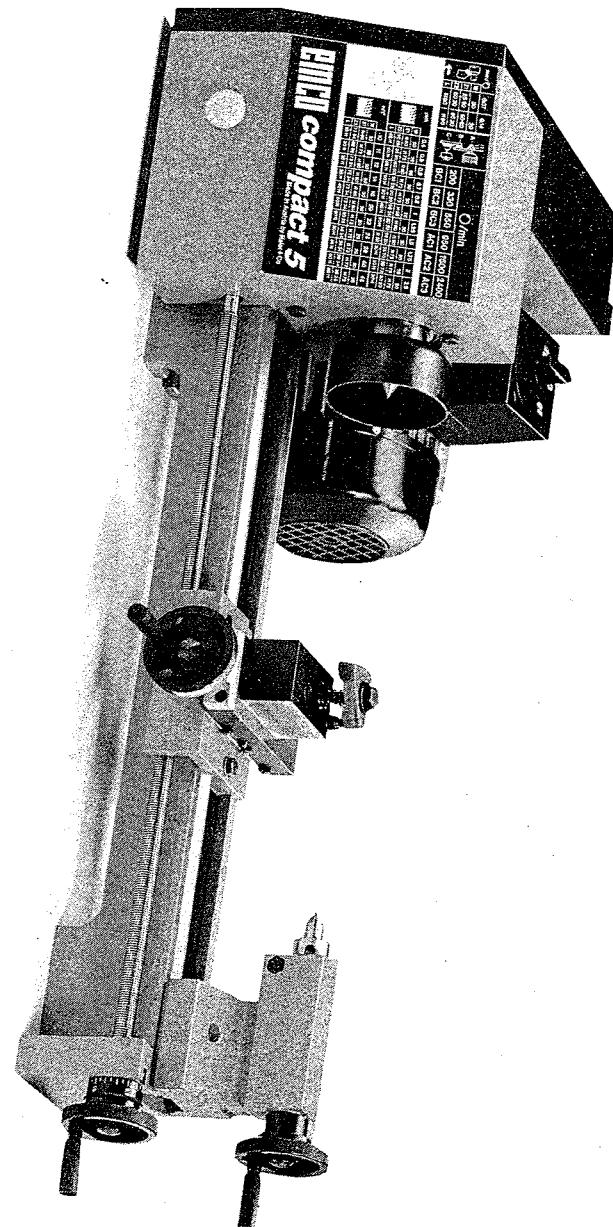


Instruction book

Service parts

EMCO compact 5



Englisch Order No. EN 2001

Auflage: 10. 9. 8. 7. 6. 5. 4. 3. 2. 1.

92 91 90 89 88 87 86 85 84 83

EMCO MAIER
GESELLSCHAFT M.B.H.
A-5400 Hallein / Austria

Adequate Use

The machine is designed for turning of machinable metals. Machining of other materials is not admitted and may be carried out in particular cases only after consultation with the machine manufacturer.

Adequate use also includes compliance with the operating and maintenance instructions indicated by the manufacturer.

The machine may exclusively be operated by persons familiar with operation, maintenance and repair and who know about the hazards.

All regulations for the prevention of accidents and safety instructions for work with machine tools have to be complied with at any time.

In case of inadequate use of the machine the manufacturer renounces any liability and the responsibility is transferred exclusively to the user.

Warranty Conditions for New EMCO Machines

1. The warranty period for new EMCO machines is, without limitation of operating hours, 12 months after initial shipment of the machine from EMCO or its authorized representative. Should the installation be completed by EMCO or its authorized representative, the warranty period begins with the completed installation of the machine.
If a delay of installation occurs which is not caused by EMCO or its representative, the warranty period becomes invalid 12 months after scheduled installation date.
2. The warranty extends to the elimination of all defects in material or workmanship which affect the regular function of the machine.
3. Occurring defects must be immediately reported to the EMCO representative or the next EMCO service department with detailed description of the defect in written or oral form, followed by a written verification.
4. Defects which are correctly reported and under warranty will be corrected by either repair or replacement delivery to the original buyer free-of-charge; defective parts are to be returned to EMCO or the EMCO authorized representative, freight prepaid, if requested.
5. Warranty for spare parts: Emco guarantees to the original buyer that, only those parts sold directly by Emco or through an authorized representative will be free, from defects, which render part commercially unacceptable in material and workmanship, for a period according to applicable national law, at least three (3) months, but not to exceed six (6) months from the date of initial shipment or installation by Emco or its representative.
In the case of repeated claims for the same part: Warranty replacement does not extend the period of the original warranty.
6. There is no claim of warranty for defects which occurred by:
Negligence of operating instruction manuals, safety and handling regulations or other instructions regarding delivery, installation, set-up or usage of the machine, incorrect set-up resp. installation, as well as, unauthorized, not expressed regulated or allowed alterations or modifications of the machine by the original buyer or third parties, natural wear, improper or negligent handling, chemical, electro-chemical or electrical influences, inadequate energy supply or force majeure.
7. Any service performed by EMCO or its authorized representative beyond warranty will be charged at EMCO's or its authorized representative's regular rates.

Safety recommendations - Lathe

Read documentation

Read this documentation completely before you start up the machine.

Electrical connection

The electrical connection of the machine must only be carried out by electrics experts.

Authorized operation

The machine may only be operated by authorized persons.

Protect the machine against unauthorized start-up (main switch which can be locked).

Start-up

Make sure that prior to each start-up the machine is in perfect maintenance state and that no safety features have been removed.

No modifications on machine

Modifications on your own on safety features, bridgings or control features as well as any interference with the electric/electronic part of the machine is prohibited.

In case of hazards EMERGENCY-OFF

In case of hazards immediately actuate EMERGENCY-OFF key to stop machine.

Safe tool-clamping

Prior to start of operation check if workpiece and tool are clamped safely.

Remove chuck key

Prior to start of operation check if chuck key has been removed.

Observe speed limits

Clamping devices are subject to speed limits. Thus observe the maximum speed of the clamping devices used by you.

Clamp only short workpieces in cantilevered mode

Support longer workpieces (> clamping diameter 3x) by means of collar plate or revolving center punch.

Do not clamp too short

Avoid small clamping diameters with large turning diameters.

The workpiece should fit tightly.

Use chip hook
Remove chips only with machine switched off and by means of a chip hook.

Do not reach into running machine!

Use protection for projecting parts
During machining of rod material the parts projecting over the headstock should be covered by a fixed protection device along the entire length.

Tool change

Change machining tools only during standstill of machine.

Measurement work

Carry out measurement work only during standstill of the machine and with EMERGENCY-OFF key actuated.

Wear body protection

Mind that your hair does not get caught in the machine - hair protection to be worn.

Protect your eyes with safety-glasses.
Do not wear loose working clothes. Mind that the working clothes are tight around the wrists and hips.

Machine supervision

Never leave running machine unattended.
Before leaving the working place switch off machine.

Maintenance and readjustment work

All maintenance and readjustment work may be carried out only with machine switched off and EMERGENCY-OFF key actuated.

Claim

In the event of a collision or instance of damage, contact the representative or manufacturer.
In case of complaints, damage, confusions and spare parts orders always indicate the machine number.
For parts not supplied by EMCO, EMCO will not assume liability.

Safe Clamping

Clamp only short workpieces in cantilevered mode

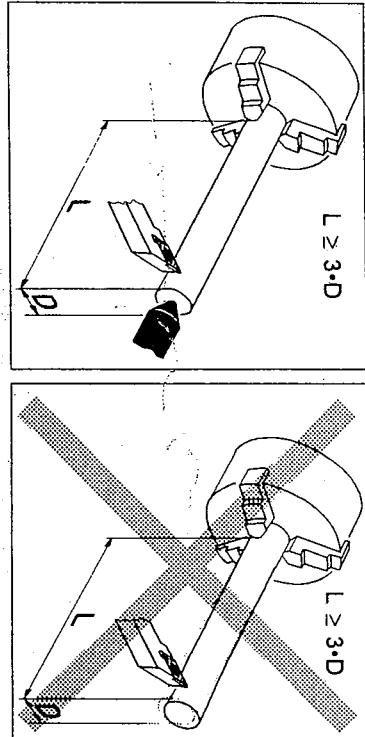
If the outstanding workpiece length is longer than the triple diameter, the workpiece must be supported with the tailstock (with live centre) or with the steady.

Cause:

Otherwise the workpiece will be bended by the cutting pressure and start chattering.

Result:

Bad turning result, breaking of the tool, bending or catapulting out of the workpiece.



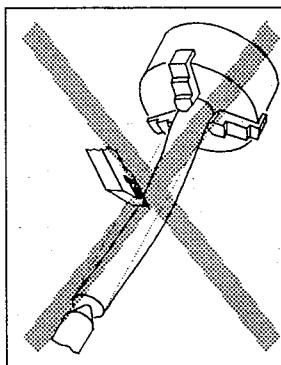
$$L \geq 3 \cdot D$$

Travelling steady

If the outstanding length of the tool is too long and supporting by the tailstock is not possible, use the **traveling steady**.

The fixed steady will be mounted at the machine bed.

Dangers without fixed steady:
Bad turning result, breaking of the tool, bending or catapulting out of the workpiece.

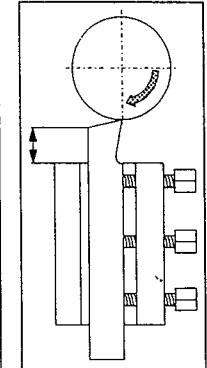


Fixed steady

A tool which is clamped too long will bend, starts **vibrating** and will **break**. The fragments will **shoot out like gun bullets**. The tool tip must be exactly at turning centre height.

Clamp the tool as short as possible!

A tool which is clamped too long will bend, starts **vibrating** and will **break**. The fragments will **shoot out like gun bullets**. The tool tip must be exactly at turning centre height.



Never clamp the workpiece too short (A). The workpiece must be well attached, otherwise it will be **catapulted out of the chuck**.

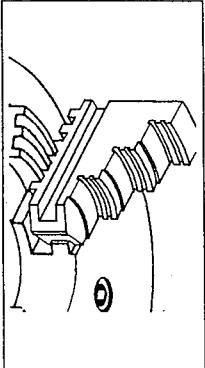
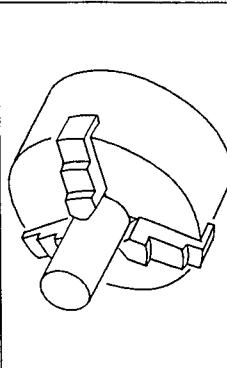
Avoid small clamping diameters (d) with large turning diameters (D).

The clamping forces at the small diameter would get too small, the workpiece will be **catapulted out**.

Never exceed the clamping range of the chucks!

Too far outstanding jaws will break and shoot out like gun bullets.

The maximum clamping range of a chuck is determined by the chuck manufacturer.



EMCO COMPACT 5

Addition to Technical Data

SOUND PRESSURE LEVEL

Max. sound pressure level Lathe 64,5 dB(A)

Max. sound pressure level Milling and drilling equipment 65,3 dB(A)

With the following conditions:

- * Measurement method enveloping surface method according to DIN 45 635
- * Measured point distance 1 mm and 1,6 m above ground
- * Operating mode maximum speed with idle running

Declaration of conformity

Product: Lathe

Machine data:	<i>Model</i>	<i>Type</i>
<i>EMCO</i>	<i>COMPACT 5</i>	

Address of manufacturer: Emco Maier Ges.m.b.H
Friedmann-Maier-Str. 9
A-5400 Hallein

Bases of standards: EN 60204-1 (6/93)

Regulations: MSV (BGB). Nr. 306/1994, 27.4.94)

Test certificates:

Particular notes , enclosures: Electrical documentation as applicable

We herewith declare that the above-mentioned product referring to the subject declaration is in conformity with the currently valid stipulations of the directive of the Council dated June 14th, 1989 for the alignment of the legal stipulations of the member states for machines (89/392/EEC) and its modifications dated June 20th, 1991 (91/368/EEC), June 14th, 1993 (93/44/EEC) and July 22nd, 1993 (93/68/EEC). Furthermore, the conformity of the subject product with the above-mentioned standard bases and regulations is effective.

Place, date: Hallein, 02.01.95

Authorized person: Head of quality department Dr. Wilfried Brugger

b. Brugger

Starting with machine ref.no. 85 06 001 we shall supply COMPACT 5 machines with adjustable screw nuts for longitudinal and cross slides. Therefore the following information has to be added to instruction book and spare parts list:

1. Compensating play of lead screw in the lead screw nut (annex to chapter "Adjustments", page 32)

Note: Necessary when the handwheel is turned a certain angle, without moving the longitudinal slide.

- a) Adjusting the handwheel clamping: see instruction book page 32
- b) Adjusting the nut: Adjust hexagon head screw (39) in lead screw nut until play is eliminated.

Checking:

It should be possible to move longitudinal slide without play smoothly. A too rough adjustment causes unnecessary wear off the lead screw nut.

2. Compensating play of cross screw in cross nut

Note: Necessary when cross slide handwheel is turned a certain angle and cross slide does not move.

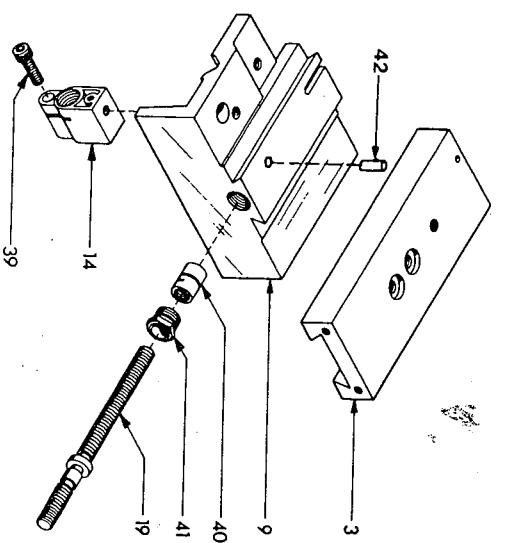
- a) Adjusting the handwheel clamping: see instruction book page 32
- b) Adjusting the nut: Adjust setting screw (41) until play is eliminated.

Checking:

It should be possible to move cross slide without play smoothly. A too rough adjustment causes unnecessary wear off the cross nut.

3. Changed reference numbers in service parts list (page 6)

Pos.	Ref. Nr.
3	A5A 020 021
9	A5A 020 011 A5B 020 011
14	A5A 000 091 A5B 000 091
19	A5A 021 021 A5B 021 021
39	ZSR 12 0516
40	A5A 020 060 A5B 020 060
41	A5A 020 050
42	ZHL 81 0214

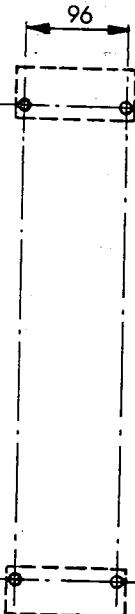


Leveling Device for COMPACT 5

(Ref. No. 200 210)

If you demand highest precision work from a lathe, the machine has to be put on a leveling plate and aligned by means of a leveling device. Without such an alignment it may occur that you do not succeed in turning cylindri-

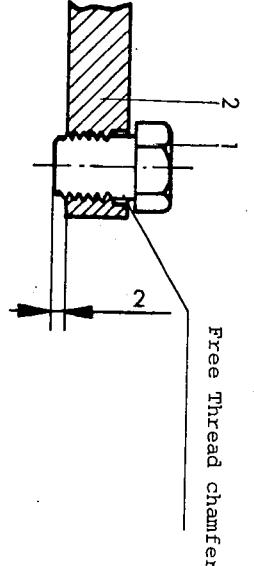
cally.



Use of leveling device:

This device serves for alignment of the COMPACT 5.

1. Drill 4 holes dia. 4 x 35 mm into the ground plate (see drill template). A stable, torsion-free wood or wood-fibre board approx. 50 mm thick can be used as ground plate. If you use an old chip pan, then rough-drill it accordingly.



2. Screw leveling bolt (1) into leveling plate (2). The bolts should stand out some 2 mm. Use leveling plate (2) such that free thread chamfer is like on drawing.

3. Place washers (3) underneath and tighten leveling plate with screws (4) onto ground plate. Put a drop of oil between screws (4) and leveling bolt.

4. Put down COMPACT 5 and screw tightly.

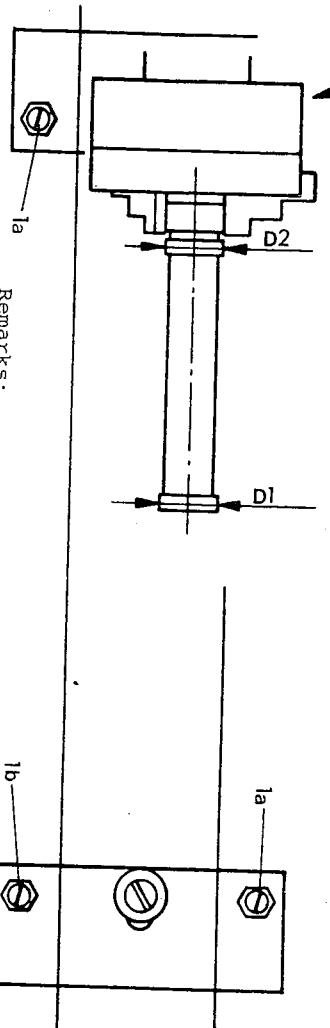
5. Alignment:

- 5.1. Mount ready-turned workpiece (comes with leveling device) in 3-jaw chuck and tighten slightly, support workpiece using tailstock, tighten firmly, move tailstock away and turn without tailstock support.

- 5.2. Use right hand side tool and turn off at both diameters D1, D2. Depth of cut 0,1 mm.

- 5.3. Measure diameters by one-hundredth of mm. If D2 is bigger than D1, screw in leveling bolts 1a or screw out leveling bolts 1b. - Thereby, screw (4) must not be turned round. If D1 is bigger than D2, your proceed vice-versa.

- 5.2. and 5.3. have to be repeated so many times until diameters are identical.



Remarks:

Without the leveling device the machine can be aligned by placing metal sheets under the lathe bed.

Inch version of Compact 5 (60 cycles)

In the instruction manual the metric version is described. The inch version has the following basic differences:

Pitch of leadscrew, cross slide spindle have inch pitches. This causes another gear combination for feeds and thread pitches as well as different readings on the dials. In the spare parts list you find the metric and inch numbers for parts which differ.

Differences concerning the inch version

Page 4

Technical Data:

Pitch of leadscrew: 16 tpi

Pitch of cross slide spindle: 20 tpi

Range of speeds: 50 cycles 200-2400 rpm
60 cycles 250-2800 rpm

Feeds: 0,003" per revolution
0,004" per revolution

Thread pitches with accessory automatic feed mechanism (on inch type machine)

16, 20, 24, 32 tpi

Thread pitches with change gear set (on inch type machine)

Inch threads: 10, 12, 13, 14, 15, 18,
26, 28, 36, 40, 48, 56 64

Metric threads: 0,25/0,3/0,45/0,5/0,6/
0,75/0,8/1,0/1,25/1,5/1,75 mm

Page 8

The chart shows speeds for 50 cycles
0,003" and 0,006" equals approx. 0,07 mm
and 0,14 mm so that you can read out recommended speeds.

Page 13

Illustrations and examples show 50 cycles machine.
The corresponding speed of BC3 (550 rpm) is 650 rpm on a 60 cycle machine.

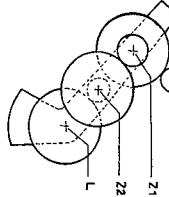
Page 14/15/16

Handwheel for longitudinal slide

As the spindle has a pitch of 16 tpi, the longitudinal slide moves 0,0625". When you make a full revolution of the handwheel. Turning the handwheel one graduation, the slide moves 0,00125".

Handwheel on cross slide

The cross slide spindle has a pitch of 20 tpi. Turning the handwheel a full revolution, the slide moves 0,05". The scale and its divisions relate to the diameter. It shows 0,1" with a full



n/1"	10	12	14	16	18	20	24	28	32	40	48
w	20	20	20	20	20	20	20	20	20	20	20
Z1	H72	H72	H72	H60	H72	H60	H72	H60	H40	H60	
Z2	40	20	60	25	40	20	60	25	50	35	25
L	25H	36H	35H	60H	36H	60H	60H	50H	60H	60H	H60

mm	0,25	0,3	0,45	0,5	0,6	0,75	0,8	1,0	1,25	1,5	1,75
w	20	20	20	20	20	20	20	20	20	20	20
Z1	H60	H60	H72	H72	H72	H72	H72	H72	H72	H72	H72
Z2	34	60	34	50	34	40	34	36	34	30	34
L	72H	72H	60H	60H	50H	40H	35H	36H	34H	36H	26H

Additional thread pitches not shown on the chart

Page 30

Thread sizes and gear combinations shown on the chart (inch version)

n/1"	8	13	15	26	36	56	64
w	20	20	20	20	20	20	20
Z1	H60	H72	H72	H72	H72	H72	H72
Z2	50	20	40	25	40	35	40
L	25	H	26	H	30	H	40

Page 38
Speeds for 60 cycle machine: 450, 800,
1900 rpm.

Page 41/45

Concerning speed chart:
Take instead of 1600 - 1900
700 - 800
380 - 450

if you have a 60 cycle machine.

revolution. So if you turn the handwheel one revolution, the diameter is reduced 0,1".

Turning the handwheel one graduation, the diameter will be reduced 0,02".

Top slide:

With one revolution the slide moves 0,04". One graduation is 0,002".

Page 29/30

The feed sizes on the inch machine differ (see plate on your machine), but the gear combinations are the same for this example.

66/C	W	0,003	0,006
	Z1	25	60
	Z2	60	20
L	H60	H60	H60

Forward

This Instruction Manual contains a general description of the machine and its operating elements, mounting instructions for the accessories, working tips and rules for accident prevention. The chapters "Basics about Turning, Drilling and Milling" and the numerous working tips actually exceed the usual contents of an Instruction Manual. We feel, however, that these chapters convey the necessary basic information to the aspiring professional and draw the professional's attention to special features and the universality of the machine.

The working tips are indicated with the mosaic screen pattern. The sizes of screws, nuts, bolts, etc. are not always indicated in the mounting instructions. These dimensions can be found in the Service Parts List.

Always follow the rules for accident prevention!

The construction of the Compact 5 and the accessories meets all current safety regulations in industry and schools, but improper or careless working methods can lead to injuries.

Read the Instruction Manual carefully before starting the machine - a few minutes now can save valuable time and frustration later. Only proper operation can guarantee the desired results.

Index – Turning

Accident Prevention	3
Technical Data	4
Basic Equipment, Care of machine	5
Accessories lathe (summary)	6
Basic terms about Turning	7/8
Turning tools	9/10
Setting up the machine, electrical Connection	11
Main Components	12-16
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Turning between centers	17
Clamping devices for Workpieces (summary)	18
3-jaw chuck	19-22
Clamping plate	22
Independent chuck	23
Collet chuck attachment	24
2-way toolholder, Quick-change toolholder	25
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Mounting the gears	29/30
Thread pitches, gear combinations	30/31
Adjustments	32
Lubrication	33
Troubleshooting chart	34
Drilling and Milling	35-54
Wiring diagram	55
Spare parts list follows!	

Accident Prevention: Milling – Drilling

- + **FOLLOW ALL ACCIDENT PREVENTION RULES!**
Read instruction manual before working with the machine.
- + **ELECTRICAL CONNECTION:** The electrical connections must be carried out professionally. A grounding receptacle must be available. Mounting of the plug (if not already mounted) must also be carried out professionally.
- + **DO NOT ALTER GUARDS!** When turning between centers, mount lathe dog guard. Close belt guard before starting machine. Never open belt guard while machine is running.
- + **KEEP CHILDREN AND VISITORS AWAY!** The machine should be stored so that children and visitors not acquainted with the use of the machine cannot start it.
- + **ALWAYS WEAR SAFETY GOGGLES!** Be also aware that some materials (for example brass) spray while being worked on. Therefore, it is important that all persons near the machine are protected.
- + **WEAR PROPER APPAREL!** Loose sleeves could get caught in chuck or work-piece.
- + **KEEP WORK AREA CLEAN!** Cluttered areas and benches invite accidents.

+ **REMOVE ADJUSTING KEYS AND WRENCHES;** even when machine is not being used. The chuck keys should never be attached to the machine with chains or similar.

