces, the fixed steady (accessories) is used for the additional guidance.

Reversing the jaws

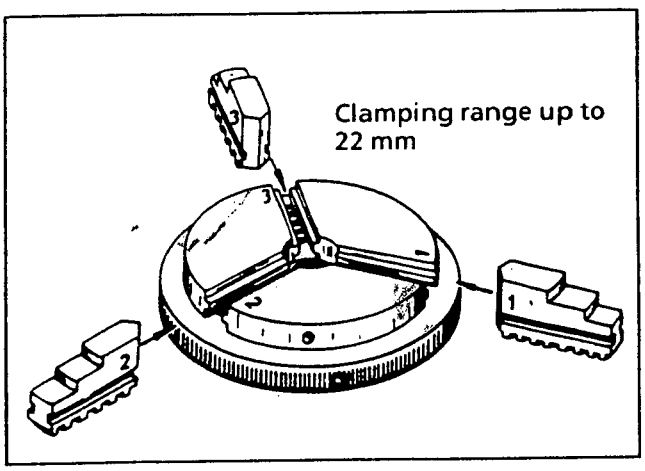
The jaws are unscrewed and cleaned. The knurled tension ring is turned, until the beginning of the spiral thread is just in front of the jaw guide groove no. 1.

The jaw no. 3 is put into the groove no. 1; the tension ring is turned further.
The jaw no. 2 is put into the groove 2, the jaw no. 1 in the groove 3 in the same way.



If the jaws are used as jaws stepped outside again, this happens in this order:

1. Jaw 1 in groove 1
2. Jaw 1 in groove 2
3. Jaw 3 in groove 3

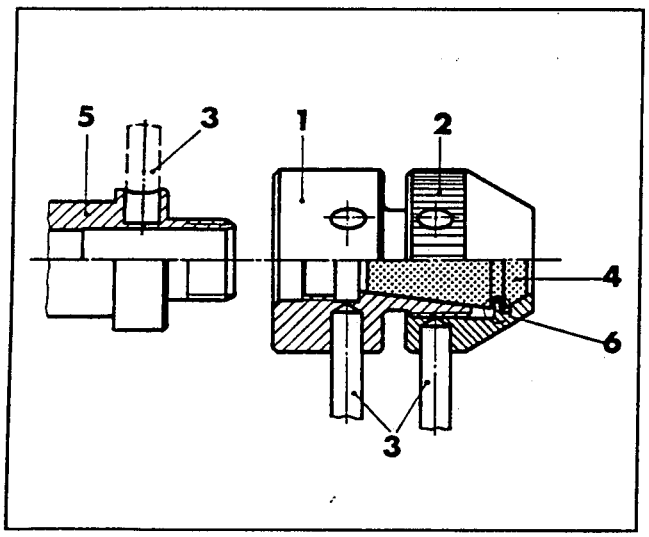


The collet chuck attachment ESX 16

The collet chuck attachment ESX 16 serves for clamping milling cutters, drills, etc., but also round material with a smooth surface, if the highest true running accuracy is required.

Mounting the collet chuck attachment

- Screw on the mounting (1) onto the main spindle (5) and tighten it clockwise with the pins (3).
- Insert the collet (4) off-set into the locking ring (2), so that the eccentric ring (6) engages in the groove of the collet.
- Screw the locking ring (2) together with the completely inserted collet (4) onto the mounting (1).
- Put the tool or round material into the collet and tighten the locking ring (2) clockwise with the pins (3).



Taking out the collet:
Unscrew the locking ring (2) with the pins (3). When unscrewing the locking ring (2), the collet is pushed out by the eccentric ring (6) in the locking ring.

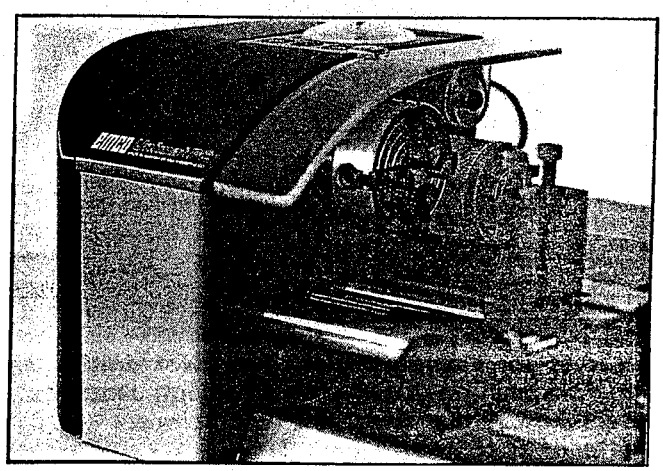
Care:
Before and after use, clean and oil the collets and collet attachment.
Chips and dirt can damage the clamping cone and the clamping taper and reduce the precision.

Available collets:
Collets ESX 16 from 1 - 8 mm or 1/32"- 5/16"

Nominal Ø Inches	Clamping range Inches
1.0 mm / 1/32"	0.5 - 1.0 mm / 0.0197 - 0.0394"
1.5 mm / 3/64"	1.0 - 1.5 mm / 0.0394 - 0.059"
2.0 mm / 1/16", 5/64"	1.5 - 2.0 mm / 0.059 - 0.0787"
2.5 mm / 3/32"	2.0 - 2.5 mm / 0.0787 - 0.0984"
3.0 mm / 7/64"	2.5 - 3.0 mm / 0.0984 - 0.1181"
4.0 mm / 1/8", 764", 5/32"	3.0 - 4.0 mm / 0.1181" - 0.1575"
5.0 mm / 11/64", 3/16"	4.0 - 5.0 mm / 0.1575 - 0.1968"
6.0 mm / 13/64", 7/32", 15/64"	5.0 - 6.0 mm / 0.1968 - 0.2362"
7.0 mm / 1/4", 17/64"	6.0 - 7.0 mm / 0.2362 - 0.2756"
8.0 mm / 9/32", 19,64", 5/16"	7.0 - 8 mm / 0.2756 - 0.3150"

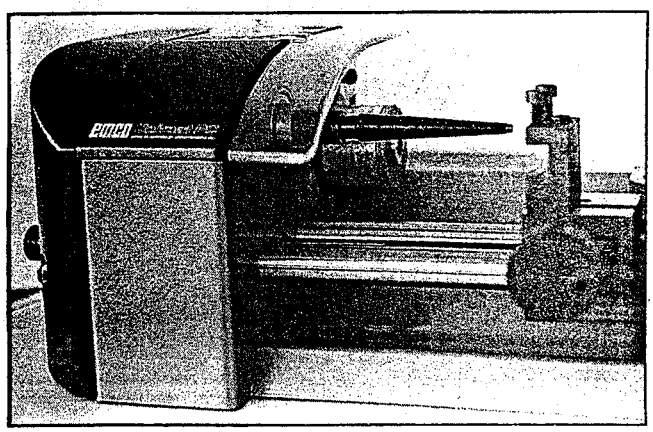
The independent chuck

is screwed directly onto the spindle nose. It is used for clamping round, square, rectangular and uneven shaped workpieces.
Each jaw can be adjusted individually. Workpieces can be clamped centrically and eccentrically.
The jaws can also be used as reversible jaws.



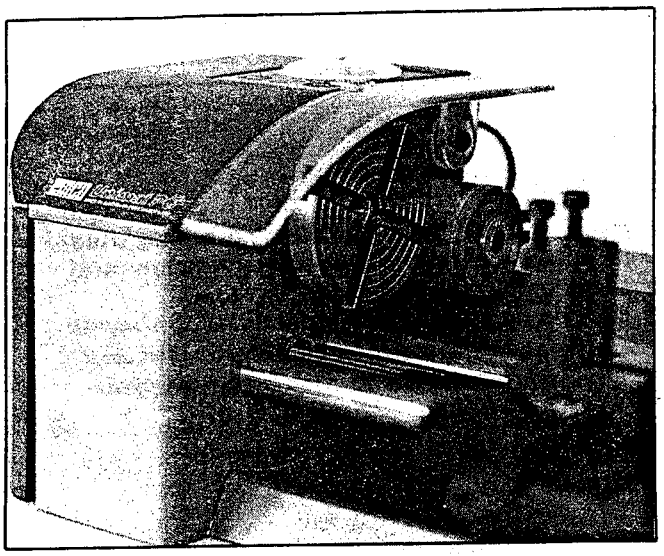
The dentist spindle

The dentist spindle is screwed directly onto the spindle nose. It serves for the mounting of felt discs, cloth discs, round brushes and other grinding and polishing discs. The discs are tightened by the conical thread and align themselves through the centrifugal force.



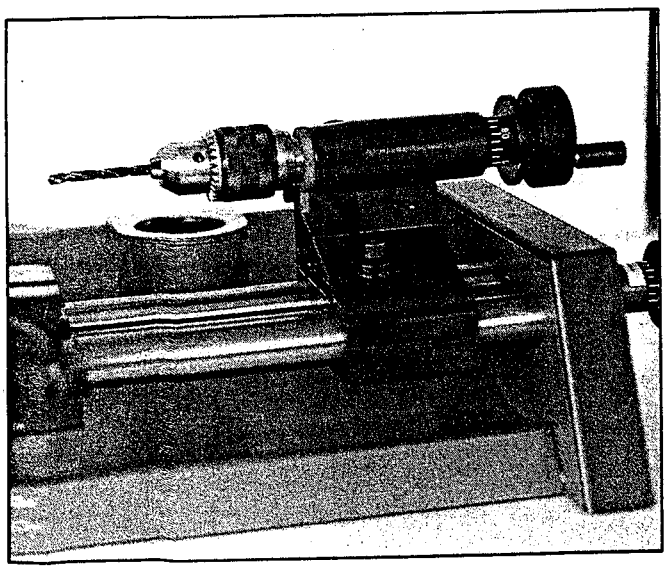
The clamping plate

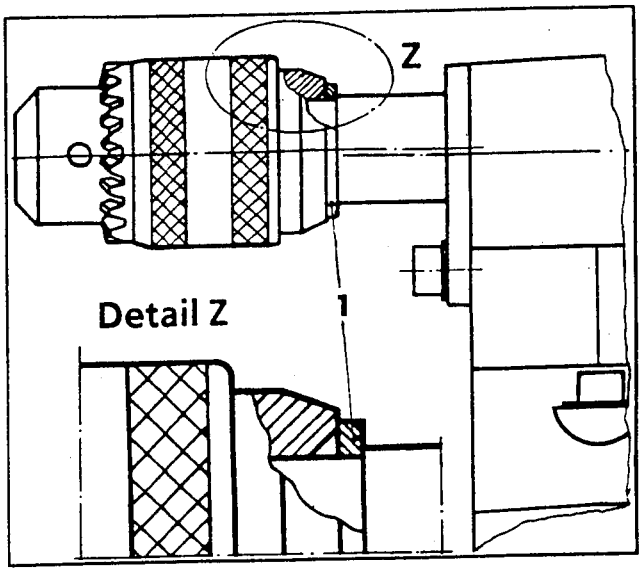
The clamping plate is screwed directly onto the spindle nose and serves for the clamping of uneven or irregular shaped workpieces. Clamping shoes are used for the clamping.
These are suspended into the clamping plate with T-nut screws and supported with hexagon head screws.
Irregular shaped workpieces often cause irregular cycles. Thus, you should machine with low cutting speeds.
Always observe the protruding parts.



The three-jaw drill chuck

This serves for clamping tools, like twist drills, centre drills, milling cutter, core drills, taps, pencil grinders, etc., but also workpieces with a diameter of up to 8 mm (.3").
Depending on the use, it can be screwed directly onto the spindle nose of the main spindle, vertical spindle or tailstock sleeve. Always withdraw the key when not in use.





The supporting ring (1) enlarges the stop surface of the sleeve shoulder.

In this way, a safe stop is guaranteed for drill chucks with a bevel, which is too large for the stop surface.

It can also remain on the sleeve during the use of other clamping devices.

Drilling
Crank the drill backwards from time to time, so that the drill chips are removed from the hole.

Use oil for lubrication and cooling.

The cutting speed during the drilling is dependent on the diameter of the drill.

You can find the cutting speed in the chapter "Technical Data". You only need to exchange the drill diameter for the workpiece diameter.

Cutting internal threads with taps

- Pre-drill the core diameter D1 (D1 = see page 4.9)
- Spot-face the hole with a 90° drill to the thread nominal diameter (e.g., for M5 threads, a bevel with an outer diameter of 5 mm is necessary).
- Clamp the tap in the drill chuck.
- Open the tailstock clamping mechanism.
- Set the smallest cutting speed (20).
- For blind hole threads, mark the maximum thread depth on the tap with chalk or sticky tape in order to be able to switch-over the machine in time.
- Put some cutting oil onto the tap.
- Push the tailstock to the workpiece under constant pressure with your right hand, so that it does not cant. Switch on the lathe to forwards or reverse motion with your left hand.
- Switch the lathe over (change turning direction) for a short time now and again during the thread cutting, so that the chips are broken.

The turning equipment between the centres

Application:
For long, slim workpieces with a high true running accuracy.

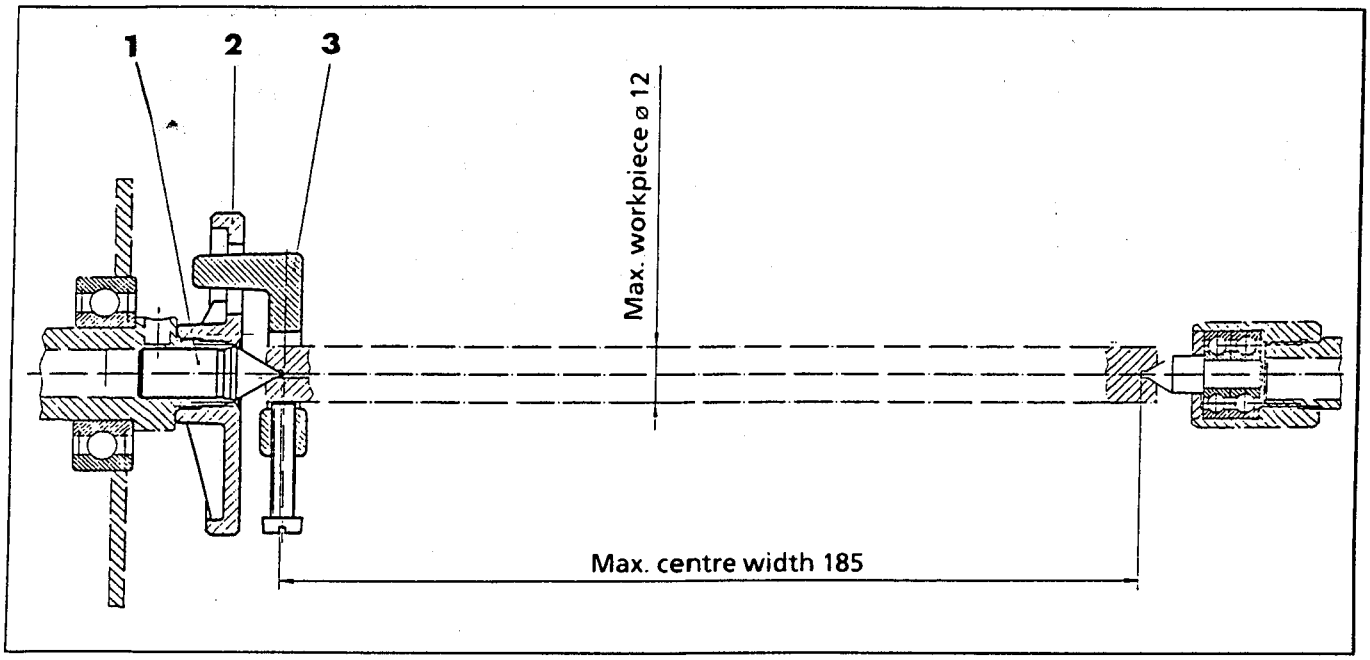
The advantage of turning between centres is that a workpiece can be clamped and unclamped as required without a true running error occurring.

