

TOS HOSTIVAŘ - PRAHA-ČSSR



"DEMCO"

267 CLEVELAND ST., LEEDFERN, SYDNEY.

699 4121

BN 102 B

**Operating
instructions**

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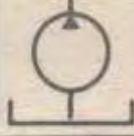




Serial No.

415/50

Service voltage

Inventory No.

INDEX TO CHAPTERS

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PREFACE

We have pleasure in submitting the present instruction manual and wish to inform you that you will find in it all technical specifications of the delivered machine, instructions and hints for its correct installation, and all information on how to operate and set it into operation correctly. A detailed description of the machine and its working capacities is accompanied by drawings and tables.

The chapter dealing with the electrical equipment includes information on operating voltage, frequency, machine power requirement and voltage for the control circuits and lighting.

Machine maintenance is facilitated by instructions concerning assembly and dismantling of the individual machine groups, as well as by specifications of parts subject to more rapid wear. The instructions for ordering replacement parts will help you to order replacement parts - not only those included in the separate specifications, but all replacement parts - and will speed up their delivery.

The instruction manual would fail in its purpose if the heads of departments and those who are to attend the machine directly were not fully acquainted with its entire contents.

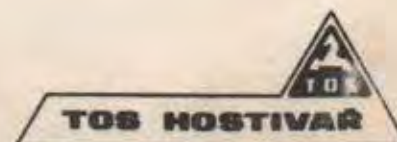
If all hints given in this manual are fully complied with, you will be fully satisfied with the accuracy and output of the machine.

Finally, we would like to assure you that all possible care was devoted to the manufacture of the machine. A hundred per cent inspection ensures accuracy of the delivered machine within the acceptance tolerances laid down for this type of machine.

We feel certain that the present instruction manual will prove a valuable guide when utilizing the delivered machine and we wish you much success and the best results in your working on it.

TOS HOSTIVAR, n.p.
Bearer of Order of Work
Prague 10 - Hostivař

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MAIN PARTICULARS

Description of machine and its field of application

Main specification of machine

List of basic machine groups

List of standard equipment

List of optional accessories and attachments

Description of basic machine groups

Stand

Columns

Wheelhead

Slide and tables

Description of standard equipment

Workhead

Left-hand and right-hand tailstock

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10. Workhead
11. Standard equipment
12. Optional accessories and attachments /4 sheets/

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Description of Machine and Its Field of Application

The BN 102 B universal tool and cutter grinder with its standard and extra accessories is intended for sharpening of all normally used metal cutting tools. It enables also grinding of cylindrical and tapered surfaces, both externally and internally, as well as grinding of flat surfaces.

With the application of the wide range of accessories available, it is possible to sharpen on the machine twist drills, roughing reamers, reamers, backed-off disc-type milling cutters, long tapered tools, broaches, turning tools and cutter heads of a max. dia. of 380 mm. The optional accessories enable sharpening of hobs, grinding of radii on milling cutters and grinding of profile turning tools.

Design of the machine permits the grinding wheels to be profile dressed by copying from a template and the diamond wheels for grinding the carbide-tipped tools to be used.

The various accessories are clamped in the T-slots or on the quick-change clamping fixture delivered as an optional extra.

The optional extras include also cooling equipment, dust exhaust attachment and equipment for hydraulically-operated feed to the table.

The wheelhead is mounted on an adjustable column. Vertical adjustment of the latter column is power-operated, under control of pushbuttons, or hand-operated /for fine setting/, controlled by a handwheel.

The wheelhead is constructed with a view to allowing the use of change spindles. The wheel spindle is mounted on journal-thrust bearings and driven by a flat belt. It can rotate in either direction. The grinding wheels are clamped with the aid of clamping arbors.

The tables move on antifriction prismatic ways ensuring precision and easy control.

The workhead is provided with an indexing equipment and can be swivelled both in the horizontal and vertical plane. It is fixed on the upper table. The work spindle is mounted on antifriction bearings.

The controls of the machine are located in such a manner that they are easily accessible in performing any kind of grinding.

The design arrangement of the electrical equipment permits any attachment, bought and delivered even at a later date, to be connected without any modification and without losing any time.

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MAIN SPECIFICATION OF MACHINE

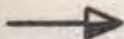
Maximum swinging diameter	mm	280
	in	11.02
Maximum swinging diameter when raising plate is used	mm	370
	in	14.56
Maximum distance between centres of tailstocks	mm	760
	in	29.92
Maximum distance between centres of tailstock and workhead	mm	615
	in	24.20
Height of axis of workhead above table	mm	130
	in	5.11
Height of axis of tailstocks above table	mm	130
	in	5.11
Tapers in bores of wheelhead spindle	Morse No.3	
Tapers in bore of workhead spindle or	Morse No.5/ISO50 Morse No.6	
Maximum diameter of wheel for tool sharpening	mm	175
	in	6.88
Maximum diameter of wheel for cylindrical grinding	mm	200
	in	7.87
Maximum diameter of wheel for surface grinding	mm	175
	in	6.88
Maximum swivelling of wheelhead in horizontal plane		350°
Maximum swivelling of workhead in vertical plane		360°
Maximum swivelling of workhead in horizontal plane		360°
Maximum swivelling of table to either side through 45°		90°
Fine swivelling of table to either side through 9°		18°
Maximum length of vertical adjustment of wheelhead	mm	290
	in	11.41
Rate of power-operated adjustment of wheelhead	m/min	1,2
	in/min	47.24
Maximum length of longitudinal traverse of table	mm	510
	in	20.07
Maximum length of cross traverse of table	mm	250
	in	9.84

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Max. length of cross traverse of table provided with coolant discharge trough	mm	230
	in	9.05
Clamping width of table	mm	140
	in	5.51
Clamping length of table	mm	980
	in	38.58
Speed to spindle of wheelhead-reversible	r.p.m.	2800
	r.p.m.	5600
Output of main motor	kW	0,55/0,75
	HP	0,75/1.02
Total power required by machine	kW	3
	HP	4
Weight of machine with standard equipment	kg	995
	lb	2190
Weight of machine with complete accessories	kg	1544
	lb	3397
Weight of railway packing	kg	50
	lb	110
Weight of seaworthy packing	kg	350
	lb	770



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LIST OF BASIC MACHINE GROUPS

Stand
Columns
Wheelhead
Slide-tables
Electrical equipment

LIST OF STANDARD EQUIPMENT

Illustration - chapter 1, Fig. 11

	No. of pcs.	Machine group
Workhead /Morse 5/ISO 50/ including reducing sockets 5/4, 5/3, 5/2, ISO 50/4/	- 1	05
Left-hand tailstock	- 1	06
Right-hand tailstock	- 1	
Centre Morse No. 2	- 2	
Grinding wheel arbors - 125 mm (4.92 in) long	- 1	07a
65 mm (2.56 in) long	- 3	
5 mm (0.19 in) long	- 2	
Clamping tube of arbors	- 1	
Flanges of grinding wheels - 36 mm (1.41 in) dia.	- 1	
40 mm (1.57 in) dia.	- 2	
45 mm (1.77 in) dia.	- 3	
60 mm (2.36 in) dia.	- 2	
Grinding wheels (dia. 75 mm, (2.95 in), dia. 100 mm (3.93 in) - 2 pcs. dia. 150 mm (5.90 in) dia. 175 mm (6.89 in)) total	- 5	
Holder of grinding wheel covers	- 1	07b
Rod for holders of grinding wheel covers	- 2	
Guard covers of grinding wheels -		
for 100 mm (3.93 in) dia., 30 mm (1.18 in) wide	- 1	
for 100 mm (3.93 in) dia., 80 mm (3.15 in) wide	- 1	
for 175 mm (6.89 in) dia., 45 mm (1.77 in) wide	- 1	
for 200 mm (7.87 in) dia., 40 mm (1.57 in) wide	- 1	

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Centring gauge	- 1	07c
Fixed toothed rest	- 1	
Universal toothed rest	- 1	
Support stand	- 1	
<hr/>		
Raising plates /blocks/incl. 4 screws	- 2	07d
<hr/>		
Mandrel for clamping tools	- 1	07e
Drift	- 1	
Inspection mandrel	- 1	
Hand grease gun	- 1	
Holder of diamond for dressing grinding wheels	- 1	
Double-ended open spanner CSN 23 0610		
- size 24/27	- 1	
- size 19/22	- 1	
- size 14/17	- 1	
- size 11/12	- 1	
- size 9/10	- 1	
Hexagonal socket spanner		
CSN 23 0710 - size 12	- 1	
- size 10	- 1	
- size 8	- 1	
- size 6	- 1	
Single-ended hook-type spanner	- 1	
CSN 23 0730 - size 30/35		
Clamping bolts M.12 x 50 including washers and nuts	- 6	
<hr/>		
Spot light		07f
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Table of values "H"		
Operation and maintenance instruction manual		



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LIST OF OPTIONAL EXTRAS

<u>Illustration - chapter 1, Fig. 12, 12.1, 12.2, 12.3</u>	<u>Group</u>
Cylindrical grinding attachment	10
Internal grinding attachment	11
Vice for surface grinding	12
Attachment for grinding between centres	13
Attachment for grinding backed-off disc-type milling cutters	14
Roughing reamer grinding attachment	15
Attachment for grinding carbide-tipped tools	16
Attachment for grinding twist drills ranging in diameter from 5 to 25 mm (0.19 - 0.98 in)	17
Dust exhaust attachment	19
Flat magnetic clamping plate with permanent magnet	20
Cooling equipment	21
Radius grinding attachment	22
Collet chuck equipment controlled from rear, for 3 - 20 mm (0.11 - 0.78 in) dia.	23a
Collet chuck equipment controlled from front, for 5 - 25 mm (0.19 - 0.98 in) dia.	23b
Mandrel for clamping tools with Morse No. 1 taper	23c
Set of collets for collet chuck equipment controlled from rear /for 3 - 20 mm (0.11 - 0.78 in) gripping range, without collet for 18 mm (0.70 in) dia./	23d
Set of collets for collet chuck equipment controlled from front /for 5 - 25 mm (0.19 - 0.98 in) gripping range, without collet for 18 mm (0.70 in) dia./	23e
Radius wheel dresser /cradle/	25a
Profile wheel dresser	25b
Attachment for grinding cutter heads ranging in diameter up to 380 mm (14.96 in)	26
Attachment for grinding hobs	27
Quick-change clamping fixture for accessories- vertical type	28a
Quick-change clamping fixture for accessories- horizontal type	28b

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Clamping fixtures	29
- 160 mm (6.29 in) dia. three-jaw chuck with Morse 5 taper shank	29a
- 160 mm (6.29 in) dia. three-jaw chuck with flange for clamping to quick-change clamping fixture	29b
- 125 mm (4.92 in) dia. four-jaw chuck with Morse 5 taper shank	29c
- 125 mm (4.92 in) dia. four-jaw chuck with flange for clamping to quick-change clamping fixture	29d
- 100 mm (3.93 in) dia. three-jaw chuck with Morse 5 taper shank	29e
- 100 mm (3.93 in) dia. three-jaw chuck with flange for clamping to quick-change clamping fixture	29f
- 160 mm (6.29 in) dia. face plate	29g
- quick-change collet chuck for 3 - 16 mm (0.11 - 0.62 in) dia.	29h
- 160 mm (6.29 in) dia. round magnetic clamping plate with permanent magnet	29i
Equipment for hydraulically-operated longitudinal feed to table	30

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DESCRIPTION OF BASIC MACHINE GROUPS

Stand

The machine stand is box-shaped and provided with precision guideways. At the front of the stand is located the panel with electrical instruments and on its top is fixed the sleeve in which the adjustable column moves. Vertical adjustment of the column is actuated by a hand-wheel or motor, through a worm gearing and rack fixed to the column.

In the adjustable column is located the swivelling column, which carries the wheelhead.

Columns

Illustration - chapter 1, Fig. 2, 3.

The sleeve of the columns /Fig. 2/3/ is bolted to the machine stand and sealed to prevent grinding dust and coolant from penetrating inside.

The adjustable column /Fig. 2/4/ is guided by the sleeve and secured against rotation by the wedged strip piece /Fig. 2/8/. Excessive clearance between the column and its sleeve is eliminated by the strip piece. The adjustable column can be secured in any position by the braking screw /Fig. 2/2/. Underneath the screw an insert from plastics is located. In adjusting the column, do not forget to loosen the screw! The column is protected against penetration of impurities by the bellow /Fig. 2/1/. Fine vertical settings of the adjustable column are produced by the handwheels /Fig. 3/3/, the rotation of which is transmitted through the gearing /Fig. 3/5, 6/, worm /Fig. 3/9/, worm gear and pinion to the rack provided on the column /Fig. 2/12, 10, 9/. However, prior to the fine vertical setting, it is necessary to engage the clutch /Fig. 3/2/. Simultaneously with engagement of the clutch, the motor for power adjustment /Fig. 3/8/ is put out of operation. One graduation on the handwheel /Fig. 3/4/ is equal to 0.01 mm (0.00039 in) long adjustment.

The clutch /Fig. 3/2/ being disengaged, the hand-operated adjustment of the column is put out of operation and the limit switch /Fig. 3/1/ connects the motor for power-operated adjustment to power. Thereafter, the latter motor can be controlled by pushbuttons located both at the front and on left-hand side of the machine stand. The rate of power-operated adjustment in the vertical direction is 1.2 m/min (47.24 in/min).

The drive is transmitted from the motor to the worm gearing by a V-belt. The latter belt is tensioned by shifting the bracket /Fig, 3/7/.

Maximum length of hand-operated adjustment of the columns is 290 mm (11.41 in). In the upper and lower reversing point, the movement is restricted by positive stops.

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Maximum length of power-operated adjustment of the columns is 270 mm (10.62 in). The adjustment is restricted by the limit switches /Fig. 2/11/, which switch off the motor 10 mm (0.39 in) in front of the reversing points. This arrangement prevents "hard" bearing against the positive stops.

The swivelling column /Fig. 2/5/ is located inside the adjustable column and can be swivelled through 350 deg. about its vertical axis. Amount of swivelling can be read off a graduated scale. On top of the swivelling column, the wheelhead is assembled. At the bottom of this column there is located the motor driving the wheel spindle /Fig. 2/7/. The motor is secured to the bracket /Fig. 2/6/. The bracket is adjustable and permits thus the driving belt to be tensioned. The driving belt is tensioned with the aid of two spanners. One spanner serves to loosen nuts of the pinion /Fig. 2/13/ and the other serves to turn the pinion according to need. The driving belt being tensioned, the bracket with motor has to be secured in its set position by tightening the nuts of the pinion.

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Wheelhead

Illustration - chapter 1, Fig. 4, 5
chapter 5, Fig. 1

The wheelhead spindle /Fig. 4/1/ is mounted on journal thrust bearings selected in pairs and provided with the textile-rubber cages /Fig. 4/2/. The bearings are located in special boxes /Fig. 4/3/. Rotation of the spindle is reversible. Drive is taken from a two-speed motor, by flat endless belt.

The spindle speed /either 2.800 or 5.600 r.p.m./ is preselected by a selector switch and spindle rotation is started by push-buttons on the pushbutton panel located at the front and left-hand side of the machine stand. Spindle rotation is stopped by the central pushbutton marked in red.

At both ends, the spindle is provided with taper bore Morse No.3. In clamping the arbors carrying the grinding wheels, the spindle can be secured against rotation by the arresting pin.