- + **NEVER TOUCH RUNNING MACHINE PARTS!** Never try to stop workpiece or chuck with the hand.
- + **DO NOT SURPASS THE CLAMPING CAPACITY OF THE LATHE CHUCK!** The maximum clamping capacities are indicated on page 11 and 14.
- + **BE CAREFUL OF EXTENDING CHUCKS!** Never reach over running (rotating) chucks.
- + **SWITCH MACHINE OFF BEFORE SERVICING!** Remove plug from socket.
- + **TURN OFF MOTOR BEFORE ATTEMPTING adjustments,** maintenance or measuring work.
- + **USE ORIGINAL SPARE PARTS!**

Technical Data

Center height

65 mm

TAILSTOCK:

Distance between centers

350 mm

Center sleeve diameter

22 mm

Swing over bed

130 mm

Inside taper

MT 1

Swing over cross slide

80 mm

Stroke of center sleeve

35 mm

Travel of cross slide

50 mm

Travel of top slide

45 mm

Leadscrew diameter

12 mm

FEEDS (with accessory automatic feed mechanism)

Leadscrew pitch

1,5 mm

2 longitudinal feeds: 0,07 mm/rev,
0,14 mm/rev

Approx. net weight

20 kg

HEADSTOCK:

Spindle nose

Factory standard

Spindle bore 16 mm

MT 2

Spindle inside taper

6

Number of spindle speeds

5

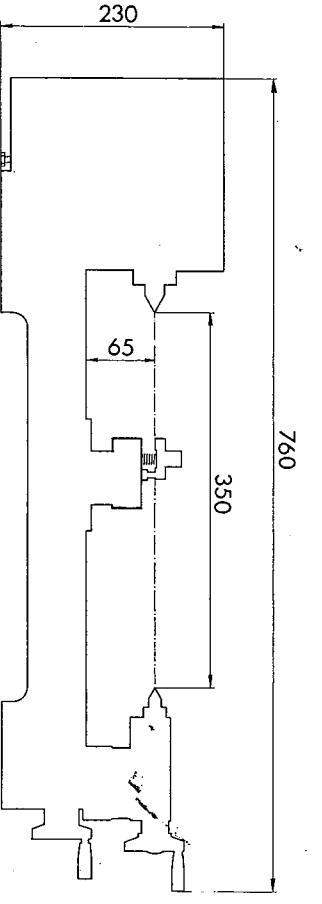
Range of speeds (50 cyc.) 2000-2400 rpm

MOTOR (220 V, single-phase):

Input power (P1) 500 W, S3-60%

Output power (P2) at 300 W, S3-60%

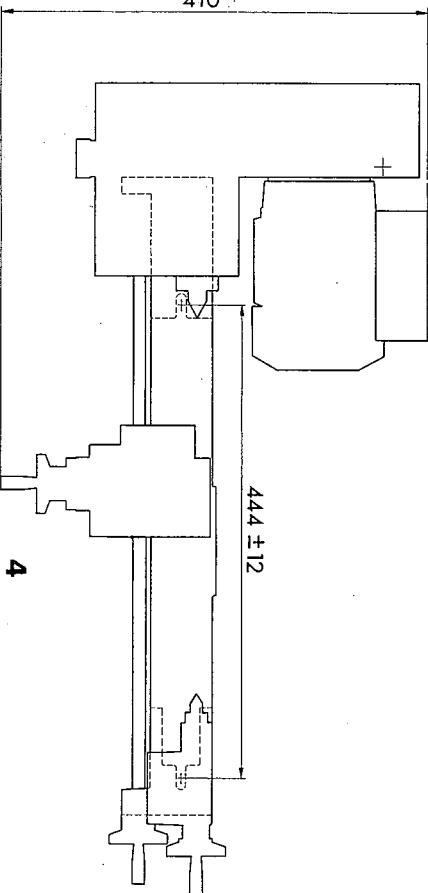
With Set of Change Gears:
Additional 10 metric threads: 0,25/0,3/
0,35/0,5/0,7/0,75/0,8/1,75/2,0/2,5 mm
and 14 inch threads: 48/40/36/32/28/24/
22/20/18/16/14/12/11/10 tpi



Front view

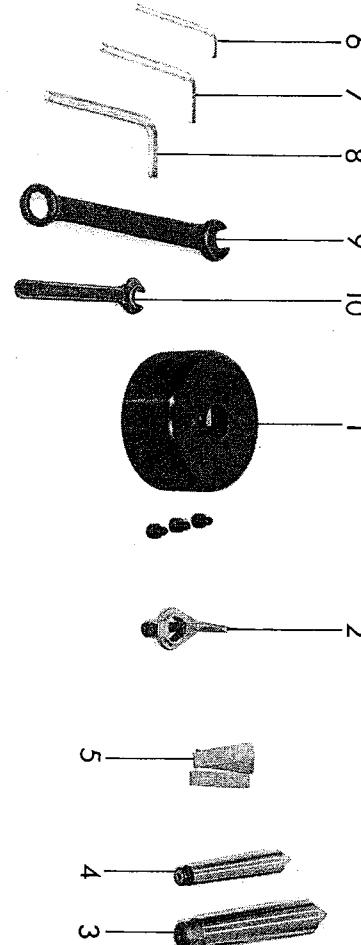
410

444 ±12



Front view

Basic Equipment



Lathe bed, headstock, tailstock, longitudinal and cross slide with single toolholder and clamping shoe, motor with belts and pulleys, instruction book, spare parts list.

BASIC EQUIPMENT

	SERVICE TOOLS	
1	Safety driving plate	
2	Lathe dog	
3	MT 1 center	
4	MT 2 center	
5	Tool spacers	
6	Hexagon key 3 mm	
7	Hexagon key 4 mm	
8	Hexagon key 5 mm	
9	Key 10/13 mm	
10	Single-ended spanner 8 mm	

Unpacking, Cleaning the Machine

Check the machine for possible transport damages and for completeness of the delivered parts. - See "Basic Machine".

The blank surfaces of the machine are coated with a rust-protective. Remove this substance carefully with petrol and oil machined surfaces with light machine oil.

Care of Machine

The Compact 5 is a precision machine tool. Exact care of the machine is a pre-requisite for the long-lasting precision and efficiency.

Have a look to the professionals operating their machines and how they care about it - and you will do it all right.

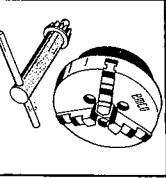
- Clean and oil all machine surfaces regularly!! (light machine oil)
For cleaning use a brush or a cloth.
Chips and dirt on the leadscrew cause quick wear of the leadscrew nut.

- Clean the spindle nose and threads before mounting the chuck or independent chuck.

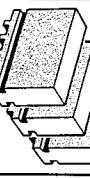
- Never use force!

Accessories Lathe

Three-jaw lathe chuck
80 mm dia., with scroll, reversible jaws, and tee-handle pinion key

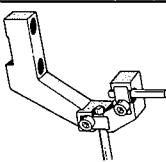


Set of three soft jaws
for three-jaw chuck Order No. 200 410



Order No. 200 430

Travelling steady
for workpieces from 4–25 mm dia.



Top slide
for taper turning



Order No. 200 230

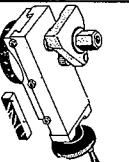
Clamping plate
90 mm dia., with reversible jaws



Four-jaw independent chuck
90 mm dia., with reversible jaws

Order No. 200 420

Automatic feed mechanism
consisting of gear quadrant with six change gear-wheels and clutch for two longitudinal feeds and five thread pitches (four thread pitches on inch type machine)



Order No. 200 300

Morse taper arbor MT1
with M 14x1 mounting thread (for mounting drill chuck to tailstock) **Order No. 200 280**



Order No. 152 500

Three-jaw drill chuck
capacity 1–8 mm, with M 14x1 mounting thread



Order No. 200 360

Revolving center MT1 **Order No. 200 270**



Order No. 152 120

Double tool holder
for square tools up to a maximum cross-section of 6x6 mm.
Technical tip: Fits on top slide Order No. 200 500



Order No. 200 010

Quick-change tool holder
consisting of tool holder body, 3 standard tool holders, 1 operating key. For square tools up to a maximum cross section of 8x8 mm.
Technical tip: Fits on top slide Order No. 200 500 (200 550). **Order No. 202 000**



Order No. 200 040

Fixed steady
for workpieces from 2–40 mm dia.



Order No. 200 240

6 turning tools
assorted, ground



Order No. 111 500

5 turning tools
unground



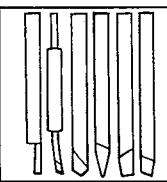
Order No. 110 010

2 threading tools
external and internal

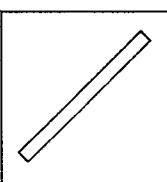


Order No. 111 600

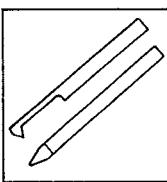
Tools Lathe



6 turning tools
assorted, ground



5 turning tools
unground



2 threading tools
external and internal

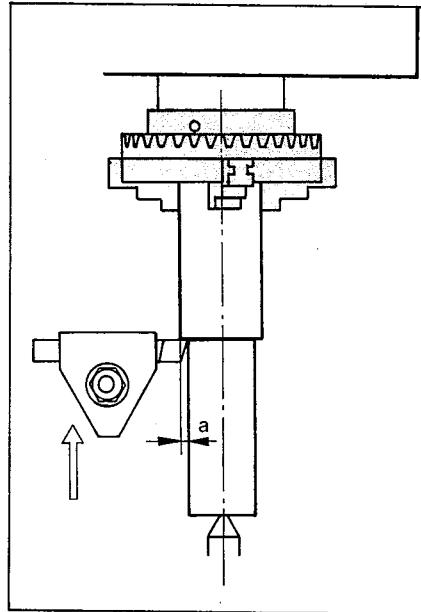
Some Basic Terms About Turning

Longitudinal Turning

The turning tool is moved parallel to the axis of rotating workpiece and removes material (feed direction of the tool is parallel to the axis).

"a" is the depth of cut.

If the feed is carried out from left to right (in the direction of the headstock), then a righthand tool must be used.



Taper Turning

The top slide is clamped at an angle in relation to the axis of rotation. Feed direction is in this adjusted angle.

The Feed (s)

The size of feed (s) is the path of the turning tool during one revolution of the workpiece.

SIZE OF FEED IS CALLED FEED FOR

SHORT

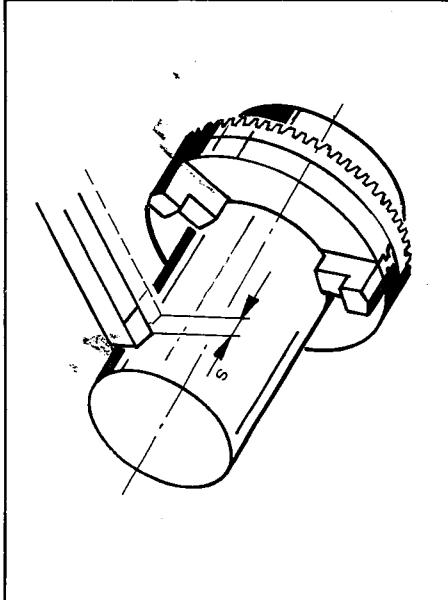
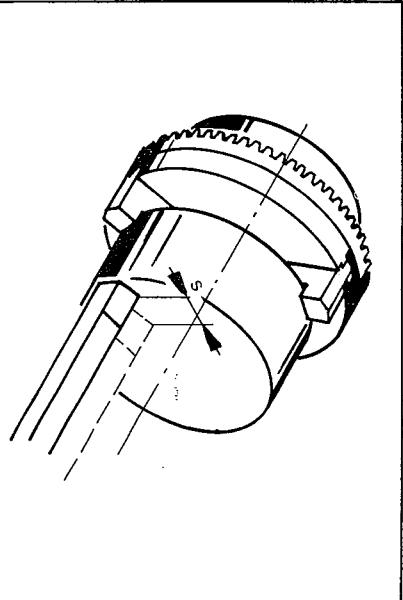
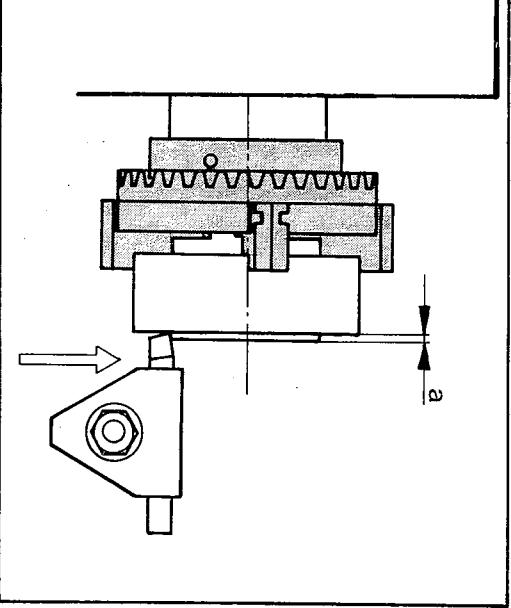
Large feed: → Rough surface

Small feed: → Smooth surface

Feeding is done by turning the respective handwheels. With the accessory "automatic feed mechanism" you can turn with automatic feeding in longitudinal directions with two feed sizes ($0,07$ and $0,14$ mm/rev). - Adjustment see pages 16, 17, 18.

Facing

The tool is moved at a right angle to the axis of rotation (feed direction: at a right angle to the axis). - The illustration shows a left turning tool. "a" is the cutting depth.



Spindle Speeds

On the Compact 5 six spindle speeds can be set:
200/330/550/950/1500/2400 revolutions per minute.- Adjusting the speeds see page 7.

Why different main spindle speeds?

1. Torque:

When turning large diameters or hard materials you need a higher torque than for small diameters or soft materials.
As the motor power is constant, you achieve the different torques by changing the spindle speeds. Low spindle speeds mean higher torque.

2. Heating of the turning tool:

- The higher the spindle speed (with equal diameters of the workpiece),
- the harder the workpiece,
- the larger the feed (s),
- the more the temperature of the tool will increase. - High speed tool steel (HSS) looses sharpness at a temperature of approx. 600°C.

As the workpiece diameter is assumed as existing, you have to regulate the spindle speed, the depth of cut, the feed as not to overheat and damage the cutting tool.

Cutting Speed Chart

The Speed chart

The chart shows the recommended speeds considering the parameters

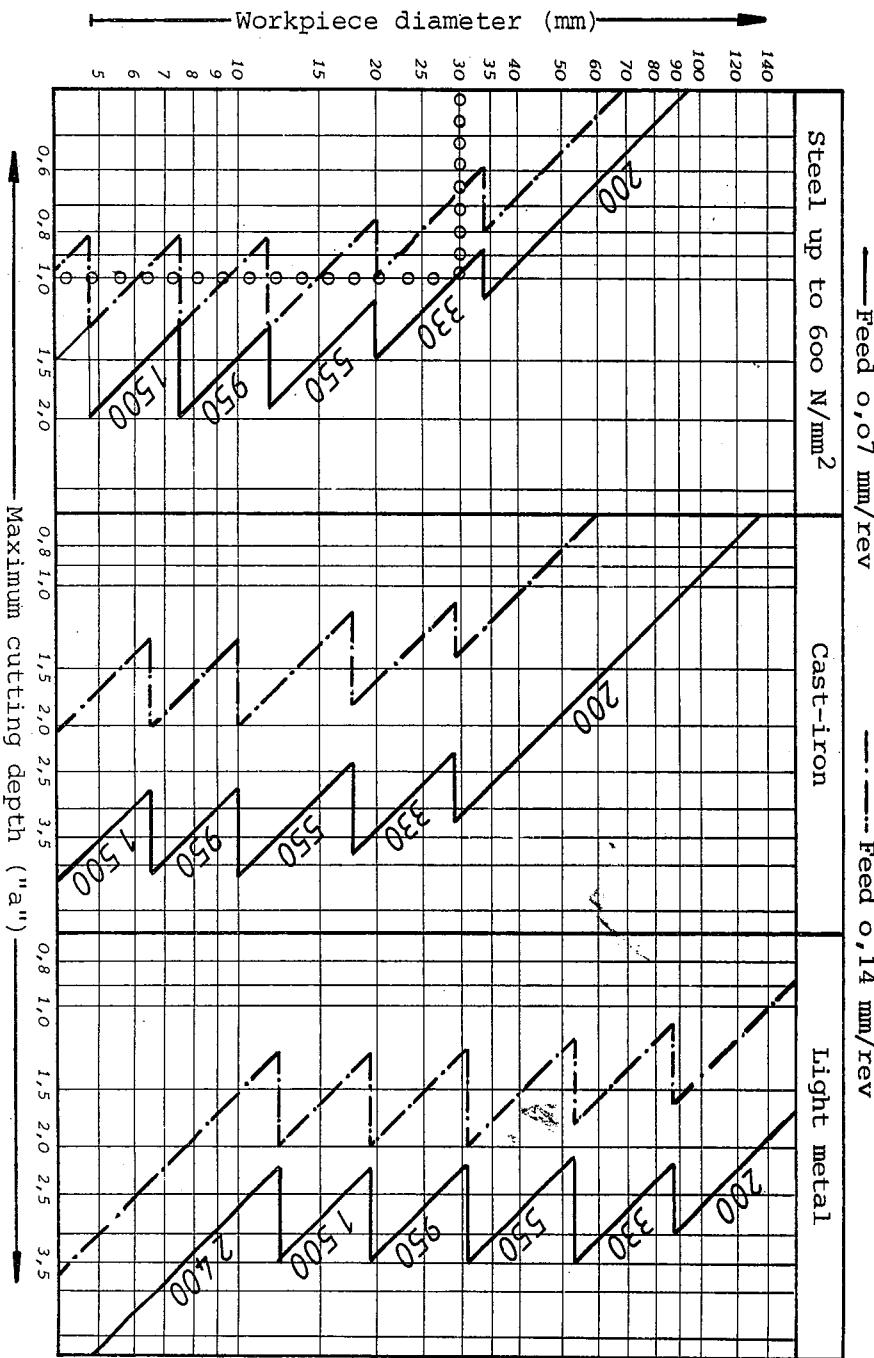
- diameter of workpiece
- material of workpiece
- depth of cut "a" and
- feed "s"

The values are valid for carbon tool steel. Using high speed tools you can increase the speed one step but you must reduce the cutting depth then.

Example:

Tool: Carbon tool steel
Workpiece material: Steel
Diameter of workpiece: 30 mm
Feed: 0,07 mm/rev

shows a speed of 330 rpm with a cutting depth (a) of 1 mm.



The Turning Tools

With the Compact 5, 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 the possible feed directions.

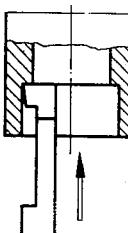
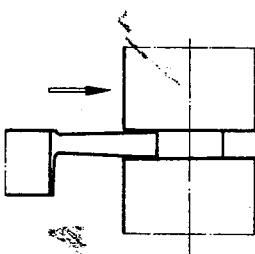
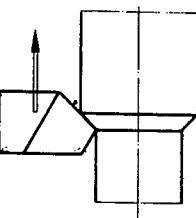
Longitudinal feed 

Cross feed
(transverse) 

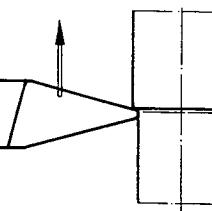
Note the different clamping angles of the turning tools (see illustration).

Set of 6 Turning Tools

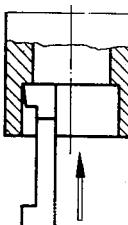
Roughing Tool is used for removing a large amount of material in a short time.



Boring Tool

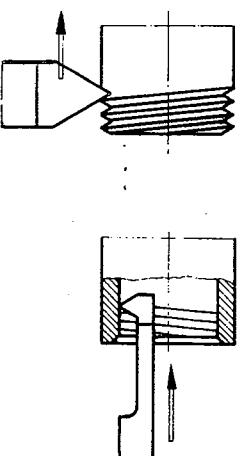
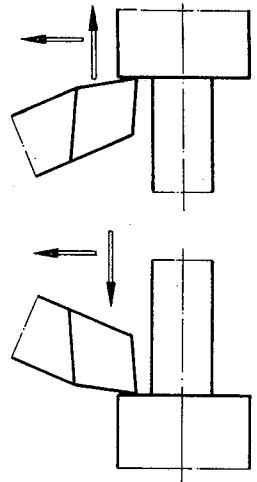


Parting-Off Tool it is used for grooving and parting-off. When parting-off, you must note: exact center height of tool bit point, low spindle speed, lubrication.



Thread-Cutting Tools

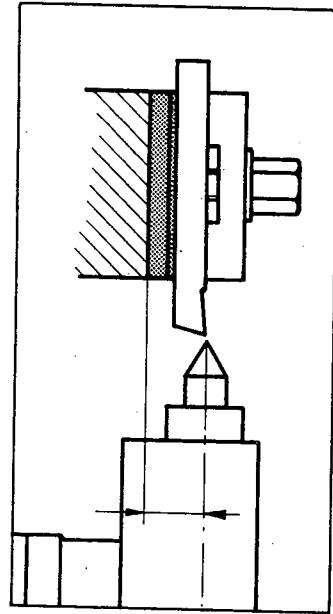
External and internal thread-cutting tool, angle 60°



Side Tools they are used for longitudinal and transverse turning and for turning acute corners.

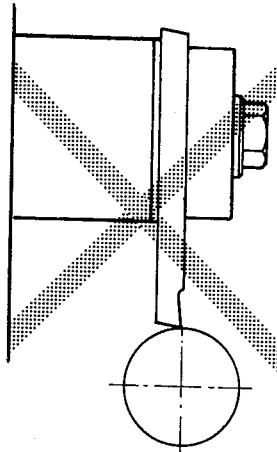
Planing Tool for a smooth surface. The depth of cut (a) may not be too big.

Correct Mounting of Tools



1. Mounting tools at center height:

The turning tools must be clamped so that the main cutting edge is exactly at center height. For this purpose, spacers of steel are used.



2. Overhang:

Clamp the turning tool with as little overhang as possible; a tool with too much overhang bends and causes rattling and an uneven workpiece surface.

Sharpening Tools

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

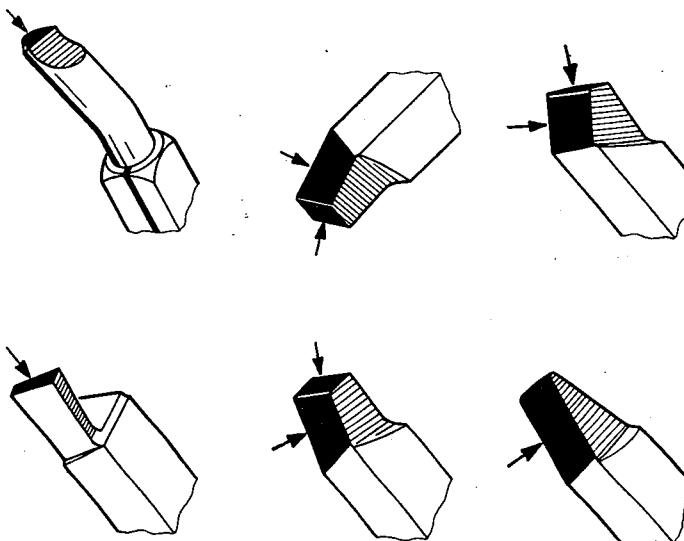
Sharpening with oilstone:

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 Tools

Strongly worn-off turning tools must be ground. Grinding requires some practice and feeling.

- Grind only blackened surfaces
- Note that the angles of the surfaces are not altered.



Care of Tools

The tools must be stored so that the cutting edges are not damaged.

WORKING TIP:

Note that your turning tools lose their cutting ability when the cutting speed is too high. - See cutting speed chart, page B.