In order to be able to mount the workpiece between the centres, centre boreholes must be made on the front sides first.

Mounting:

- Screw on the driving plate (2).
- Put in the centre point (1).
- Clamp the workpiece together with the lathe dog (3) between the centres. Only allow the revolving centre to protrude from the tailstock as short as possible for this. In this way, you obtain a high stability.

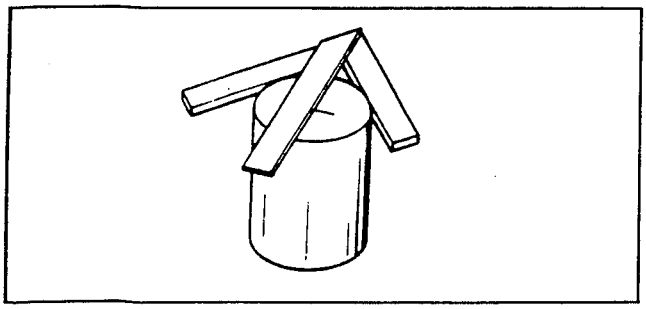
The lathe dog is clamped onto the workpiece in such way that the pin of the lathe dog engages into the slot of the driving plate. Workpieces with a diameter larger than 12 mm (.5") are either turned off so far, that they can be clamped with the lathe dog or a pin is attached to the front side of the workpiece.



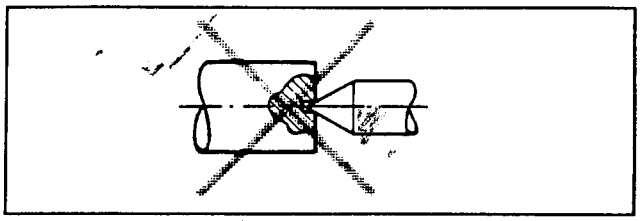
Making a centre borehole:

- If the workpiece is not too long, you can mount it in the turning chuck and centre it. Screw the drill chuck into the tailstock sleeve and clamp centring drill. Start the machine. The drilling feed is carried out by turning the tailstock handwheel.

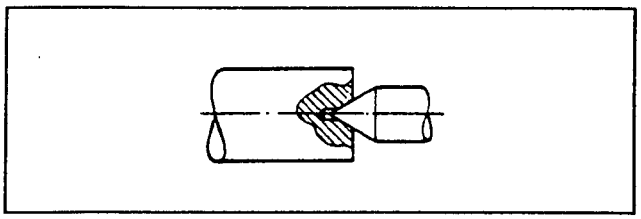
- It is best to make centre boreholes on long workpieces with a hand drill.
  Mark the centre before drilling with a centre ruler or a centre punch.



Wrong:
If the centre borehole is not deep enough, the centre would only touch the sharp corners.



Correct:
The centre fits completely into the 60° centre borehole.



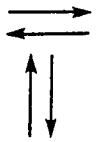
The turning tools

With the Uni mat PC, various turning work, such as longitudinal turning, facing, grooving, parting-off, internal turning, form turning and thread cutting can be done.

For each type of work, the corresponding turning tool is required. - The arrows on the illustrations indicate possible feed directions.

Longitudinal feed

Cross feed (Transverse)



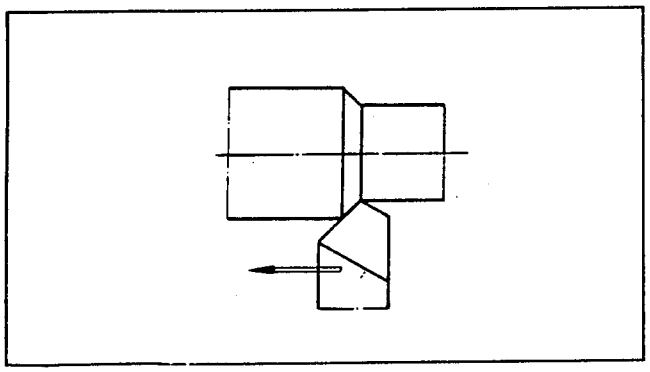
Note the different clamping angles of the turning tools (see illustration!).

Roughing tool

This is used for removing a large amount of material in a short time (no consideration is taken for a good surface quality).

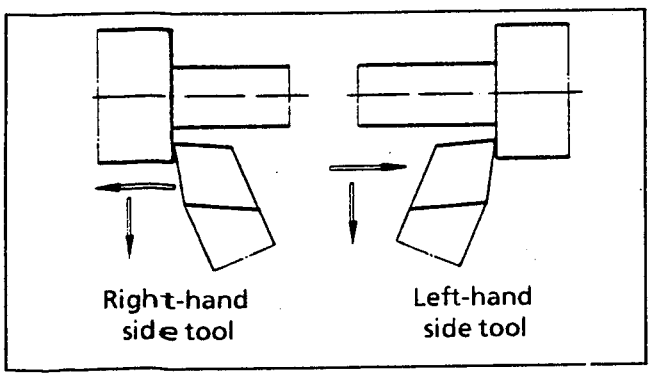
Example: Longitudinal turning

The turning tool is guided parallel to the rotary axis.



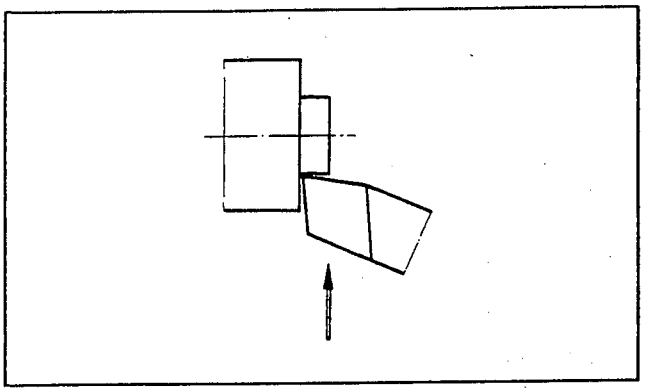
Side tool

This is used for longitudinal and transverse turning and for turning acute corners.



Example: Transverse turning

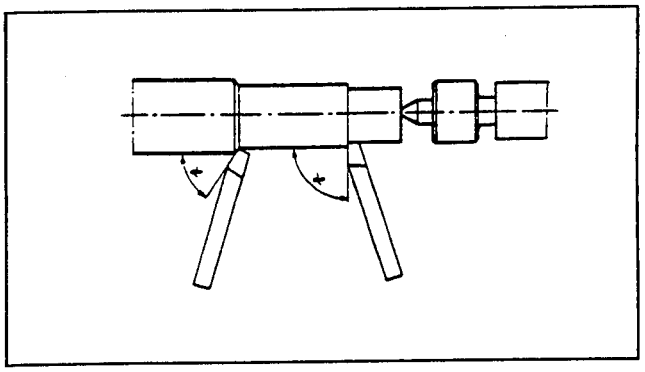
The turning tool is guided at right angles to the rotary axis.



Example: Longitudinal turning

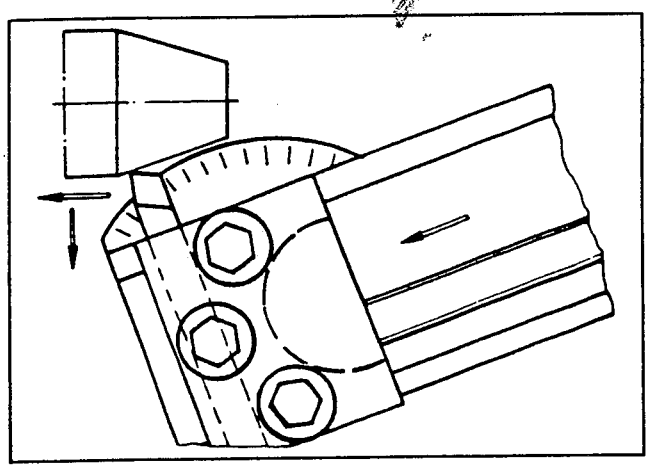
You can obtain an even surface with the automatic feed. The chip shape and surface alter with the angle of incidence " $\varkappa$ " of the turning tool.
Try clamping with various angles $\varkappa$. The best angle is dependent on the material of the workpiece. The angle should not be smaller than 45° in any case.

Select the angle of incidence $\varkappa$ of 90° for slim workpieces with a tendency to bend.



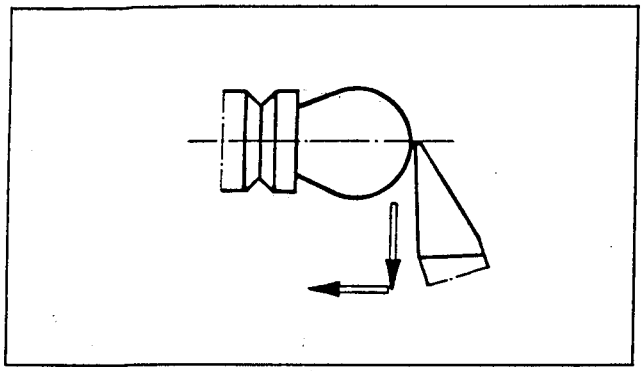
Example: Taper turning

For machining with the top slide, this is turned according to the taper angle and guided along its feed axis.



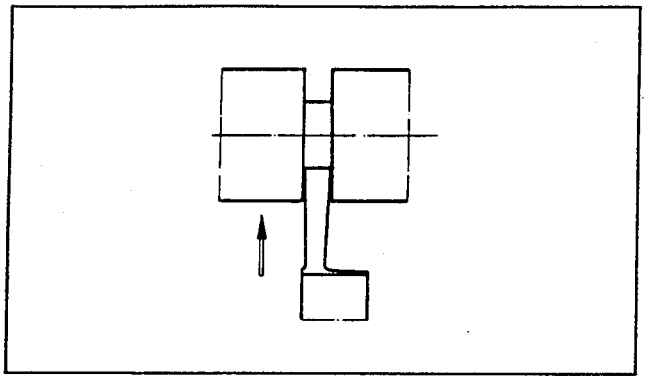
Form turning tool

This is used for special forms, whereby processing takes place with the longitudinal and cross slide at the same time.



Parting-off tool

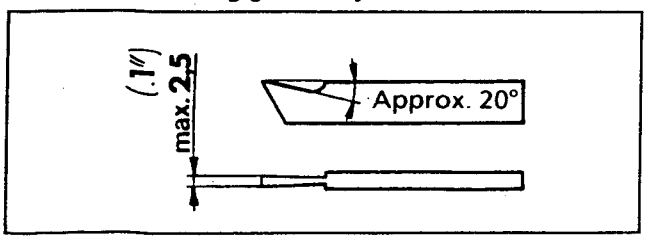
This is used for grooving and parting-off.



Working tips for parting-off

- Clamp the workpiece as short as possible, so that the workpiece is not bent by the cutting pressure.
- The parting-off tool must be clamped exactly at the height of the centres and at right angles to the rotary axis.
- Part off with a low spindle speed.
- Oiling eases the parting-off.
- Clamp the longitudinal slide.

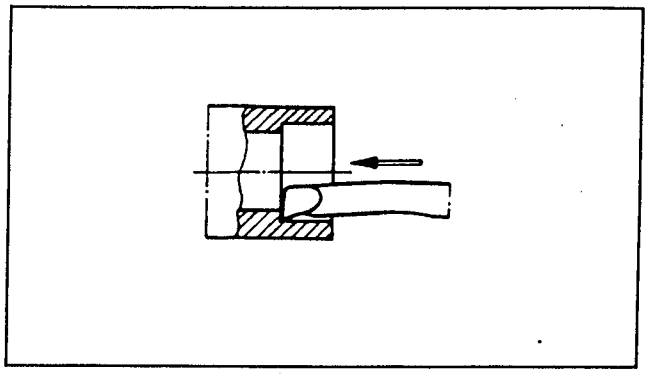
It is recommended to grind the parting-off tool with the following geometry.



In this way, the cutting forces are reduced and finer machining procedures are possible.

Boring tool

The turning tool is guided parallel to the rotary axis.

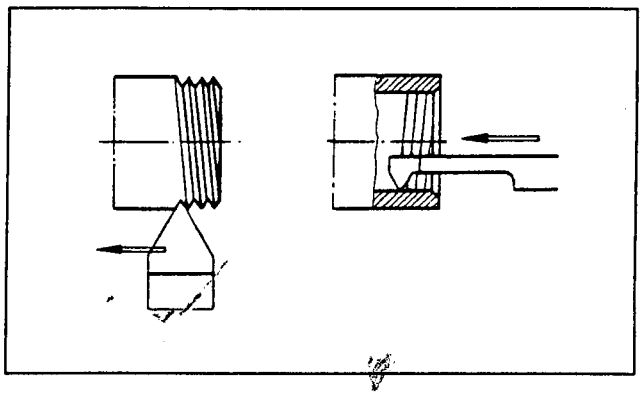


Example: Boring a borehole

After 8 mm (.3"). was pre-drilled with a twist drill, you can start the boring.

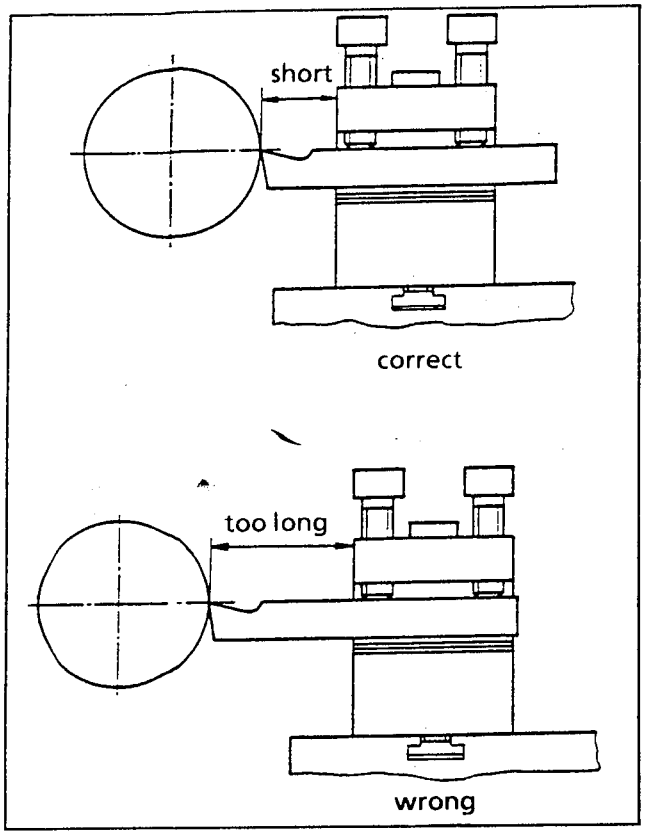
Thread-cutting tool

External and internal cutting tool, flank angle 60°.