The top of the wheelhead body is provided with crosswisely arranged T-slots intended for fixing of various accessories and attachments /e.g., arm of internal grinding attachment, spot light, universal and fixed rest, etc./.

The wheelhead is located on the swivelling column, together with which it can swivel about its vertical axis through 350 deg. Swivelling can be effected after loosening the nut of the locking pin /chapter 5, Fig. 1/22/. The wheelhead is secured in its swivelled position by tightening the respective nut.

Setting Clearance in Bearings

Clearance in the wheelhead bearings is set in the manufacturing works. It should be re-set only if the surface finish obtained makes it necessary.

The bearings are delivered by the sub-contractor in pairs. It means that they are ready for assembly with the necessary amount of pre-loading. Axial clearance of the bearings is changed exclusively by modification of the width of the middle distance rings /Fig. 5/3, 4/. The nuts /Fig. 5/6, 7/ are firmly tightened. With the new bearings the distance rings have the same width. If you replace the bearings delivered in pair /Fig. 5/2, 5/ by bearings that are not selected in pairs, it will be necessary to measure the difference in width of the internal and external bearing rings.

The axial clearance should be checked and the bearings replaced according to the following instructions:

1. The bearing /Fig. 5/2/ has to be supported on its internal ring.
2. The distance ring /Fig. 5/4/ and the other bearing /Fig. 5/5/ has to be placed on the external ring of the bearing.

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3. A pressure of 10 kg (22 lb) has to be applied to the internal ring and distance between the internal rings of both the rings measured. Thereafter, the internal distance ring /Fig. 5/3/ has to be reduced by grinding to a width equaling the measured value. The pressure of 10 kg (22 lb) represents the required pre-loading of the bearing.
4. The bearings with the distance rings modified as stated above have to be assembled in the boxes /Fig. 5/1 - right-hand box/ and the spindle allowed to run for 24 hours.

The right-hand box serves to compensate for thermal dilatation. Do not mistake it for the left-hand box.

The bearings have to be lubricated with the special grease SP 2. While the spindle is being run-in, its temperature should be checked. It should not exceed 60° C. If, however, the temperature is higher, it is necessary to modify still more the axial ring of the bearing. For the wheelhead, bearings CSN /SKF/ A 7207 AT are used.

Replacement of the bearings and clearance setting in them should be carried out by skilled staff only.

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Slide - Tables

Illustration - chapter 1, Fig. 6, 7, 8.

The cross slide is slidably mounted on prismatic and flat ways provided on the machine stand. The front side of the slide is provided with T-slots intended for clamping various accessories and attachments. Cross feed to the slide is actuated by the handwheels /Fig. 7/3/ located both at the front and rear of the machine. One division of the graduated scale on the handwheels /Fig. 7/1/ is equal to a 0.02 mm (0.00078 in) long displacement. Length of traverse of the slide provided with the coolant discharge trough is 230 mm (9.05 in) and of the slide without the trough 250 mm (9.84 in). The lead screw /Fig. 7/2/ has thread Tr 30 x 4 and is mounted on one end on a thrust bearing.

The cross slide carries the tables. The bottom table /Fig. 6/6/ moves in antifriction ways, on rollers of 18 mm diameter /Fig. 6/2/. The rollers are guided by cages in the ground strip pieces /Fig. 6/1, 3, 7, 8/. The longitudinal traverse of the table is hand-operated, or, when use is made of the equipment for hydraulic table feed, hydraulically-operated.

The hand-operated traverse of the table is controlled by a crank at the rear of the cross slide. Fine setting of the table is accomplished by the handwheel on the right-hand front side of the slide, through a reduction gearing and differential /Fig. 8/1/.

The hand-operated travel for fine setting of the table is engaged by pulling out the button /Fig. 8/2/. Thereby, the gear wheel /Fig. 8/3/ is brought into mesh.

Length of the longitudinal traverse of the table can be limited by the adjustable stops. Maximum length is 510 mm (20.07 in).

The upper table /Fig. 6/5/ can be swivelled on the bottom table through 45 deg. to either side. Rough angular setting of the table is done with reference to a graduated scale provided on the swivel base. Fine angular setting within a range of ± 9 deg. is accomplished with the aid of the screw /Fig. 9/3/ and with reference to the index plate /Fig. 9/2/, after previous loosening of the levers /Fig. 9/1/ and nuts /Fig. 6/4/. After rough angular setting, the starting position of the table for fine angular setting is secured by a lever to engage with a groove in the rack /Fig. 9/4/.

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DESCRIPTION OF STANDARD EQUIPMENT

Workhead

Illustration - chapter 1, Fig. 10

The workhead is the equipment mostly used. It can be swivelled both in the vertical and horizontal plane. Amount of swivelling is read off graduated scales.

The work spindle /Fig. 10/2/ is mounted on antifriction bearings and provided with a graduated scale allowing cutting angles to be selected. The workhead is provided with T-slots /Fig. 10/1/ for clamping the work rests. The workhead has an in-built dividing attachment including basic dividing plate providing for 24 divisions /Fig. 10/4/. After loosening the nut /Fig. 10/6/ and removal of the distance ring /Fig. 10/5/, the basic dividing plate can be replaced by other dividing plates, according to need and selection. The following further plates are available, providing for divisions:

- z = 20 for 20, 10, 5, 4 and 2 divisions
- z = 22 for 22 and 11 divisions
- z = 24 for 24, 12, 8, 6, 4, 3 and 2 divisions
- z = 25 for 25 divisions
- z = 26 for 26 and 13 divisions
- z = 28 for 28, 14, 7, 4 and 2 divisions
- z = 30 for 30, 15, 10, 6, 5, 3 and 2 divisions
- z = 32 for 32, 16, 8, 4 and 2 divisions
- z = 34 for 34 and 17 divisions
- z = 36 for 36, 18, 12, 9, 6, 4, 3 and 2 divisions
- z = 38 for 38 and 19 divisions
- z = 40 for 40, 20, 10, 8, 5, 4 and 2 divisions

The above-stated dividing plates are delivered as optional extras. The work spindle can be locked in any set position by means of the screw /Fig. 10/3/.

The workhead is fixed on the table, in any desired position. When used in conjunction with the tailstock, the workhead is fixed on the left-hand side.

For the grinding of tools ranging in diameter from 280 to 370 mm (11.02 to 14.56 in) raising blocks are used. For the clamping of tools the work spindle /Fig. 10/2/ is bored taper Morse No. 5 and taper ISO 50. With the aid of reducing sockets delivered along with the machine it is possible to fix in the spindle bore also the tools with taper shank Morse No. 5, 4, 3, 2 and ISO 50 and 40. On special order, the workhead can be delivered with the work spindle with Morse No. 6 taper bore.

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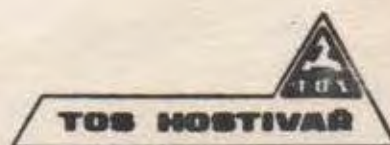
Left-hand and Right-hand Tailstock

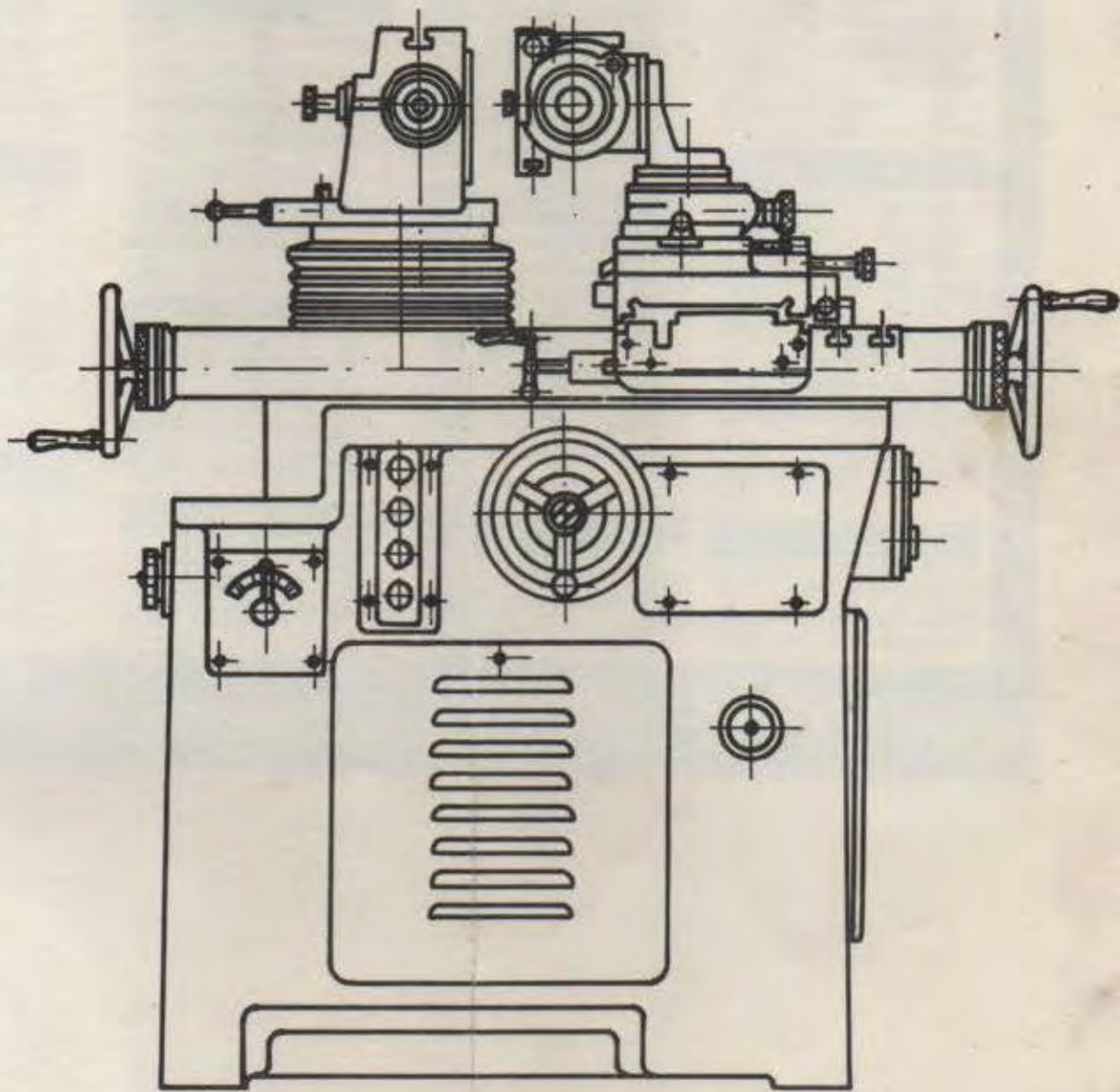
Axis of work holding centres of the tailstock is aligned with axis of spindle of the workhead. This arrangement permits the tools to be clamped between centres of the tailstocks, or between centres of the tailstock and workhead. The barrel of the right-hand tailstock is spring-loaded and adjustable by means of a hand lever. Pressure produced by the work holding centre can be set by pre-loading of the respective spring.

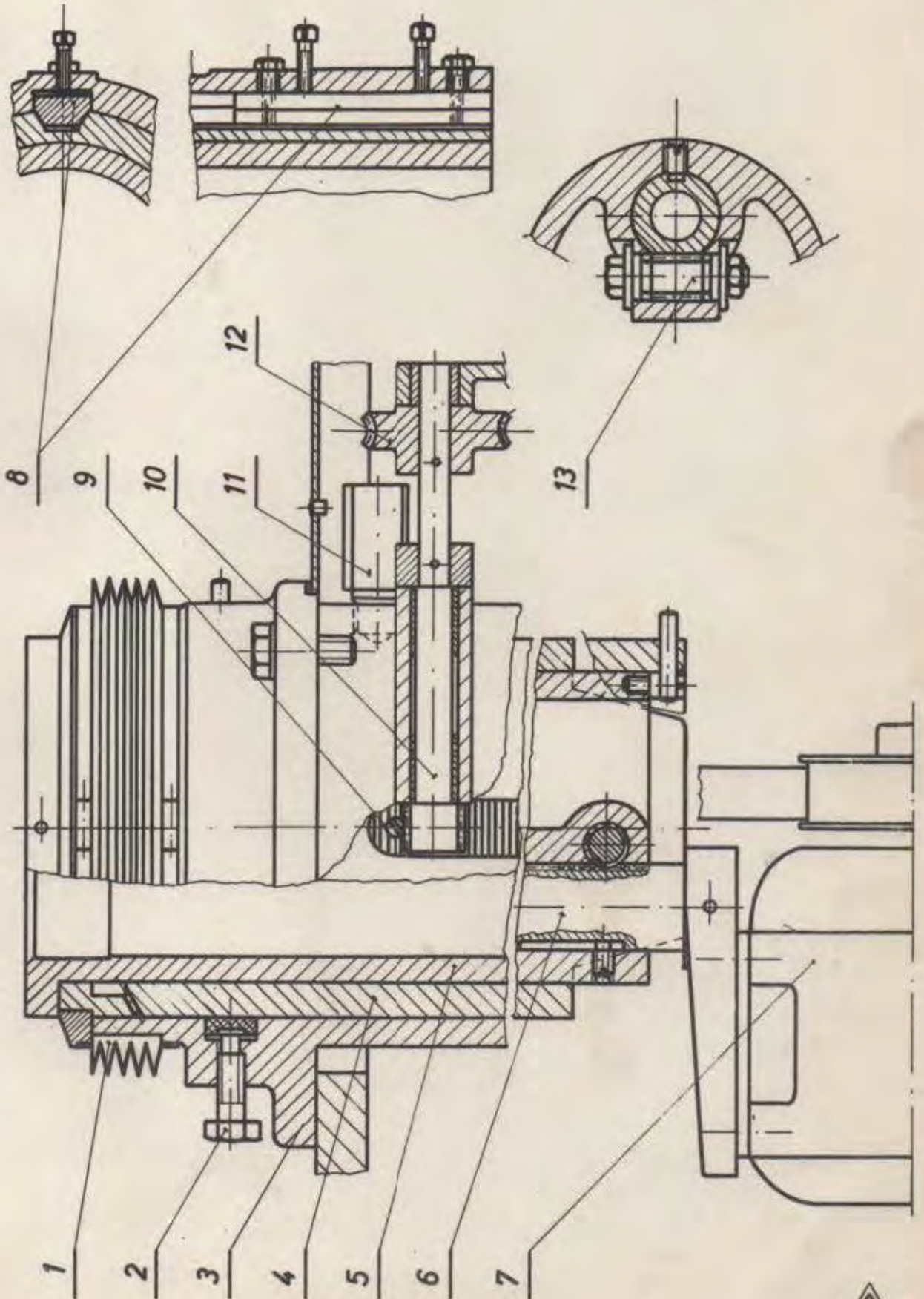
Height of the work holding centres of the tailstocks above the clamping surface of the upper table is 190 mm (5.11 in). Maximum distance between the centres of the tailstocks is 760 mm (29.92 in). Maximum distance between the centres of the tailstock and workhead is 615 mm (24.21 in). Maximum swinging diameter is 280 mm (11.02 in) and when raising blocks are used 370 mm (14.56 in). The tailstock barrels are bored Morse No. 2 taper.