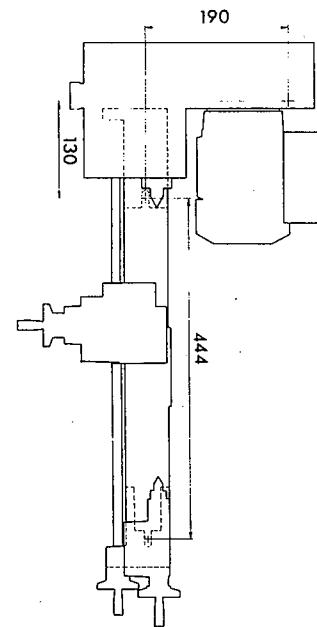
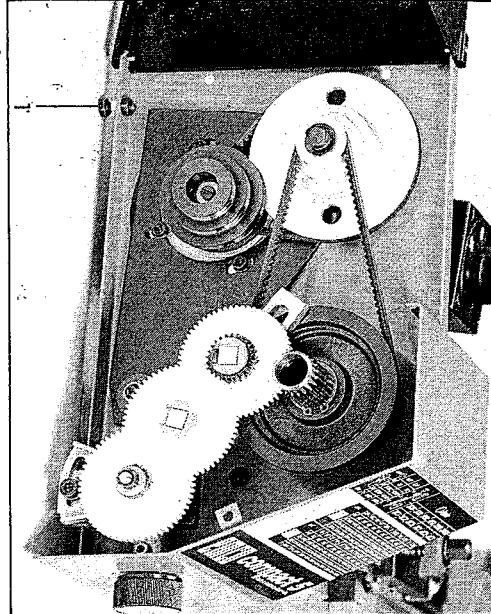
Setting-Up the Machine

Mount the machine on an appropriately stable and absolute uneven workbench, fastening with screws, or if the working area should be variable, on an even wooden board resp. plywood board (3-4 cm thick).

If the machine is not fastened with screws, vibrations could occur, which would encourage a negative turning result.

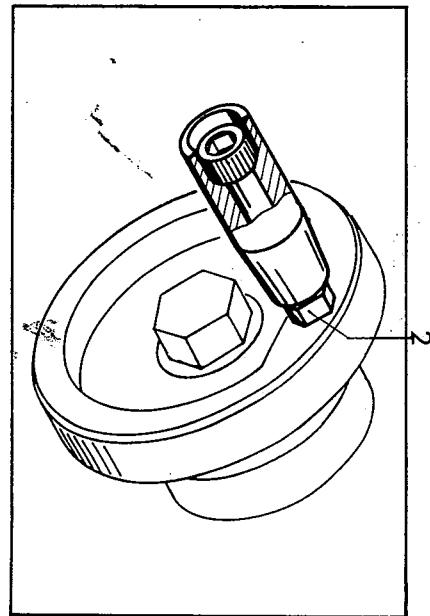
The sketch indicates the distance between holes for bolting down the machine and the distance of the support screw.

Recommended size of screws: 6-8 mm dia. Support the carrier plate with the hexagon screw (1). The hexagon nut serves for tightening the screw.



MOUNTING THE HANDLE ON THE LONGITUDINAL SLIDE HANDWHEEL AND CROSS SLIDE HANDWHEEL

Mount handle with allen screw and tighten hexagon nut (2) so that the handle turns freely and does not have too much axial play.



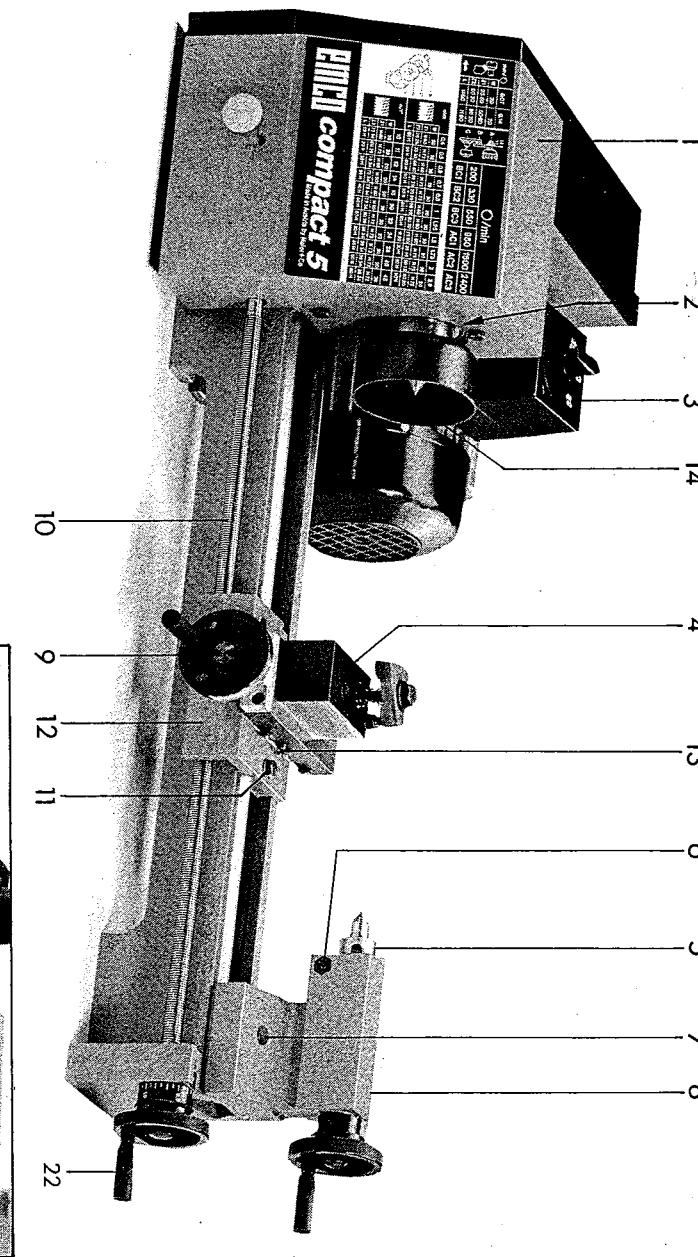
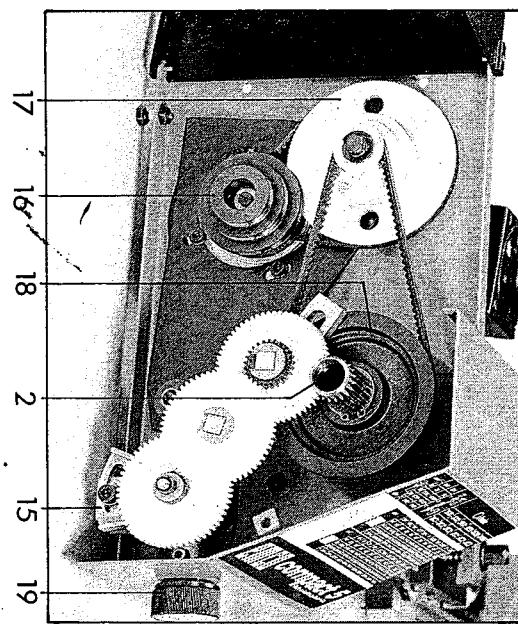
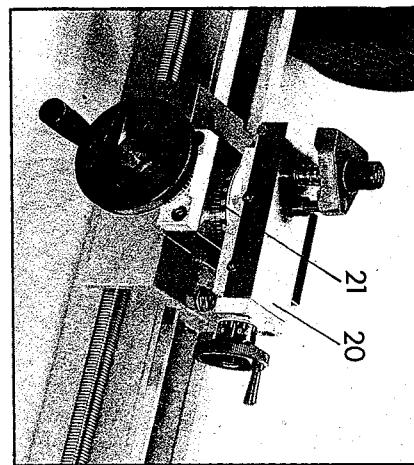
Electrical Connection

Mounting the Plug

Clamp the grounding wire (yellow-green) to the grounding contact (symbol \oplus). Clamp the other two wires to contact R and N.

A grounding receptacle must be available for connection of the machine!

- 1 HEADSTOCK
 2 MAIN SPINDLE
 3 MOTOR SWITCH
 4 TOOLHOLDER WITH CLAMPING SHOE
 5 TAILSTOCK SLEEVE
 6 CLAMPING SCREW FOR TAILSTOCK SLEEVE
 7 CLAMPING SCREW FOR TAILSTOCK
 8 TAILSTOCK
 9 CROSS SLIDE HANDWHEEL
 10 LEADScrew
 11 CLAMPING SCREW FOR LONG. SLIDE
 12 LONGITUDINAL SLIDE

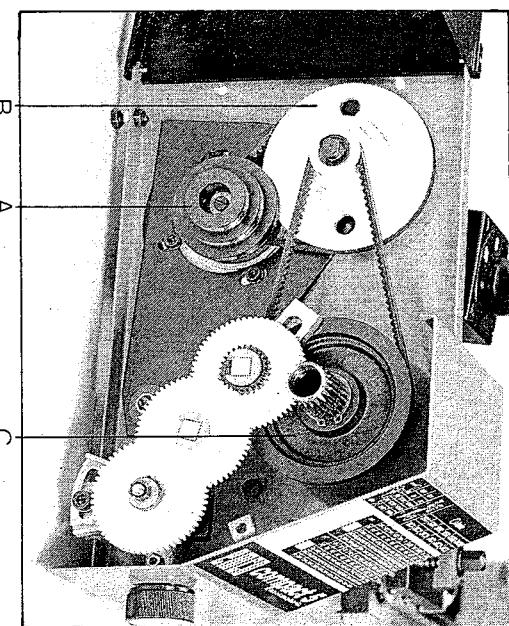


Design, Controls, Operating Elements

Lathe Bed

The lathe bed is made of high-quality cast-iron. The strong side walls and ribbing assure high rigidity and torsion resistance. Cast-iron absorbs vibrations exceptionally well.

The high precision ground guideways guarantee lasting and exact slide and tailstock running guidance.

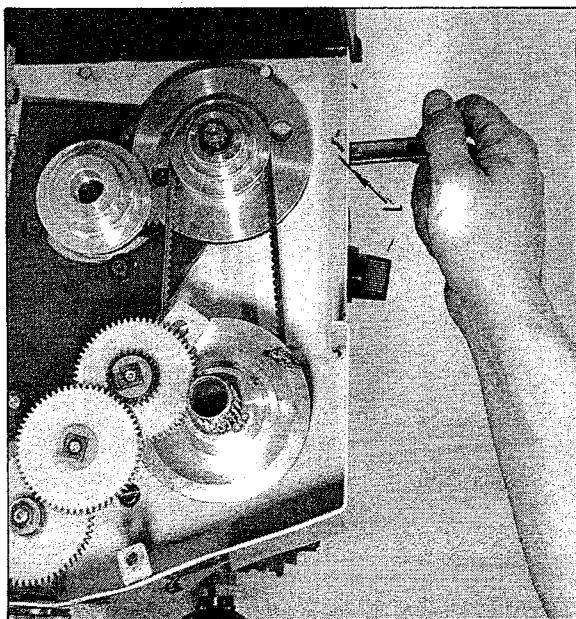
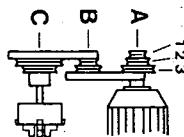


The Main Spindle Drive

The motor is reversible (this is necessary for thread-cutting). The main spindle is driven either directly from the

- + Motor pulley A to the main spindle pulley C (speeds 950/1500/2400 rpm) or from the
- + motor pulley A to the idler pulley B and from the idler pulley B to the main spindle pulley C (speeds 200/330/550 rpm).

The belt from the motor pulley to the idler pulley is never changed.



Spindle Speed Chart

The spindle speeds and the corresponding belt positions are indicated on the front plate of the spindlestock.

A B C	123	○ / min					
		200	330	550	950	1500	2400
		BC1	BC2	BC3	AC1	AC2	AC3

Setting the required spindle speed:

Loosen the hexagon screw (1) and lift the motor upwards. Place the belt on the required pulley combination. Press the motor downwards - this tightens the belt - and tighten the hexagon screw. The illustration below shows belt position BC3 (550 rpm).

TIP

If the belt should slide when using low spindle speeds, the belt must be tightened or the cutting depth must be reduced.

HEADACHE, MIGRAINE



The main spindle is supported by 2 ball bearings in the sturdy headstock housing. The ball bearings are completely enclosed and lubricated for life (no lubrication). The bearings are pre-loaded by a special spring so the main spindle runs always playfree (no adjustment is to be done).

Lathe chuck, independent chuck, etc. are mounted onto the main spindle. The inside taper MT2 serves for mounting the MT2 center (turning between centers). Explanation about feed and thread-cutting charts, see page 17/18.

The Slides

Longitudinal Slide

The longitudinal slide (2) runs playtree in the guideways of the lathe bed and can be clamped with the hexagon screw

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Longitudinal adjustment (manual feed) is achieved via handwheel to the leadscrew. The scale divisions on the handwheel: 0,05 mm. When a complete turn of the handwheel is made, the longitudinal slide moves 1,5 mm.

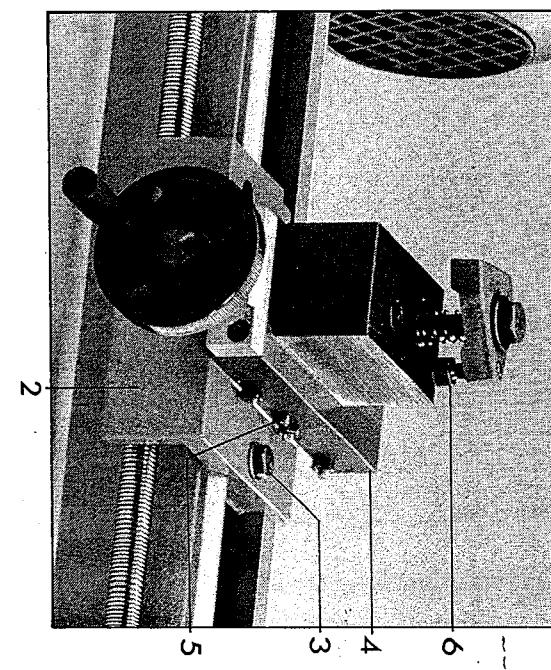
CrossSlide

The cross slide (4) runs playfree in the adjustable dovetail guideway of the longitudinal slide. The cross slide can only be adjusted by hand (manually). The scale divisions relate to the diameter and are indicated by 0,05 mm.

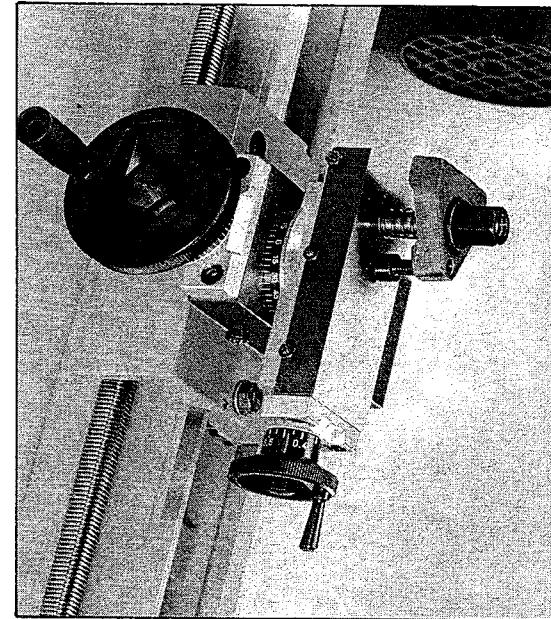
Justed 1 mm according to the scale ring 1 mm of the diameter of the workpiece will be turned off. The actual movement of the cross' slide is, however, 0,5 mm. The cross' slide can be clamped with the set screw (5).

Tool Holder

The toolholder is designed for tools with 6x6 mm cross-section. When clamping the turning tool, adjust the allen screw (6) so that the bracket is horizontal in clamped position.

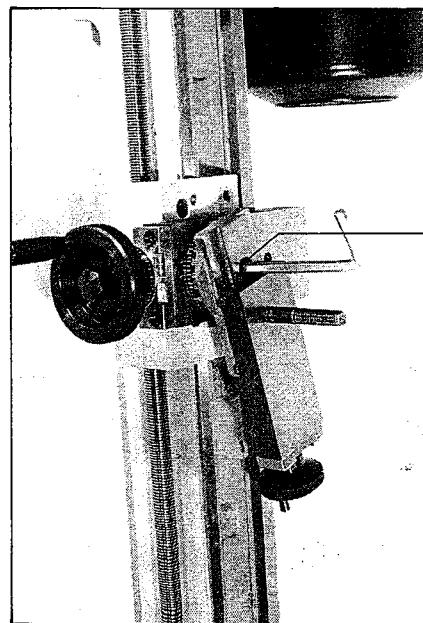
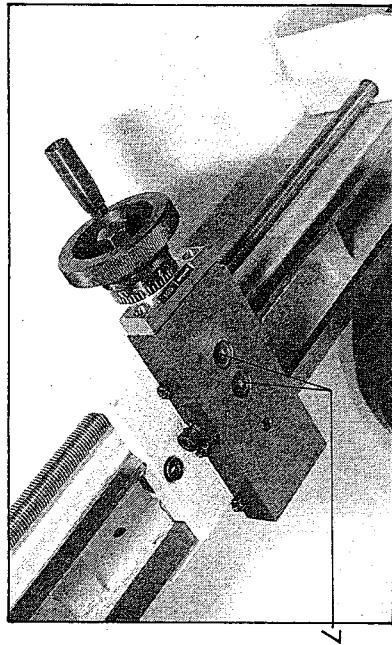


Top Slide (Accessory)



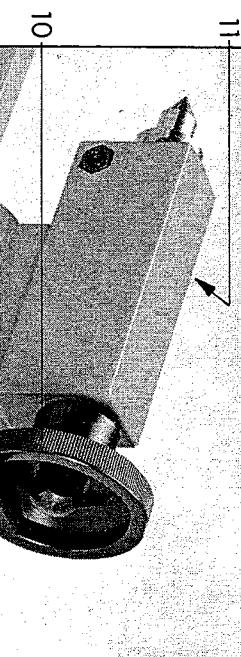
The top slide runs playfree in a dovetail guideway and can be clamped in any required angle relating to the turning axis. The graduated scale enables exact angle adjustment. With the clamping shoe, tools with a maximum size of 12x12 mm cross-section can be clamped. - Scale divisions on handwheel: 0,05 mm

Mounting the Top Slide:



Tailstock

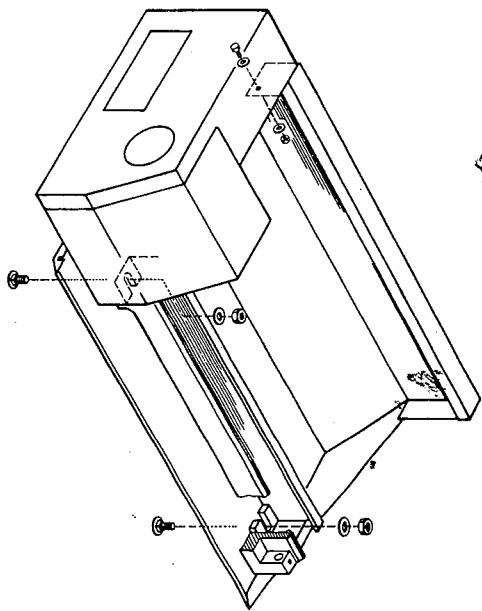
The tailstock serves for holding long workpieces. For this purpose, the fixed center or the revolving center is placed into the inside taper of the tailstock



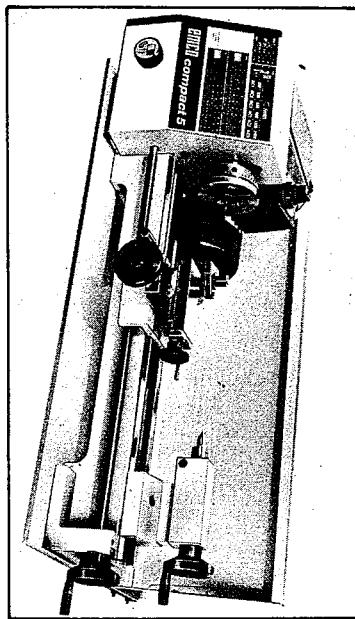
sleeve. After loosening the clamping screw (9), the tailstock can be moved on the lathe bed. The tailstock sleeve can be adjusted by turning the handwheel (10) and is fixed before turning work with the clamping screw (11).

If you turn back the sleeve all the way, the center is automatically ejected.

For drilling, the drill chuck is placed into the sleeve. The drill feed is effected with the handwheel. The drilling depth can be seen on the scale on the sleeve.

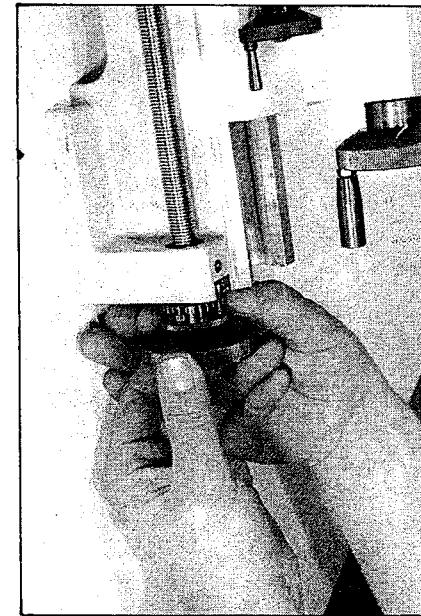
Splashguard with Chip Tray

The working area is kept clean by the chip tray and splashguard. With the splashguard it is not necessary to bolt the machine to a workbench. The 4 plastic washers on the bottom of the chip tray are shock absorbing. The unit can be placed on every stable table.

**Splashguard with Chip Tray**Mounting

1. Assemble the chip tray and splashguard with screws (dimensions see spare parts list).
2. Set up machine, bolt splashguard with carrier plate of the machine with screws. Tighten machine bed onto chip tray.

Adjustable Scale Rings on Longitudinal- and Cross Slide Handwheel
 The scale rings on the handwheels can also be adjusted. You can set the scale ring to zero position without changing the position of the slide. This saves calculation work.



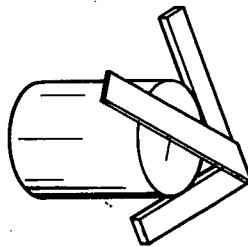
Turning between Centers

In order to clamp the workpiece, a center bore must be made at each face end.

Wrong: If center bore is not deep enough, the center would only touch the sharp corners.

Making a Center Bore

- If the workpiece is not too long, you can mount it in the lathe chuck and align it so that the free end runs centrically. Insert drill chuck into tailstock sleeve taper and clamp centering drill. Start machine. Move center drill towards face end of workpiece by turning tailstock handwheel.

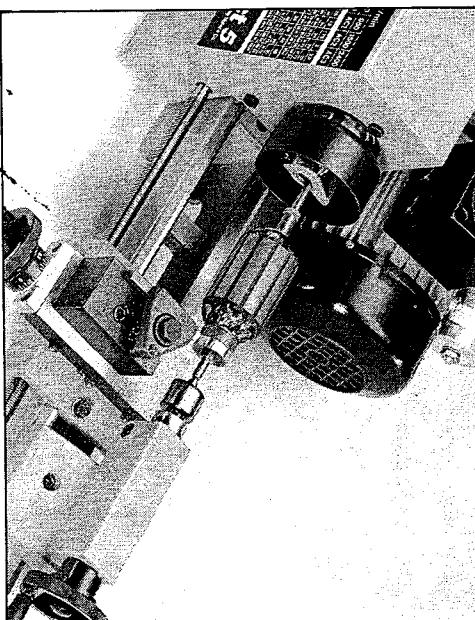


Correct: The center fits completely into the 60° center bore.



Working Example:

Turning a rotor
Spindle speed 950 rpm.

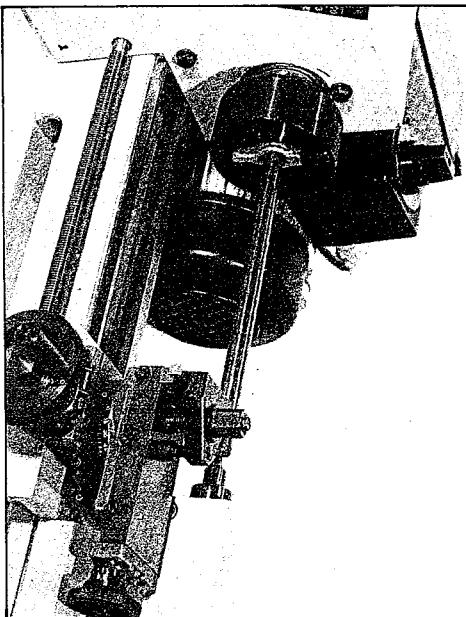


Mounting the Workpiece

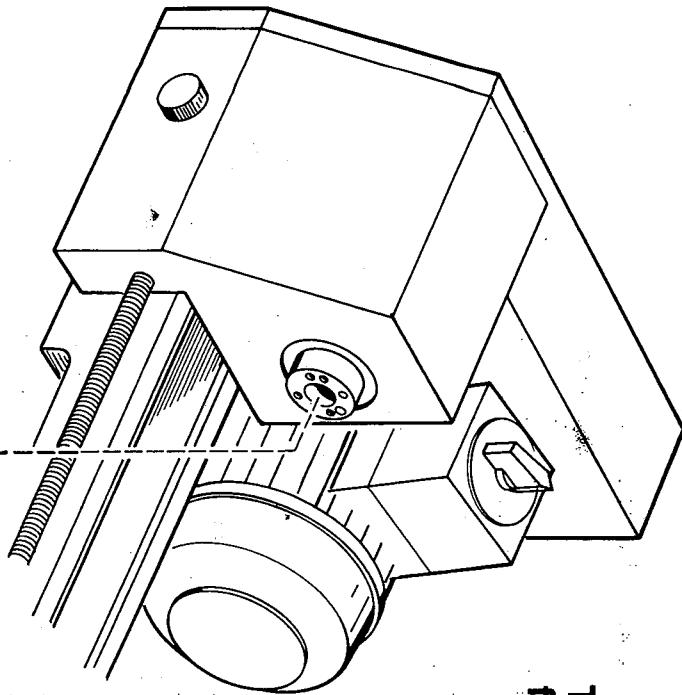
Mount lathe dog guard onto the spindle nose with the 3 allen screws M5 x 10. Clamp lathe dog on workpiece. Mount workpiece between centers.