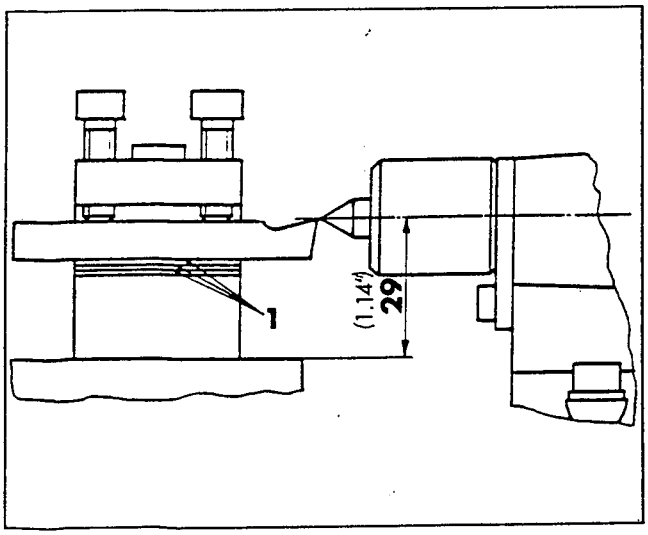


Correct mounting of tools:

Overhang:
Clamp the turning tool with as little overhang as possible. Tools with too much overhang can bend and thus cause rattling and unsatisfactory work surfaces.

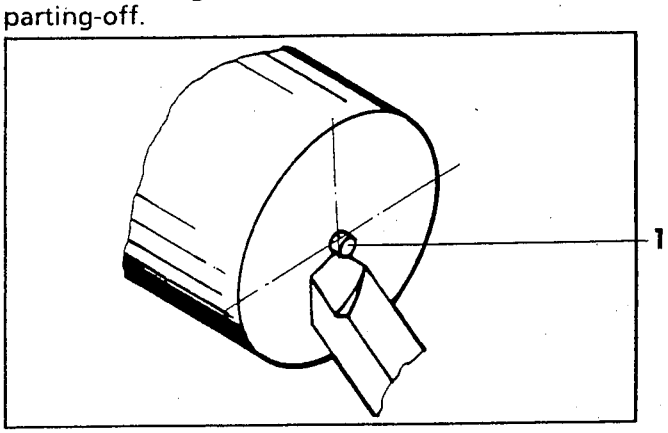


Mounting tools at centre height:
The turning tools must be clamped, so that the main cutting edge is exactly at the centre height of the tailstock. Use spacers of steel (1) to reach the centre height, if required.



The measurement from the tool tip to the surface of the cross slide can be measured for determining the centre height, as well, with the UNIMAT PC. It must amount to 29 mm (1.14") or be slightly above.

If the centre height is not reached, a pin (1) remains during the transverse turning and parting-off.



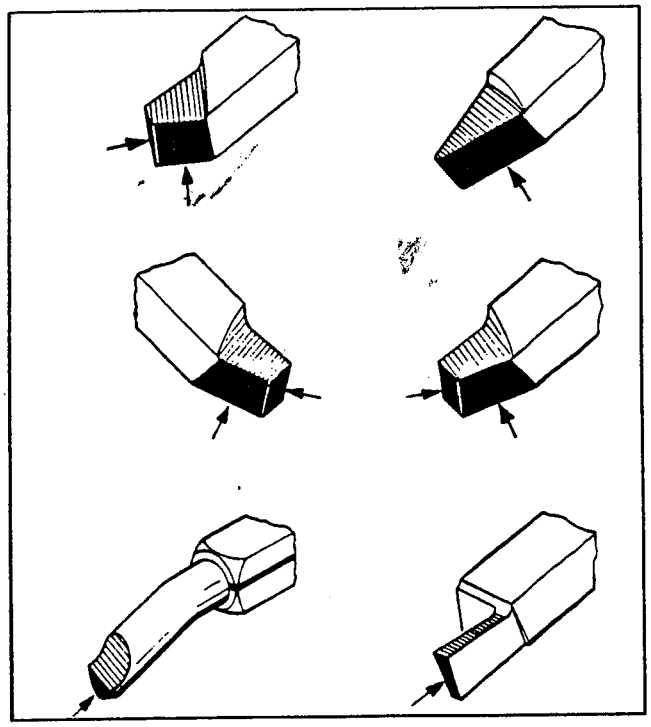
Sharpening the tools:

(Only HSS tools)

After longer use or when turning with too high a cutting speed, the cutting edge of the turning tool is worn off. Dull turning tools cause rough and uneven surfaces as well as unnecessary wear and overload of the machine. For this reason, the dull turning tools should be sharpened immediately.

Re-sharpening with oilstone:
Sharpen only the blackened surfaces of the tools, in no case the ribbed ones.
Note that the angles of the surfaces are not changed.

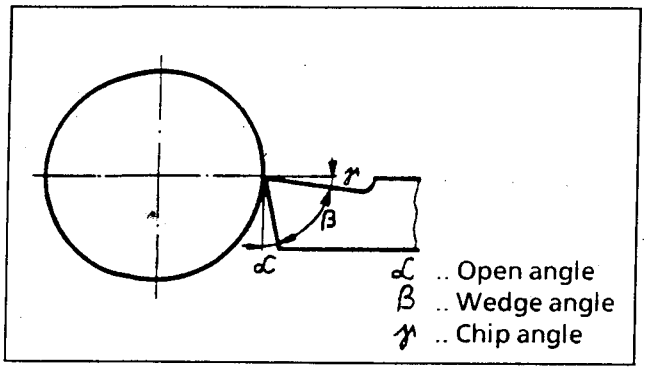
Grinding the tools:
Strongly worn turning tools must be ground. The grinding requires some practice and feeling.
- Grind only blackened surfaces.
- Note that the angles of the surfaces are not altered.



Basic information:

The basic shape of any tool cutting edge is a wedge. This wedge shape (= geometry of the tool cutting edge) must be formed according to the material to be machined in order to gain optimum machining results.

Tool geometry:

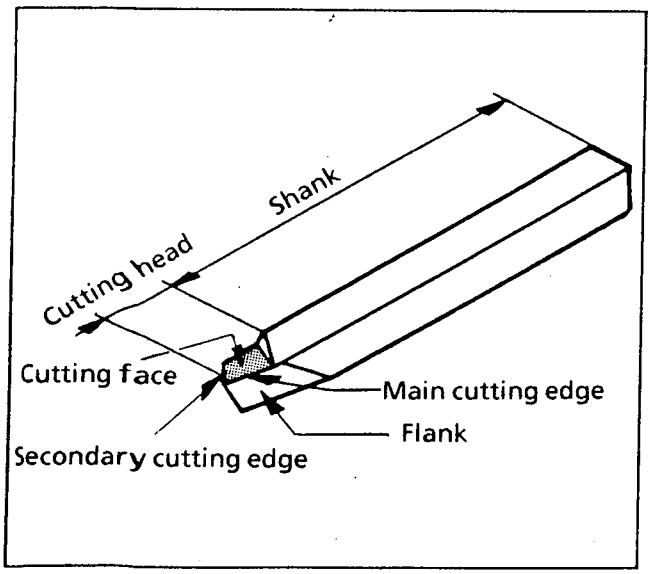


The angle α facilitates the insertion of the cutting tip into the material.

The angle β : larger for softer materials
smaller for harder materials

The angle γ influences the chip discharge.

Terms:



Note:
For chip-forming machining, always use the main cutting edge.

Roughing:
This is understood as the removal of as much material in a short time without taking the surface quality into consideration.

Finishing:
If a clean surface and an accurate dimensional stability is required for the finished workpiece, finishing is carried out after the roughing procedure.
The cutting depth may not exceed 0.2 mm (.008") for this. The feed is reduced as opposed to the roughing procedure.

Turning tool material:

- Tool steel (low wear resistance)
- HSS - high-speed-steel
  (good wear resistance)
- HM - hard metal (high wear resistance)

HSS and hard metal tools are supplied by EMCO.

Why hard metal tools?

Post-grinding is not applicable with hard metal tools, as is the case for HSS tools.

When the cutting edge is worn, only the HM turning plate must be replaced.
Moreover, this must be re-adjusted again at centre height for post-ground HSS tools. This is not applicable when replacing the HM turning plates.

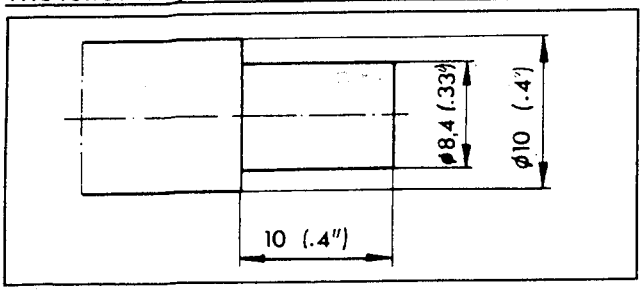
Every tool cutting edge is subject to wear. The lifetime of the tools is increased through greater hardness and temperature resistance of hard metal tools. Tool life is the term used for this.

Care of the tools:
The tools must be stored, so that the cutting edges are not damaged.

Working tip:
Note that your tools lose their cutting ability, when the cutting speed is too high.

Machining example with the right-hand side tool

The following workpiece is to be machined:

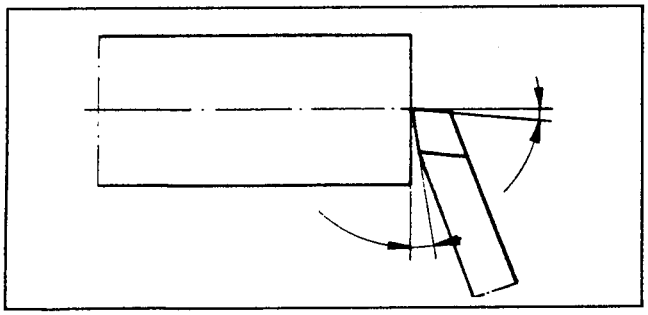


Technical data:

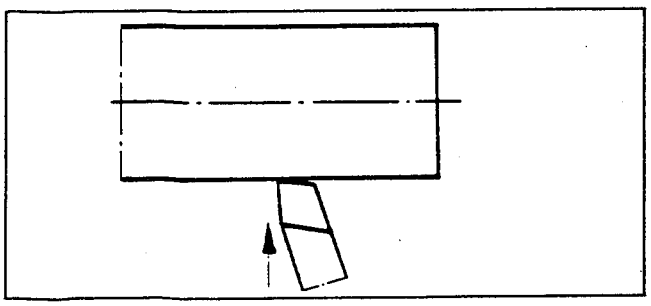
Workpiece:	Steel	V_c = 30 m/min (= 100 ft/min)
Tool:	HSS - right-hand side tool	
Feed:	0.04 mm/rev. (.0015 inch/rev)	
Cutting speed:	for ø 10 mm (.4") according to the diagram 5.2	
	1000 rpm	

Procedure:

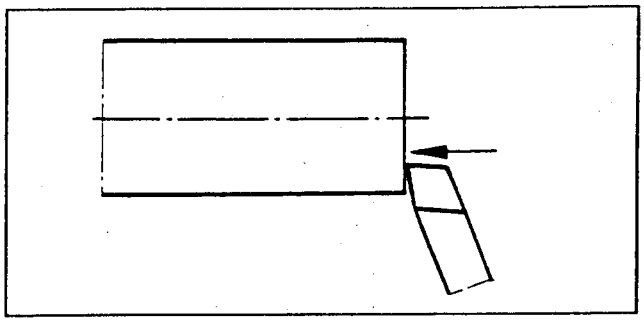
- Set the feed to 0.04 mm/rev.
- Set the cutting speed.
- Clamp the raw material.
- Set the turning tool according to the sketch.



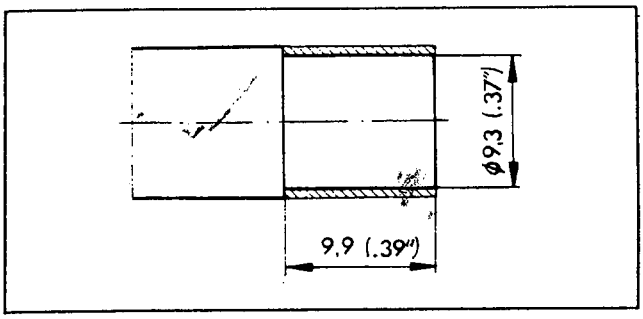
- Switch on the main spindle in counterclockwise rotation.
- Approach the cross slide to the workpiece, until this is slightly scratched.
- Set the graduated ring of the cross slide handwheel to 0 (= 0 position).



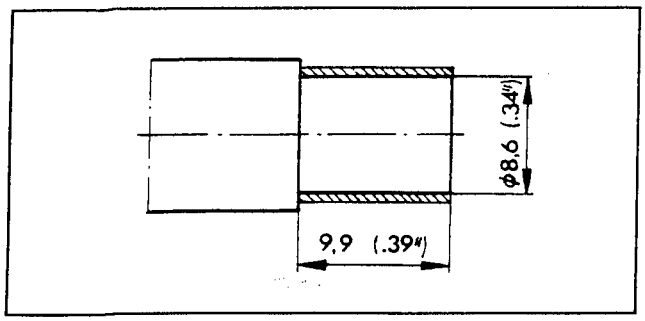
- Move the turning tool with the longitudinal slide a few millimeters in front of the end face of the workpiece.
- Feed the cross slide approx. 2 mm.
- Approach the longitudinal slide to the end face, until this is slightly scratched.
- Set the graduated ring of the longitudinal slide handwheel to 0.



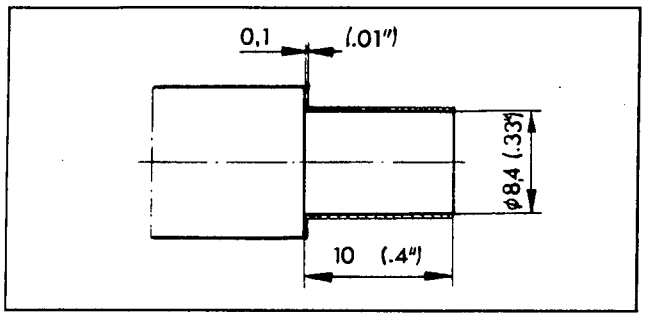
- Return the cross slide to the starting position (= 0 position).
- Feed the cross slide 0.35 mm (.015") (according to the diagram on page 5.2) (= cutting depth).
- Operate the sleeve for the feed and switch it off again, when approx. 9 mm (.35") shoulder length is reached.
- Feed the longitudinal slide a further 0.9 (.4") mm with the handwheel.
- Move back approx. 0.5 mm (.02") with the cross slide and switch off the lathe.
- Switch on the lathe in the opposite direction and return with the feed of the longitudinal slide to the starting position.
- Switch off the feed and lathe.