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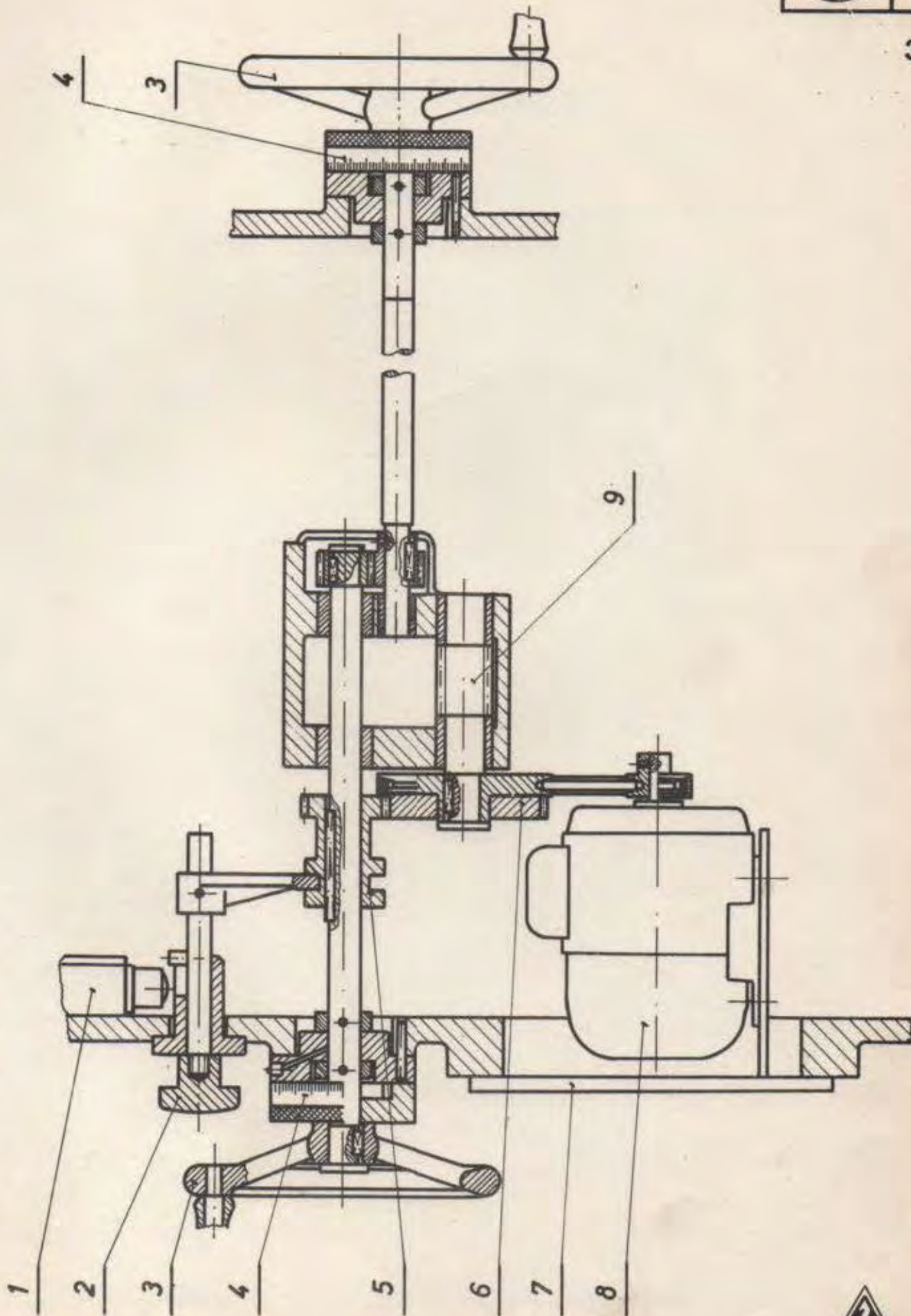


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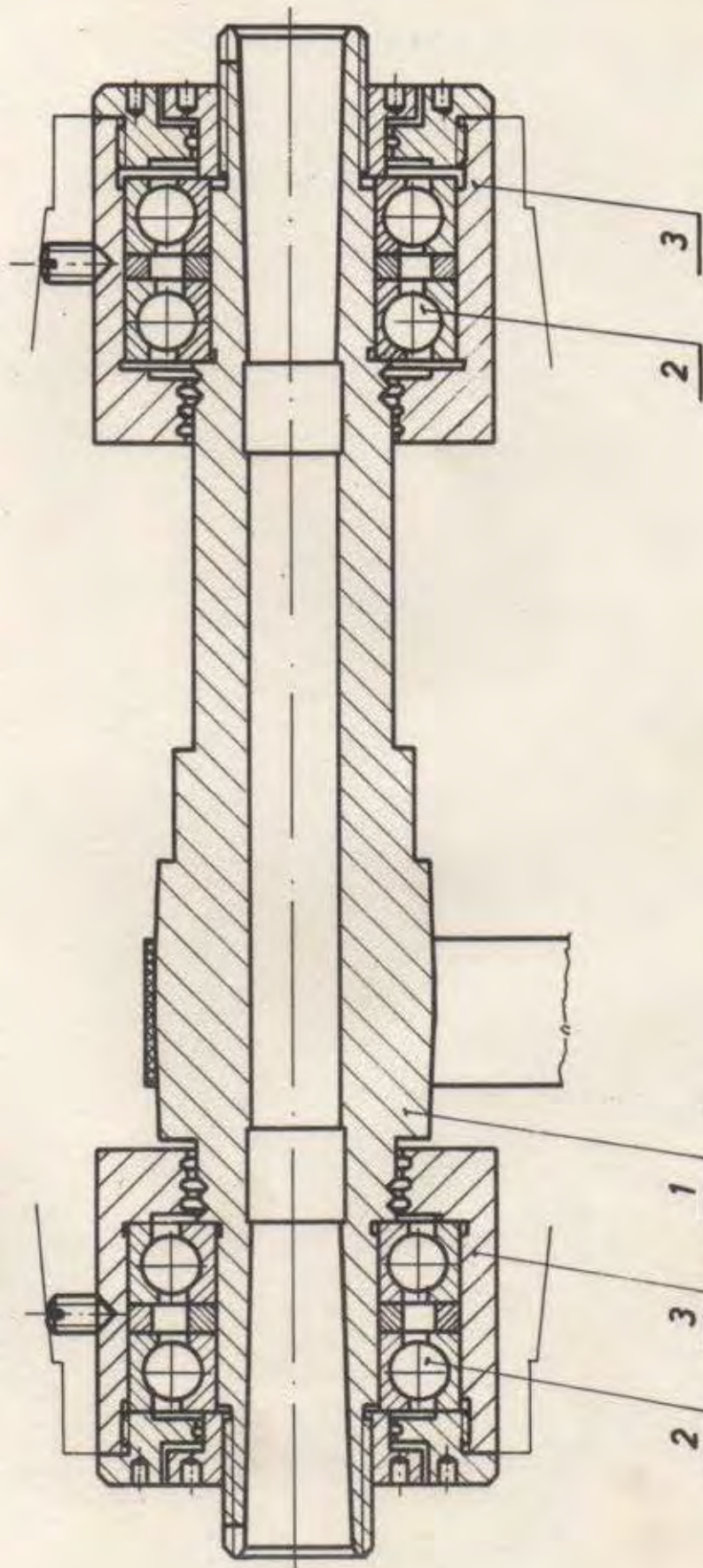
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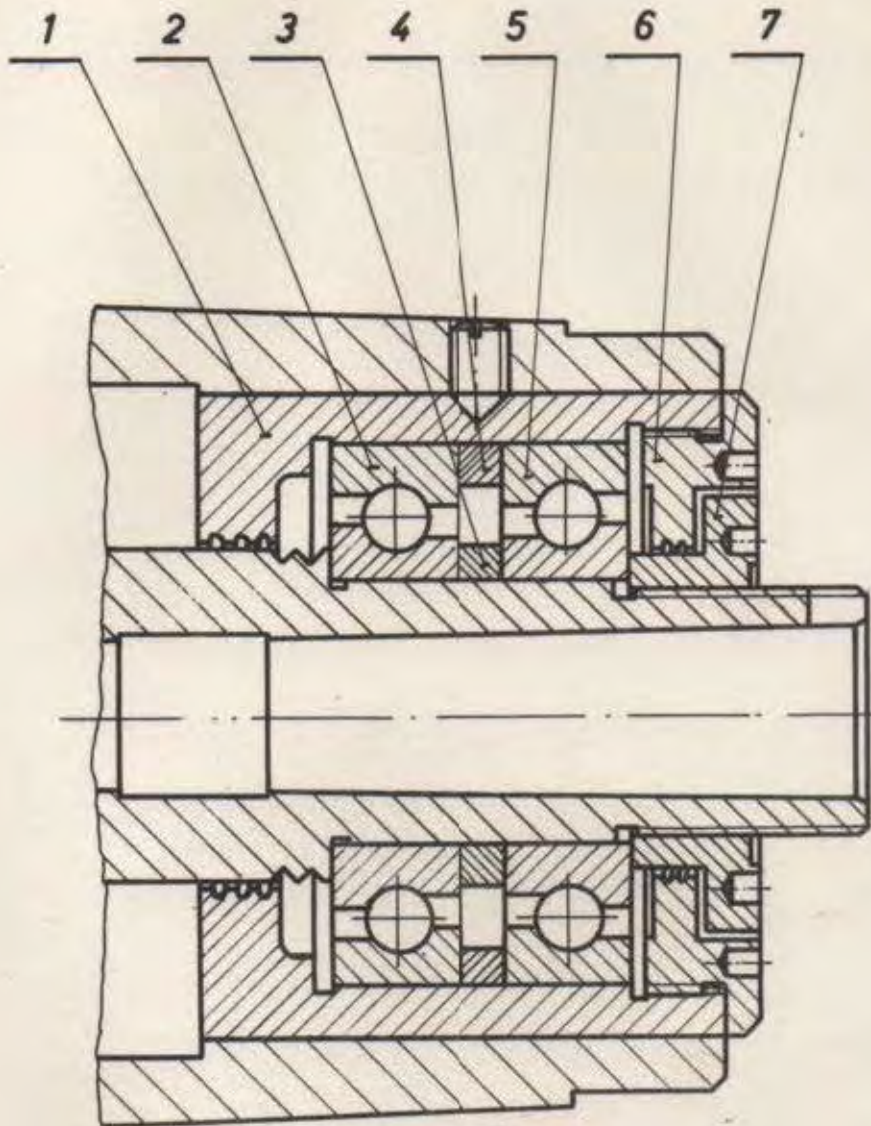
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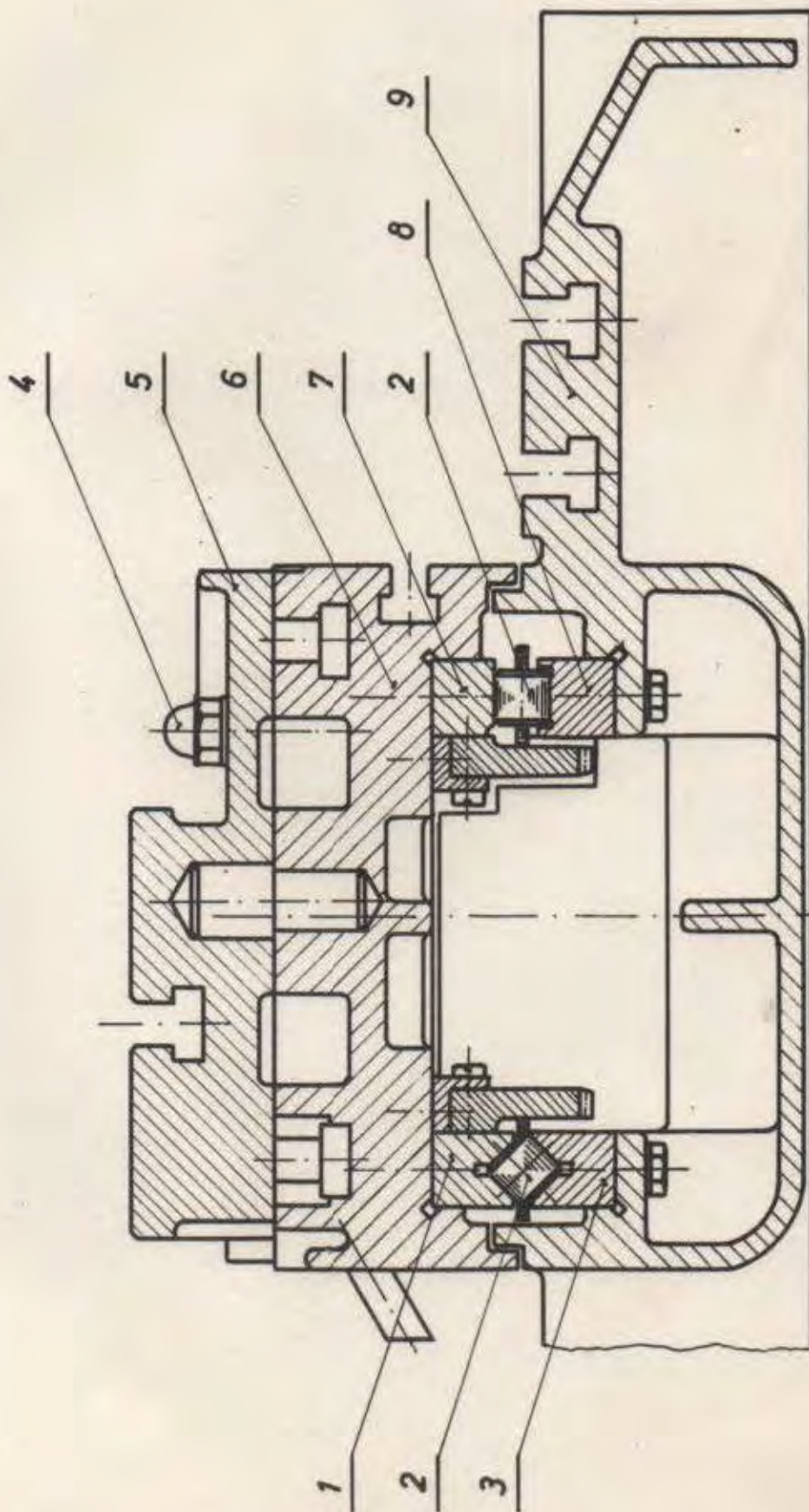