Working tip:

Continually lubricate contact points of workpiece - tailstock center or use revolving center.



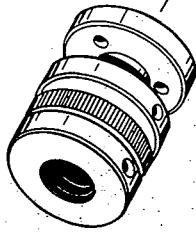
Turning: Clamping Devices for Workpieces (Summary)



Collet chuck attachment

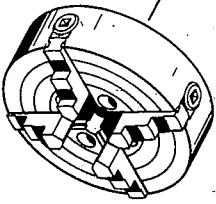
Clamping capacity 1,5 - 14 mm in connection with collets type ESX 25.

Round workpieces can be clamped with highest round-run accuracy using the collets. Collets leave no clamping marks on the workpiece.



4-jaw independent chuck 90 mm diameter

With the 4-jaw independent chuck, workpieces can be clamped centrically and eccentrically. Each jaw can be individually adjusted and reversed.



3-jaw chuck, 90 mm diameter

The 3-jaw chuck serves for centrically clamping round, hexagon or twelve-sided workpieces.

Clamping plate, 90 mm diameter

For clamping large-dimensioned workpieces that cannot be clamped with the 3-jaw or 4-jaw independent chuck. The workpiece is clamped by using the clamping shoes.

Clamping Devices – Working Examples

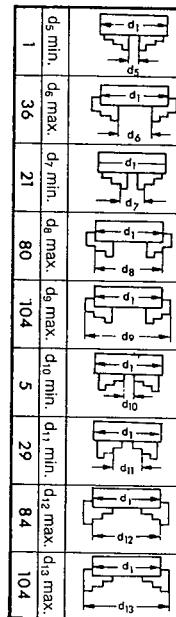
3-Jaw-Chuck, Ø 80 mm

For centrically clamping of round, hexagon and 12-sided workpieces. Square workpieces cannot be clamped centrically with the 3-jaw chuck.



Clamping Capacities:

If the maximum clamping capacities are passed, there is the danger of breaking the jaw teeth. Safe clamping is no longer guaranteed.

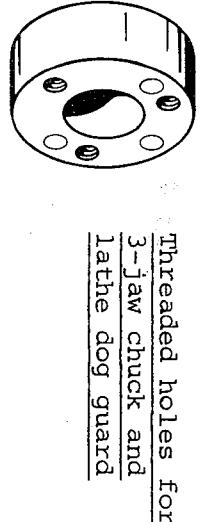


Mounting

Spindle nose and chuck bore must be dust-free. Mount the 3-jaw chuck onto the spindle nose with the 3 allen screws (M5 x 30, DIN 912).

Do not use longer screws – this would prevent the correct contact with the spindle nose.

Do not use shorter screws – the screws could break or tear out.



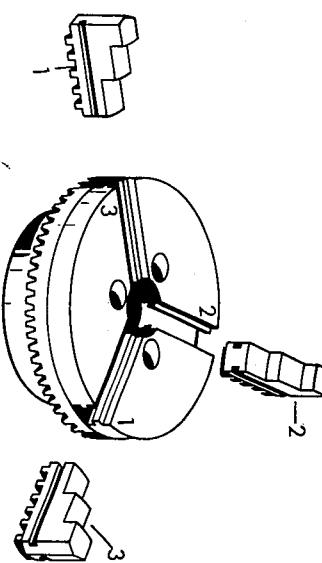
Reversing the Jaws

The jaws can be reversed: jaws mounted stepped outside or jaws mounted stepped inside. Note the correct mounting order for the jaws. Clean the jaws before re-inserting.

A) Jaws stepped inside (external):

Turn the toothed tension ring until the beginning of the spiral thread comes to groove 1.

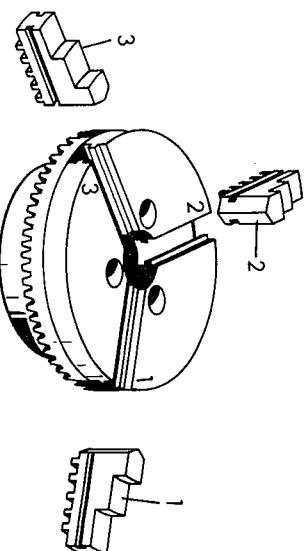
1. Insert jaw no. 3 into groove 1 and turn the tension ring until spiral comes to groove 2.
2. Insert jaw no. 2 into groove 2, turn tension ring.
3. Insert jaw no. 1 into groove 3.



B) Mounting the jaws, stepped outside:

Inserting order:

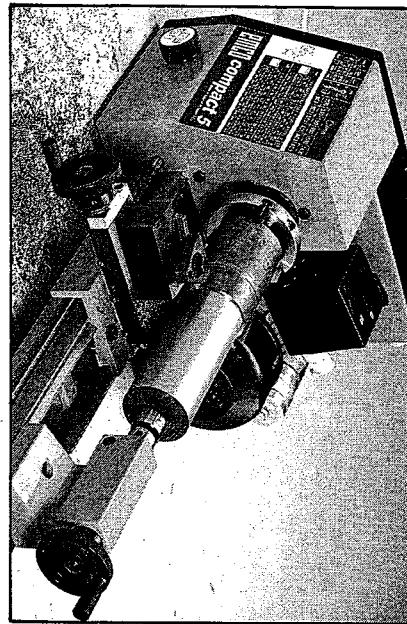
1. Jaw no. 1 in groove 1
2. Jaw no. 2 in groove 2
3. Jaw no. 3 in groove 3



SUPPORTING LONG WORKPIECES

Working with 3-Jaw-Chuck,

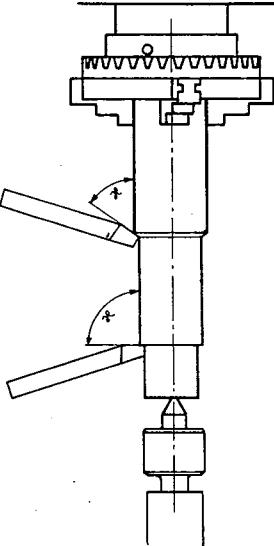
The workpiece is of steel, 65 mm diameter, spindle speed 200 rpm, feed is 0,14 mm/rev, turning tool: side tool, right, chip removal 0,8 mm (see chart, page B).
The center bore was made with a hand A-11



An even surface is achieved with the automatic feed mechanism.

The chip form and the surface of the workpiece alters with the clamping angle "γ" of the turning tool. Try clamping the turning tool at different angles "γ".

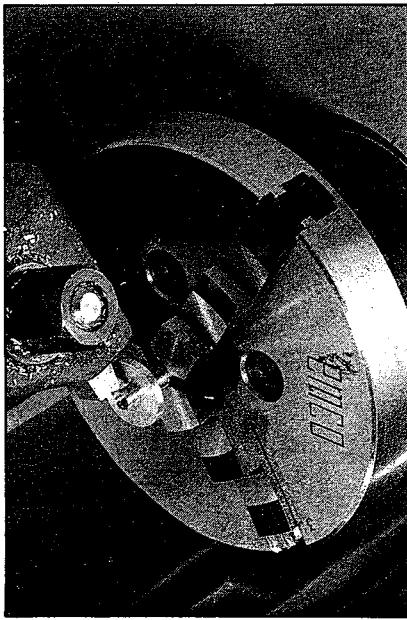
The most advantageous angle depends on the workpiece material. In no case should the angle be smaller than 45°. When working on thin workpieces, which have the tendency to bend, use a tool angle "γ" of 90°.



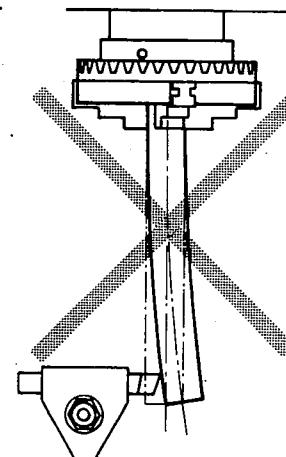
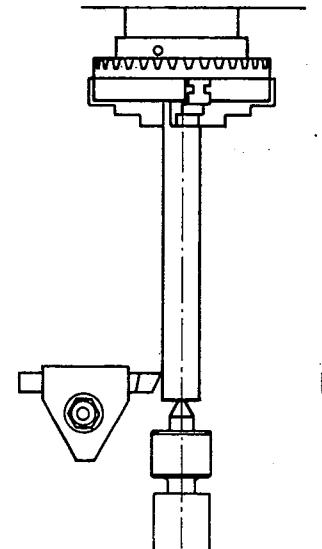
SAFETY TIP

Never exceed the maximum clamping capacity of the chuck. (see page 19)

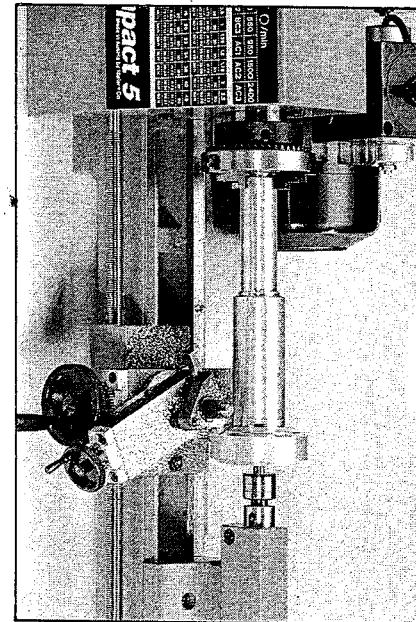
This could cause the chuck teeth to break - the jaws and the workpiece would be thrown out and could cause severe injuries.



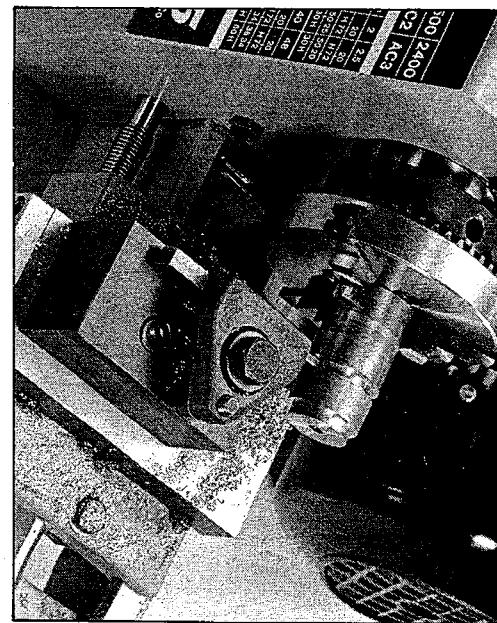
WORKING WITH THE REVOLVING CENTER
With spindle speeds over 550 rpm, it is recommendable to use the revolving center.



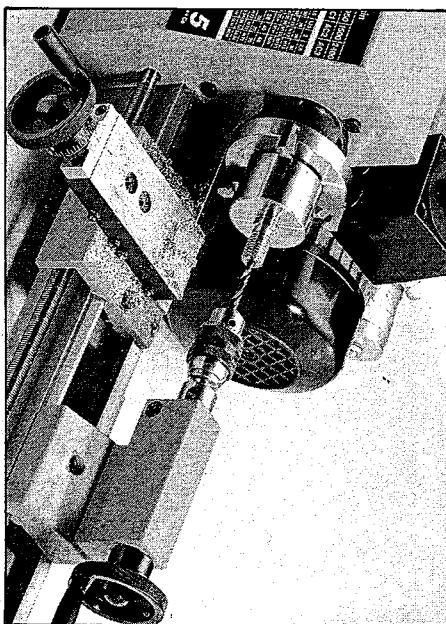
When turning off small diameters, the exact center height of the turning tool is especially important.



The speed must always match with the diameter of the workpiece. A spindle speed, which is too high, causes damage of the tool. Too slow cutting speeds may cause rough workpiece surfaces (for instance with aluminium alloys).

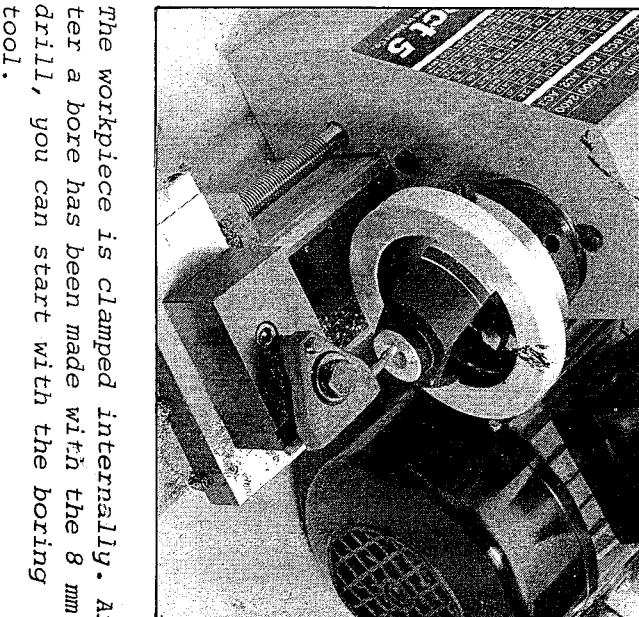


BORING



DRILLING

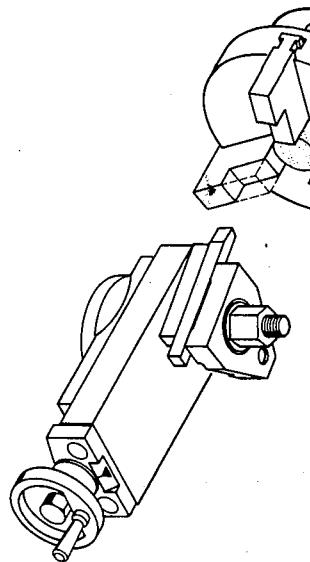
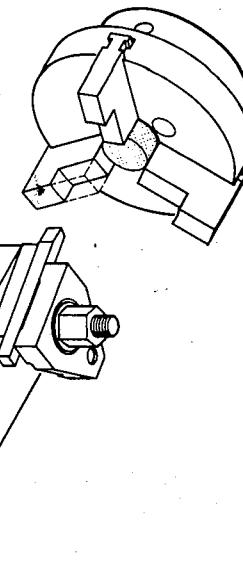
- + Turn back the drill so that the chips are removed from the bore.
- + Use oil for lubrication and coolant
- + The spindle speed for drilling depends on the bore diameter. See chart on side B. Simply exchange the workpiece diameter with the drill diameter.



The workpiece is clamped internally. After a bore has been made with the 8 mm drill, you can start with the boring tool.

Soft jaws for the chuck

The steps of the soft jaws must be turned by the user. When turning these steps, clamp a round workpiece to fix the jaws.



Procedure:
Clamp a round workpiece and turn the step.

Safety tip:

The overhang of the jaws may never be more than 12 mm, otherwise the teeth might break. If the teeth break, the jaw could be thrown out and cause severe injuries.

SAFETY TIP:

The steps must be turned so deep that the workpiece is clamped securely.

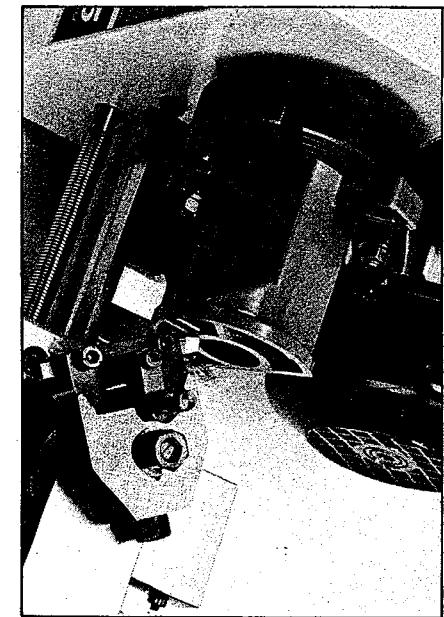
The Clamping Plate 90 mm diameter

Clamping capacity using the small T-nut screws: up to 13 mm

Clamping capacity using the big T-nut screws: up to 33 mm

Mounting

Mount the clamping plate onto the spindle nose with the 4 socket head screws M5 x 20.



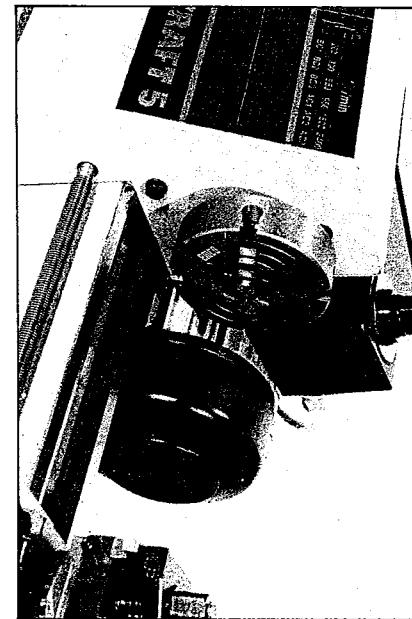
Safety Tip:

Uneven workpieces often cause unbalanced round-run. Therefore always work with low spindle speeds. Be careful of extending parts.

Often uneven or irregular shaped workpieces cannot be clamped with the 3-jaw chuck or the 4-jaw independent chuck. Using the T-nut screws and the clamping shoes, uneven or large-dimensioned workpieces can be clamped. The rings turned into the clamping plate serve as an aid for centrical clamping.

The Independent Chuck, \varnothing 90 mm

For clamping round, square, rectangular and uneven shaped workpieces. Each jaw can be adjusted individually. Workpieces can be clamped centrically and eccentrically.

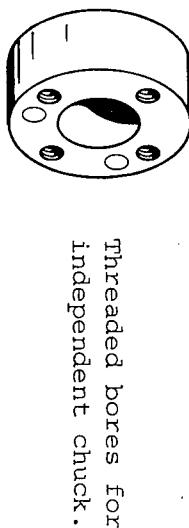


The rings turned into the independent chuck provide a means of orientation for centric or eccentric clamping of workpieces.

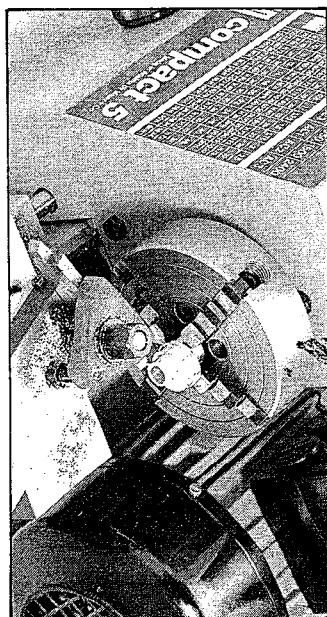


Example:

Mount the independent chuck to the spindle nose with the 4 allen screws (M5 x 25, DIN 912).



Clamping Capacities



Square material (workpiece) cannot be clamped centrically in 3-jaw chuck.

Turning a crank

	d ₅ min.	d ₆ max.	d ₇ min.	d ₈ max.	d ₉ max.	d ₁₀ min.	d ₁₁ min.	d ₁₂ max.	d ₁₃ max.
1	42	21	86	110	9	22	90	110	

The Collet Chuck Attachment for the Lathe

Clamping capacity 1,5 - 14 mm using the collets type ESX 25.

Round workpieces can be clamped with highest round-run accuracy using the collets. Collets leave no clamping marks on the workpiece.

Mounting

Mount collet holder (1) onto the spindle nose with the 3 hexagon screws (2).

Clamping the workpiece

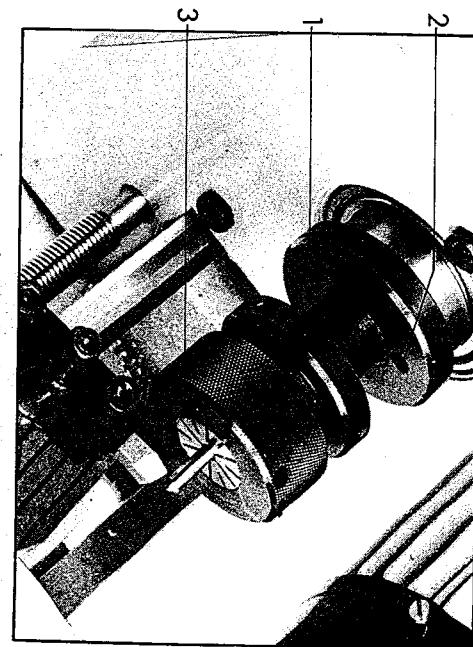
Insert collet, loosen clamping nut (3), insert workpiece and re-tighten clamping nut with the socket head key. Tightening is done clockwise!

Changing the collets

When the clamping nut is removed, the collet is automatically ejected from the cone of the collet holder.

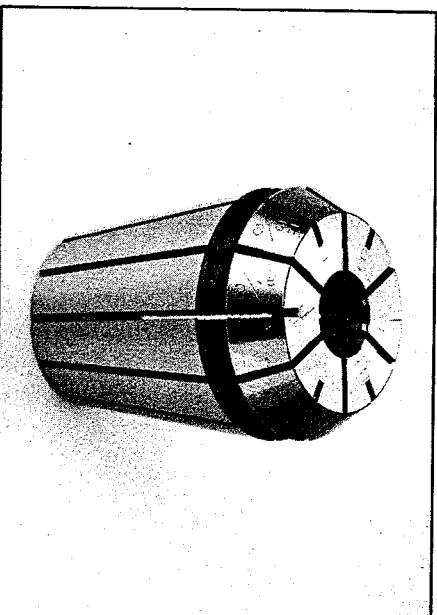
Care/Service

Clean and oil collet holder before and after use - chips and dirt could damage the clamping taper and cone and influence the precision.



The ESX 25 Collets

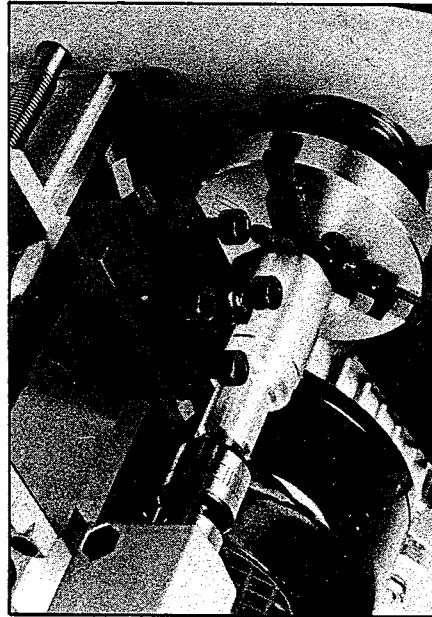
The metric and inch clamping capacity is engraved in the collets. Larger or smaller diameters cannot be clamped.



The Two-Way Toolholder

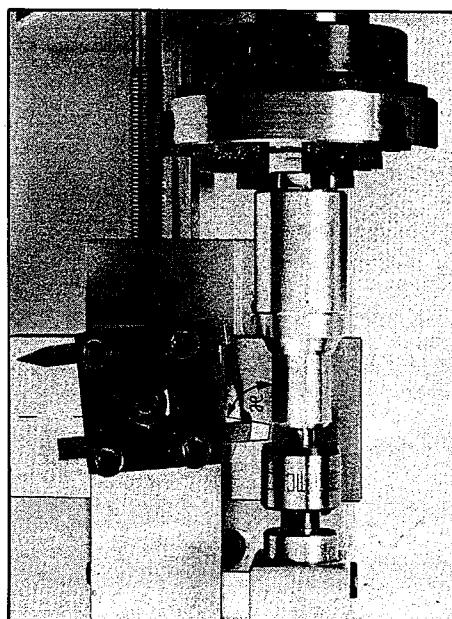
Max. tool section: 6 x 6 mm

The 2-way toolholder can only be mounted onto the top slide. In order to reach the exact center height, spacers must be used.