- Position the cross slide on the measurement already turned (9.3 mm) (.37") and feed it a further 0.35 mm (.015"), in addition.
- Switch on the lathe.
- The further procedure is the same as for the first roughing, until the longitudinal slide is at the starting position.



- Feed the cross slide the remaining 0.1 mm (.005").
- Switch on the lathe.
- Switch on the feed and switch it off again, when approx. 9 mm (.35") is reached.
- Feed the finished measurement (10 mm) (.4") with the longitudinal slide handwheel.
- Turn out the cross slide slowly, until no cutting is carried out any longer.
- Switch off the lathe.



The top slide

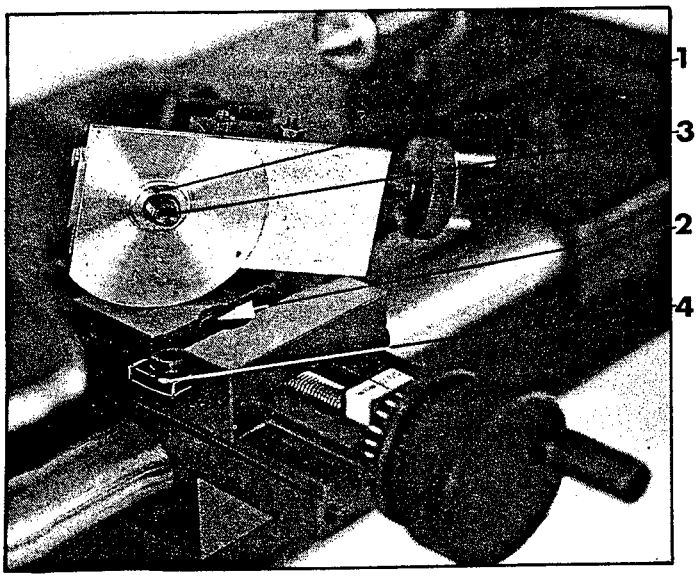
The top slide serves for turning tapers.

The top slide runs play-free in a dovetail guideway and can be clamped in any required angle relating to the turning axis. The scale division on the handwheel amounts to 0.1 mm. The maximum stroke of the top slide amounts to 40 mm (1.57").

The tools are clamped in the tool holder with as little overhang as possible and at the centre height. Use turning tool supports for this.

Setting the angle positions:
A graduation in degrees is provided at the top slide.
Using this graduation, the top slide is fed to the corresponding position according to the desired angle position, and is then clamped.

Mounting:
Insert the T-nut (4) in the groove of the cross slide. Place the shoulder (1) of the top slide into the centring (2) of the cross slide and clamp it in the desired angle with the socket head screw (3)



The quick-change toolholder

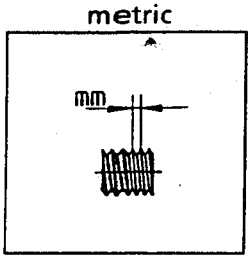
(in preparation)

The metric or inch gear sets

The metric and inch gear sets comprise 5 gears each.

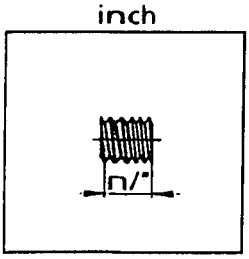
Number of teeth on the gears	
metric	inch
48 20	17 45
32 24	17 40
24 28	17 36
18 30	17 30
24 50	41 31

metric



With the accessorial metric gear sets, the following thread pitches can be produced: 0.125; 0.225; 0.25; 0.35; 0.4; 0.45; 0.5; 0.7; 0.8; 1, 1.25 mm in addition to the thread pitches 0.2; 0.3; 0.6; 0.75; 1.5 mm already manufacturable with the basic equipment.

inch



With the accessorial inch gear set, the following threads can be produced: 16; 18; 20; 24; 32; 36; 40; 48; 56; 64 gears/inches [n/"].

The spare parts package

Spare parts are included in the spare parts package for parts, which are subjected to a high wear on the lathe.

It comprises the following parts:

- 1 item toothed belt MXL 90Z-3/16" for the drive of the countershaft pulley from the motor pulley.
  (See spare parts list, page 8, position 6.)
- 1 item toothed belt MXL 150Z-3/8" for the drive of the pulley (main spindle) from the countershaft pulley.
  (See spare parts list, page 8, position 9.)
- 1 item toothed belt MXL 80Z-3/16" for the drive of the longitudinal or cross slide from the stepping motor.
  (Only for use with the accessorial PC package UNIMAT)
- 2 items unit glass tube fuses for the power supply.
- 1 item tip for the revolving centre
  (See spare parts list, page 3, position 4.)
- 1 item change gear 18-54.
- 1 item motor pulley.
- 5 items shear pins for overload fuse of the lead screw.
  (See operating instructions, page 7.1, position 6.)

7. Maintenance, care and servicing

The Unimat is a precision machine. Thorough care of the lathe is a prerequisite for longterm precision and performance.

- Regularly clean the spindles, mounting thread, slide guideways.
- Regularly coat all blank surfaces with a light machine oil.

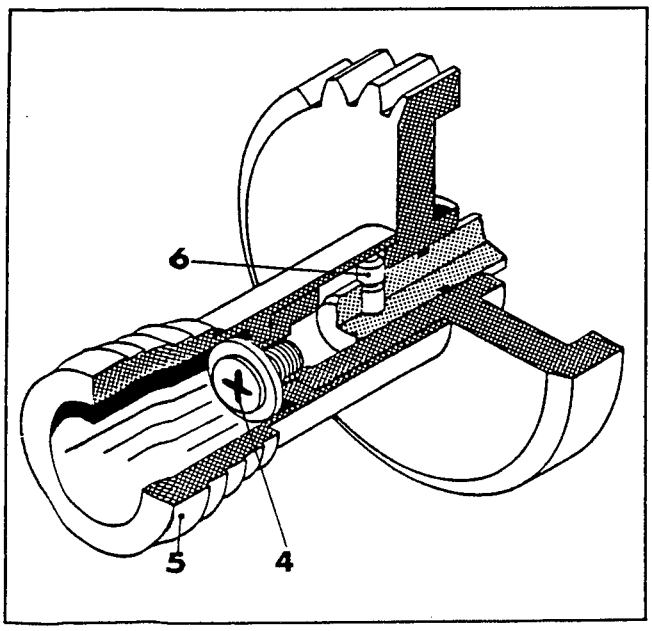
Attention:
- The Unimat PC is a machine with very small dimensions. Thus, never tighten all screws of the lathe too tightly.
- Disconnect the machine from the mains before all servicing.

Changing the shear pin

If the shear pin should break due to overload or the false operation of the lathe (e.g., when you switch on the automatic feed with the longitudinal slide clamped), you must insert a new original shear pin.

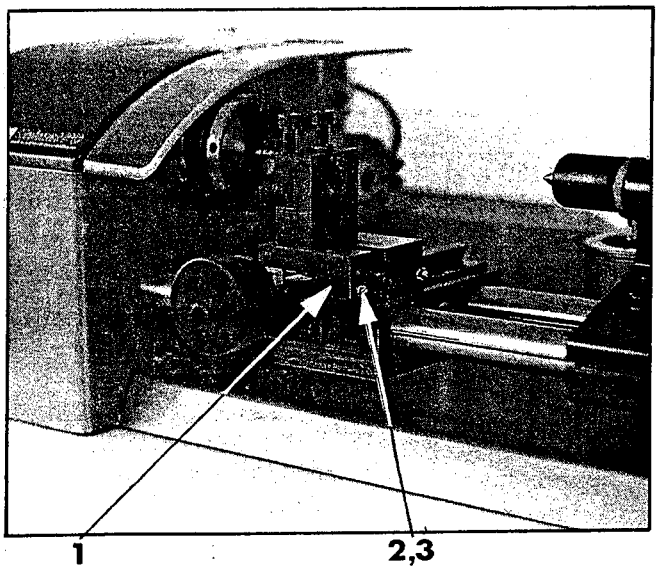
Procedure:
- Open the cover.
- Unscrew the sheet metal screw (4) and remove the switching tube (5).
- Remove the broken shear pin (6) with a drift punch.
- Remount an original EMCO shear pin and re-assemble the dismounted parts.

Note:
Only use original EMCO shear pins!
The correct functioning is not guaranteed for shear pins, which are not original EMCO ones, and serious damage can be caused to the lathe.



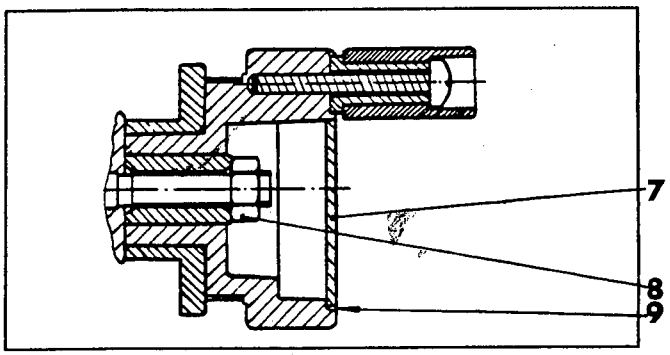
Re-adjusting the cross and top slide guideways

The dovetail guideways are equipped with adjustment strips (1). The play-free slide guide is adjusted with the studs (2), which push onto the adjusting strip. The hexagonal nuts (3) prevent the studs from being twisted.



Re-adjustment:
Loosen the hexagonal nuts, re-adjust the studs, until the slides run play-freely. Hold the studs in the re-adjusted position with the screwdriver and tighten the hexagonal nut.

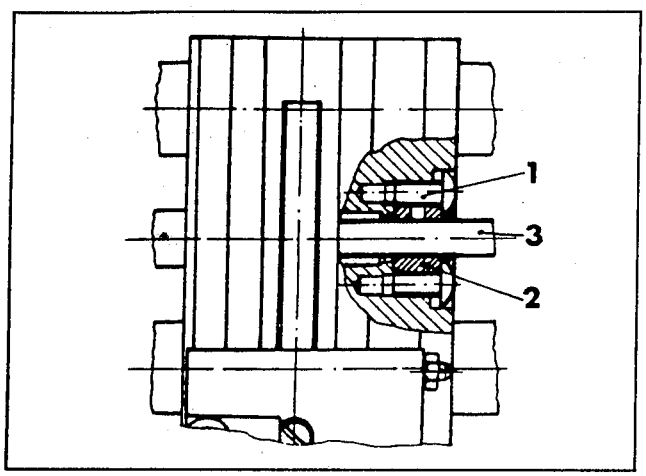
Re-adjustment of the handwheel clearance:



Procedure:
- Remove the cover (7) by introducing a pointed tool (e.g., pen-knife) into the opening (9) of the handwheel.
- Loosen the nut (8) (holding the handwheel at the same time).
- Turn the handwheel, until it is tightened (hold the spindle at the same time).
- Then, turn back the handwheel somewhat and tighten the nut (8). (Hold the handwheel at the same time.)
- Fix on the cover (7) again.

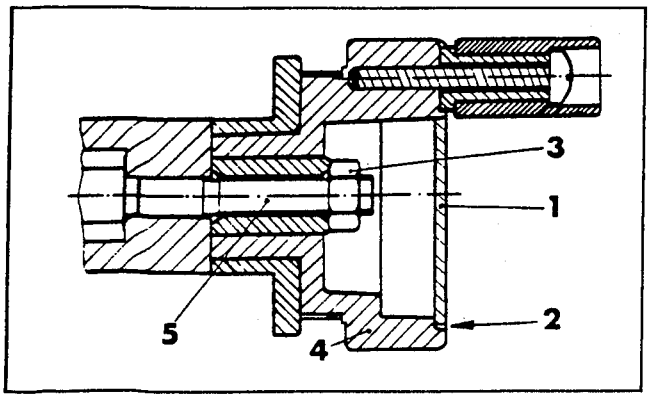
Re-adjustment of the lead screw nut for the clearance compensation of the longitudinal slide

After the machine has been in use for a long time, it may happen that a noticeable clearance between the lead screw nut (2) and the lead screw (3) occurs.
This clearance can be compensated by slightly tightening the fillister head screw with a hexagonal socket-head M5x10 (1).
Always take care, however, that the lead screw can always be twisted easily. Thus, never tighten the fillister head screw with the hexagonal socket-head M5x10 (1) too tightly.



Lubricating the spindle slide bearing of the longitudinal slide, cross slide and tailstock

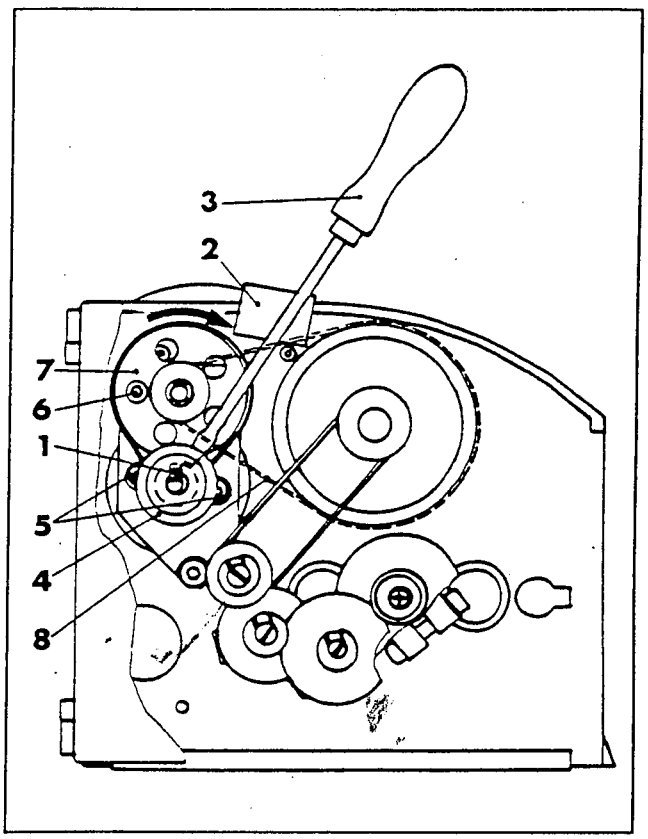
- Remove the cover (1) by introducing a pointed object (e.g., pen-knife or similar) into the opening (2) of the handwheel.
- Unscrew the nut (3) (holding the handwheel (4) at the same time).
- Unscrew the handwheel from the spindle (5) (holding the spindle (5) at the same time).
- Set the lathe in such a way that the spindle of the spindle bearing to be oiled is standing vertically.
- Allow a light machine oil (e.g., sewing machine oil) to drip into the spindle bearing and turn the spindle several times at the same time.
- Re-assemble the handwheel. (Note the point "re-adjustment of the handwheel clearance" for this.)