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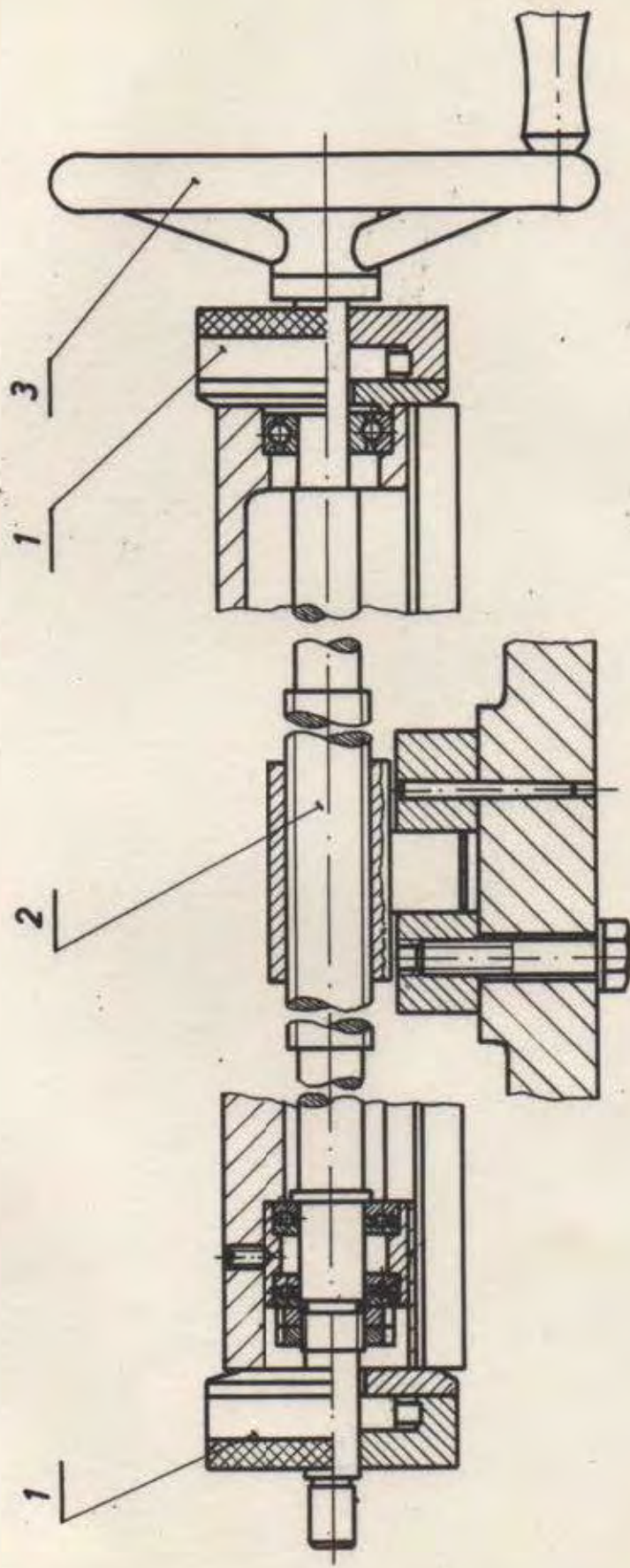
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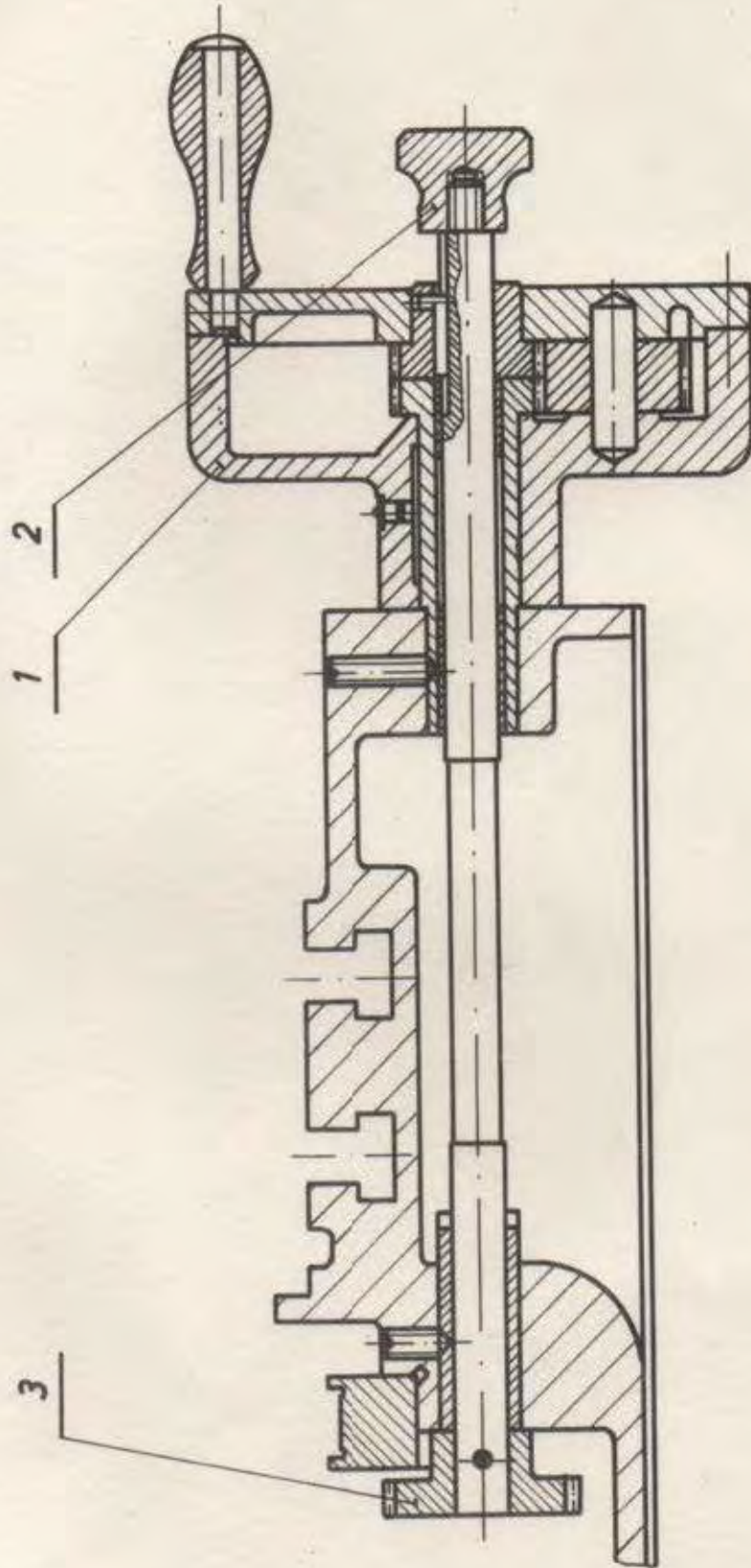
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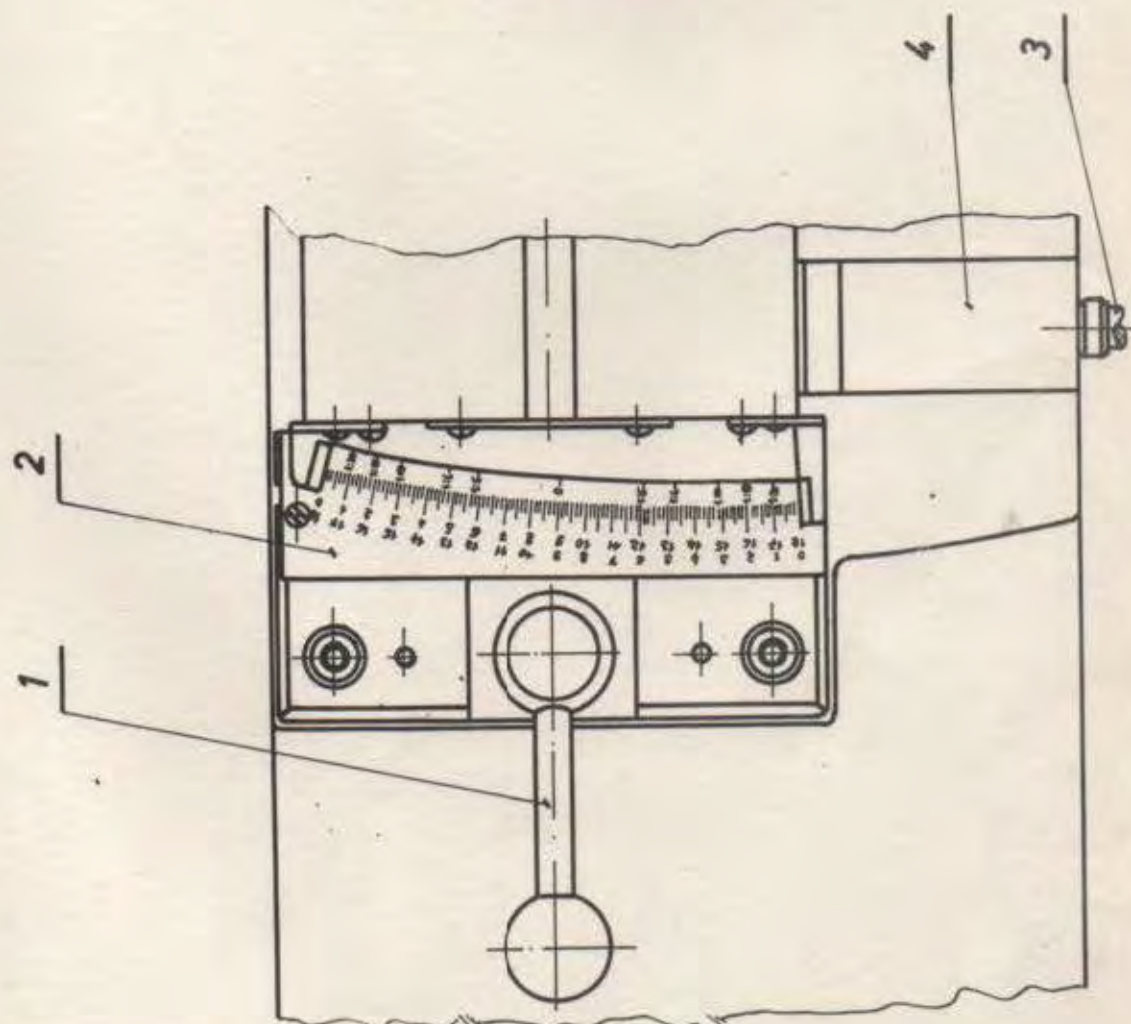
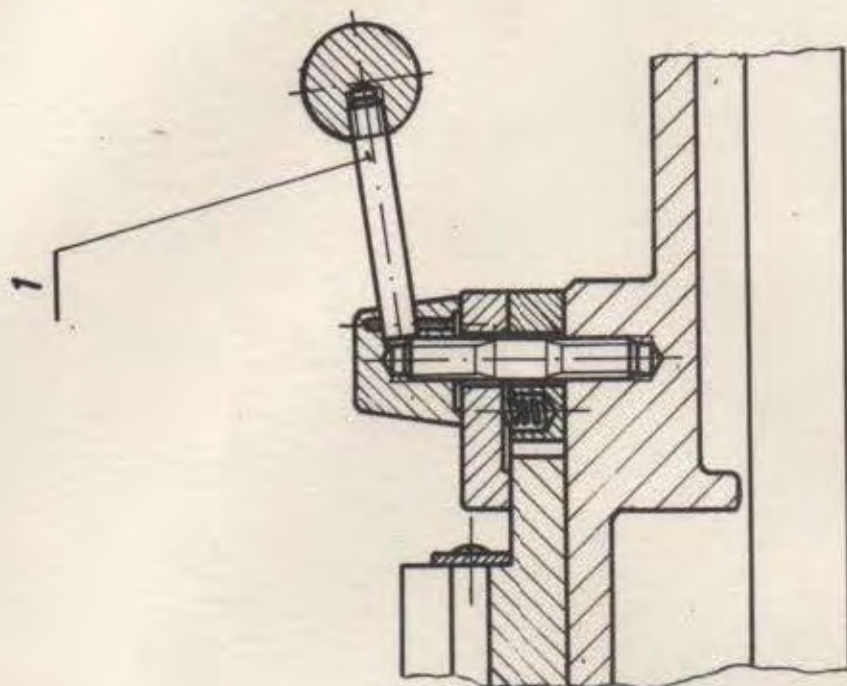


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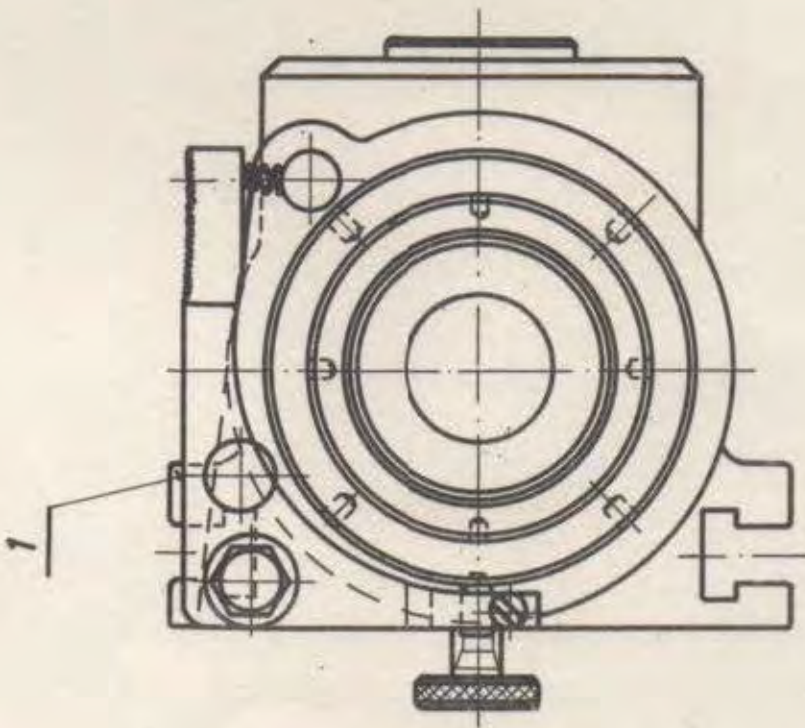
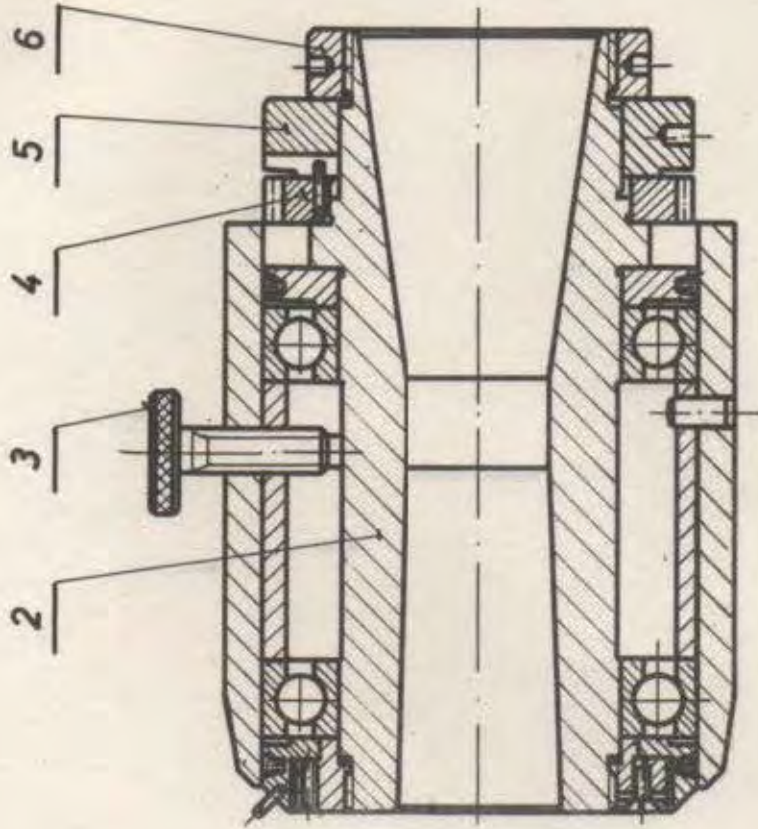
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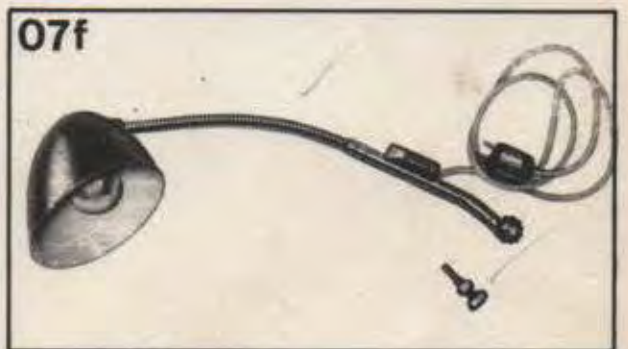
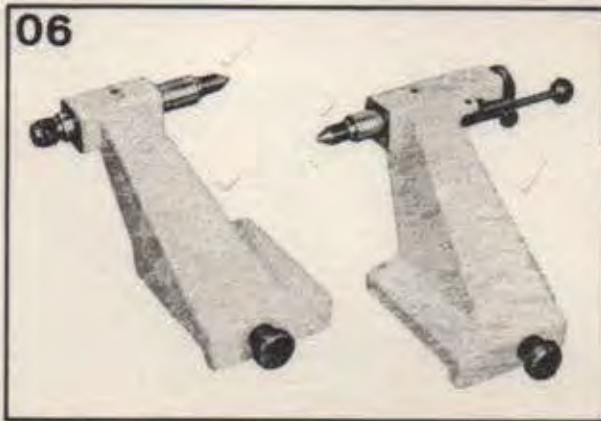
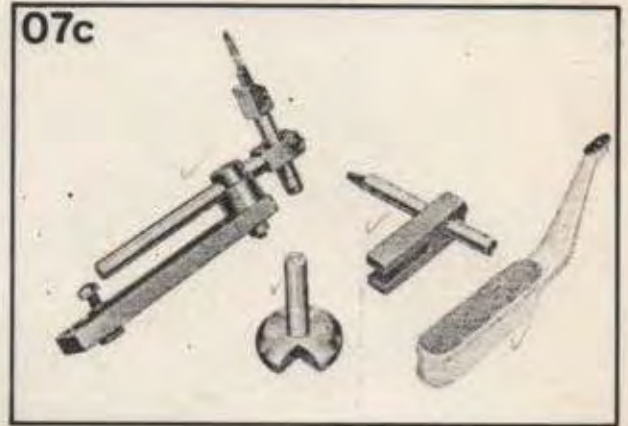
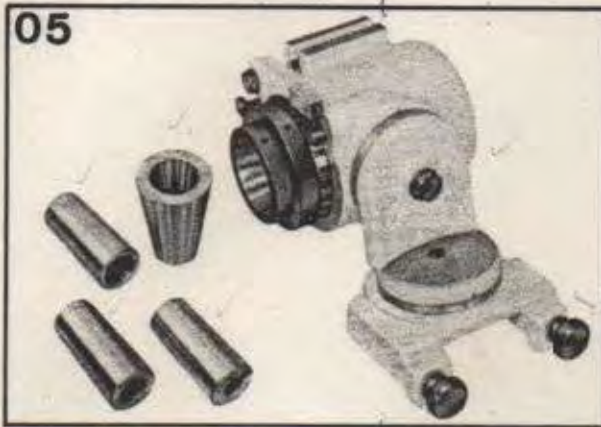