Working tips:

The 2-way toolholder can be turned. This enables easy adjusting of the clearance angle "X". The clearance angle "X" influences the type of chips and the surface quality. Try it and see!



The Quick-Change Toolholder

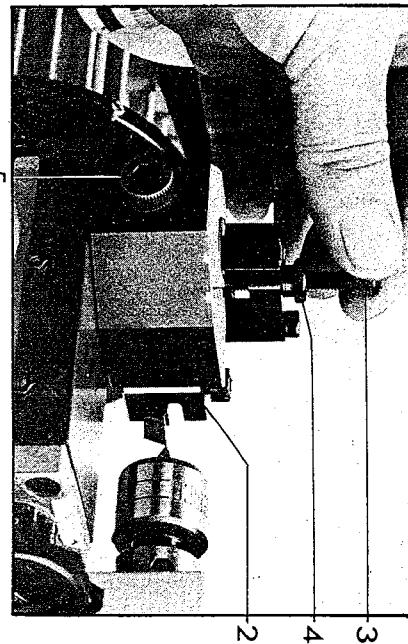
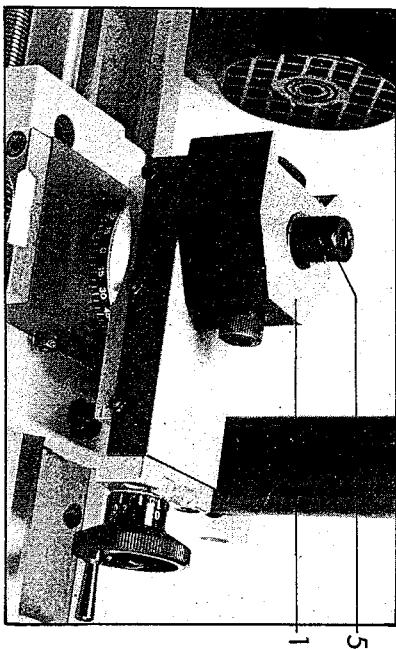
Max. tool section: 8 x 8 mm
Can only be mounted on top slide.

Should several tools be necessary for turning a certain workpiece, continual changing of tools would be very time-consuming.

With the quick-change toolholder, the tool can be clamped beforehand and adjusted to exact center height.

Mounting

- + Set basic element (1) onto the top slide.



+ Clamp the tool in the toolholder (2) and mount onto the basic element from the top.

+ Adjust center height with the knurled screw (3), tighten knurled nut (4). The knurled screw is thereby fixed in the adjusted height.

+ Tighten socket head screw (5); the toolholder is clamped.

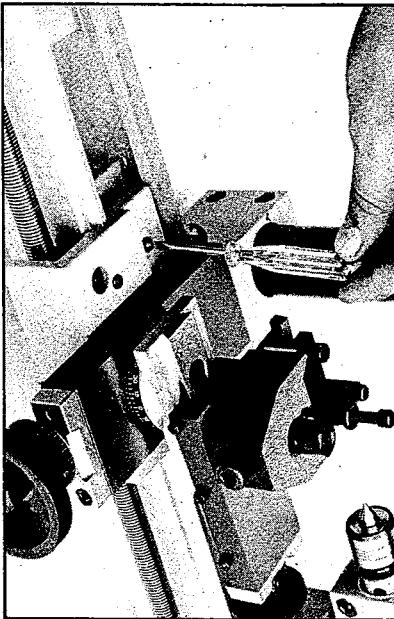
+ Clamp the basic element in the required angle with the hexagon screw.

The Travelling Steady

For long round workpieces with diameters from 4 - 25 mm.

Narrow workpieces bend under the pressure of the turning tool. The workpiece would not be cylindrically. The supporting pins of the travelling steady support the workpiece near the tool and prevent bending.

Mounting



Remove the 2 set screws on the longitudinal slide.

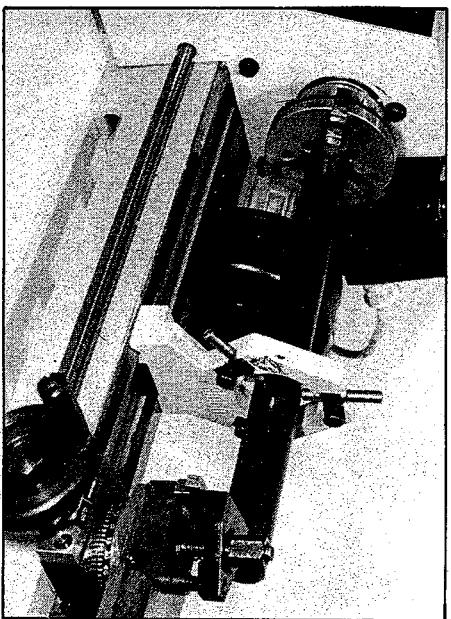
The Steady Rest

Capacities:

Smallest workpiece diameter: 2 mm

Largest workpiece diameter: 40 mm

With some work, such as boring, drilling, turning pipes, taper turning, etc., the steady rest is necessary for supporting the workpiece, since the center cannot be used. Also when turning very narrow (thin) workpieces, which are supported with the center, the steady rest prevents the workpiece from bending.



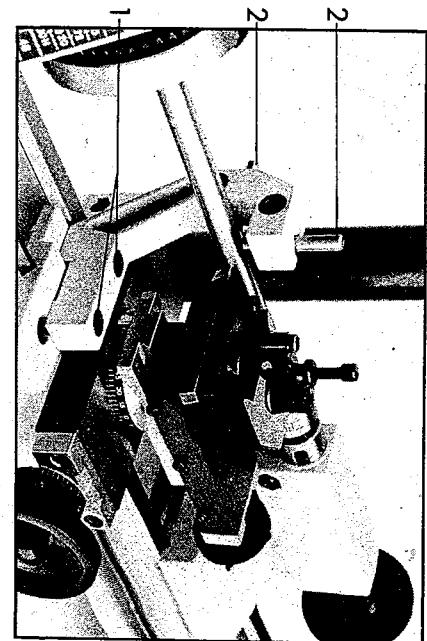
A smooth pipe is turned internally and on the face side, supporting with the center is not possible.

Mounting:

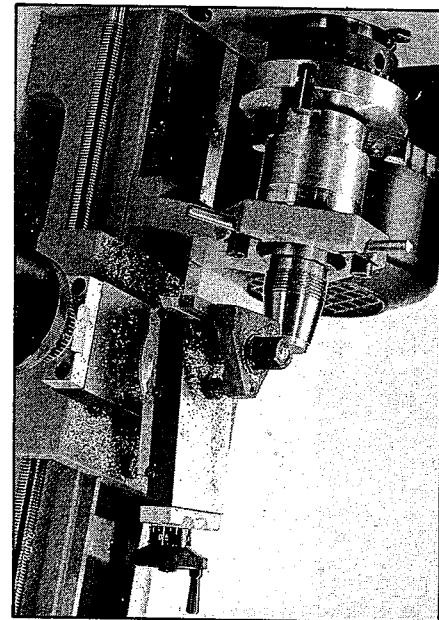
Mount the steady rest on the lathe bed with the clamping plate. Clamp the slide pins so that the workpiece is centrally supported, but not clamped.

Working tip:

Tighten the travelling steady with the socket head screws (1). Re-insert the set screws in the longitudinal slide after dismounting the travelling steady, in order to prevent dirt from damaging the threads.



Working tip:
Oil contact points to decrease friction and heating up.



At the end of the shaft, a taper is turned; the steady rest prevents a possible movement (pressing out of position) of the workpiece.

Follow all Accident Prevention Rules!

**Always wear Safety Goggles.
Foresight is better
than no Sight!**

Never surpass the Clamping Capacity of the Lathe Chuck and the Independent Chuck!

Always check the Workpiece before Working – is it securely clamped?

The Automatic Feed Mechanism

Delivered Units

- + Coupling with control knob
- + Quadrant with 6 gear wheels
- + 3 shear pins
- + 2 spacers

Function

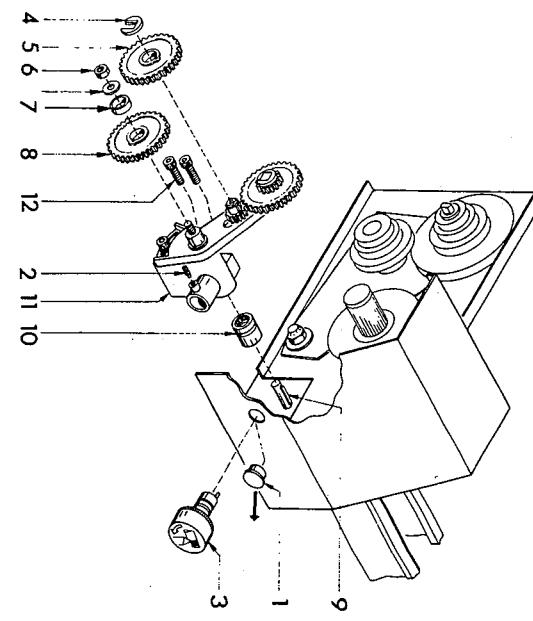
- a) Turning with automatic longitudinal feed:
- You save turning the longitudinal slide handwheel
- The surface of the workpiece is even.

b) Thread-cutting:

- With the exception of the two feeds ($0,07$ and $0,14$ mm per main spindle revolution) you can cut 5 metric threads: $0,4/0,6/1,0/1,25/1,5$ mm.
- With the change gear set you can cut additionally 10 metric threads and 14 inch threads (see technical data).

Mounting

- Remove plastic plug (1)
 - Loosen set screw (2) and pull out control knob (3)
 - Remove washer (4) and gear wheel 60 (5)
 - Unscrew hexagon nut (6), remove washer, spacer (7) and gear wheel 60 (8).
 - The gear wheels must be dismounted, so that the coupling housing can be mounted with the allen screws (12).
 - Remove the tape on the leadscrew - its purpose was to hold the parallel key (9).
-
- Insert control knob (3) into the coupling housing. The pin on the control knob must be engaged with the groove in the coupling.
 - Lightly tighten set screw (2). The set screw is for axial securing the control knob.
 - Move longitudinal slide to left towards spindle stock to center the lead screw shaft and fasten the socket head screws (12).
 - Mount gear wheels (note the instructions about mounting the gear wheels see next pages).



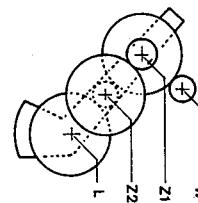
Mounting the Gears

On the front panel the gear combinations for the two feeds ($0,07$ mm/rev) and for the thread pitches are indicated.

Example of mounting:

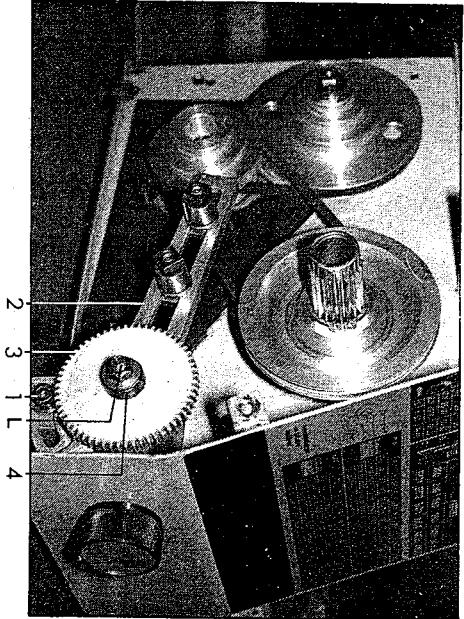
Required feed size: $0,07$ mm/rev. On the top left side of the front panel, you will find the gear wheel combination.

mm/ \circ	0,07	0,14
W	20	20
Z1	25,60	50,60
Z2	60,20	60,20



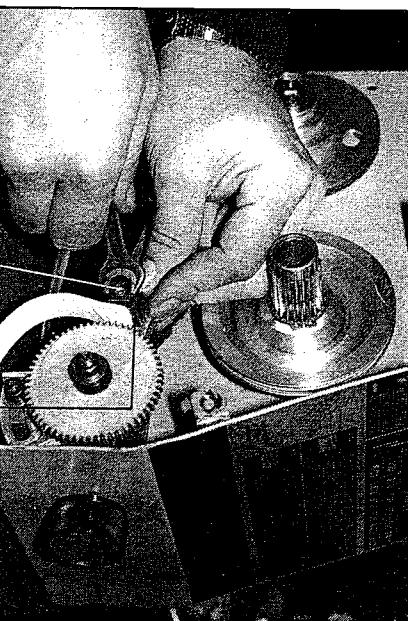
Steps for Mounting the Gears

W		
Z1		
Z2		
L	H 60	



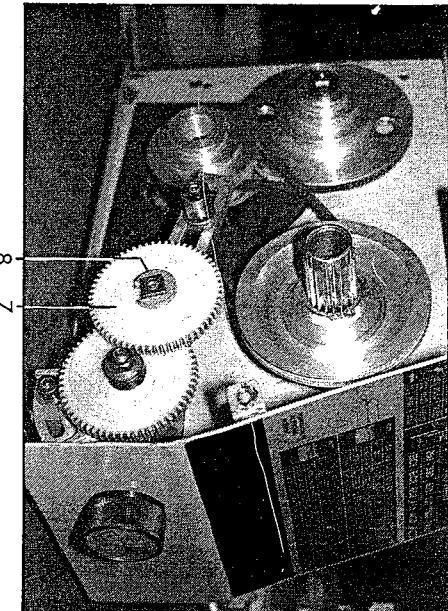
(2)

Mount gear wheel 20 (5) onto the axis Z2 (6). Clamp axis Z2, so that gear wheel 60 and gear wheel 20 are engaged.



(3) Mount gear 60 (7) onto axis Z2. Place ring (8) onto Z2 in order to fix gears axially.

W		
Z1		
Z2	60,20	
L	H 60	



Correct Play of the engaged Gear Wheels

A small amount of play must be present, otherwise the gears would wear out quickly. This play in no way influences the accuracy of the thread pitch.

Recommended method:

Place a piece of paper between the gears; press the engaging gears together and clamp axis Z2. Remove paper.

$\text{mm}(\text{in})$	0.25	0.3	0.35	0.75
W	20	20	20	20
Z1	H 60	H 72	H 72	H 72
Z2	30 60	30 50	35 50	25 50
L	60 H	60 H	60 H	H 40

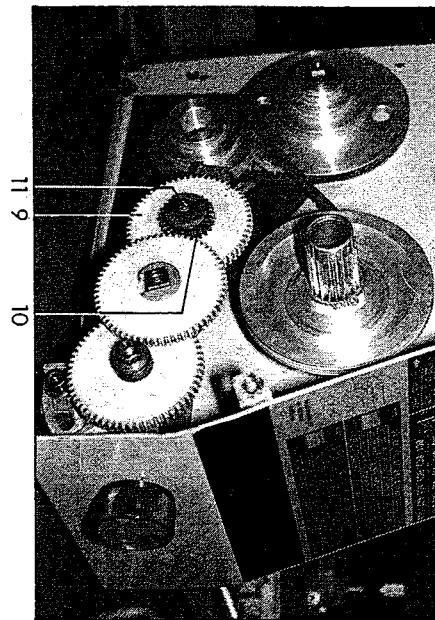
mm	0.4	0.5	0.6	0.7	0.8	1	1.25	1.5	1.75	2	2.5
W	20	20	20	20	20	20	20	20	20	20	20
Z1	H 60	H 72	H 60	H 72	H 60	H 60	H 60	H 72	H 72	H 72	H 72
Z2	20 25	25 30	60 50	35 25	20 25	50 25	50 20	25 50	35 20	50 25	50 20
L	60 H	50 H	60 H	60 H	60 H	60 H	H 20	30 H	30 H	30 H	30 H

n/in"	10	11	12	14	16	20	22	24	28	40	48
W	20	20	20	20	20	20	20	20	20	20	20
Z1	H 60	H 72	H 60	H 60	H 60	H 60	H 72				
Z2	72 34	60 26	72 34	72 34	72 34	72 34	60 26	36 34	36 34	36 34	36 34
L	25 H	30 H	30 H	35 H	40 H	50 H	60 H	30 H	35 H	50 H	60 H

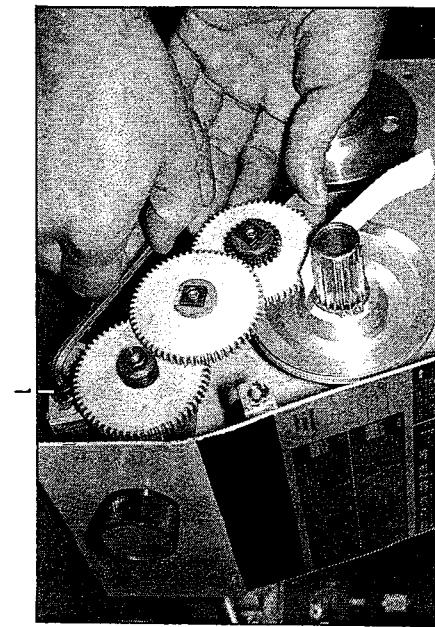
Metric Threads

ADDITIONAL THREAD PITCHES, WHICH ARE
NOT SHOWN ON THE FRONT PANEL

Inch Threads



11 9 10



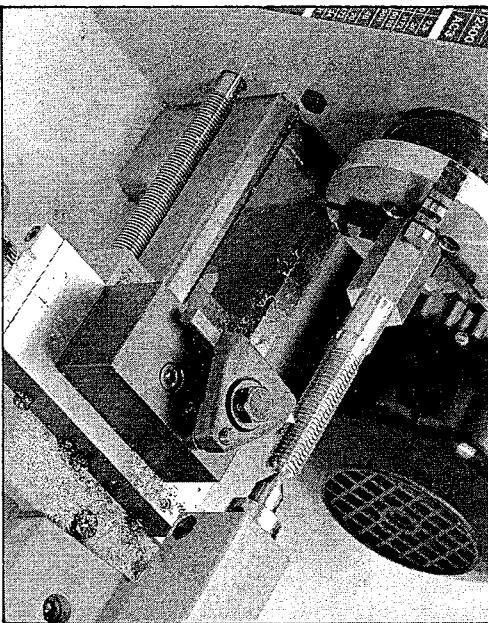
W	25	60
Z1	25	60
Z2	60	20

④ Mount gears 60 (9) and 25 (10) onto axis Z1 so that tooth surface play is present.
Mount ring for axial fixing.

W	20	
Z1	25	60
Z2	60	20

⑤ Swivel quadrant upwards around axis Z1 with socket head screw (1). Note tooth surface play.

Working Tips – Thread-Cutting



Metric and Inch Threads, the Chart on the Spindle Stock

All threads and their geometrical sizes and shapes are standardized. The thread charts (see page 18) show the gear combination for the respective thread pitch.

Metric threads:

The pitch size "p" is given in mm with metric threads.

Inch threads:

The inch threads are defined by the number of threads per inch (abbreviation: tpi, symbol: n/1"). For example: 10 tpi or n/1" means 10 threads per inch. The actual pitch size is:

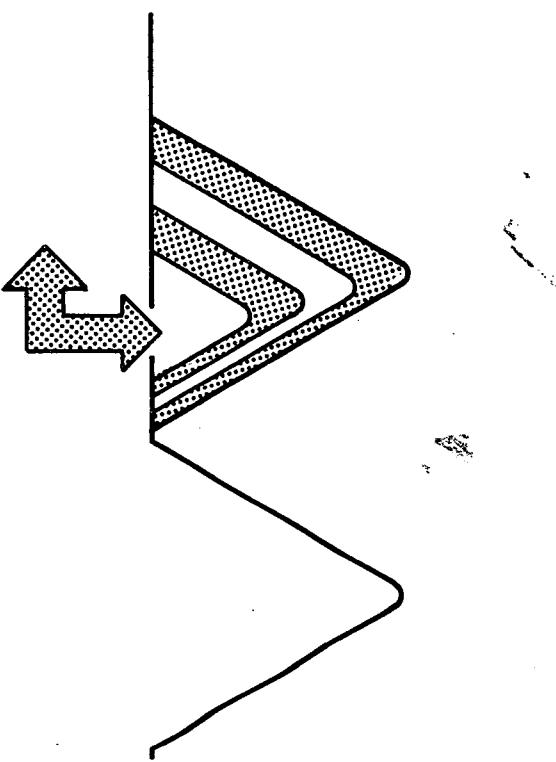
$$\frac{1 \text{ inch}}{10} = \frac{1''}{10} \text{ or } 0,1''$$

Procedure

- + Tool must be clamped at an exact right angle to the turning axis.
- + Mount gears for required pitch (see pages 17/18)
- + Choose spindle speed so, that you have enough time to turn back the cross slide and switch off the machine.
- + It is recommendable to use oil as lubricant.

Each thread has to be cut in several steps. The cutting depth must not be large. Turn back the cross slide at the end of one cut, reverse the motor to bring the tool to the start position. Adjust the tool to a new cutting depth using the dial on the cross slide handwheel.

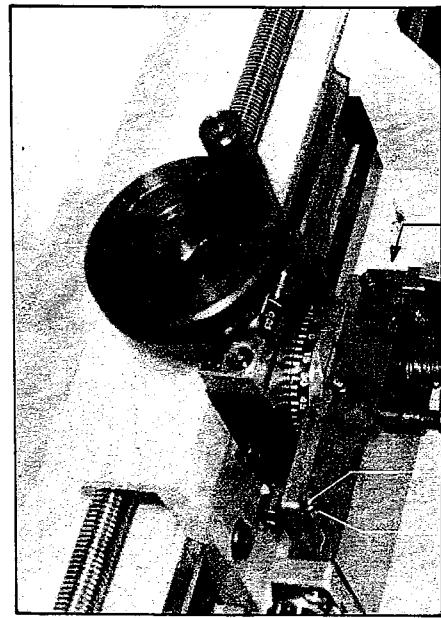
The top slide is recommendable for thread-cutting to adjust the tool sideways, as shown in the illustration.



Adjustments

Playfree Re-Adjustment of Cross Slide and Top Slide Guidance

The dovetail guideways are fitted with gibbs (1). With the set screws (2), which press on the gibbs, the play-free slide guidance is adjusted. The hexagon nuts (3) serve for securing the set screws in adjusted position.



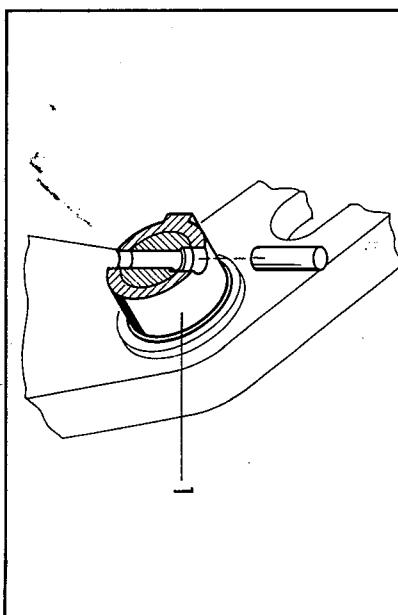
Adjustment:

Loosen hexagon nuts, adjust set screws until the slides run without play. Hold set screws in the adjusted position with a screwdriver and tighten the hexagon nuts.

Adjustment of the Handwheel Clamping on Longitudinal-, Cross-, Top Side and Tailstock

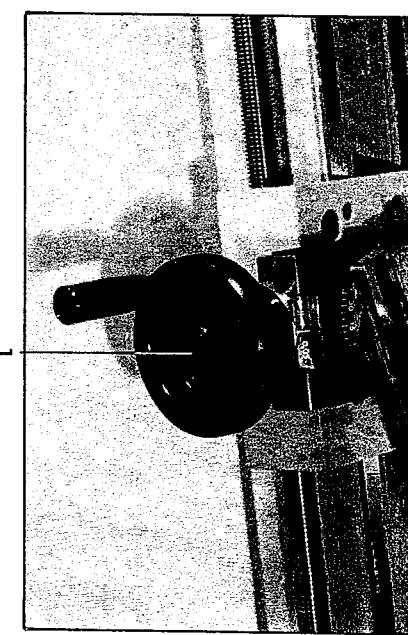
- Hold handwheel and loosen cap nut (1).
- Turn handwheel inwards, hold in the adjusted position and re-tighten cap nut.