Exchanging the main motor

Dismounting:

- Disconnect the connecting cable between main motor and main drive regulator from the main motor.
- Loosen the socket head screw (6), swivel the countershaft pulley (7) in the direction of the arrow and remove the belt (8).
- Loosen the thread plug SW2 (1) of the motor pulley.
- Insert the jaw (2) (approx. 20 mm thick) according to the diagram and push the motor pulley (4) from the motor butt with a large screwdriver (3).
- Attention:
  During the assembly of the motor pulley, note the truncation of the motor butt and the position of the thread plug (1).
- Unscrew the two socket head screws (5) and push out the main motor to the rear and remove the covering washer located on the main motor.



Mounting:

Similar to the mounting, but in the reverse order.

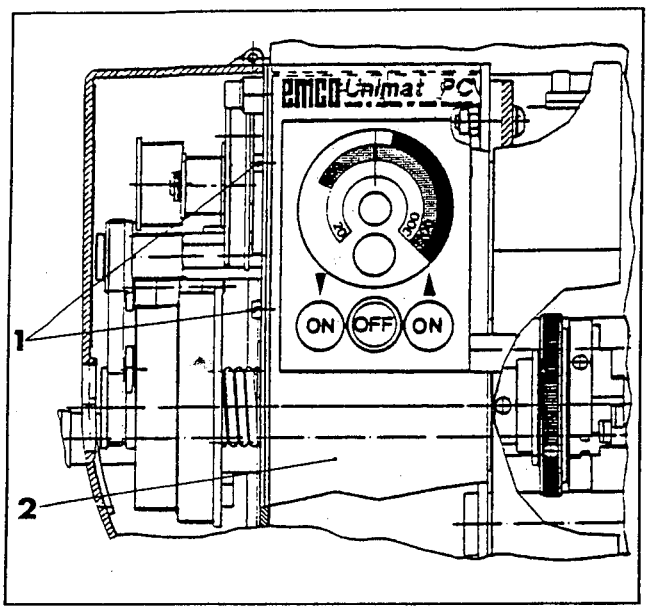
Attention:

After mounting the motor, check whether the main drive belt can be correctly tensioned or released. If necessary, loosen the two screws (5) and reposition the motor.

Replacing the control board of the main motor

Dismounting:

- Remove the connection cable between the main drive regulator and the main motor.
- Open the cover.
- Unscrew the two socket head screws M3x8 (1).



- Remove the board group (2).
- Unscrew the two cables of the board from the clip (the clip is located inside the spindle stock).

Mounting:

Similar to the dismounting, but in the reverse order.

8. The vertical drilling and milling equipment

Technical data - dimensions

Mounting

Operation
- Swivelling the vertical unit
- Adjusting the height
  Coarse feed
  Fine feed
- Setting the cutting speed
- Switching on the vertical spindle

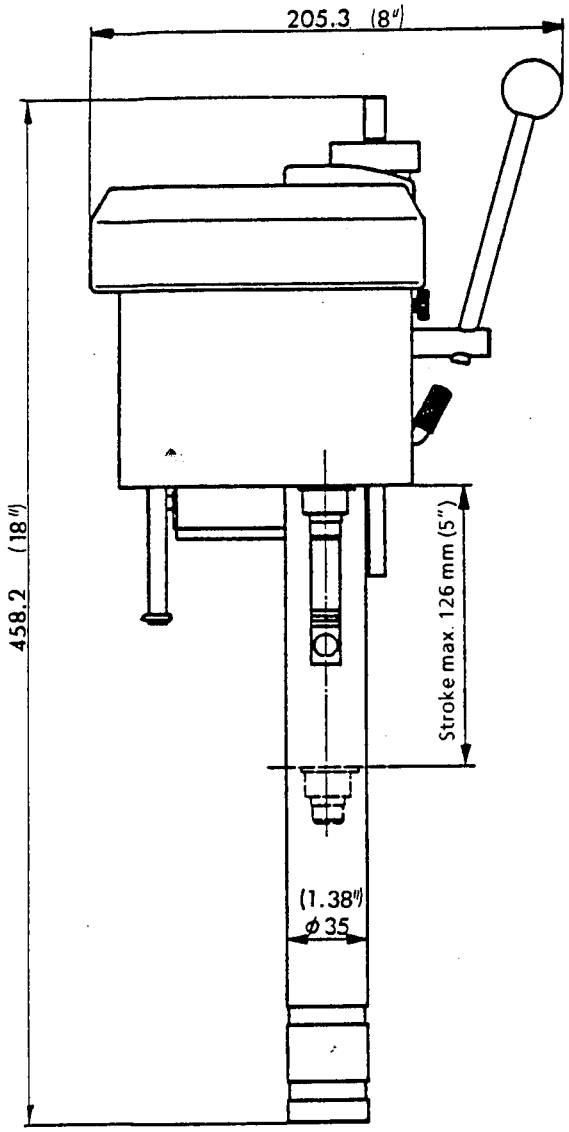
Technical data
- Milling
- Drilling

Accessories:
- Tools
- The milling table
- The dividing attachment
- The machine vice
- The clamping shoes
- The cutter arbor

Practical tips - working examples

Re-adjustments

Technical data - dimensions



WORKING AREA:

Range	70 mm	(2.75")
Stroke	max. 126 mm	(5")
Diameter of columns	ø 35 mm	(1.38")

VERTICAL SPINDLE:

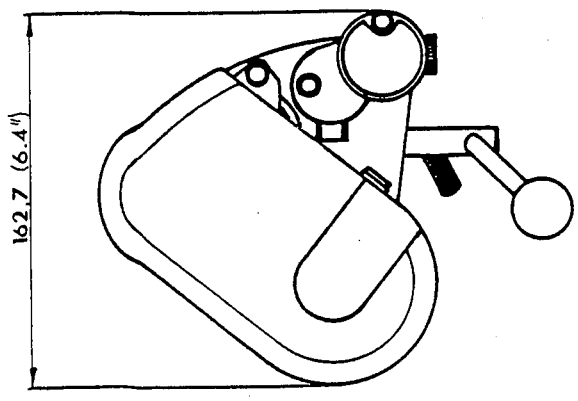
Spindle nose					M14x1	
Spindle speed	n_1:	1200	to	2200	rpm	
	n_2:	300	to	1200	rpm	
	n_3:	20	to	300	rpm	
Max. torque					0.48 daNm	(3.5 ft-lbf)

MOTOR:

Direction of rotation	clockwise and counterclockwise		
Nominal voltage	42 V =		
Motor power: (Input)	80 % duty cycle	80 W	(.11 HP)
(Output)	80 % duty cycle	50 W	(.7 HP)

WEIGHT: 4.4 kg (9.7 lb)

The technical data are subject to change without notice!

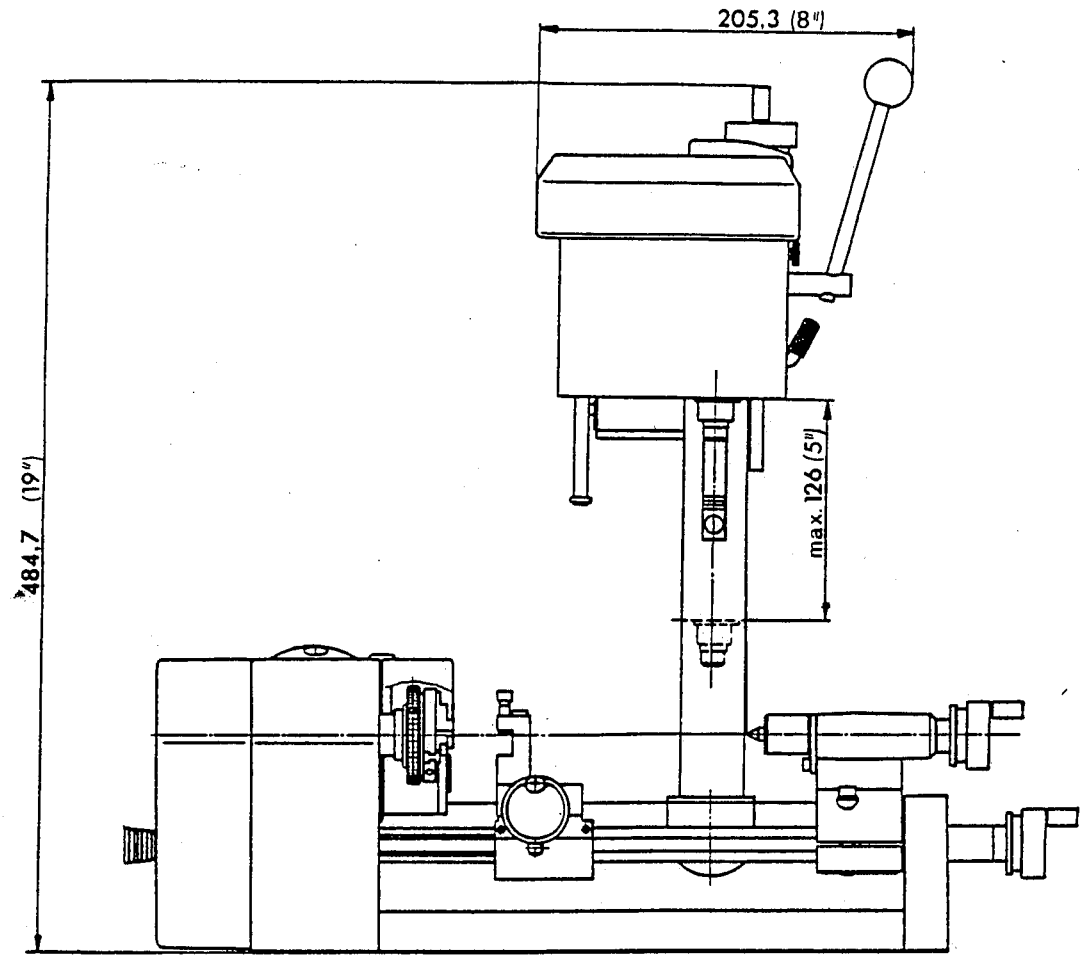


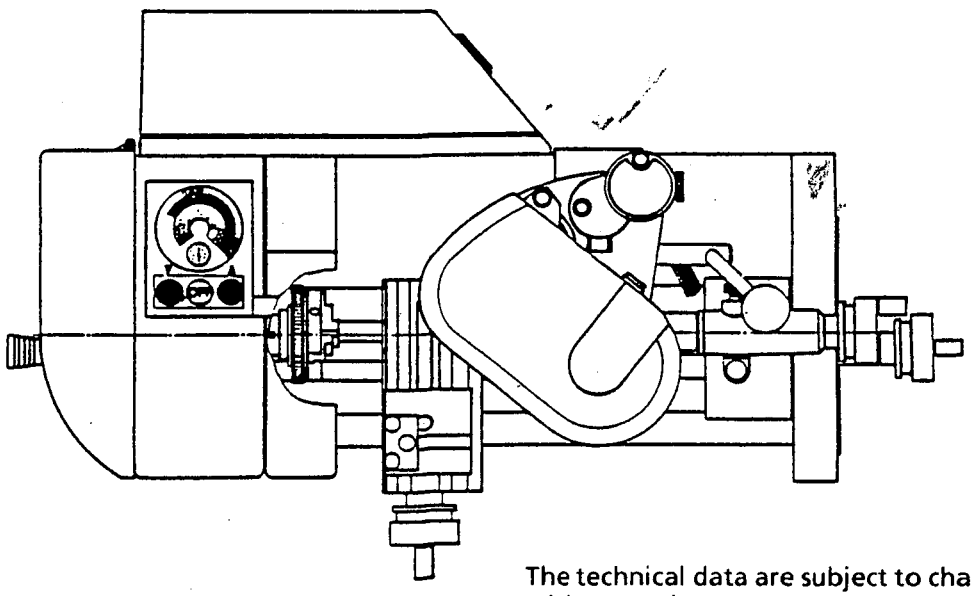
DELIVERY SCOPE:

Check the vertical equipment for possible transport damage, and if all supplied parts are present.

- Vertical unit complete with motor
- Toggle
- 2 items socket head screws
- Grooved screw

Dimensions - EMCO Unimat PC with vertical equipment

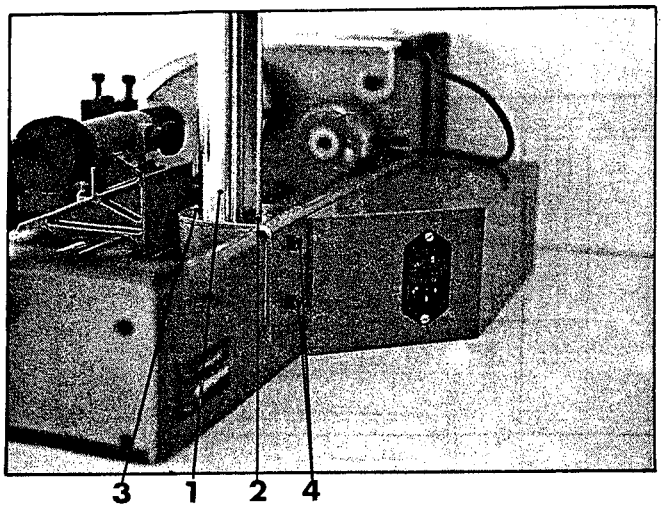




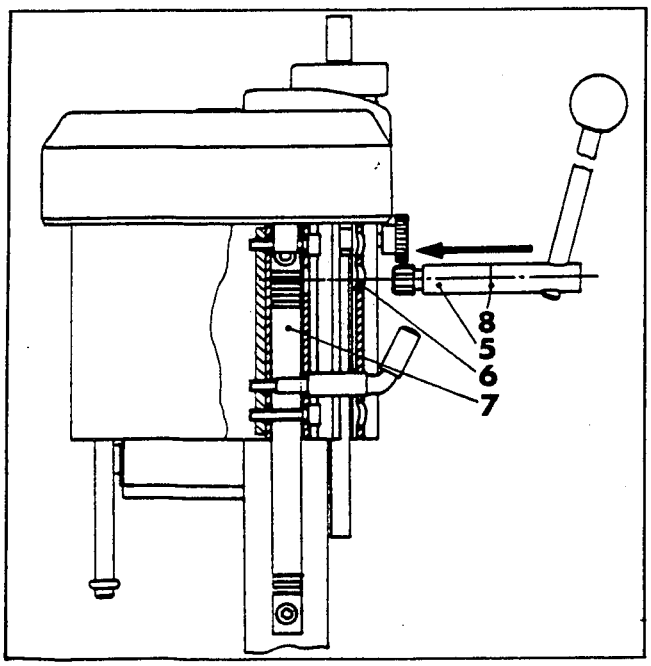
The technical data are subject to change without notice!

Mounting the vertical equipment

Remove the cover of the mounting (2). Put the vertical column (1) into the mounting bore (2) of the basic machine, until the pin (3) is supported by the mounting.
The vertical equipment is clamped with the 2 socket head screws (4).