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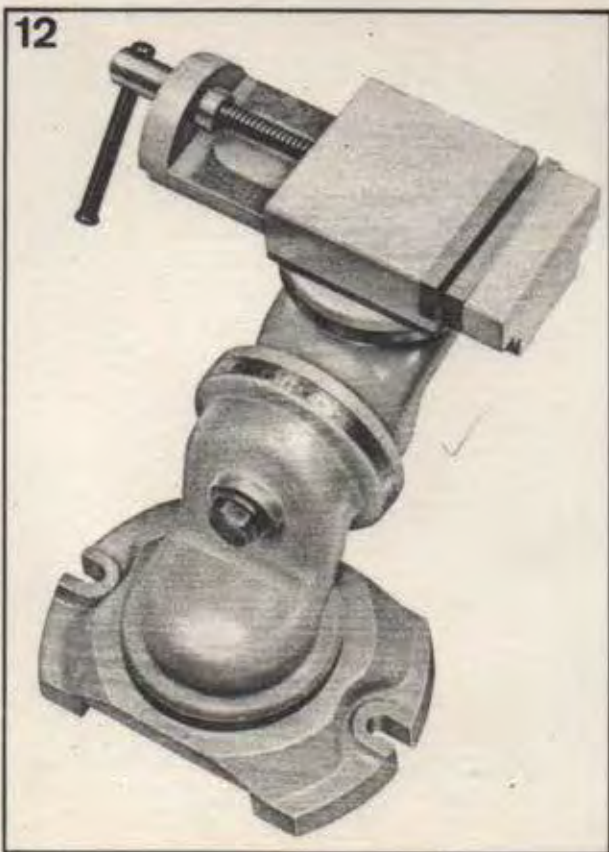
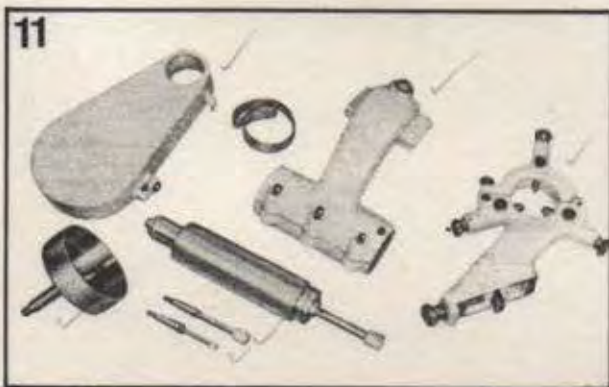
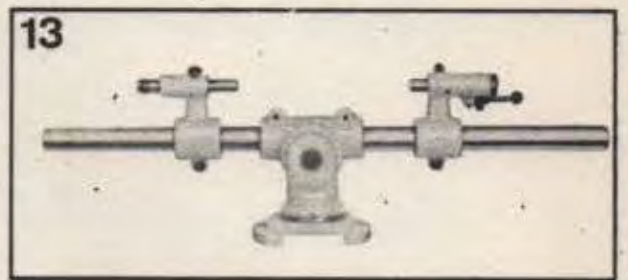
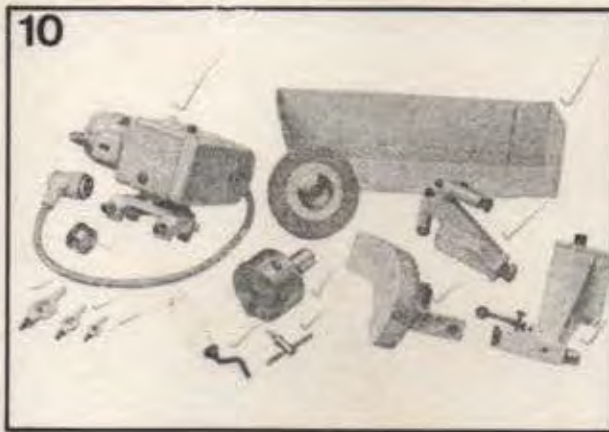


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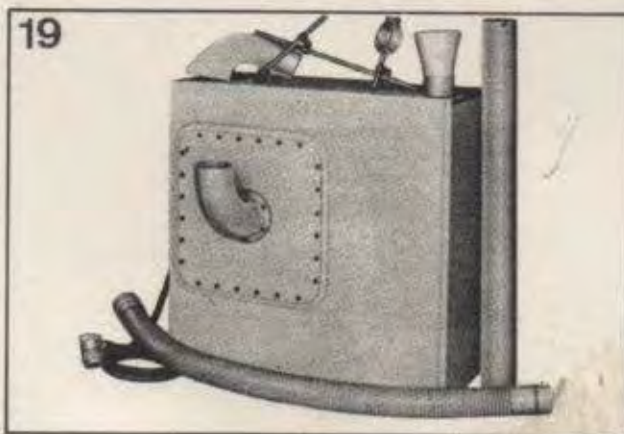
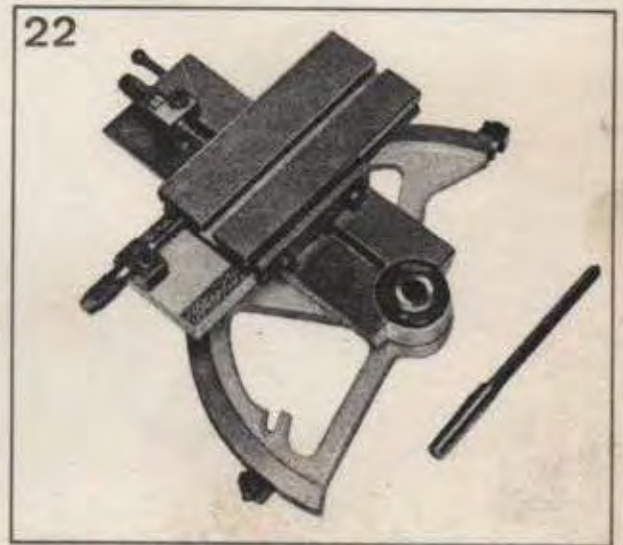
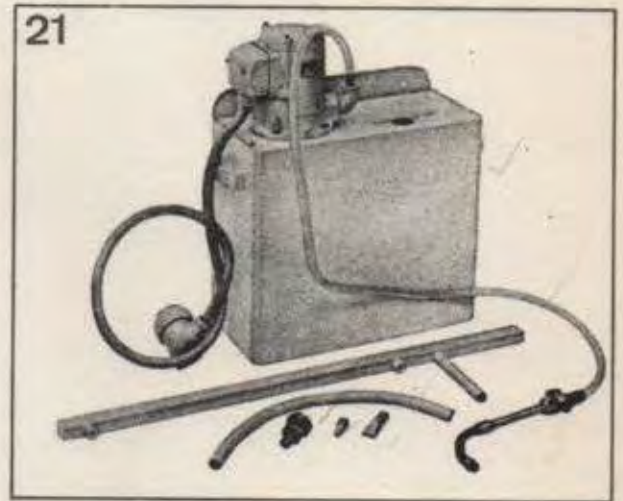
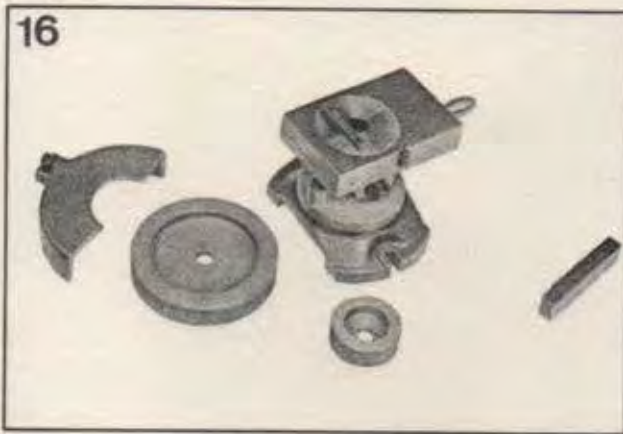




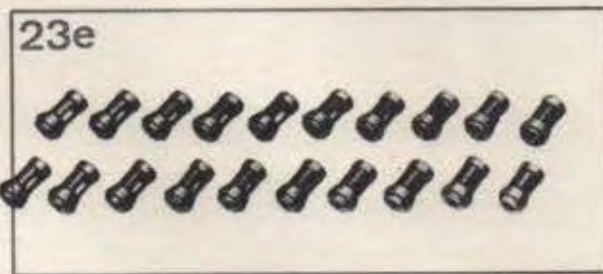
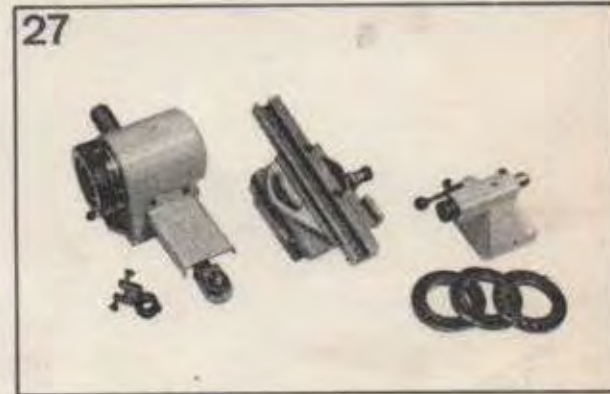
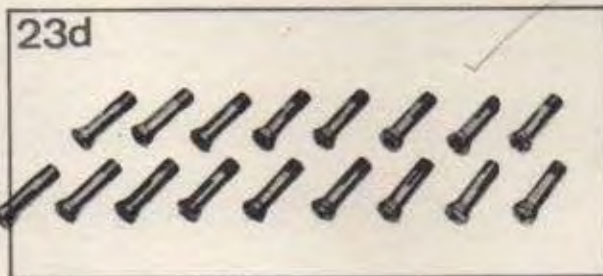
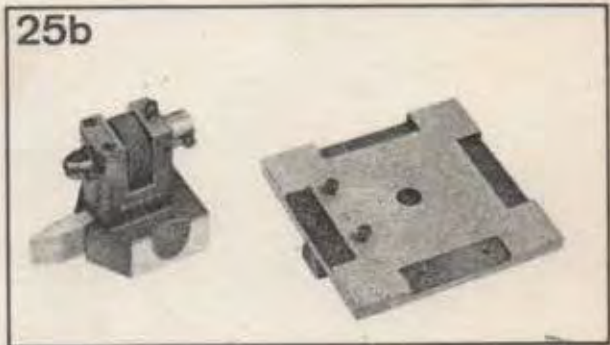
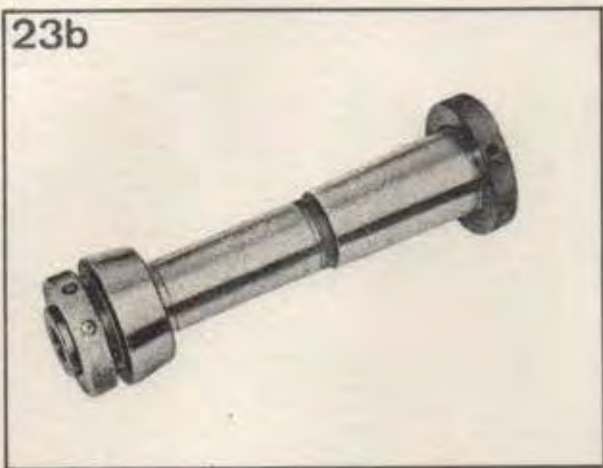
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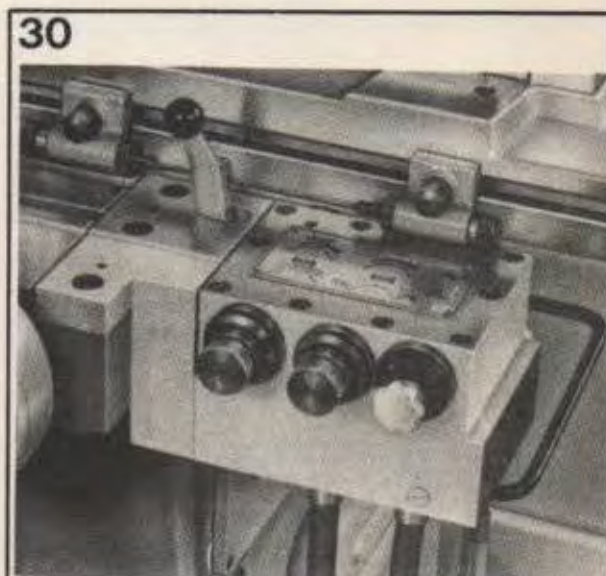
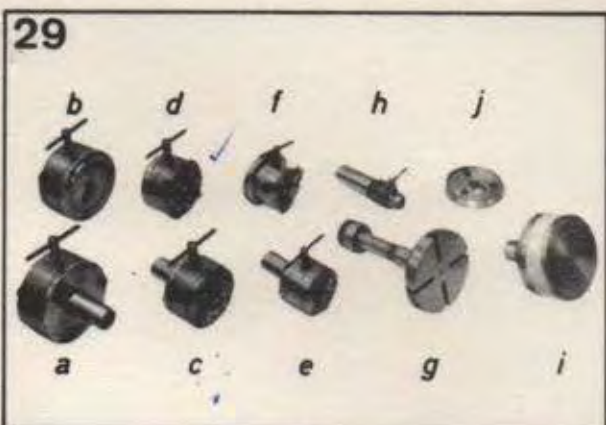
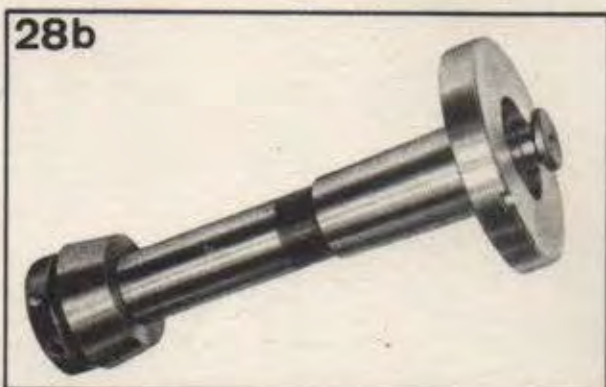
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TRANSPORT AND INSTALLATION