Procedure:



Changing the Shear Pin

If the shear pin should break, due to overload or incorrect handling of the machine (if the automatic feed is switched on while longitudinal slide is clamped), a new original shear pin must be inserted.

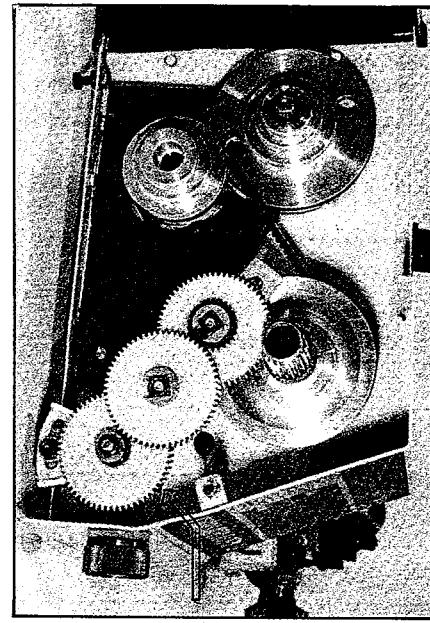


USE ONLY ORIGINAL SHEAR PINS!

Lubrication

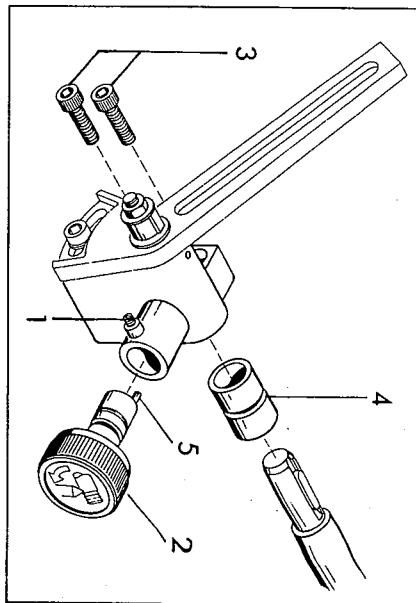
Interval approx. 20 Working Hours

Oil coupling bolt through the opening of the feed housing (1), with an oil can (light machine oil).



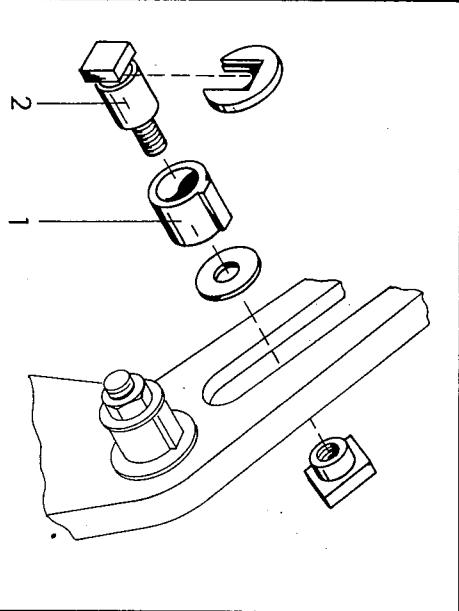
Interval approx. 200 Working Hours

Coupling in housing:



Interval approx. 50 Working Hours

Bushes and bolts (axis Z1,Z2) on the quadrant: remove gears, unscrew bolts. Oil bush (1) and bolt (2).



1. Dismount gears, unscrew set screw (1) until you can pull out the control knob (2).
2. Move longitudinal slide towards spindle stock (for centering lead-screw).
3. Unscrew the 2 allen head screws (3) and remove feed mechanism.
4. Remove coupling (4) from the feed gear housing and lubricate with grease.
5. Re-mounting:
 - Place coupling (4) onto lead screw and mount feed mechanism housing with the two allen head screws.
 - Insert control knob, so that bolt (5) is in the groove of the coupling; turn set screw (1) until it touches bottom of groove, then turn 1/4 revolution back again.

Problems – Possible Causes – Remedy

Chattering	Spindle speed is too high or too low	Decrease or increase spindle speed. It could happen that the eigenfrequency is identic with the spindle speed.
	Machine not bolted down	Bolt machine to even workbench
	Too much tool overhang	Clamp tool with smallest overhang possible
	Long or narrow workpiece not supported either by tailstock center or by fixed steady. Workpiece bends through the power generated by the cutting operation.	Support workpiece with tailstock center or fixed steady. Sharpen tool. Increase adjusting angle to 90°.
	Cutting tool dull, or cutter angles not correct	Grind cutting tool
	Main cutting edge not on center height	Adjust cutter to center height
	Play in the slide guideways	Adjust slides playfree
	Increased cutting depth "a"	Reduce cutting depth
Rough surface	Dull tool	Sharpen tool
	Tool is too pointed	Grind a small radius to the tool point
	Play in the slide guideways	Adjust slides playfree
Machine stopped or speed is reduced strongly	Dull tool	Grind tool
	Spindle speed to high, or cutting depth too large	Reduce spindle speed and cutting depth
Workpiece not round	Tailstock center does not fit to center bore	Machine correct center bore, adjust tailstock center into center bore
	Long or narrow workpiece not supported by tailstock center or fixed steady	Support workpiece
Shear pin breaks	Drive overloaded, longitudinal slide clamped	Reduce feed and/or cutting depth. Loosen hexagon bolt on longitudinal slide.

Drilling – Milling

With the vertical milling and drilling unit, the Compact 5 can be converted into a drilling machine and a universal milling machine.

Note:

The name "vertical milling and drilling unit" has become well known, but it is not descriptive. It is really a universal milling and drilling unit, since the milling spindle can be used for milling not only vertically, but in any required angle position.

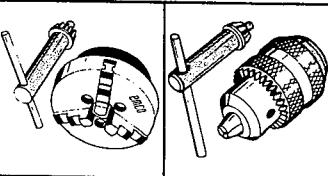
Index Drilling – Milling

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Dividing Attachment	51-54

Accessories for milling and drilling attachment

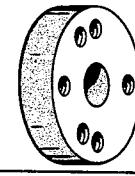
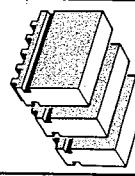
Three-jaw drill chuck
capacity 1 to 8 mm, with M 14x1 mounting thread

Order No. 152 500



Set of 3 soft jaws
Technical tip: For three-jaw lathe chuck
Order No. 200 410

Order No. 200 410

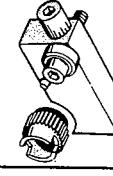


Support flange
Technical tip: For mounting three-jaw lathe chuck
Order No. 200 410, four-jaw independent chuck
Order No. 200 360,
collet attachment Order No. 200 040

Order No. 200 250

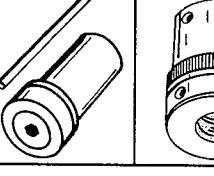
Facing and boring head (Fly cutter)
with 1 ground facing and boring tool, 2 unground
tools, operating key

Order No. 150 100



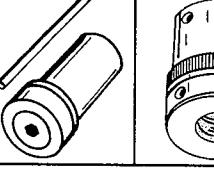
Vertical fine feed attachment
1 division = 0.1 mm

Order No. 151 110



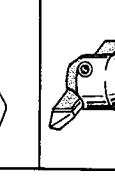
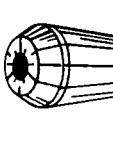
Collet attachment
for collets type ESX-25, gripping capacity
1.5-14 mm

Order No. 200 050



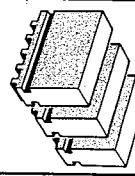
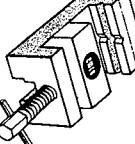
Cutter arbor
for tooth milling cutters and circular saw blade

Order No. 151 070

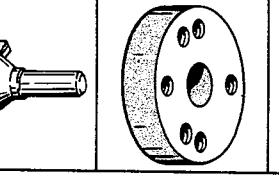


Milling plate
90 mm dia., with 2 clamps
Technical tip: Fits on spindle of headstock and dividing
attachment Order No. 200 320

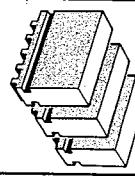
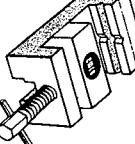
Order No. 200 360



Dividing attachment
with integrated dividing plate for direct dividing.
22 possible divisions: 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15,
16, 18, 20, 24, 28, 30, 36, 48, 56, 60

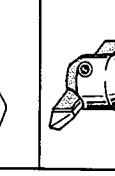
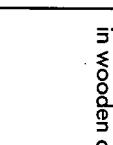


Technical tip: Chucking means that can be used -
Three-jaw lathe chuck Order No. 200 410
Clamping plate Order No. 200 360
Four-jaw independent chuck Order No. 200 420
Collet attachment Order No. 200 040



Machine vice
Clamping range 32 mm
Width of jaws 46 mm
Height of jaws 18 mm

Order No. 200 310



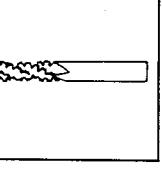
Set of 14 collets ESX-25
in wooden case, gripping capacity from 1.5-14 mm

Order No. 225 000



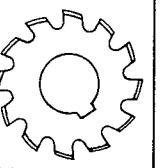
Individual collets ESX-25
Nominal dia. in mm Chucking capacity in mm Shaft dia. in inches Order No.

Nominal dia. in mm	Chuckling capacity in mm	Shaft dia. in inches	Order No.
2.0	1.5-2.0	1/16-5/64	225 020
2.5	2.0-2.5	5/32	225 025
3.0	2.5-3.0	7/64	225 030
4.0	3.0-4.0	1/8	225 040
5.0	4.0-5.0	1/16-9/64	225 050
6.0	5.0-6.0	13/64-7/32	225 060
7.0	6.0-7.0	1/4-17/64	225 070
8.0	7.0-8.0	9/32-19/64	225 080
9.0	8.0-9.0	21/64-11/32	225 090
10.0	9.0-10.0	23/64-3/8-29/64	225 100
11.0	10.0-11.0	13/32-27/64	225 110
12.0	11.0-12.0	15/32-39/64-15/32	225 120
13.0	12.0-13.0	21/32	225 130
14.0	13.0-14.0	31/64-17/32-25/64	225 140

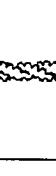


Heavy-duty end mill
high speed steel with roughing toothting, shaft dia.
8 mm

Order No. 764 200

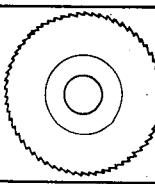


Set of 6 gear mills
dia. 40 mm, Module 0.5 (No. 1-6)



Order No. 152 110

Tools for vertical milling and drilling attachment



Circular saw blade
for metal, 60 mm dia.

Order No. 123 100

- Tool assortment, large**
- 15 twist drills, 1-8 mm dia. in steps of 0.5 mm
 - 2 center drills 1.5 mm dia.
 - 4 grooving cutters dia. 3, 4, 5, 6 mm
 - 1 roughing mill dia. 8 mm
 - 8 turning tools, ground, assorted
 - 1 turning tool, unground
 - 1 circular saw blade for metal dia. 60 mm
 - 1 countersink 90°
 - 1 T-slot cutter Ø 16x4 mm

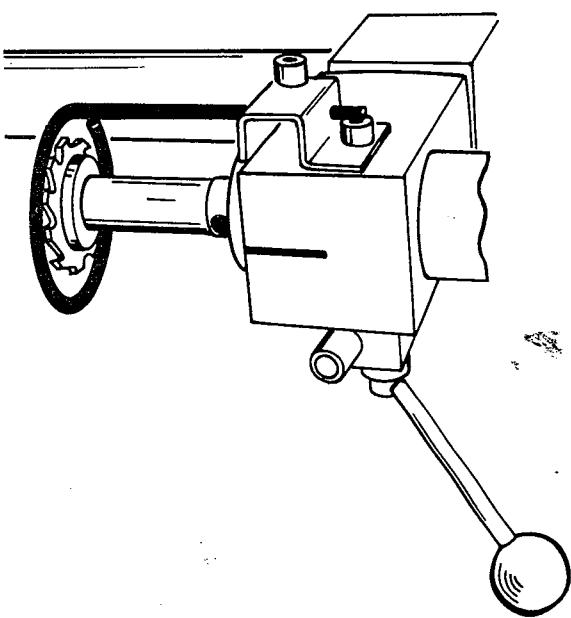
Order No. 152 100

- Individual gear mills**
- Ø 40 mm, module 0.5, No. 1, for 12-13 teeth
 - Ø 40 mm, module 0.5, No. 2, for 14-16 teeth
 - Ø 40 mm, module 0.5, No. 3, for 17-20 teeth
 - Ø 40 mm, module 0.5, No. 4, for 21-25 teeth
 - Ø 40 mm, module 0.5, No. 5, for 26-34 teeth
 - Ø 40 mm, module 0.5, No. 6, for 35-54 teeth
- Service parts set**
- 1 twist drill each 2, 3, 4, 5 mm dia., 1 center drill 1.5 mm dia.,
 - 1 countersink 90°, 1 grooving cutter 4 mm dia.,
 - 1 T-slot cutter 16x4 mm dia.

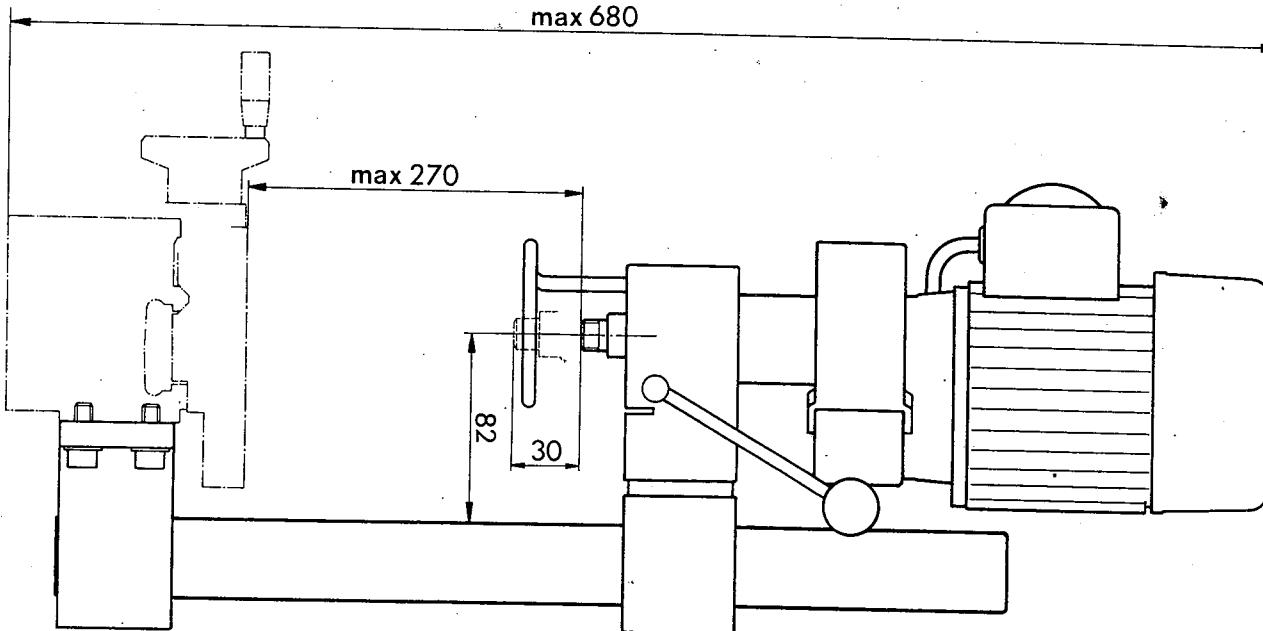
- Order No. 200 990**
- | | |
|---|-------------------|
| Ø 40 mm, module 0.5, No. 1, for 12-13 teeth | Order No. 764 601 |
| Ø 40 mm, module 0.5, No. 2, for 14-16 teeth | Order No. 764 602 |
| Ø 40 mm, module 0.5, No. 3, for 17-20 teeth | Order No. 764 603 |
| Ø 40 mm, module 0.5, No. 4, for 21-25 teeth | Order No. 764 604 |
| Ø 40 mm, module 0.5, No. 5, for 26-34 teeth | Order No. 764 605 |
| Ø 40 mm, module 0.5, No. 6, for 35-54 teeth | Order No. 764 606 |

Accident Prevention: Milling – Drilling

- + Always follow the rules for accident prevention on page 3!
- Additional tips:**
- + Clamping the workpiece
When drilling or milling, the workpiece must be clamped securely, in order to prevent the workpiece from being loosened by the cutting force of the tool.
Clamping tools: machine vice, milling table with clamping shoes, 3-jaw chuck, 4-jaw independent chuck ...
- + Work only with perfectly ground and sharpened tools!
- + Close belt cover before switching on machine.
- + Remove milling and drilling chips only with brush and only when machine is not switched on.
- + Loose clothing and hairs can be especially dangerous! Hair or clothing can easily get caught in the spiral grooves of the millers and drills.



Technical Data



Motor:

IEC-standard single-phase motor, dust and splashproof according to IP 44
Input power (P1) 200 W, S3-60 % ID
Output power (P2) 100 W, S3-60 % ID
For voltage and frequency - see label on motor.

Spindle speeds: 380/700/1600 rpm

Spindle nose (main spindle):

according to factory standard, with M14 x 1 thread.

Weight: 6,5 kg

For dimensions - refer to sketch

Electrical Connection

The vertical milling and drilling unit may only be plugged into outlets with grounding contacts (a grounding receptical must be available for connection of the machine).

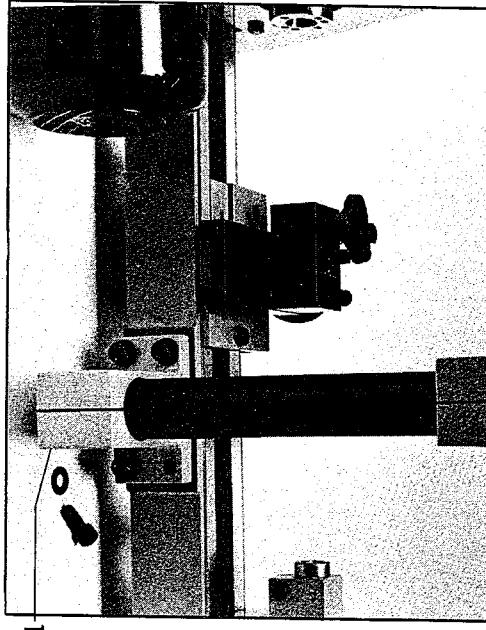
Mounting the plug:

Due to the different requirements in different countries, the machines are not delivered with plugs everywhere. Mounting of plugs must be carried out professionally!

Clamp the grounding wire (yellow-green) to the grounding contact (symbol \oplus). Clamp the other two wires to contact R and N.

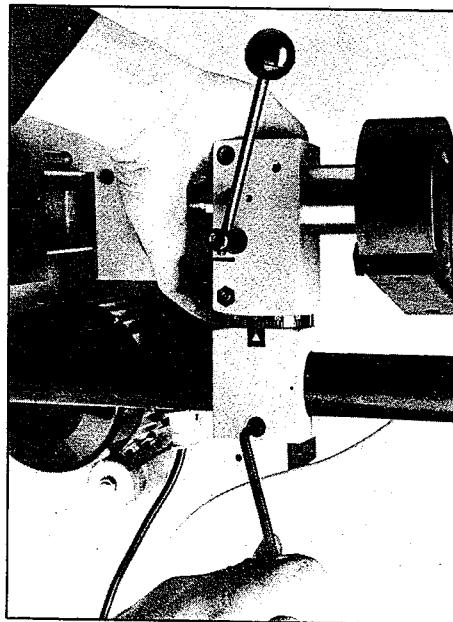
Mounting the Vertical Unit – Operating Elements

Attach the base to the lathe bed with the 4 socket head screws and washers. Clean contact surfaces thoroughly before mounting.



Height adjustment and turning the vertical unit

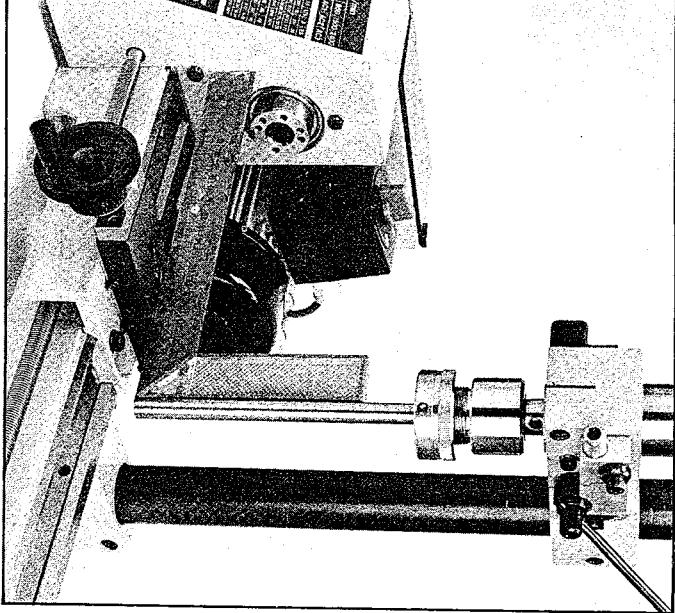
The cross slide throat is limited to 50 mm. By clamping the vertical unit in different angles, you can match the working requirements to the cross slide travel.



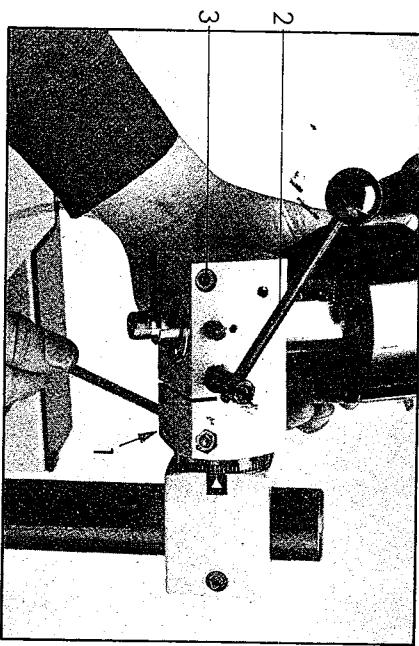
Fixing the vertical column

Tighten the two socket head screws (1).

Loosen the socket head screw on the clamping head and bring the vertical unit into the required position and height.



Swivelling the quill holder



Loosen socket head screw (1) and swivel the quill holder to the required angle. The graduated scale enables accurate positioning.

Vertical adjustment

The base must be clamped so, that the vertical column is at a right angle to the cross slide.

Through these turning and swivelling movements, the quill can be set at any required angle.

Moving the quill

Insert toggle into the bore. By swiveling the toggle, the quill is lowered. A built-in spring returns the quill into the original position.

Clamping screw for the quill (3)

The quill is fixed with the socket head screw.

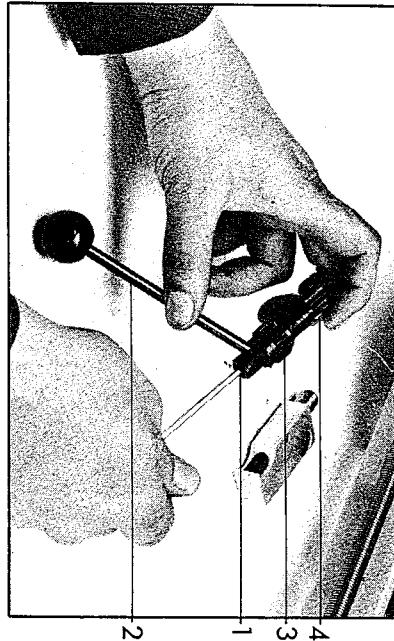
Always clamp quill when milling, never force the toggle.

The Vertical Fine Feed Attachment

The vertical fine feed serves for accurate depth adjustment for milling and drilling operations.