Insert the toggle (5) into the mounting bore (6).
For this, note that the teeth of the pinion at the toggle completely engage into the teeth of the rack (7) (insert the toggle up to the stop in the mounting bore).

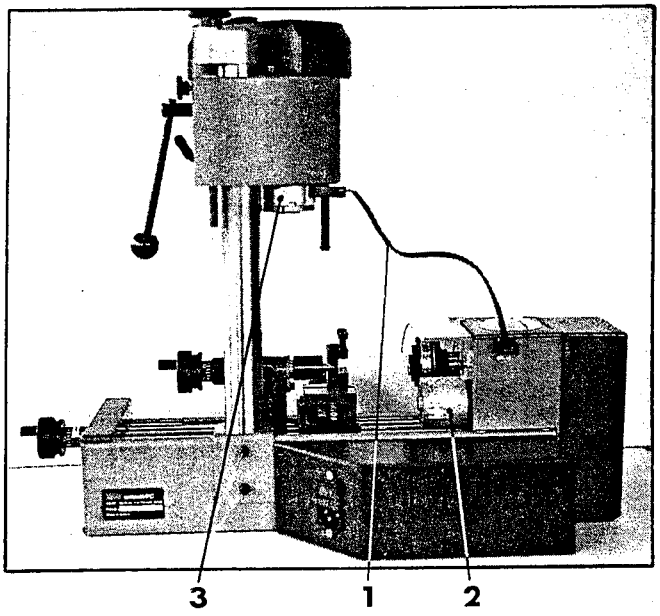


Note:
A mark (8) is located on the toggle (5). This mark must just be visible, when the toggle is completely inserted.

Electrical connection:

Note:
Only connect the machine to a ground socket!

Re-plug the connection cable (1) from the drive motor of the lathe (2) to the drive motor of the vertical equipment (3).



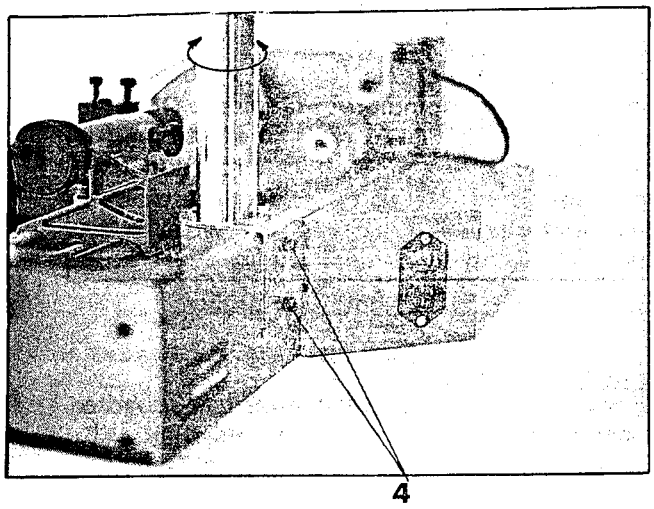
Note that the plug of the red cable is plugged into the + pole (red) and the plug of the blue cable into the - pole (blue) of the main motor.

Operation:

Swivelling the vertical equipment:

For the more flexible design of the working area, it is possible to swivel the vertical unit around the axis of the vertical column.

Procedure:
- Loosen the socket head screws (4).
- Swivel the vertical unit to the desired position.
- Retighten the socket head screws (4).



Height adjustment:

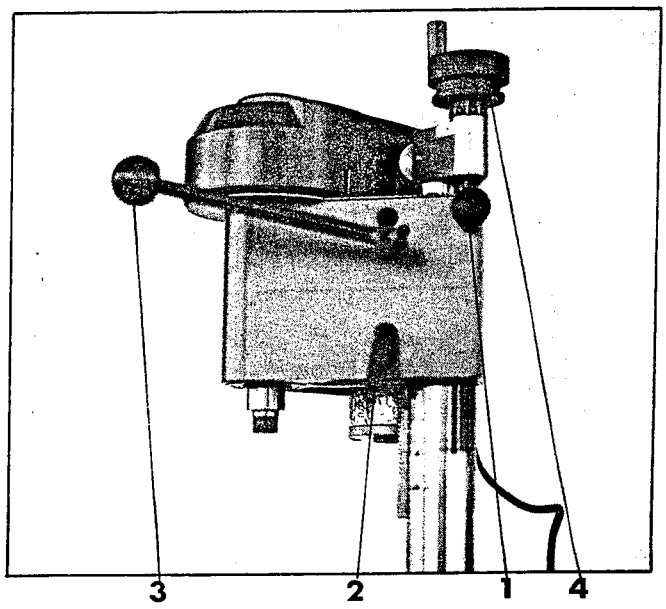
For the height adjustment, a distinction is made between 2 types:
- Coarse feed (via rack)
- Fine feed (via screw)

1. Coarse feed
(Feed during drilling, coarse setting during milling)

- Unscrew the knurled screw (1) by a few revolutions, so that the vertical motion is not blocked by the screw.
- Loosen the clamping screw (2).
- Adjust the vertical equipment vertically with the toggle (3).

Note:
In order to avoid unfavourable positions of the toggle during the feed, this can simply be pulled out. Put the toggle in the desired position and insert it again into the mounting bore.
Note here that the teeth of the pinion at the toggle engage into the teeth of the rack, and that the toggle is inserted into the mounting bore up to the stop.

A vertical movement during the positioning of the toggle is prevented by tightening the clamping screw (2).



2. Fine feed
(Dimensionally stable feed during drilling, milling)

- Tighten the knurled screw (1).
- Loosen the clamping screw (2).
- By turning the handwheel (4) clockwise, the vertical unit moves downwards;
by turning counterclockwise, it moves upwards.

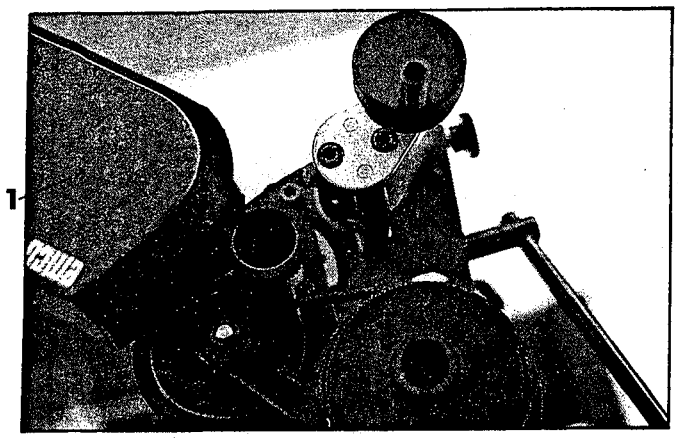
Note:
Turning the handwheel by one division marking of the graduated ring causes the vertical unit to move by 0.05 mm.

If the toggle (3) causes problems during the feed, this can simply be pulled out.

If the height of the vertical equipment should remain unchanged during the machining (e.g., groove milling), this can be fixed with the clamping screw (2).

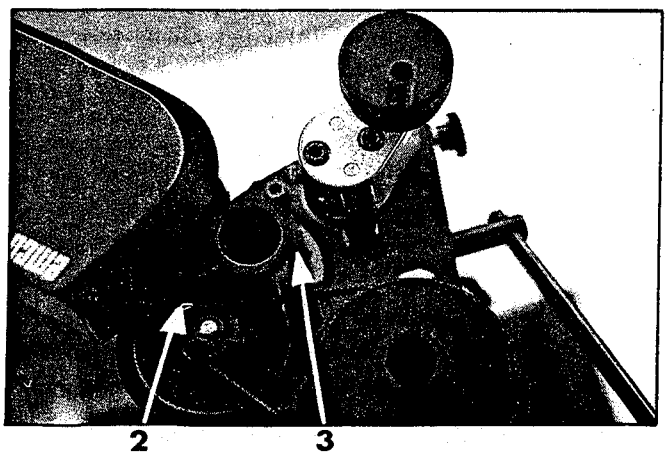
Adjusting the spindle speed:

The vertical spindle speed is divided into three speed ranges, just like the speed of the main spindle of the lathe.



Shifting the toothed belt:

- For this purpose, disengage the cover (1), lift it down and turn it to the side.
- Loosen the socket head screw (2) and turn the motor plate (3) in such a way, that the toothed belt is released.
- Shift the toothed belt. (The same as for the basic machine)
- Tension the toothed belt by turning the motor plate and tighten the socket head screw.

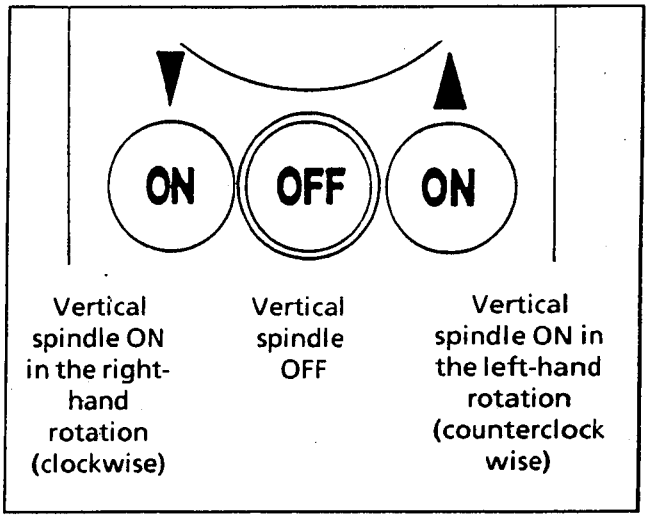


- Reposition the cover and engage it.

Note:
If the drive belt slips through during the machining, it should be tensioned somewhat more tightly or the feed reduced.
If the drive belt is tensioned too tightly, its life is reduced.

Switching on the vertical spindle:

The drive motor is reversible.
Thus, always pay attention to the correct turning direction of the clamped tool.

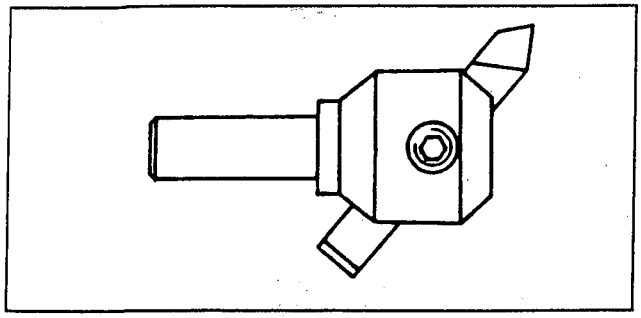


Attention:
Never regulate the speed of the vertical spindle below the respectively coloured speed range. It can happen that the necessary torque can then no longer be reached. Thus, always set the speed within the value ranges of the speed scales.

Accessories

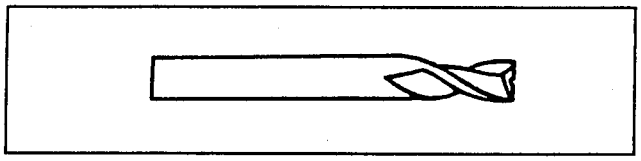
Tools

Head for turning internal surfaces



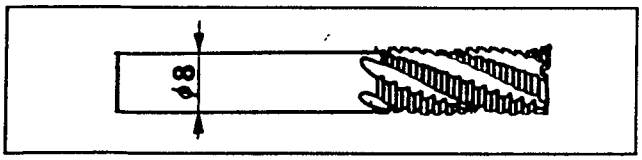
Application: Turning internal surfaces of boreholes for ⌀ 20 mm to 50 mm (⌀ .8" - 2"),
cutting end faces.

Groove cutter



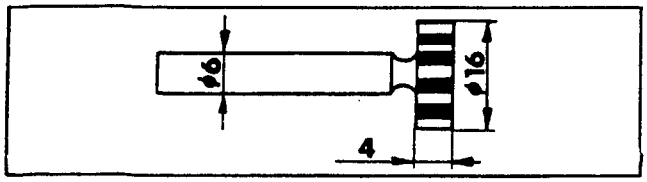
Application: Cutting grooves, steps, etc. (⌀ 3, 4, 5, 6 mm)

Roughing cutter



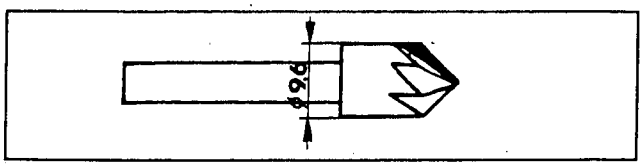
Application: For large chip removal

Slit cutter



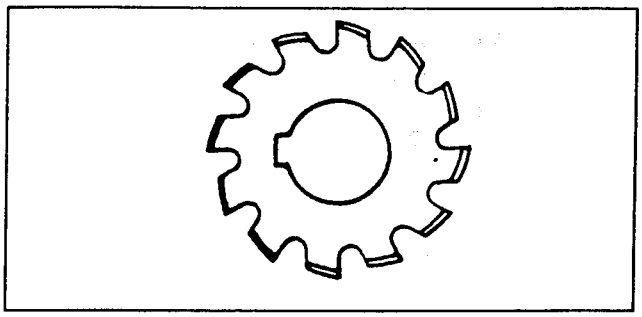
Application: Cutting T-grooves

Countersink 90°



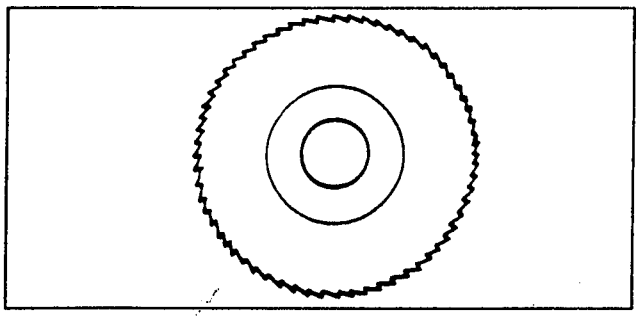
Application: Spot-facing, deburring boreholes, milling bevels

Form cutter for gear teeth



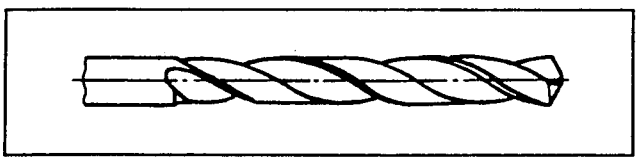
Set of 6 cutters ⌀ 40 mm (module 0.5) for the milling of gears with the number of teeth 12 to 54
Clamping: in the mounting mandrel

Circular saw blade ⌀ 60 mm



Application: Sawing, morticing
Clamping: in the mounting mandrel

Twist drill



Application: Drilling from ⌀ 1 to 8 mm in steps of 0.5 mm

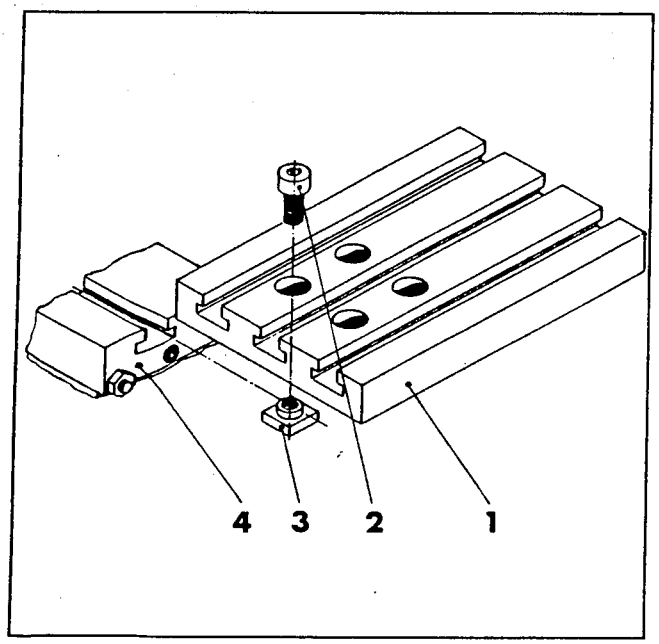
Milling table

The milling table serves for the mounting of clamping devices or workpieces for drilling and milling machining.