Taking delivery of machine
Selection of working site
Transport of machine to working site
Installation of machine

SPECIFICATION OF FIGURES

1. Transportation of machine by crane
2. Measurements of machine and working site



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TAKING DELIVERY OF MACHINE

After unpacking the machine, check it for possible damage suffered in transit.

With each machine is enclosed a packing specification listing the contents of the consignment. Check the contents to ensure that it corresponds to the packing specification. Shortages or damage, if any, have to be reported to the manufacturing works without delay.

SELECTION OF WORKING SITE

In selecting the working site is necessary to bear in mind the fact that the ambient temperature must be uniform and that the machine must not be exposed to the effects of direct sunshine. Non-uniform warming up of the machine will result in an uneven thermal dilatation of the individual working parts of the machine, thus affecting unfavourably the ultimate accuracy of the machine.

The machine should be located as far as possible from possible sources of vibration, i.e. especially from machines working on the principle of impacts.

TRANSPORT OF MACHINE TO WORKING SITE

Illustration - chapter 2, Fig. 1

The machine delivered to the user is secured to the wooden skids and covered by a tarpaulin or packed in a seaworthy case.

The machine can be delivered to the working site either by shifting it on the wooden skids or by transferring it by a crane. In shifting it on the wooden skids steel rollers should be used. During such shifting, care should be taken that the machine is not subject to excessive impacts.

For transport by crane, the machine can be suspended with the aid of an endless hemp rope of a carrying capacity of 1.200 kg (2640 lb). The rope has to be slid through the openings provided in the machine stand and accessible after removal of the respective cover. Then, the rope is suspended from the crane hook. At the same time, care has to be taken that the rope passes on either side clear of the handwheels actuating vertical adjustment and does not catch on the cross slide, column or motor. The above-described mode of machine suspension from a crane calls for extraordinary care and skill of the crane operator.

A safer and simpler mode of transfer is considered the transportation of the machine by a crane using the transportation hook. The latter hook is delivered on special order and against

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extra charge. The transportation hook is to be screwed by means of two bolts M 16 x 50 into the threaded holes provided in the machine stand /on the machine delivered by the manufacturing works these holes are closed by plugs/. After the machine has been delivered to the working site, the threaded holes have to be closed by the plugs again. The machine is balanced for transportation by a crane. Possible corrections in machine balance have to be done by adjustment of the cross slide.

For transport of the machine, the tables are freely located on their guideways and secured in their middle position by means of their stops. It is recommended to devote special care to them so that they do not leave their guideways after removal of the securing wooden beams.

The prismatic table ways are protected against damage in transit - their rollers and cages are removed from them and replaced by wooden blocks. Therefore, before completing installation of the machine, do not forget to replace the wooden blocks by the cages and rollers. This replacement should be done according to the instructions given in Chapter 5.

INSTALLATION OF MACHINE

Illustration - Chapter 2, Fig. 2

A special foundation need not be constructed. The machine has to be erected on a solid floor, steel wedges with conicity of about 1:20 driven under it and the machine levelled.

For levelling, use a precision water level placed on the upper table both in the longitudinal and transverse direction.

Checking of machine level has to be done only after the upper table has been seated on the respective rollers.

After levelling, the machine has to be grouted with cement mortar to be allowed to harden.

For special cases calling for securing the machine by anchoring bolts, the machine is provided with 17 mm (0.66 in) dia. holes receiving the anchoring bolts. Pitch distances of the holes are given in Fig. 2.

Outline of the machine and overall measurements are apparent from Fig. 2. The hatched portions indicate over-runs of both the table and cross slide performing their strokes of maximum length. To the protruding machine parts it is necessary to add about 1 m (39.37 in) wide space, ensuring thus easy access to the machine in case of possible dismantling.

In installing the machine, it is necessary to take into account also location of the optional attachments.

It is recommended to locate the attachments in accordance with the layout given in Fig. 2. The numerals given therein refer to the following attachments:

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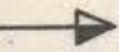
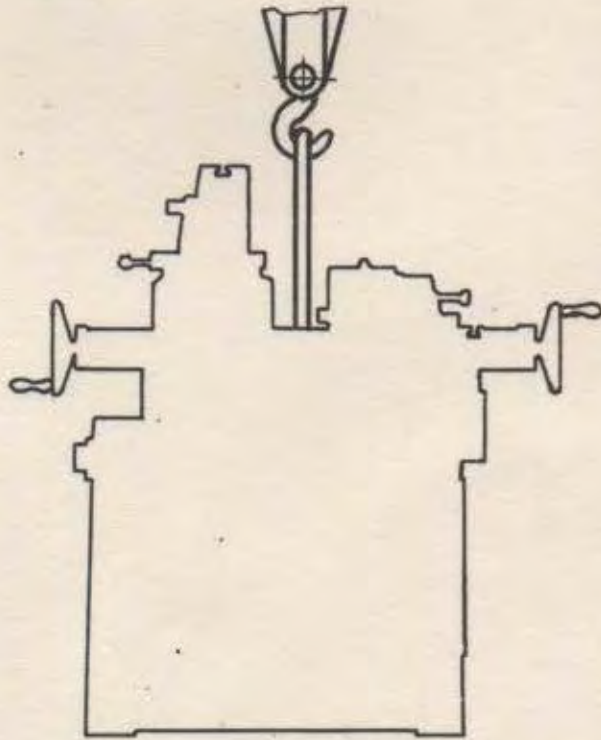
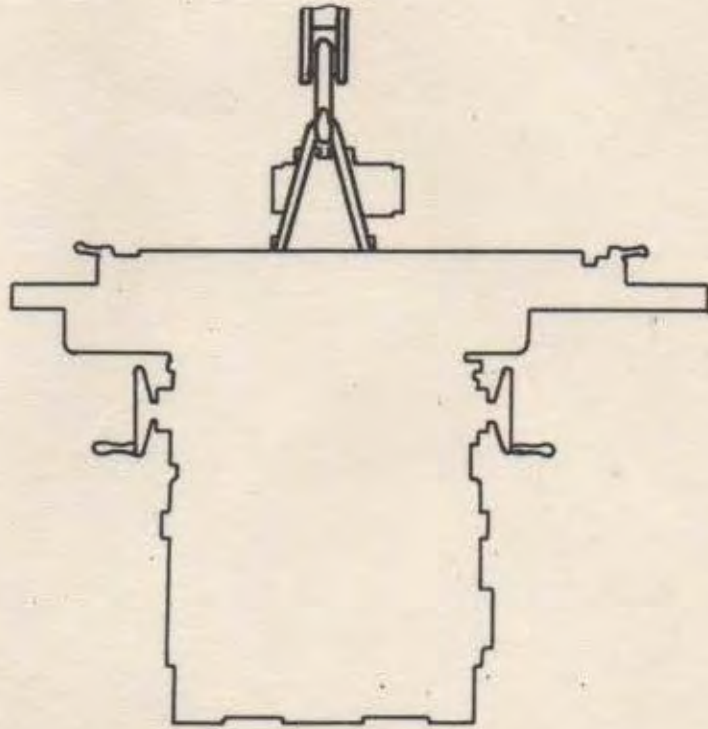
- 1 - coolant tank with pump
- 2 - hydraulic power unit
- 3 - dust exhaust attachment

The parts of the machine and attachments that are not painted are coated for transport purposes with protective grease. Before putting the machine into operation, this protective layer has to be removed and the respective parts washed with kerosene. After cleaning, all unpainted parts have to be oiled and the lubrication sockets and nipples rinsed with kerosene.

Important! For cleaning do not use spirit or acetate - they dissolve and damage the paint.

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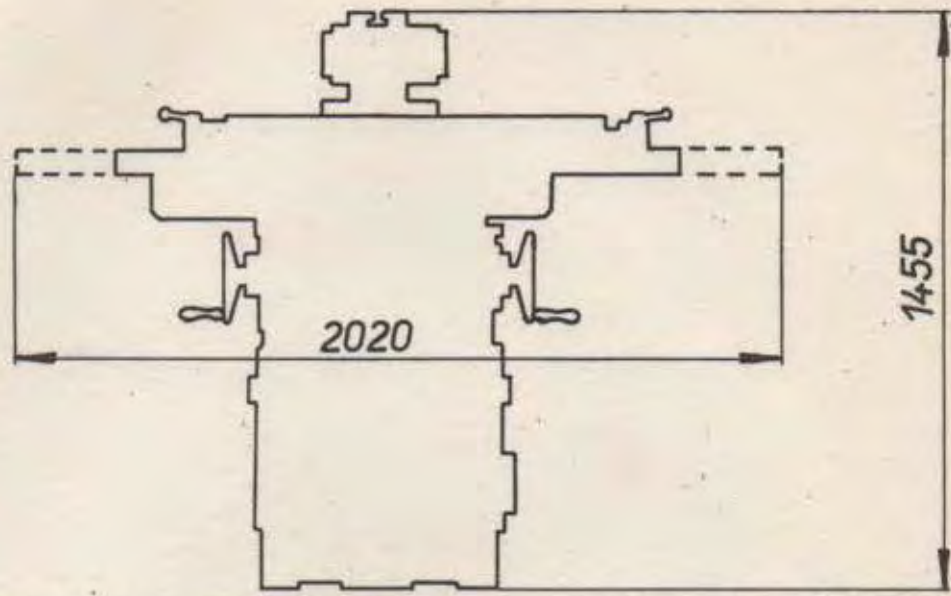
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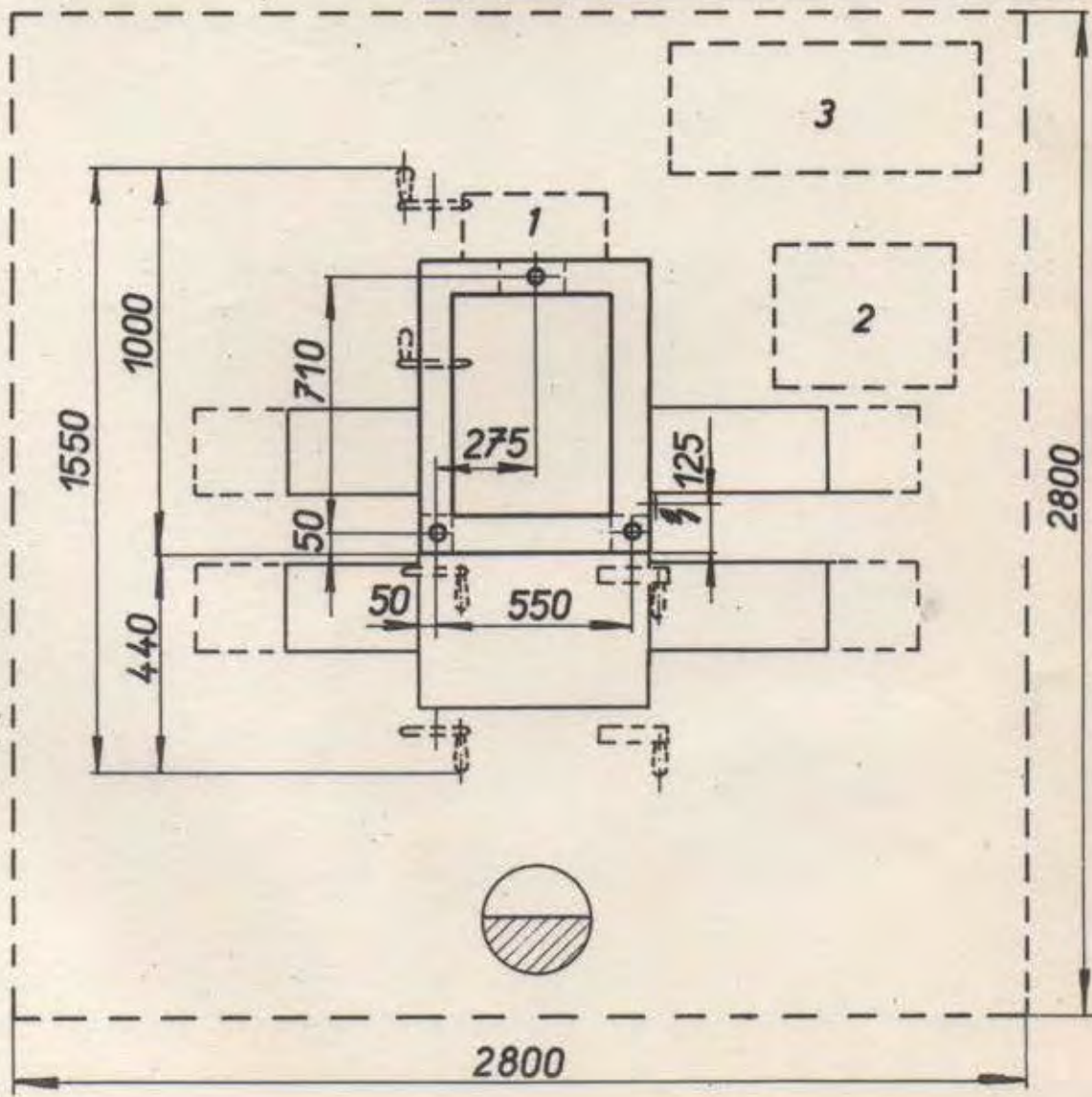
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2

1455

2020



3

2

1550

1000

440

710

50

50

550

275

125

2800

2800

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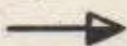


ELECTRICAL EQUIPMENT OF MACHINE

Electrical equipment
Connection of machine to power mains
Description of electrical equipment
Maintenance of electrical equipment

SPECIFICATION OF FIGURES

1. Location of electrical equipment - view from front
2. Location of electrical equipment - view from rear
3. Wiring diagram
4. Wiring diagram



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ELECTRICAL EQUIPMENT

Illustration - Chapter 3, Fig. 3, 4

The electrical equipment is arranged according to the wiring diagram /Fig. 3/. It is constructed so that all the sockets enabling connection of various attachments are alive, even if some of the attachments are not delivered along with the machine. This mode of wiring enables the user to buy such attachments later and to connect them to the respective feeding circuit without any additional adaptation of the electrical system of the machine.