Mounting

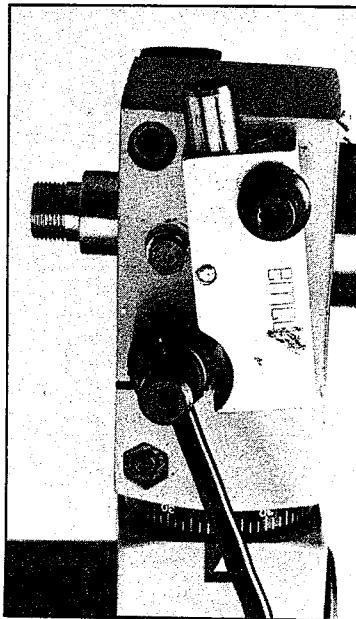
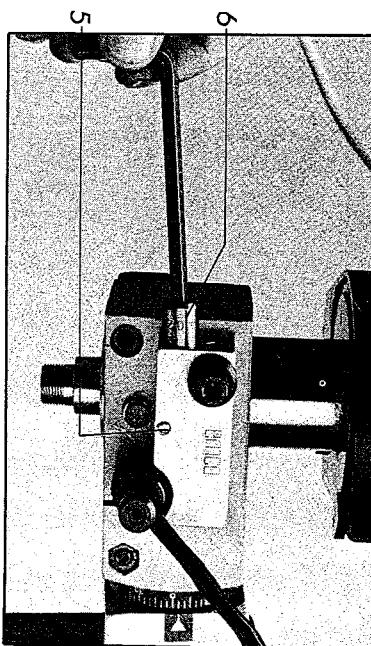
1. Loosen set screw (1), pull out toggle (2) and mount worm wheel (3) onto the pinion (4), re-tighten toggle.



2. Insert pinion into the quill holder.
3. Place centering bolt (5) of the feed unit into the bore and clamp with the socket head screw, so that the worm wheel is engaged with the worm.

If the worm (6) is turned by one division, the quill moves 0,1 mm.

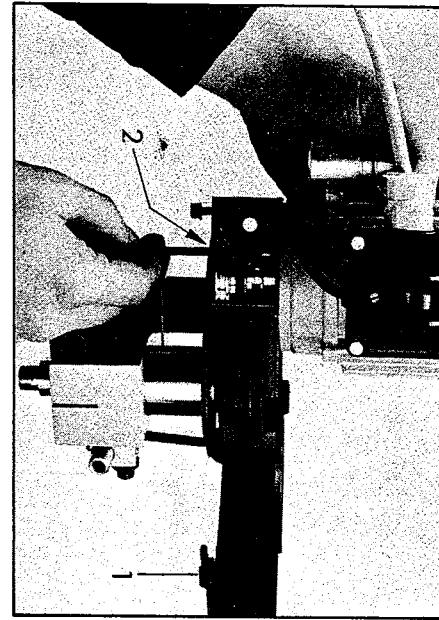
Adjusting



If the fine feed is not required, loosen socket head screw and swivel.

Worm and worm wheel are not engaged. The pinion can be moved with the toggle.

Adjusting the Spindle Speed



Open cover (1), loosen socket head screw (2) and swivel motor toward the front. The belt is loosened and can be shifted onto the required pulley combination. Tighten belt and fix socket head screw again.

Note:
Never work with belt cover opened!

Spindle Speed Chart

The spindle speed during milling and drilling depends on the diameter of the tool (miller, drill) and the type of workpiece material.
The values shown below are valid only for sharpened tools.

Diameter of miller or drill (mm)	SPINDLE SPEED Steel	Cast Iron	Aluminium/Brass
to 5	1600	1600	1600
5-10	700	700	1600
10-15	700	380	700
15-20	380	380	700
20-40	380	380	380

Drilling in General

Clamping the drill

Drills are clamped in the drill chuck or in the collet chuck.

Clamping the workpiece

The workpiece is fixed on the top slide or on the dividing attachment, using the appropriate clamping device.

Spindle speed:

The spindle speed of the drill depends on the diameter of the drill, resp. miller and the material of the workpiece.

Drill feed:

Drill feed is achieved via the quill.

Working Tips – Drilling

The smaller the drill, the easier it is that bit will break. Drill feed must be carried out with feeling (very carefully).

Coordinate drilling

With aid of the scale rings on the longitudinal and cross slide handwheels, drilling in accurate coordinates can be carried out.

Please note:

The scale on the cross slide refers to the diameter of the workpiece during turning. The scale on the cross slide handwheel indicates 2,5 mm after one complete revolution. The slide, however, moves only 1,25 mm.

Place a wooden or plastic board under the workpiece so that the milling table, machine vice, etc. are not damaged by the drill.

Use the vertical fine feed for accurate depth adjustments.

When drilling deep holes, pull the drill out of the bore regularly, so that drilling chips are removed.

A few drops of oil will decrease the friction of the drill and increase the tool's life.

Wear of the drill can first be seen edges of the main cutting surface. Re-sharpen drill in time.

Milling in General

Types of Movements

Main or working movement

The miller does the main or working movement. The cutting edges of the miller penetrate the workpiece and remove material.

Adjustments

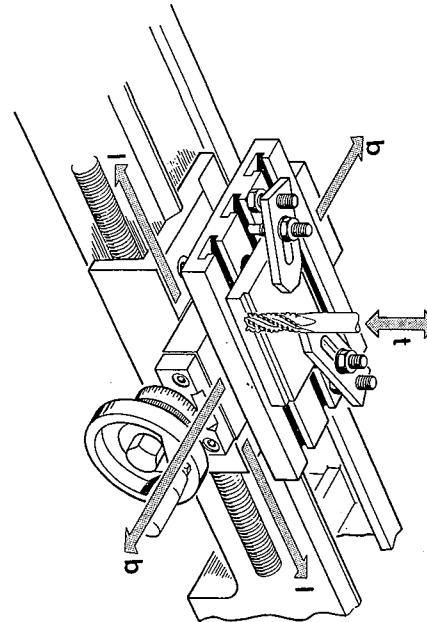
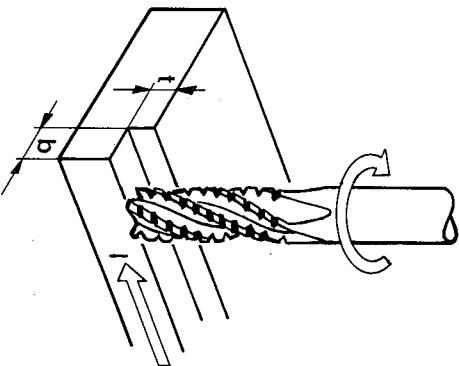
Adjustment of milling depth or width.

Feed movement

Accomplished by the workpiece.

Example:

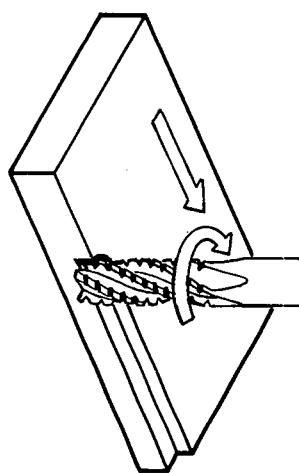
- Main movement is made by miller.
- Adjustment by the cross slide (b)
- Adjustment by the quill (t)
- The feed movement by the longitudinal slide (l)



Climb Milling (downcut milling) – Conventional Milling (up-milling process)

Climb milling

Cutting direction of the miller and feed direction of the workpiece are the same.

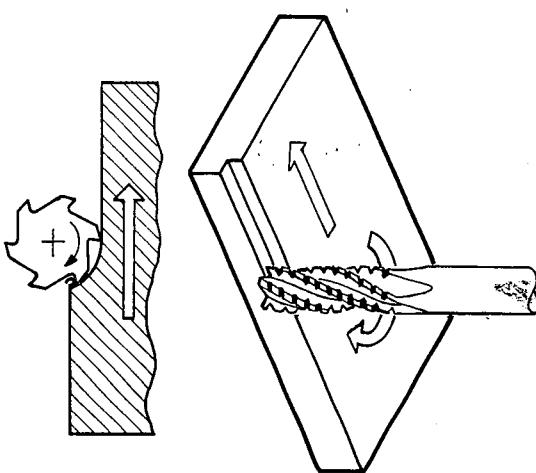


Conventional milling

Cutting direction of the miller and feed direction of the workpiece are opposite.

Working tip:

Use conventional milling method on the Compact 5, otherwise there is danger of breaking the miller.



Working Tips – Milling

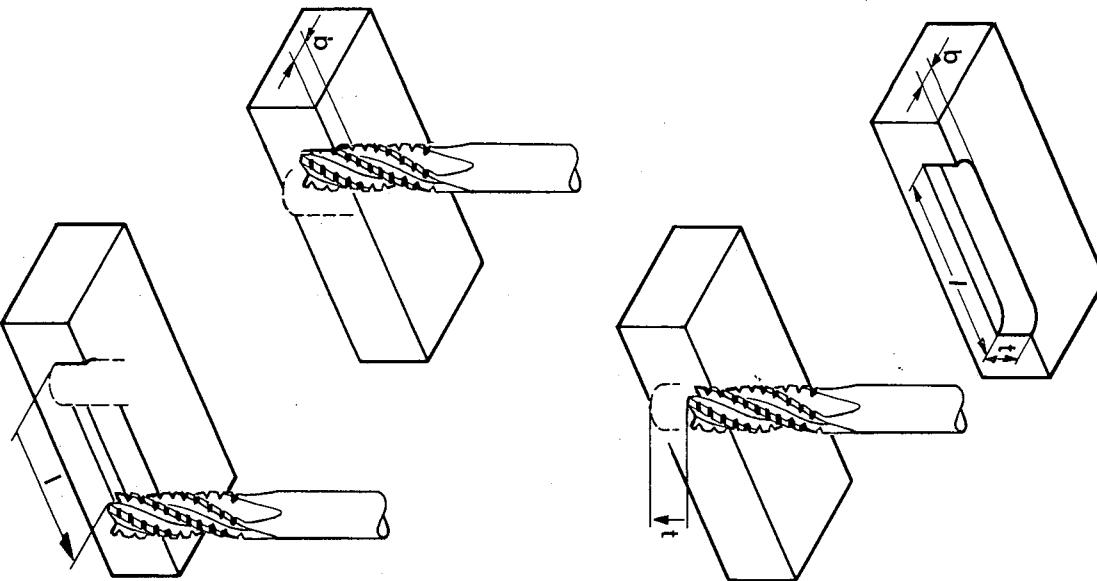
Clamping points

Tighten all clamping facilities, except that of the feed movement.

Example 1

Milling a notch with the heavy duty mill.

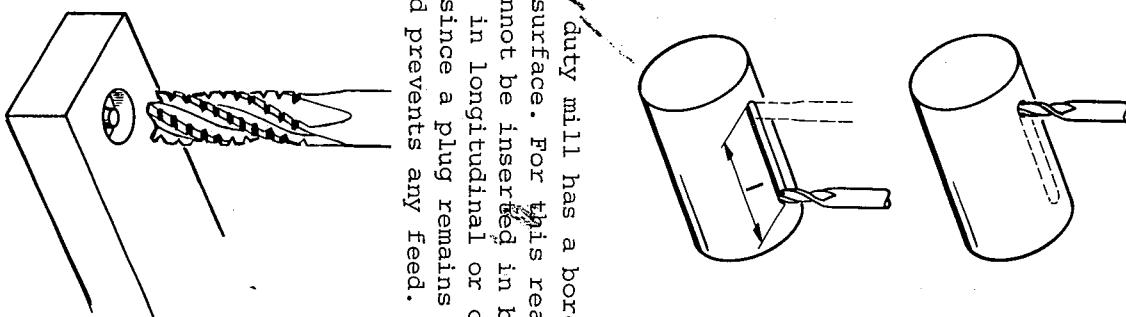
- Set milling depth "t" with the quill, clamp quill.
- Clamp longitudinal slide with cross slide feed to width "b". Clamp cross slide.
- Loosen longitudinal slide clamping, mill the length "l" of the notch.



Example 2

Milling a groove with the grooving cutter.

- Adjust center of axis using the cross slide, clamp cross quill.
- Using quill, mill depth of groove, clamp quill.
- Using longitudinal slide feed mill the length "l" of the groove.



The heavy duty mill has a bore on the face surface. For this reason this miller cannot be inserted in bore and then move in longitudinal or cross direction, since a plug remains in the center and prevents any feed.

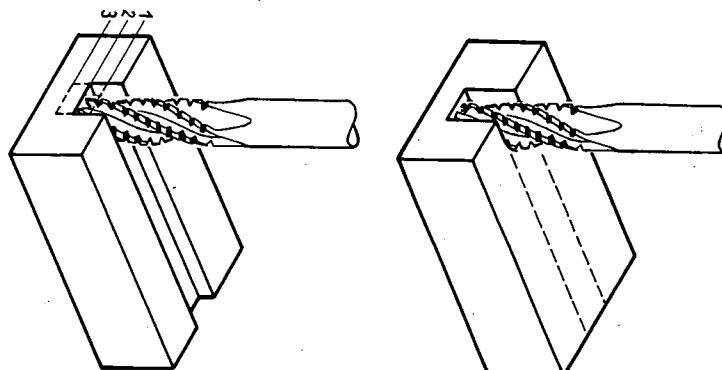
Diameter of miller or drill (mm)	SPINDLE SPEED	Cast Iron	Aluminium/Brass
to 5	1600	1600	1600
5-10	700	700	1600
10-15	700	380	700
15-20	380	380	700
20-40	380	380	380

Selecting the Spindle Speeds

The selection of the spindle speeds depends on the diameter of the miller resp. drill and not on the size of the workpiece.

In General:

- The larger the diameter of the miller, the slower the spindle speed.
- The harder the material of the workpiece, the slower the spindle speed.



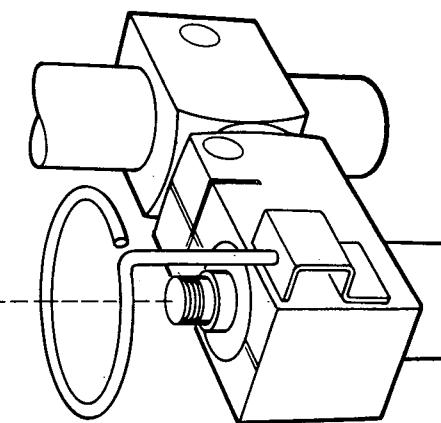
Milling depth – milling feed

If the milling depth and the milling feed are too large/fast, the miller will bend – this means danger of breaking and overloading the machine. When hard materials are used, the load is larger than with softer materials.

For this reason:

Complete deep grooves in several working steps. Feed must be carried out with feeling.

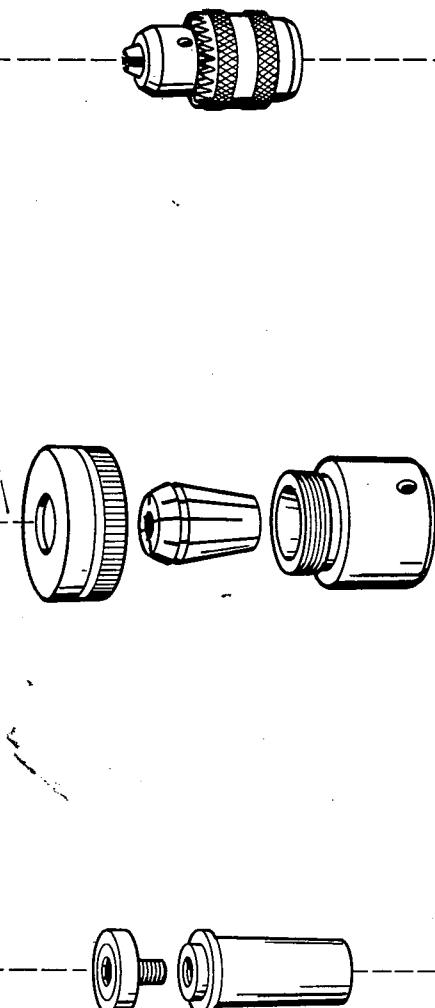
Clamping Devices for Drills and Millers (Summary)



3-jaw drill chuck

Collet attachment
(not the same as
with the lathe)

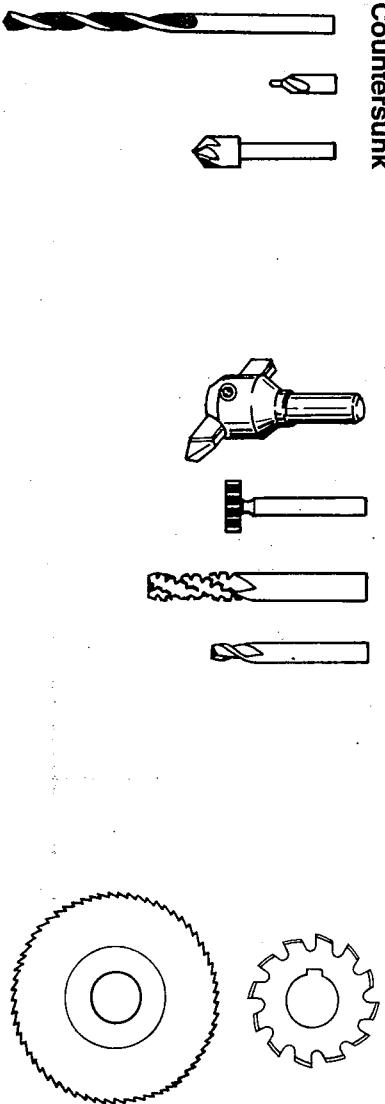
Arbor



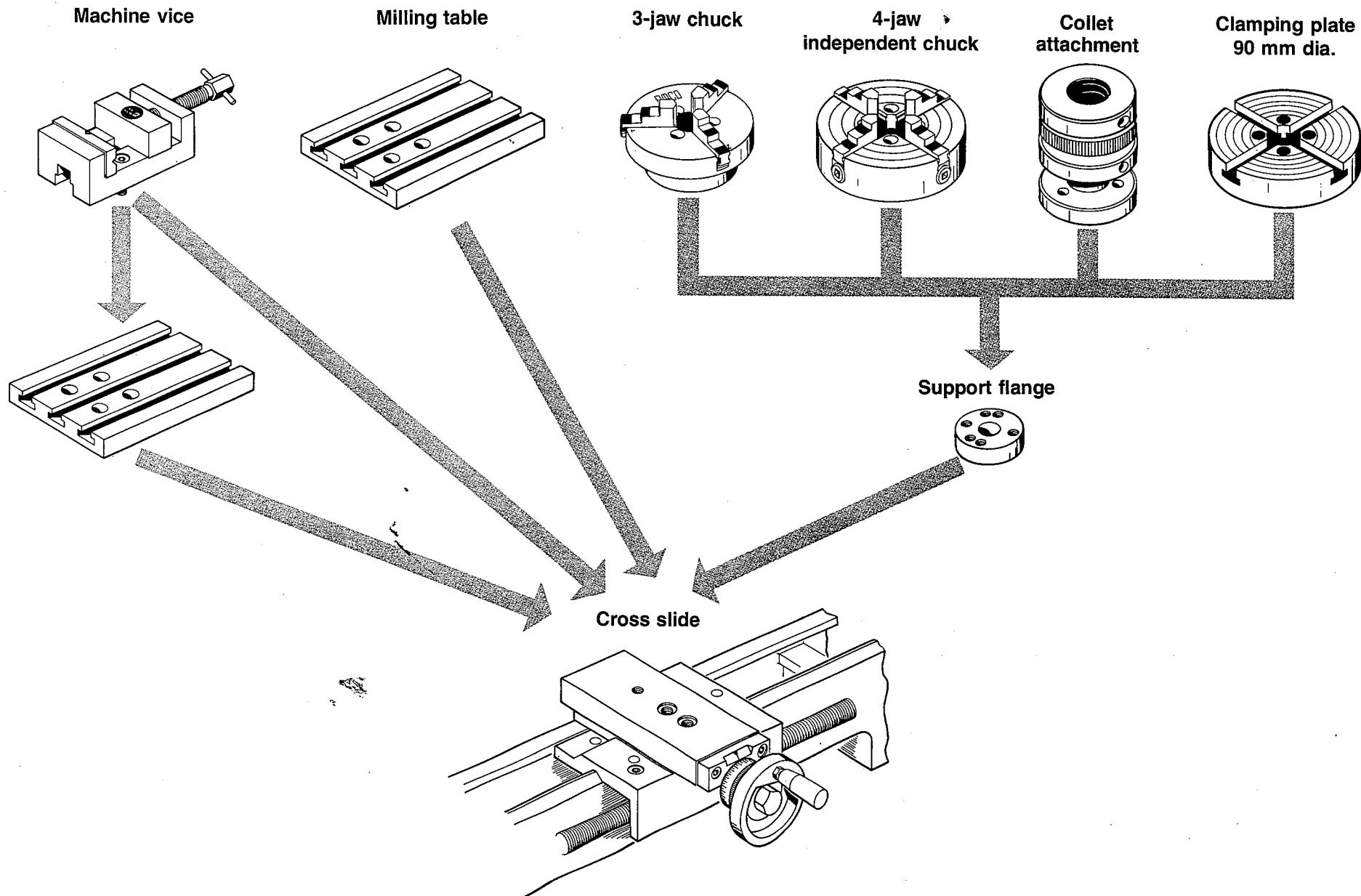
Spiral drill
Centering drill
Countersunk

Millers and fly cutter

Millers with 16 mm bore



Clamping Devices for Workpieces (Summary)

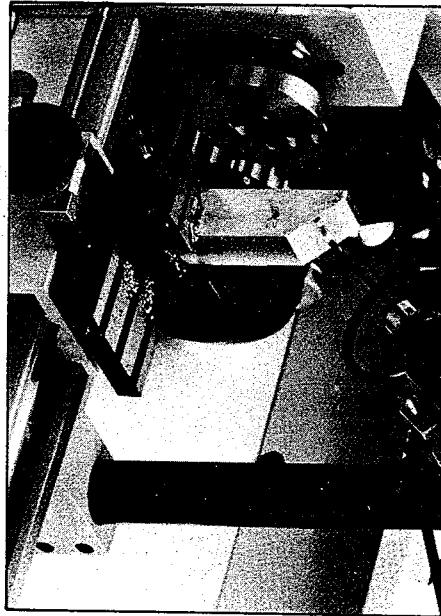


Clamping Devices for Drills and Millers

3-Jaw Drill Chuck

Clamping capacity: 1 - 8 mm

The 3-jaw drill chuck is identical with that used with the lathe. It is mounted directly onto the main spindle.

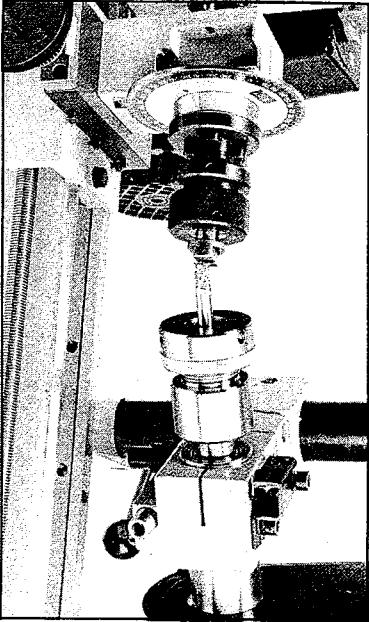


Collet Attachment

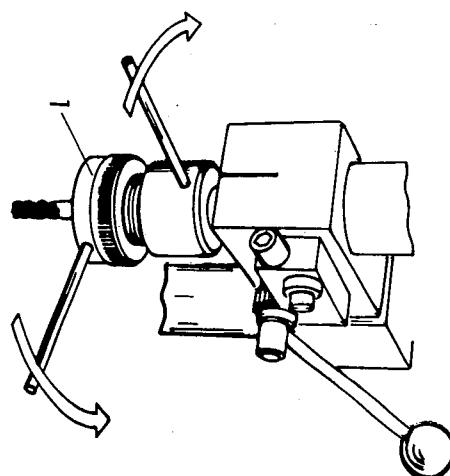
Clamping capacity using the collets ESX 25: 1,5 - 14 mm

The collet attachment for the vertical unit has an M14 x 1 mounting thread and is therefore not identical with that for the lathe. The collets for the vertical unit and the lathe are the same.

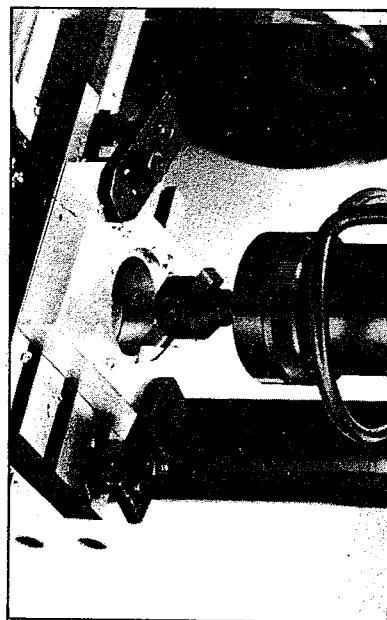
Millers must be clamped securely and with highest round-run accuracy. For this reason, the collet attachment is necessary. Clamping is accomplished by means of the pins which are included.