The milling table can be mounted optionally on the cross slide or on the milling table support (accessories).

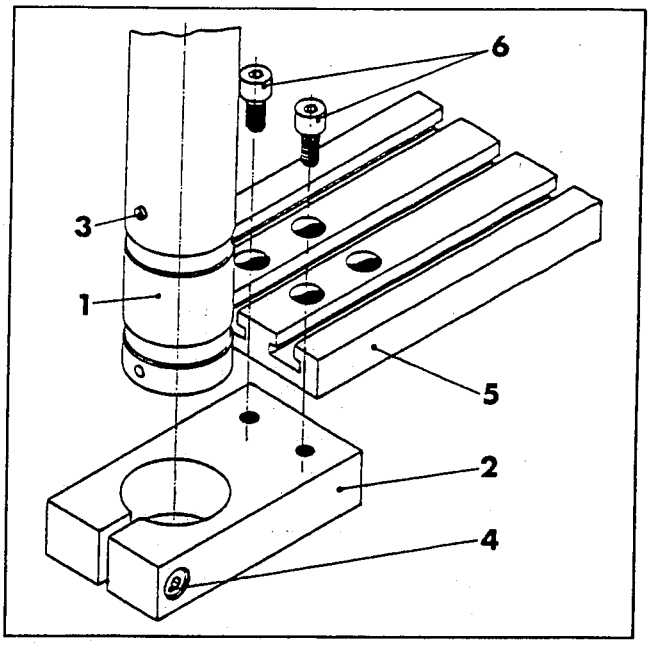
A) Mounting on the cross slide:

- Insert the supplied socket head screws M6x12 (2) into the two boreholes of the milling table (1).
- Turn the T-nuts (3) with the end face facing downwards onto the socket head screws (do not tighten them).
- Push the milling table (1) onto the cross slide (4), so that the T-nuts (3) engage in the T-groove of the cross slide.
- Tighten the socket head screws (2).



B) Mounting on the milling table support (accessories):

- Remove the vertical unit from the mounting bore of the basic machine.
- Push the milling table support (2) over the vertical column (1).
  Pay attention that the grooved adjusting pin (3) is threaded through the slot of the milling table support.
- The milling table support is clamped to the vertical column with the socket head screw (4).
- Put the vertical unit into the mounting bore of the basic machine again and clamp it.
- Place the milling table (5) on the milling table support and secure it with the two socket head screws M6x12 (6).

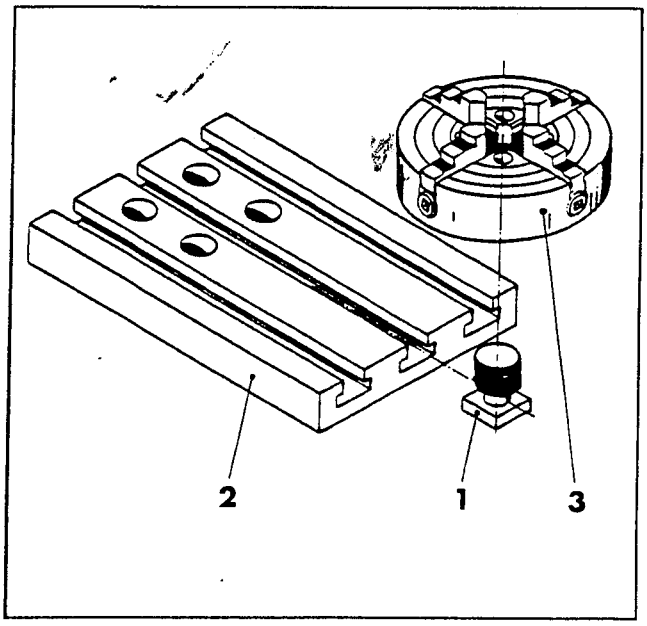


Mounting the clamping devices on the milling table

For this purpose, you need the groove screw, which is included in the delivery scope of the vertical equipment.

Procedure:

- Push the groove screw (1) into one of the three T-grooves on the milling table (2).
- Screw the clamping devices (3) (three-jaw chuck, independent chuck, etc.) onto the groove screw (1) and tighten them.



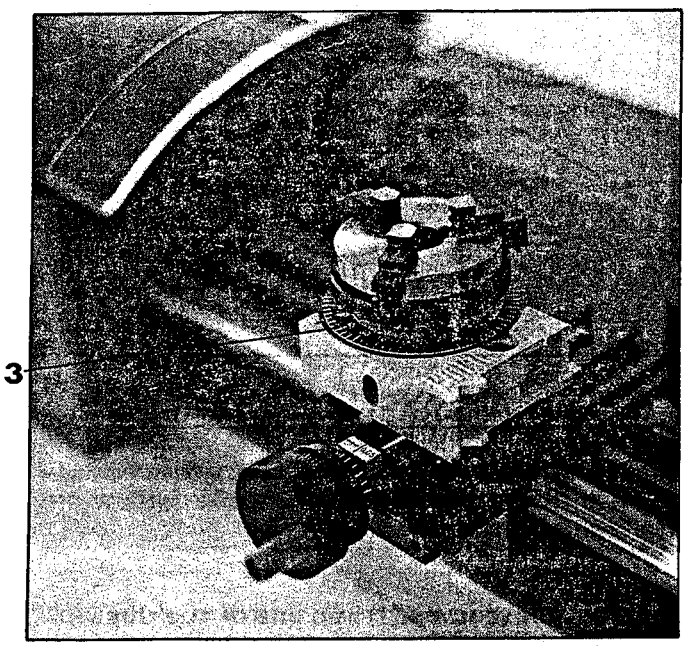
The dividing attachment

The dividing attachment is used for milling gears, grooves, multiple splined shafts, for drilling flange holes, etc.

It can be mounted on the cross slide in the vertical or horizontal position.

The dividing ring (3) with the desired divisions (24, 30, 36, 40) is pushed over the mounting thread (1), and the clamping device (3-jaw chuck, clamping plate, etc.) is screwed on and tightened with the clamping pin.

The workpiece is clamped.

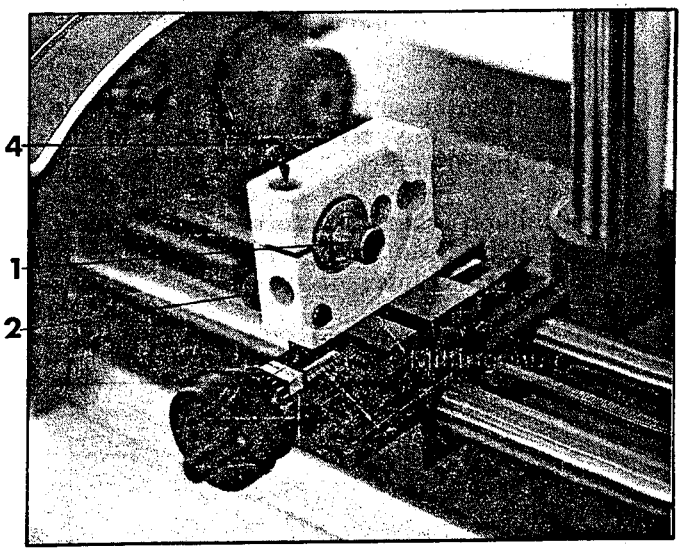


The dividing attachment mounted horizontally on the cross slide

The dividing procedure:

The index bolt (2) is pulled out, before the dividing procedure is started.
You can read the divisions from the graduated scale on the top of the dividing ring.

After the index bolt has clicked into place, the dividing mechanism is clamped with the clamping screw (4).



The dividing attachment mounted vertically on the cross slide

The dividing possibilities with the respective dividing rings can be seen in the table:

	Dividing ring no.			
	24	30	36	40
Dividing possibility	2	2	2	2
	3	3	3	
	4		4	4
		5		5
	6	6	6	
	8			8
			9	
		10		10
	12		12	
		15		
			18	
				20
	24	30	36	40

The machine vice

Technical data:

Width of clamping jaws	35 mm (1.38")
Height of clamping jaws	16 mm (.63")
Clamping width	28 mm (1.1")

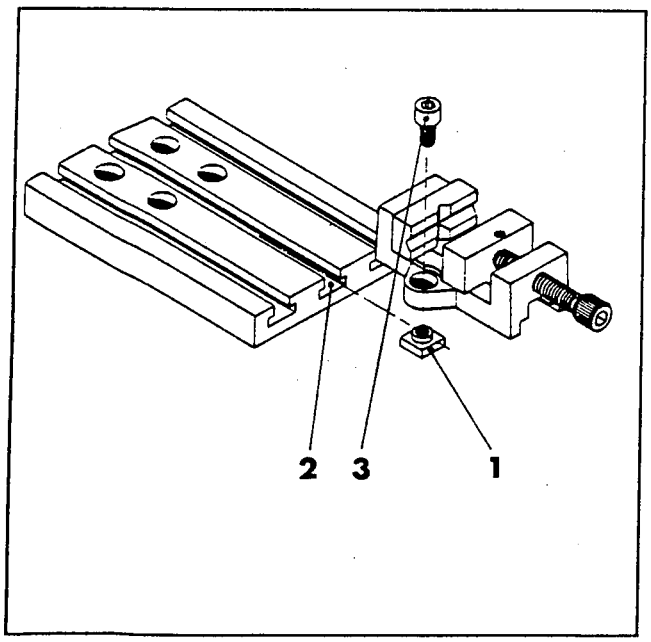
Mounting:

The machine vice can be be mounted optionally on the cross slide of the lathe or on the milling table.

Note:
When using the circular saw blade (mounted on the mounting mandrel), it should be noted that due to the limited stroke of the vertical unit the centre of the vice can only be reached, if the machine vice is mounted on the milling table.

Procedure:

- Insert the screw (3)
- Screw in the T-nut (1).
- Place the vice in such a way that the T-nuts (1) engage into the mounting groove (s) (2) of the cross slide or milling table.
- Tighten the socket head screws (3).



The clamping shoes

Clamping range until 38 mm (1.5").
The clamping shoes serve to clamp irregular shaped or large workpieces on the cross slide, clamping plate or milling table.

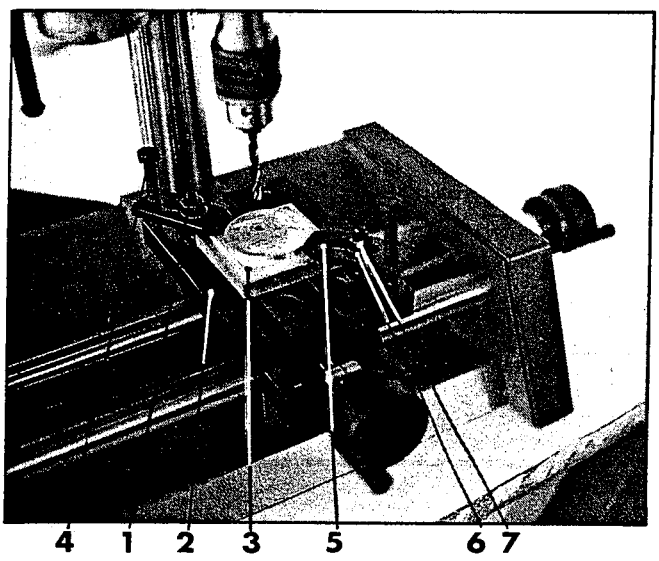
Clamping procedure:

- Push the clamping screw (1) into the mounting groove of the workpiece support (2) (cross slide, clamping plate or milling table).
- Place the workpiece (3) on the work clamping area of the workpiece support.
- Screw the hexagonal screw (4) into the holding strap (5).
- Fix the holding strap (5) with the socket head screw (4) on the clamping screw (1) in such a way that the canted sides of the holding strap lie on the workpiece (3).
- Position the washer (6) on the clamping screw and clamp down the workpiece with the hexagonal nut (7).

Note:
Secure the holding strap (5) with the socket head screw (4) in such a way that it is parallel to the work clamping area.

Unclamping the workpiece:

- Loosen the hexagon nut (7) and remove the workpiece.



Example: Clamping shoe on milling table

The mounting mandrel

This serves for mounting the gear teeth cutter and the circular saw blade.

Mounting at the main spindle:

- Screw the mounting mandrel (3) onto the mounting thread of the vertical spindle and tighten it with clamping pins (4).

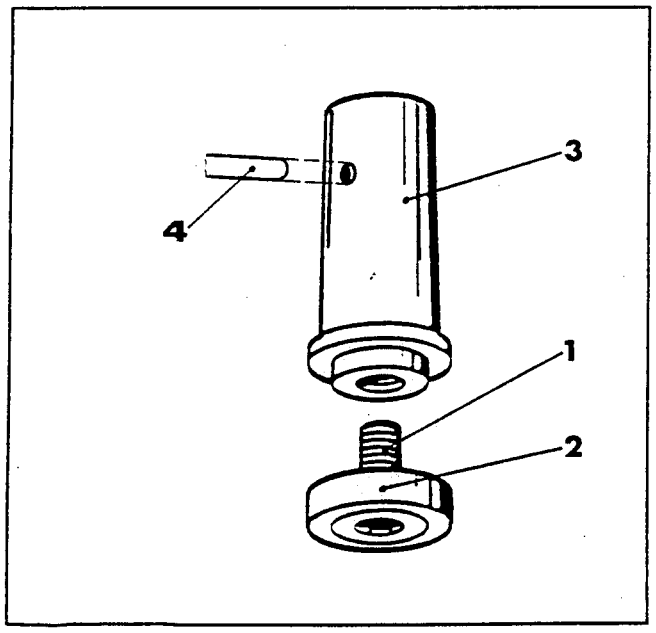
Mounting the tool at the mounting mandrel:

- Unscrew the countersunk screw (1)
- Remove the counter disk (2).
- Push tool onto mounting mandrel (3).