The machine electrical equipment is rated for the operating voltage and frequency as given in the respective purchase order.

Design of the electrical equipment enables the machine to be connected to power mains of the following voltages: 190 V, 220 V, 380 V, 400 V, 415 V, 430 V, 440 V and 500 V. It is achieved by a simple change-over of the terminal box /by change of fuses and thermal relays/.

CONNECTION OF MACHINE TO POWER MAINS

Illustration - Chapter 3, Fig. 1

Before connecting the machine to the power mains, check whether the voltage and frequency given on the name plates of the motors and other electrical instruments conform to the voltage and frequency of power mains to which the machine has to be connected. The voltage and frequency are given also on the cover of the input terminal box.

The machine has to be connected to power mains by means of correctly dimensioned conductors to be connected to the terminals P, N, R, S, T of the input terminal box /Fig. 1/PS/.

The machine being connected to the power mains, make sure that the motors rotate in the correct direction, according to index plates provided on them.

Extraordinary care has to be devoted to earthing of the machine.

In view of the fact that an incorrect connection of the machine to power mains might result in damage to the machine or injury of the attendant, it is advisable to appoint a specialist to do the job.

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DESCRIPTION OF ELECTRICAL EQUIPMENT

Illustration - Chapter 3, Fig. 1, 2, 3, 4

- Fig. 1/1 Cover of electrical gear closing switchgear
- 1/2 Socket connecting to power the cylindrical grinding attachment
- 1/3 Main switch disconnecting the machine from power mains
- 1/4 Front control panel
- 1/5 Signal lamp
- 1/6 Socket connecting to power the hydraulic power unit
- 1/PS Input terminal box /five-pole/
- 2/1 Switch for changeover of wheel spindle rotation /for changeover of speed as well as reversal of rotation/
- 2/2 Socket for lighting unit /at the left, when viewed from rear/
- 2/2 Socket for dust exhaust attachment and cooling attachment /at the right, when viewed from rear/
- 2/3 Control panel
- 3/V1 Main switch
- 3/V2 Switch of cylindrical grinding attachment
- 3/V3 Switch of lighting unit
- 3/V4 Switch for changeover of wheel spindle rotation /for changeover of speed as well as reversal of rotation/
- 3/P1, P2, P3, P4, P5, P6 - Fuses
- 3/S1, S2, S3, S4, S5 - Contactors
- 3/F1, F2, F3, F4 - Protective relays
- 3/D1, D2, D3, D4 - Sockets
- 3/H1 Signal lamps
- 3/O1 Lighting unit
- 3/M1 Main motor driving wheel spindle - 2AP 80/4/2, 3x380 V, 1,400/2.800 r.p.m., 0.55/0.75 kW (0.75/1.02 HP), 50 c/s, form HO, runout 5 microns, /TH2/.
- 3/M2 Motor powering vertical adjustment of the columns - AP 63/4, 3x380 V, 1,330 r.p.m., 0.18 kW (0.24 HP), 50 c/s, form HO /TH2/.

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- Fig. 3/M3 Coolant pump motor - COA 2 - 22, 2,800 r.p.m.,
0.125 kW (0.17 HP), 3x380 V, 50 c/s, /TH 2/.
- 3/M4 Motor of dust exhaust attachment OZ 360 - 2AP
80/2s, 3x380 V, 2,780 r.p.m., 0.75 kW (1.02 HP),
50 c/s, form H 7 /TH 2/.
- 3/M5 Motor driving hydraulic power unit IHA 2 /TH2/
- 3/M6 Motor of cylindrical grinding attachment - AP 63/4,
3x380 V, 1,330 r.p.m., 0.18 kW (0.24 HP), 50 c/s,
form H 29 /TH 2/.
- 4/A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12 -
Pushbuttons
- 4/K1, K2, K3 - Limit switches

MAINTENANCE OF ELECTRICAL EQUIPMENT

The electrical equipment calls for planned and regular maintenance. Within shorter time intervals, it is necessary to remove dust and impurities from the rooms housing the electrical equipment, as well as from all the electrical instruments and machines. Within longer time intervals, the screws of all joints have to be re-tightened and contacts of the switches checked. The fuses, insulation resistance and, or also the earthing conductor have to be checked.

The motors have antifriction bearings lubricated with grease. They can run for a very long time without adding lubrication grease. However, to extend the operative life of the motors, it is advisable to have them checked once a year by a specialist. Such a checking may be combined with replacement of the grease charge of the bearings. Before fresh grease is charged in the bearings, the latter have to be cleaned with petrol. For cleaning never use kerosene or crude oil. The fresh grease may be charged only in a well-dried out bearing.

BEFORE ANY HANDLING OF ELECTRICAL EQUIPMENT IT IS NECESSARY TO TAKE OUT FUSES FROM INPUT TERMINAL BOX AND OPEN MAIN SWITCH!

Electrical parts subject to rapid wear:

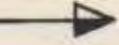
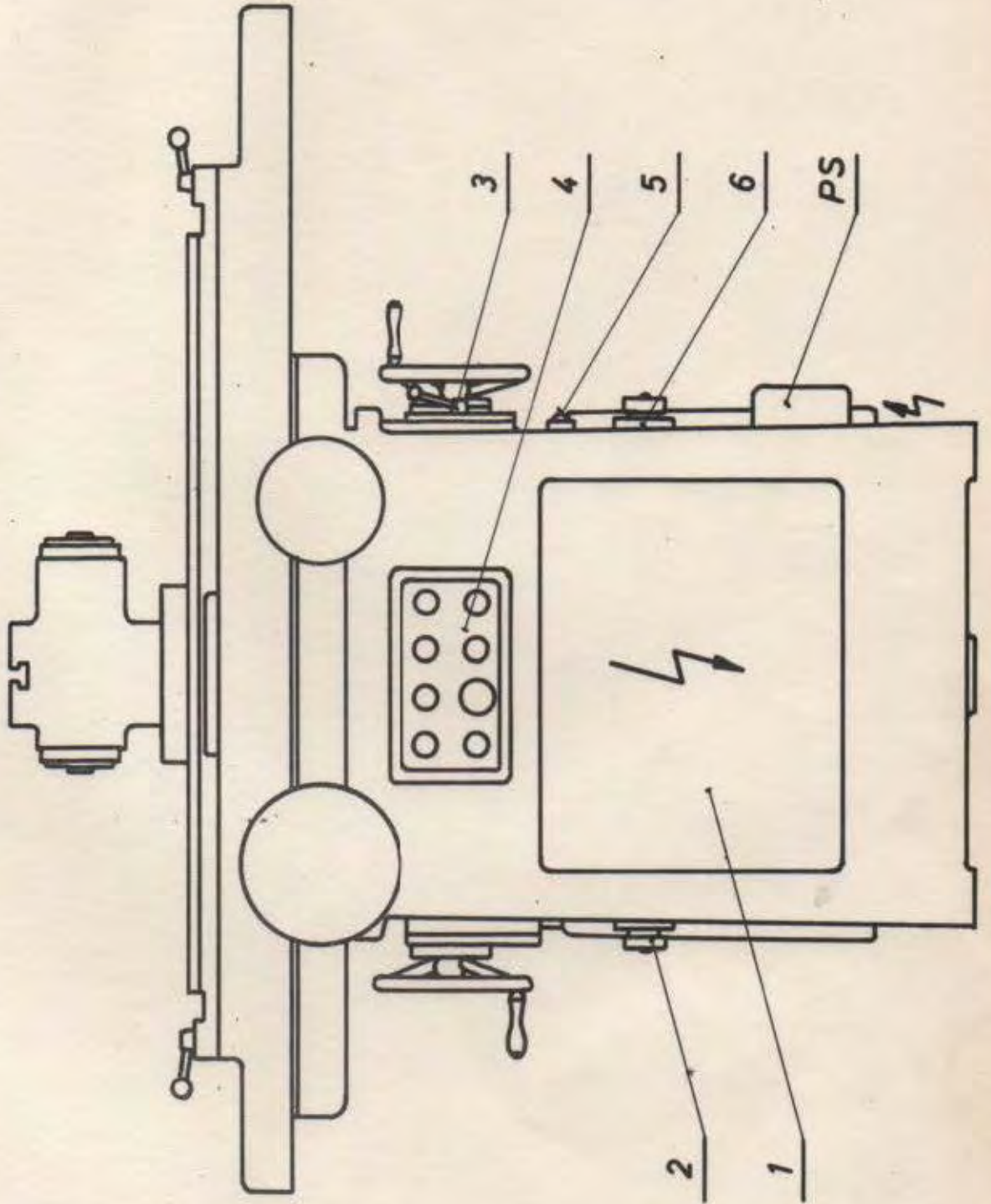
El. instrument	ČSSR ČSN	SIEMENS	KLOCKNER	BROVN BOWERI
Contactora 220 V, 50 c/s	VM 4	K915 III.1	DIL 00	SLA 6
Contactora 220 V, 50 c/s	K 1	K915 III.1	DIL 00	SIA 6
Protective relay	R 100	R1337-10	Z 0	TSA 10a
Limit switch	KS6 FK10			

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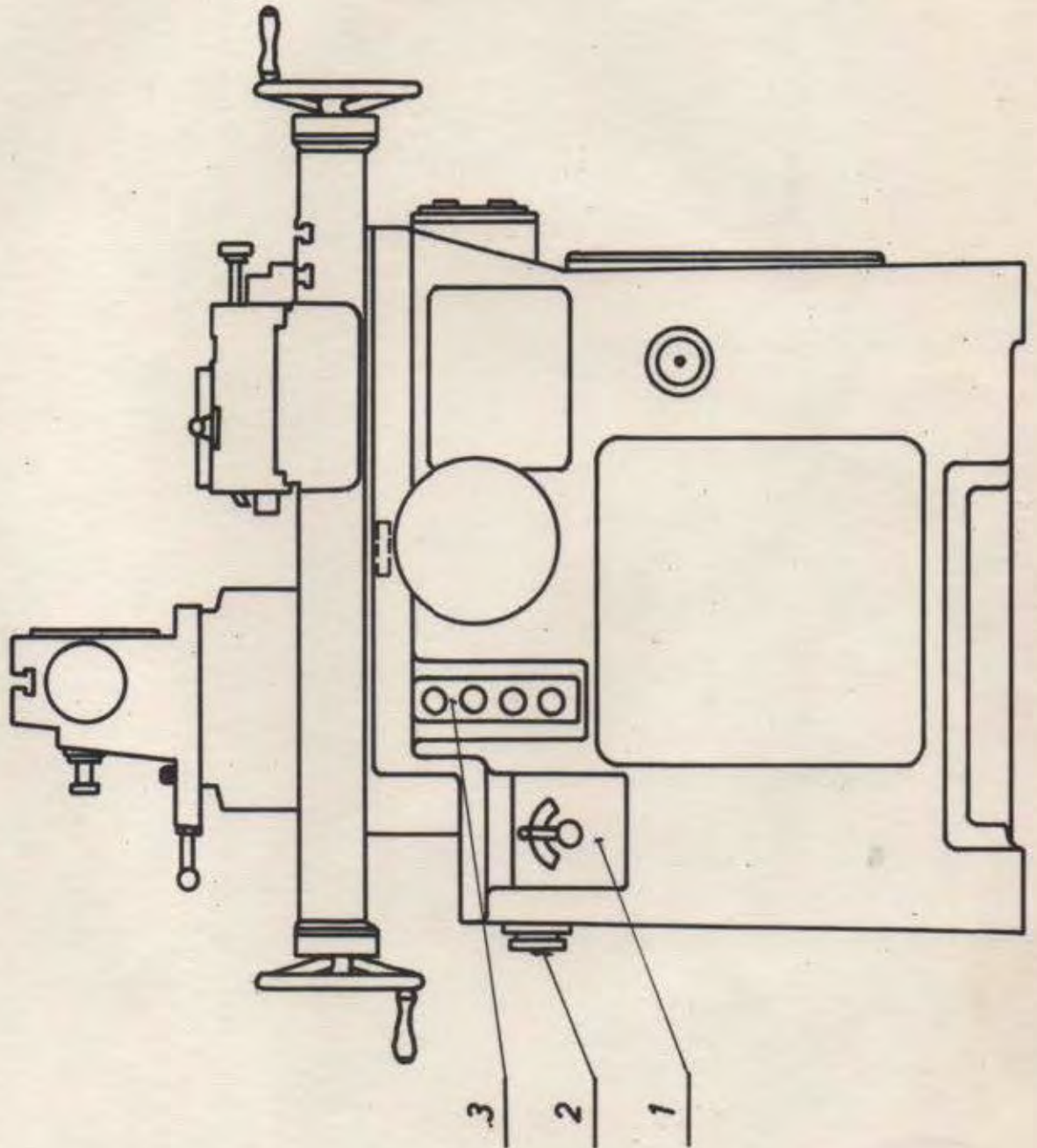