Two collet attachments being used.

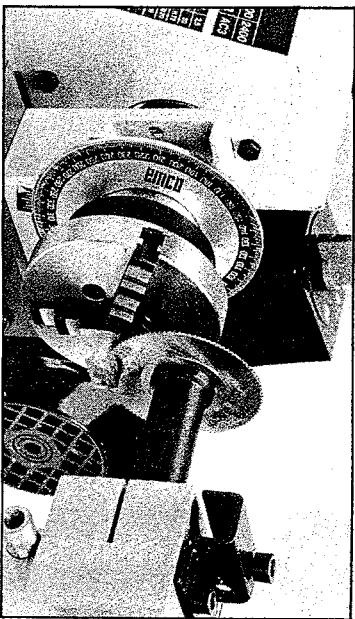


When working with the fly cutter (dia. of shaft 8 mm) secure clamping of the shaft is absolutely necessary.



Arbor

The arbor serves for clamping the gear mills, the circular saw blade and other millers with a center bore of 16 mm.



Clamping Devices for Workpieces

The Machine Vice

Mounting on milling table

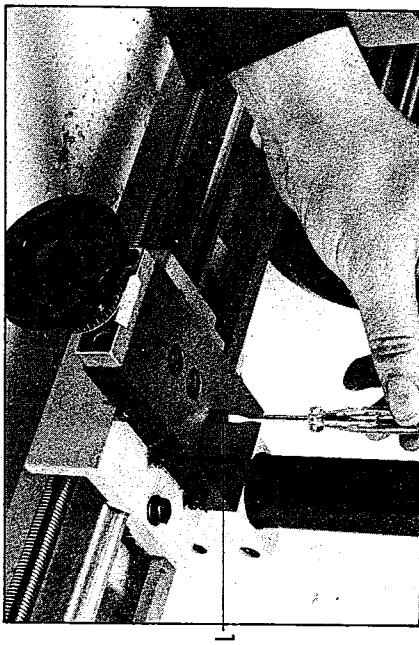
Mount the machine vice on the milling table with the two longer socket head screws M6 x 16 and the T-nuts. The machine vice can be mounted on the milling table longitudinally or crosswise.

Width of clamping jaws: 46 mm
Height of clamping jaws: 18 mm
Opening of jaws: up to 32 mm

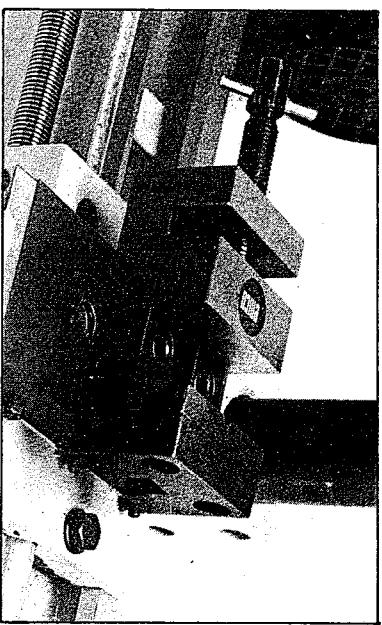
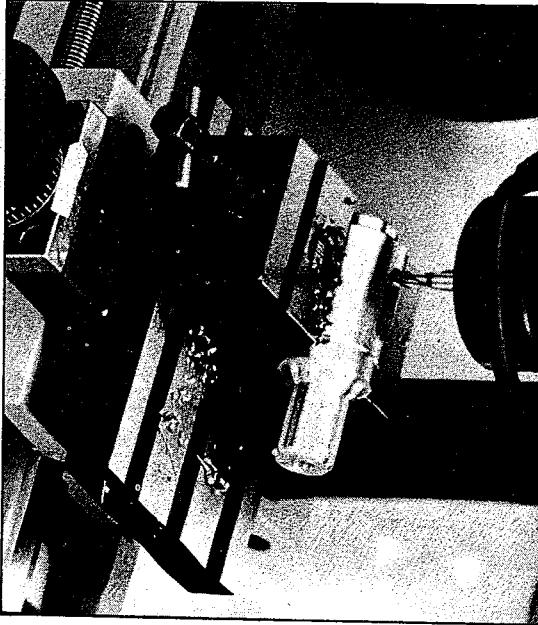
Technical data

Mounting on cross slide

1. Remove set screw (1)



Working tip



2. Mount machine vice on cross slide and tighten with the two shorter socket head screws M6 x 20.

The V-recess in the machine vice serves for vertically clamping round workpieces.

The Milling Table

Dimensions:

Length x width: 120 x 80 mm
Max. clamping height with short screws:
up to 15 mm
Max. clamping height with long screws:
up to 35 mm

Mounting on the cross slide:

The milling table can be mounted in longitudinal or cross direction on the cross slide with the socket head screws M6 x 12.

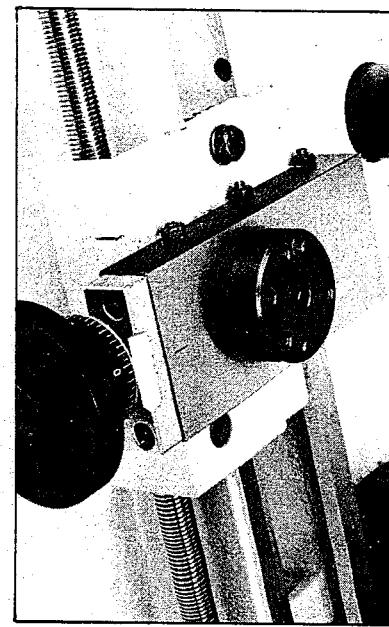


- If you want to adjust the clamping of the milling table exactly parallel to the lathe bed, feed a round pin in the collet and align the table.

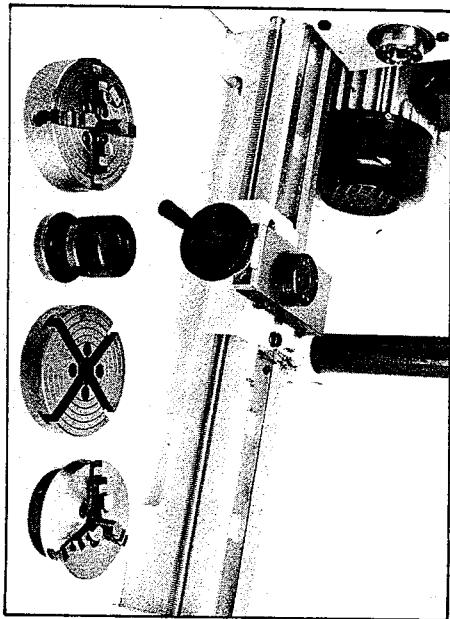
- Adjust the hexagon screw so that the clamping shoe is vertical.

The Support Flange

The support flange has the same dimensions as the spindle nose of the lathe spindle. Mount the support flange on the cross slide with the socket head screw M6 x 12.



Following devices can be mounted on the support flange: 3-jaw chuck, collet attachment for lathe, clamping plate, 4-jaw independent chuck.



- Note that all contact surfaces are clean - cross slide-support flange, support flange-3-jaw chuck.

Warranty conditions for new EMCO machines

1. The warranty period for new EMCO machines is, without limitation of operating hours, 12 months after initial shipment of the machine from EMCO or its authorized representative. Should the installation be completed by EMCO or its authorized representative, the warranty period begins with the completed installation of the machine.

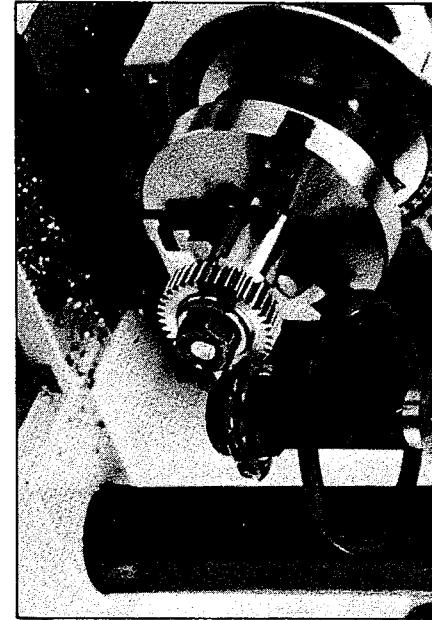
If a delay of installation occurs which is not caused by EMCO or its representative, the warranty period becomes invalid 12 months after scheduled installation date.
2. The warranty extends to the elimination of all defects in material or workmanship which affect the regular function of the machine.
3. Occurring defects must be immediately reported to the EMCO representative or the next EMCO service department with detailed description of the defect in written or oral form, followed by a written verification.
4. Defects which are correctly reported and under warranty will be corrected by either repair or replacement delivery to the original buyer free-of-charge; defective parts are to be returned to EMCO or the EMCO authorized representative, freight prepaid, if requested.
5. Warranty for spare parts: Emco guarantees to the original buyer that, only those parts sold directly by Emco or through an authorized representative will be free from defects, which render part commercially unacceptable in material and workmanship, for a period according to applicable national law, at least three (3) months, but not to exceed six (6) months from the date of initial shipment or installation by Emco or its representative.

In the case of repeated claims for the same part: Warranty replacement does not extend the period of the original warranty.
6. There is no claim of warranty for defects which occurred by:
Negligence of operating instruction manuals, safety and handling regulations or other instructions regarding delivery, installation, set-up, or usage of the machine, incorrect set-up resp. installation, as well as, unauthorized, not expressly regulated or allowed alterations or modifications of the machine by the original buyer or third parties, natural wear, improper or negligent handling, chemical, electro-chemical or electrical influences, inadequate energy supply or force majeure.
7. Any service performed by EMCO or its authorized representative beyond warranty will be charged at EMCO's or its authorized representative's regular rates.

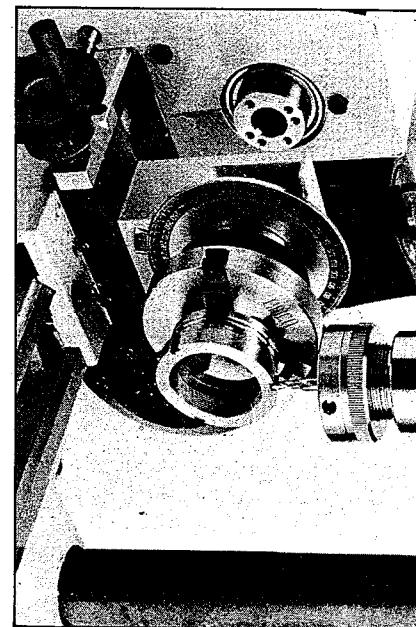
The Dividing Attachment

For drilling flange bores, for milling an exact hexagon, for milling gear wheels, etc., everywhere where exact divisions must be adjusted, a dividing attachment is required.

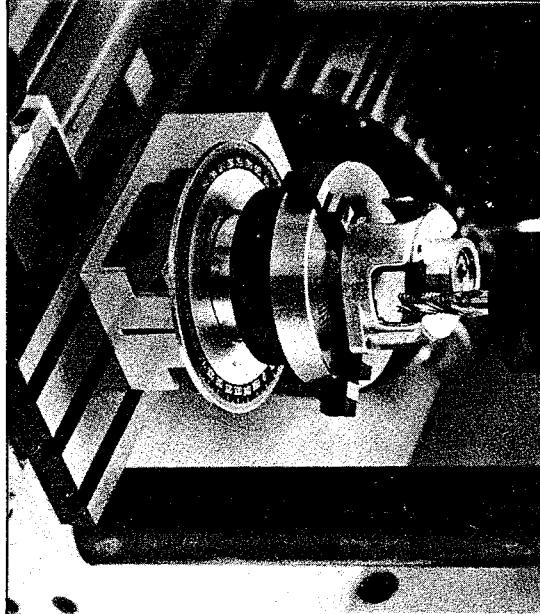
Examples:



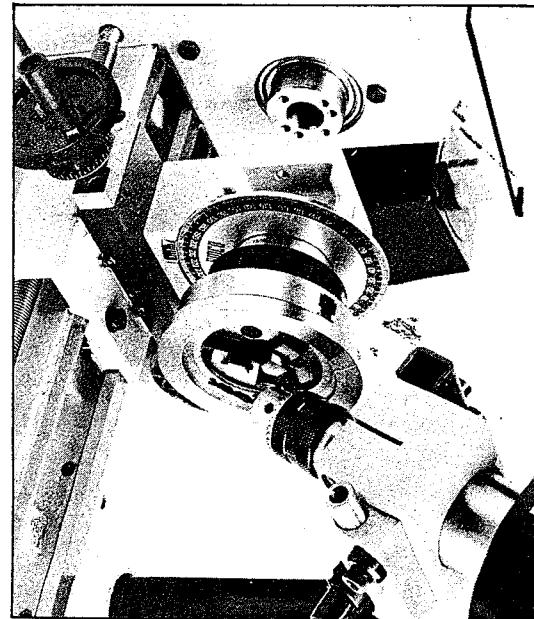
Gear milling: the pre-turned disc is clamped onto an arbor. The possible number of teeth of the gear wheel is engraved into the gear miller. When clamping gear millers, note revolution direction.



Grooves for a hooked key are milled. - The feed is carried out via the longitudinal slide, all other clamping screws (cross slide, quill, base screws, dividing attachment) are tightened.

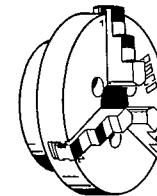


Workpiece is mounted on dividing attachment which is mounted horizontally. Feed is carried out with the longitudinal slide, adjustments with the cross slide.

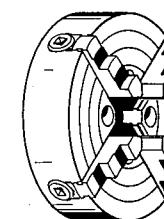


Note: when the vertical unit is turned and swivelled, solid angles are the result.

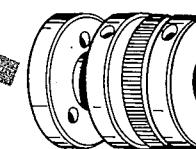
**Clamping Devices for the Dividing
Attachment (Summary)
(identical with Clamping Devices
for Turning)**



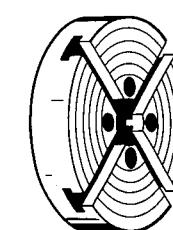
3-jaw chuck



4-jaw independent chuck

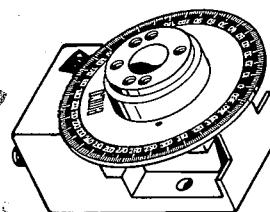
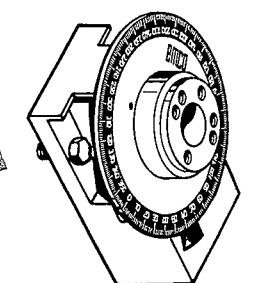


Collet attachment

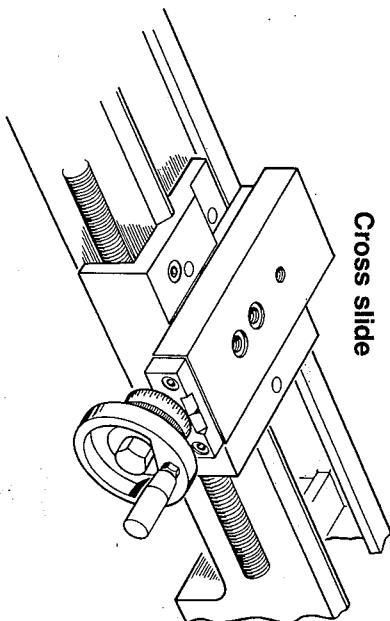


Clamping plate 90 mm dia.

Dividing attachment



Cross slide

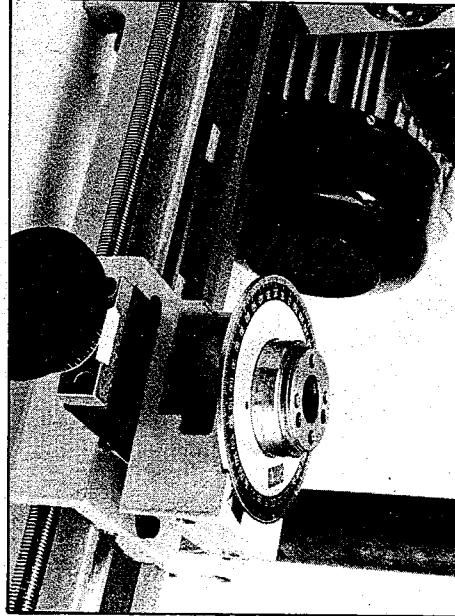


Mounting the dividing attachment

During milling operations, feed should be achieved via the longitudinal or cross slide. For this reason, the dividing attachment can be mounted either horizontally or vertically.

Horizontal mounting:

Mount the dividing attachment on the cross slide with the two hexagon screws M6 x 16.



Vertical mounting:

Mount dividing attachment on the cross slide with the two socket head screws M6 x 40.



The dividing chart

The dividing chart indicates the dividing possibilities for the respective circle of holes.

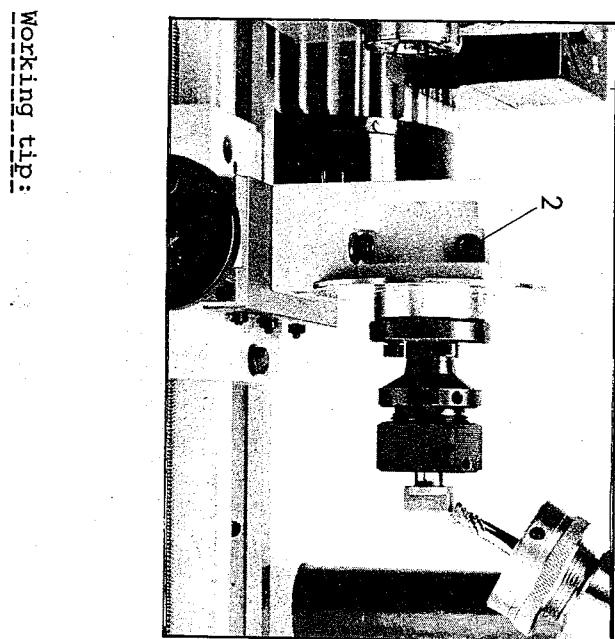
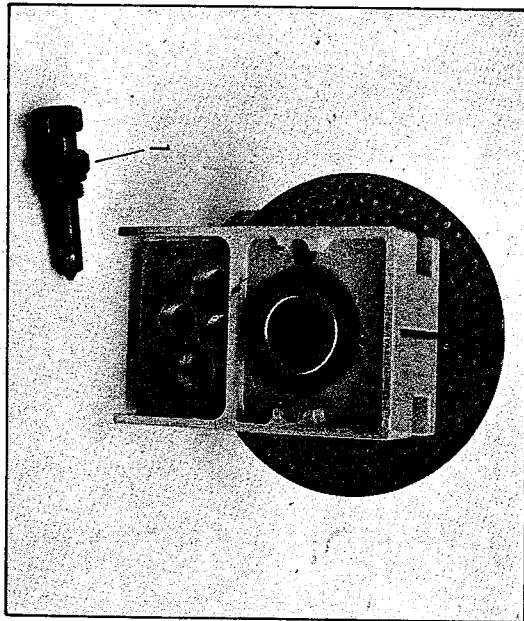
Example:

15 divisions are required. These are reached with the circle of holes 60.
 $60:15 = 4$.
I.e., division in every fourth hole.

Circle of holes	Dividing possibilities													
60	2	3	4	5	6		10	12		15		20	30	60
56	2		4		7	8			14			28	56	
48	2	3	4		6	8		12		16		24	48	
36	2	3	4		6		9	12			18		36	

Dividing procedure

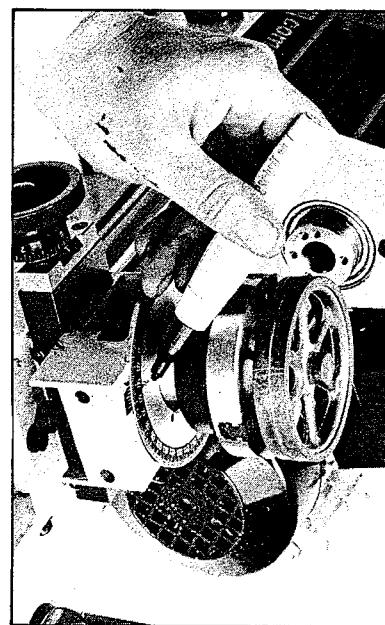
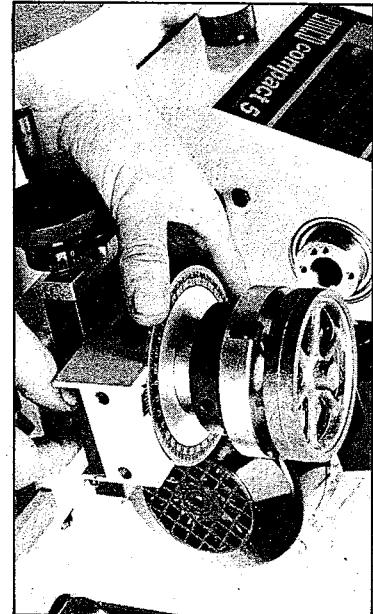
1. Insert index bolt (1) into bore for required division. The outermost circle of divisions has 60 holes, the second has 56, etc.
2. Pull the index bolt and turn dividing plate as many divisions as required.
3. Tighten clamping screw (2) before each milling or drilling operation!



Working tip:

Mark the graduation with a felt marker for better orientation.

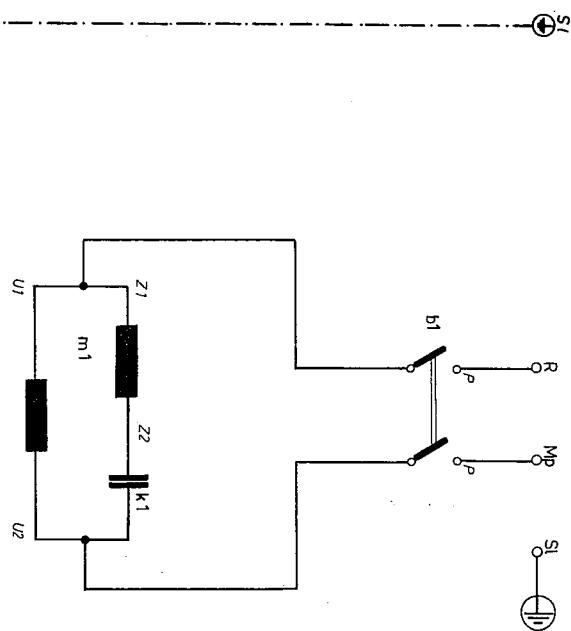
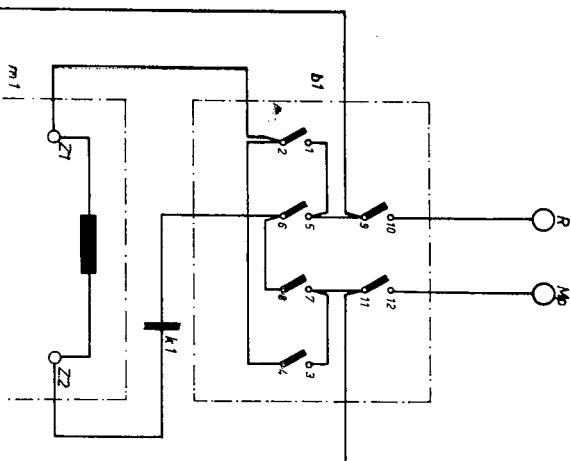
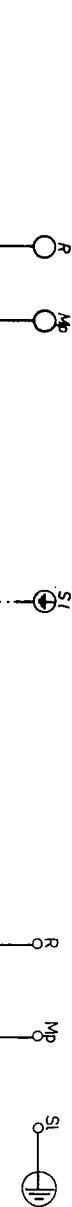
Example: 15 divisions are required.
 $360^\circ : 15 = 24^\circ$. Mark 24° , 48° , etc.



STROOMPLAN VOOR DE DRAAIBANK

A 12.819

STROOMPLAN VOOR DE BOOR- EN FREESKOLOM



b1 Motorschakelaar
k1 Kondensator
m1 Motor

Schakelschema motorschakelaar

b1	1	3	5	7	9	11
voorw.	-	x	x	-	x	x
-	-	-	-	-	-	-
0	-	-	-	-	-	-
-	-	-	-	-	-	-
terugw.	x	-	-	x	x	x