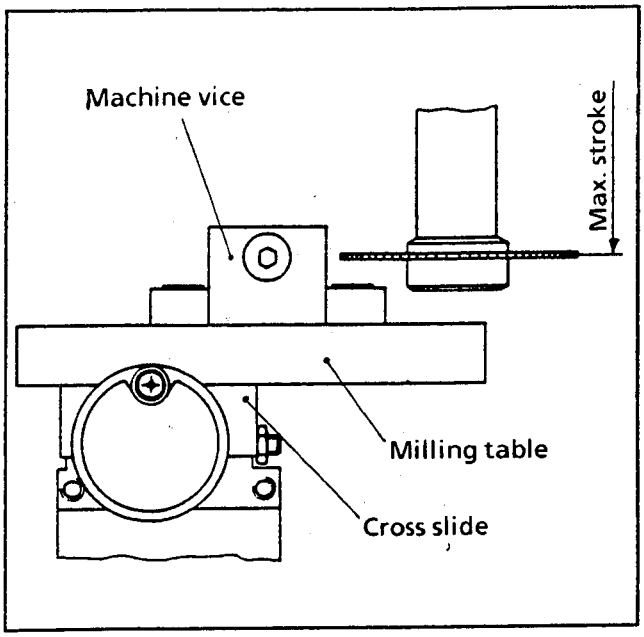
  Note:
  When mounting the tools, note the correct position of the main cutting edge.

  Only tools with a borehole of 16 mm are centred by the mounting mandrel.

- Replace the contra-propeller (2) and tighten the countersunk screw (1).
  (Use a clamping pin (4) to hold the mounting mandrel during the tightening.)



Note:
When using the circular saw blade, it should be noted that the middle of the vice can only be reached, if the machine vice is mounted on the milling table. This is due to the limited stroke of the vertical unit.

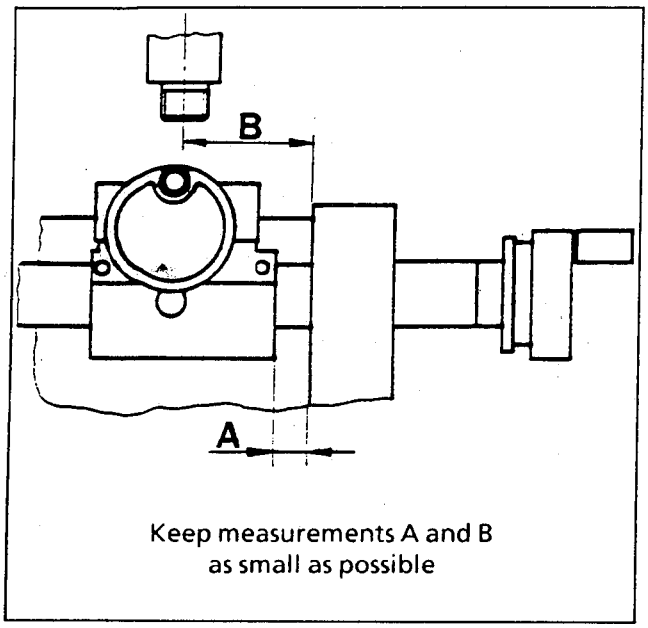


Practical tips - working examples

Stability during milling

Clamp the workpiece securely and tightly.

Principally carry out machining at the right-hand side of the machine (dismount the tailstock - keep measurements A and B as small as possible).



Keep measurements A and B as small as possible

Clamping the slides

With the exception of the feeding direction, all slides should be clamped during milling in order to obtain a surface quality, which is as good as possible.

When drilling, a more accurate diameter of the borehole is achieved in this way.

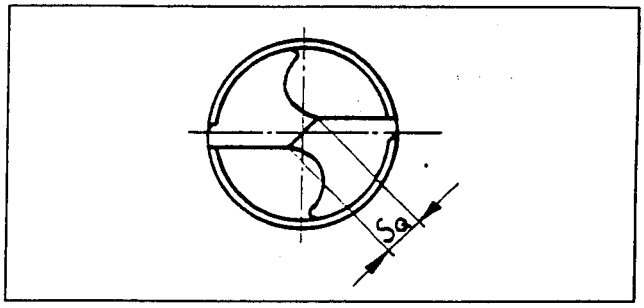
Milling work/coordinate drilling:

The Unimat PC is well suited for milling and coordinate drilling, since the path of the longitudinal and the cross slides correspond exactly to the division on the graduated rings of the handwheels.

Drilling large diameters:

When drilling larger diameters, from approx. 5 mm (.2"), it is recommended to pre-drill with a smaller drill in order to avoid overloading the cross cutting edge of the drill.

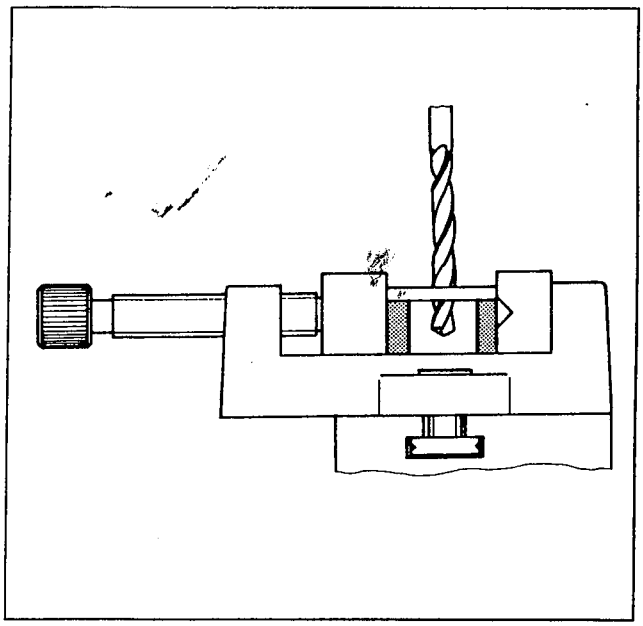
Rule of thumb:
When pre-drilling, the diameter of the tool should be at least as large as the length S_Q of the cross cutting edge of the subsequent drill.



For deeper boreholes, pull the drill back more often, so that the drill chips are removed from the borehole.

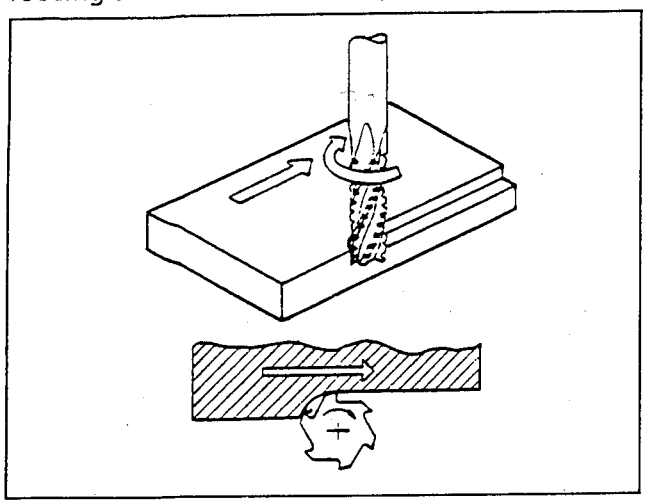
Drilling through-holes

Clamp the workpiece on a suitable support when drilling through-holes in order to avoid damaging the tool and machine, if the drill pushes through the workpiece.



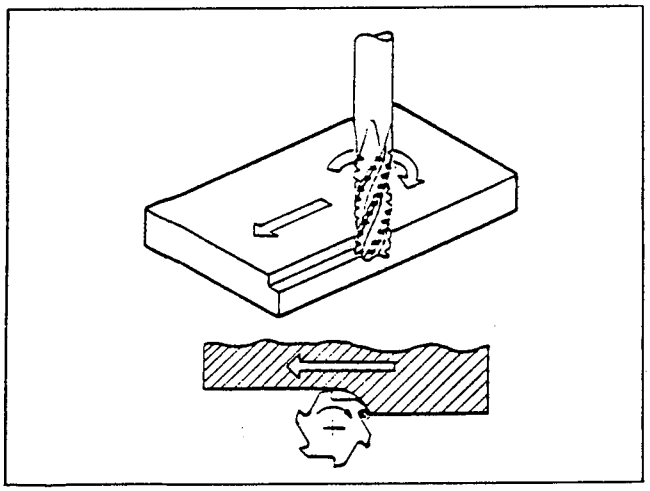
Down milling:

The cutting direction of the cutter and the feeding direction of the workpiece are the same.



Conventional milling:

The cutting direction of the cutter and the feeding direction of the workpiece are opposite to one another.



Carry out only conventional milling with the Unimat PC:

If a feed spindle has clearance in the spindle nut (air, lost motion of the handwheel), the slide can be jerkily pulled in the feeding direction by this clearance due to the cutting force of the cutter during down milling procedure.

The cutter is endangered to break here, or the workpiece can be thrown out.

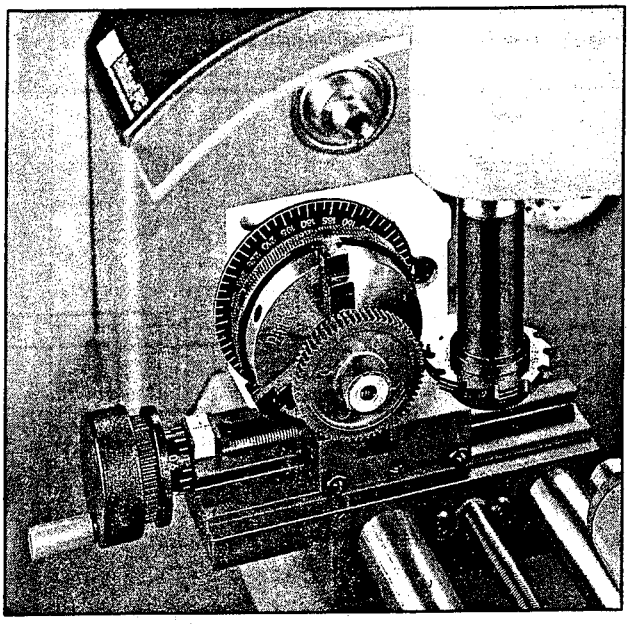
Only the longitudinal slide has a clearance compensation on the Unimat PC.

Thus, never down mill with the cross feed!

Milling large milling depths

For large milling depths, it is recommended to machine the total depth in several working cycles. (The load is larger for hard materials than for soft materials.)

Milling gears:



Used accessories:
- Mounting mandrel for modular mill
- Dividing attachment

Thread cutting with the vertical equipment

- Prerequisite information:

  Only use machine taps, with which the thread is cut in one procedure only.

  When using serial taps, the medium and the finishing cutting edge would no longer find the thread path of the pre-cutter.

  Set the vertical equipment to the coarse feed and loosen the clamp.

Through-threads:

Use suitable supports, on which you can clamp the workpiece in order to avoid damage to the cutting tool and machine.

Blind hole threads:

Mark the maximum thread depth on the tap with chalk, in order to be able to switch off the machine in time.

- Procedure

  Set the vertical equipment in such a way that the tap is just above the core-hole.

  Set the smallest speed (20 rpm) at the machine.

  Lubricate the tap with cutting oil.

  Switch on the machine (observe the rotation direction of the tap).

  Place the tap on the core-hole with a slight pressure through the vertical feed, until the tap pulls itself into the borehole.

  After obtaining the desired thread depth, switch off the machine (note instructions for through- or blind hole threads).

Switch on the machine in the opposite direction and let it run, until the tap has completely emerged from the workpiece.

Switch off the machine.

Mounting the clamping devices:

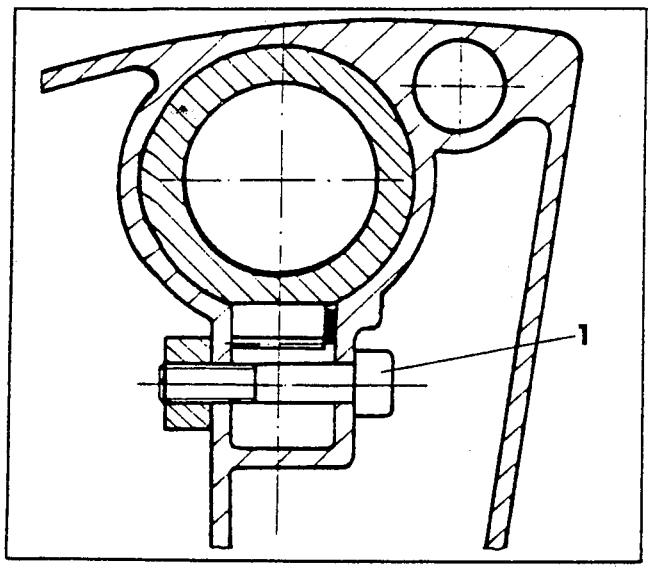
Note that the respective clamping device is screwed tightly onto the vertical spindle. Otherwise, it may happen that the clamping device loosens itself from the vertical spindle, when the motor is switched off or the tap is pulled out.

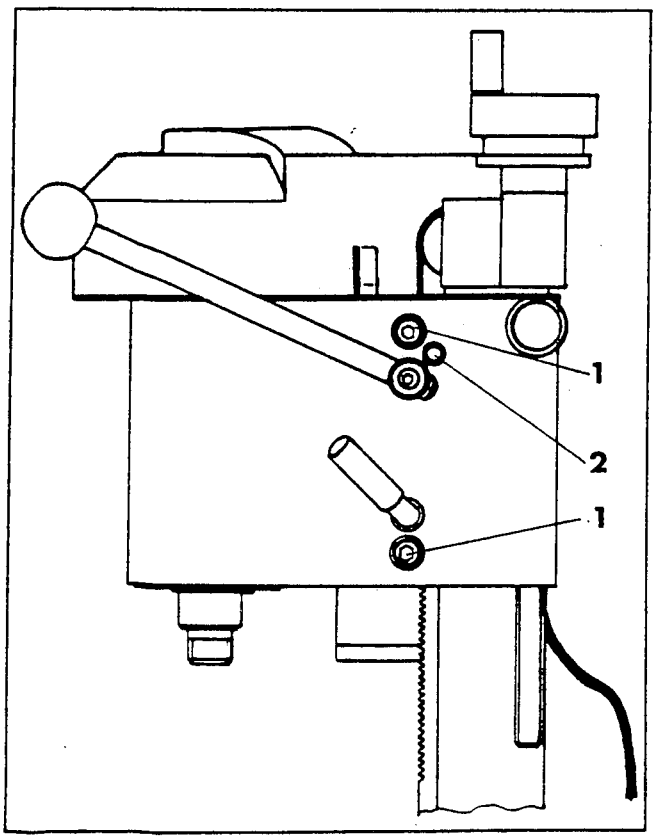
Re-adjustments

Setting the clearance between the vertical column and the vertical guide

Tighten the socket head screws (1), until the vertical guide runs play-free at the vertical column.

At the same time, make sure that the guide is smoothly running, since the guide is clamped, if the socket head screws are tightened too much.





Setting the radial clearance:

By tightening the thread plug (2), the radial clearance is removed (see direction of arrow).

If the thread plugs are tightened too much, the rack is clamped, and the vertical motion is thus blocked.