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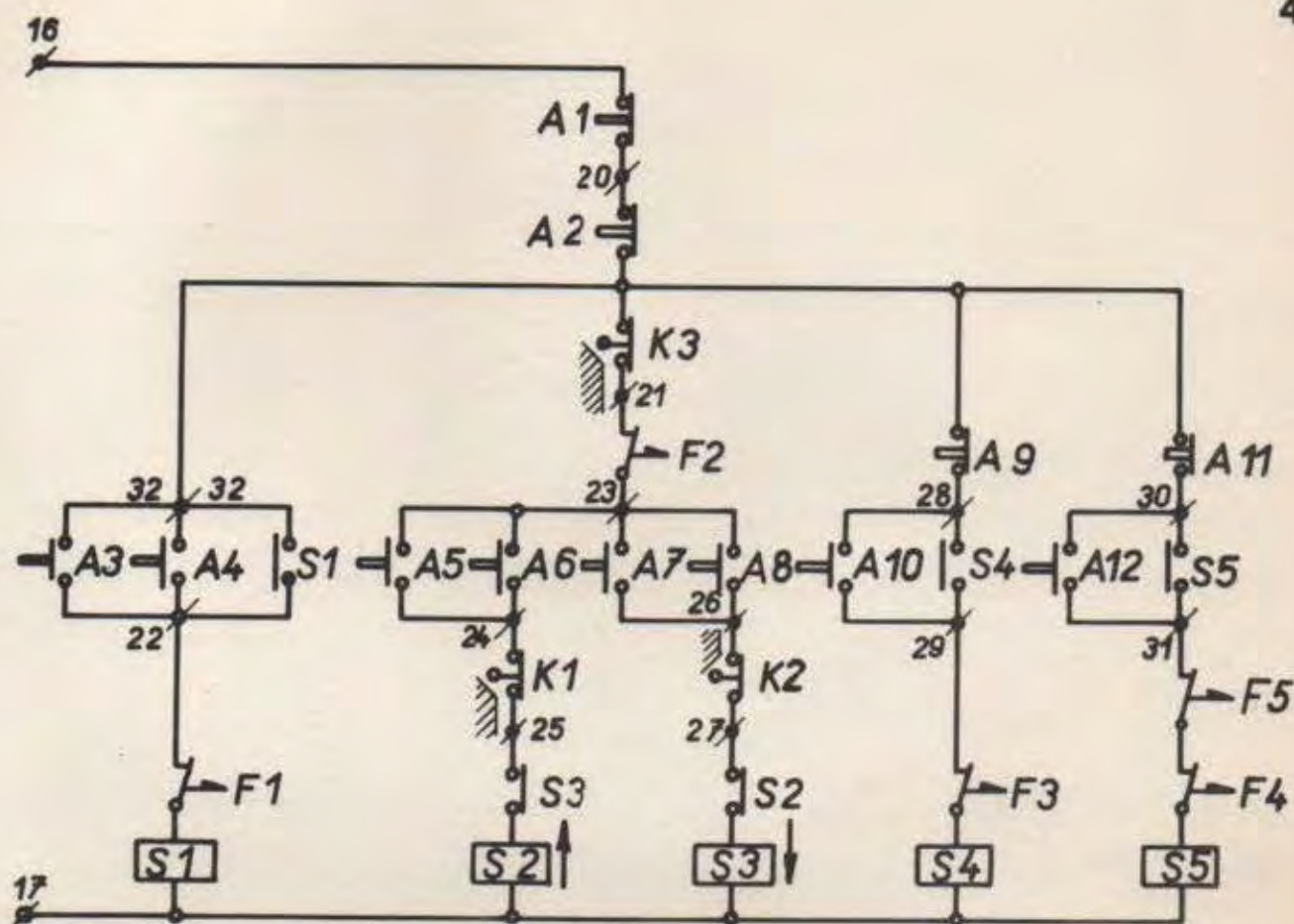




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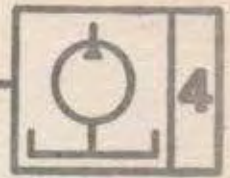


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	P1	P2	P3	P4	P5	P6	F1	F2	F3	F4	F5
190-220V	15	10	2	2	2	10	3,4	0,5	3,4	3,4	0,5
380-400V	10	6	2	2	2	6	2,3	0,5	1,5	1,5	0,5
415-440V	10	6	2	2	2	6	2,3	0,5	1,5	1,5	0,5
500 V	6	4	2	2	2	4	1,5	0,34	1,5	1,5	0,34

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HYDRAULIC EQUIPMENT

The hydraulic equipment for longitudinal traversing of the table is dealt with separately as an optional extra, in chapter 6 - "Grinding technology".

The machine has no other hydraulically operated functions.



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OPERATION

Safety of operation

Preparation of machine before putting it into operation

Control elements

Clamping of arbors and grinding wheels

SPECIFICATION OF FIGURES

1. General view of machine - control elements
2. Clamping of arbors and grinding wheels



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SAFETY OF OPERATION

The machine incorporates the following features ensuring safety of operation:

All rotating parts and driving belts are provided with guard covers.

The machine is provided also with the covers against splashing coolant and flying chips of grinding wheel in case of its sudden breakage.

The machine can be tended either from the front or side. As a result, the operator need not stand unnecessarily in front of the grinding wheel.

Design of the machine conforms to the safety prescriptions of the relevant Czechoslovak Standard Specifications CSN.

It is recommended to pay special attention to clamping of the arbors and grinding wheels. Correct and safe procedure is given in this manual.

PREPARATION OF MACHINE BEFORE PUTTING IT INTO OPERATION

You are advised to study thoroughly the present manual and thus get well acquainted with the machine and its accessories before putting it into operation. Special attention has to be paid to the paragraphs dealing with lubrication, included in chapter 7.

Replacement of wooden blocks /serving for transport purpose/
by antifriction rollers

Illustration - Chapter 5, Fig. 1; Chapter 1, Fig. 5.

For transport purpose, the antifriction rollers and cages are taken out of the table ways and in their place are put wooden blocks. The tables rest on them freely, held down only by their own gravity.

Before putting the machine into operation, the tables have to be lifted at point A /Fig. 1/A/ and transferred to an auxiliary assembly bench, to be kept in readiness in advance. The tables have to be lifted up in a perpendicular direction.

The wooden blocks have to be taken out, the guideways of the slide and tables dry cleaned and again oiled. At this stage, strict cleanliness has to be observed. On the flat guideway the silon cage and 24 antifriction rollers have to be placed. On the 90° prismatic guideway also the cage and 24 antifriction rollers have to be placed. However, the rollers have to be inserted alternately so that, every second one is slightly swivelled in such a manner that their axes are at an angle of 90 deg. /chapter 1, Fig. 5/.

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Before being inserted, the rollers have to be dry cleaned. They are graded with precision and cannot be replaced by other rollers. To compensate for a possible loss, two rollers are delivered in excess.

Thereafter, the tables have to be placed with utmost care on the guideways, while lowering them in the perpendicular direction. The tables have to be secured immediately by stops. It may be noted that the tables move on the antifriction guideways with a great ease and unless they are secured by the stops they are liable to run out of them.

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CONTROL ELEMENTS

Illustration - Chapter 5, Fig.1

The specification given below includes the machine control elements that are shown in Fig.1.

1. Socket for connection of the cylindrical grinding attachment. The socket is continuously connected to the respective feeding circuit and the attachment can be connected at any time, even if it is bought and delivered supplementarily. It is operated by means of a pushbutton /Fig.1/27 and 1/29/.
2. Central pushbutton "STOP". The pushbutton disconnects at one time all the electrical instruments and machines.
3. Pushbutton initiating power adjustment of the column carrying the wheelhead in downward direction. Over-running of the extreme bottom position is prevented by a limit switch. The column moves only while the pushbutton is kept depressed. The pushbutton being released, the movement is discontinued.
4. Pushbutton starting the motor driving the wheelhead spindle.
5. Pushbutton initiating power adjustment of the column carrying the wheelhead in upward direction. Over-running of the extreme upper position is prevented by a limit switch. The column moves only while the pushbutton is kept depressed.
6. Graduated collar of handwheel actuating vertical adjustment of wheelhead. One graduation = 0.01 mm (0.00039 in).
7. Handwheels actuating vertical adjustment of wheelhead and adjustment of cross slide.
8. Graduated collar of handwheel actuating adjustment of cross slide. One graduation = 0.02 mm (0.00079 in).
9. Screw for fine swivelling of table $+9^{\circ}$, 0, -9° /.
10. Levers for releasing table before swivelling.
11. Base plate carrying workhead.
12. Angular bearing /pedestal/. It enables the workhead to be swivelled through 360 deg. both in horizontal and vertical plane.
13. Nut and ring. The latter nut and ring being loosened, the diving plate of the dividing attachment of the workhead can be replaced by an other dividing plate.
14. Workhead.
15. Left-hand adjustable stop limiting longitudinal traverse of the table.

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16. Fixed stop.
In using the equipment for hydraulically-operated longitudinal traverse of the table, the latter stop has to be removed and the adjustable stops have to be restricted to their next positions by the respective set screws, in the T-slot.
17. Wheelhead.
18. Right-hand adjustable stop limiting longitudinal traversing of the table.
19. Differential for hand-operated slow longitudinal traversing of table. It is put into engagement by pulling out respective knob. The knob being pushed in, the differential is put out of engagement and the table can be freely moved in longitudinal direction.
20. Right-hand tailstock with spring-loaded centre.
21. Left-hand tailstock with adjustable tailstock barrel.
22. Set screw for securing the wheelhead in position after vertical adjustment.
23. Crank actuating hand-operated rapid adjustment of table in longitudinal direction. The table can be moved after the crank has been pulled out. The crank being pushed in, the table cannot be controlled by it.
24. Arresting pin securing the wheelhead spindle against rotation. Used in changing the arbors with grinding wheels.
25. Clamping slots on cross slide.
They are used for the clamping of certain attachments, gauges and auxiliary means.
26. Main switch. It cuts off the machine from power supply.
27. Pushbutton switching on the hydraulic power unit and attachment for cylindrical grinding.
28. Pushbutton switching on the dust exhaust or cooling attachment.
29. Pushbutton switching off the hydraulic power unit and attachment for cylindrical grinding.
30. Pushbutton switching off the dust exhaust or cooling attachment.
31. Signal lamp of the main switch.
32. Socket for connection of the hydraulic power unit.
33. Input terminal box.
34. Clutch of vertical feed to the wheelhead. If the knob of the clutch is pulled out, vertical feed is disengaged and the wheelhead can be adjusted by power. If the knob of the clutch is pushed in, the wheelhead is adjustable in vertical direction by means of the handwheels.

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35. Socket for connection of lighting unit /at the left - when viewed from rear/.
36. Changeover switch for selection of speed to wheel spindle.
37. Plate carrying the motor powering vertical feed to the wheelhead. The driving belt is tensioned after loosening four screws, by adjusting the plate with motor to the right. The belt being tensioned, the screws have to be tightened again.
38. Cover.
It is intended for checking and tensioning of the belt driving the grinding spindle.

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CLAMPING OF ARBORS AND GRINDING WHEELS

Illustration - Chapter 5, Fig. 2

The arbor carrying the grinding wheel /Fig. 2/3/ is fixed in the wheelhead spindle so that it is slid into the respective Morse No. 3 taper bore. Simultaneously, the small pin /Fig. 2/4/ must enter the slot provided in the spindle bore. Rotation of the spindle can be reversed. The small pin serves to prevent the arbor from loosening in the event of a sudden reversal of spindle rotation. The arbor is fixed with the aid of the clamping tube /Fig. 2/2/ and nut /Fig. 2/1/. The nut has to be screwed on the other end of the spindle and by turning the tube the arbor is either secured or slid out of the spindle bore.

The wheel flange is selected according to diameter of the respective grinding wheel. The latter wheel is mounted on the flange /Fig. 2/9/ and secured by the packing piece /Fig. 2/7 and nut /Fig. 2/6/. Paper washers /Fig. 2/8/ are to be placed between the grinding wheel and its flange.

The grinding wheel with assembled flange has to be slid on the tapered portion of the arbor and secured there by the nut with differential thread /Fig. 2/5/, in accordance with the following instructions: first of all, the nut has to be screwed on to the threaded portion of the arbor over the full length of its thread having a pitch of 1 mm (0.04 in). The flange with assembled grinding wheel has to be mounted on the arbor and screwed into the nut until it bears against the tapered portion of the arbor. The flange is secured against rotation so that the nut /Fig. 2/5/ is turned in the anticlockwise direction, by means of the hook-type spanner.

The nut is provided with two threads. One thread has a pitch of 1 mm (0.04 in) and the other has a pitch of 1.5 mm (0.06 in). By turning and tightening the nut in anticlockwise direction, the flange with assembled grinding wheel is secured against loosening, irrespective whether the wheel spindle rotates in clockwise or anticlockwise direction.

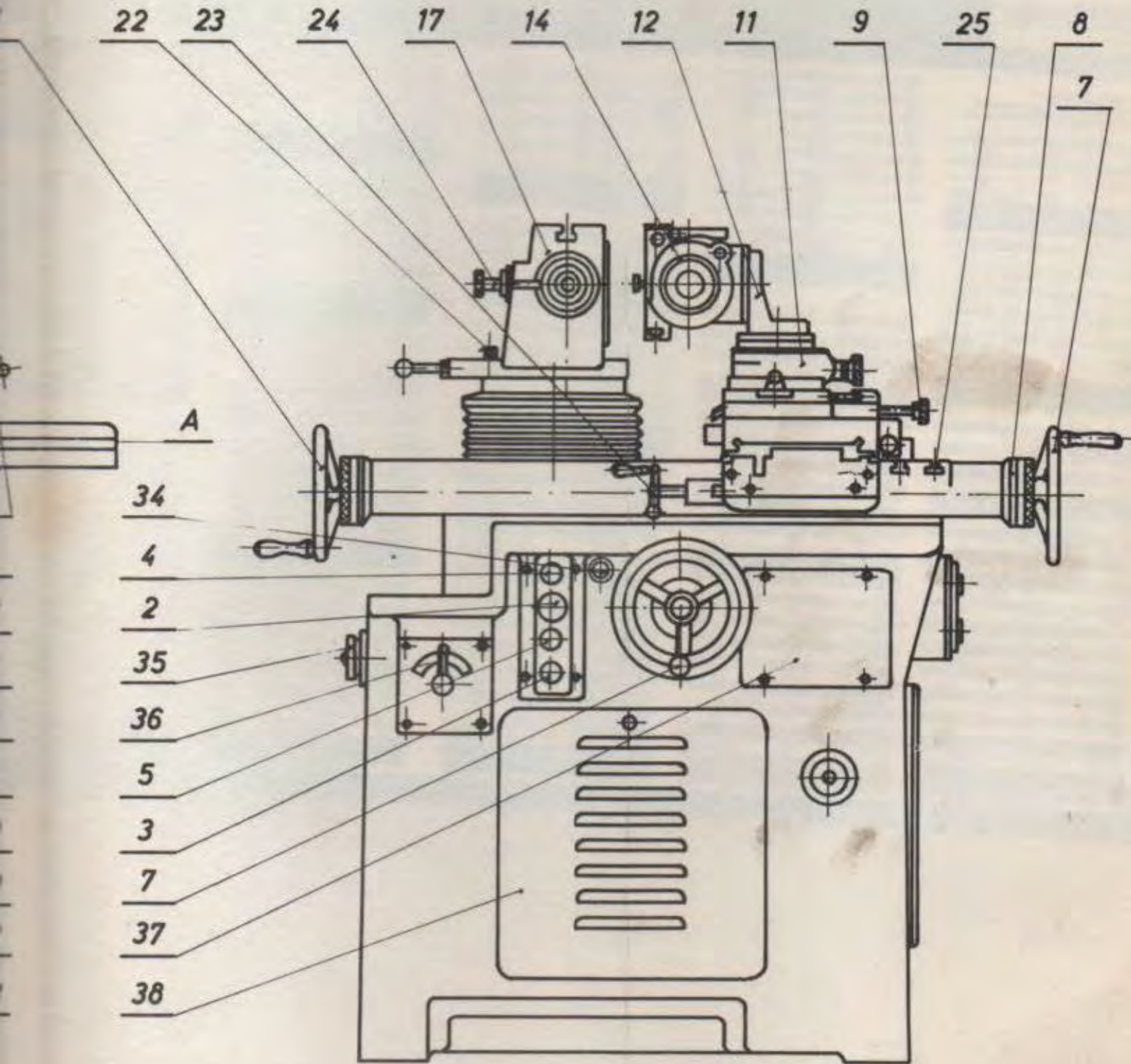
In clamping the arbors and flanges, the spindle of the wheelhead can be secured against rotation by the arresting pin. However, before starting the motor driving the wheelhead spindle, do not forget to release the arresting pin.

PAY SPECIAL ATTENTION TO THE CLAMPING OF THE ARBORS AND GRINDING WHEELS. GET FULLY CONVERSANT WITH THE PROCEDURE OF CLAMPING, ENSURING THUS COMPLETE SAFETY.

CHECK THE GRINDING WHEEL FOR POSSIBLE BREAKAGE BY TAPPING IT!

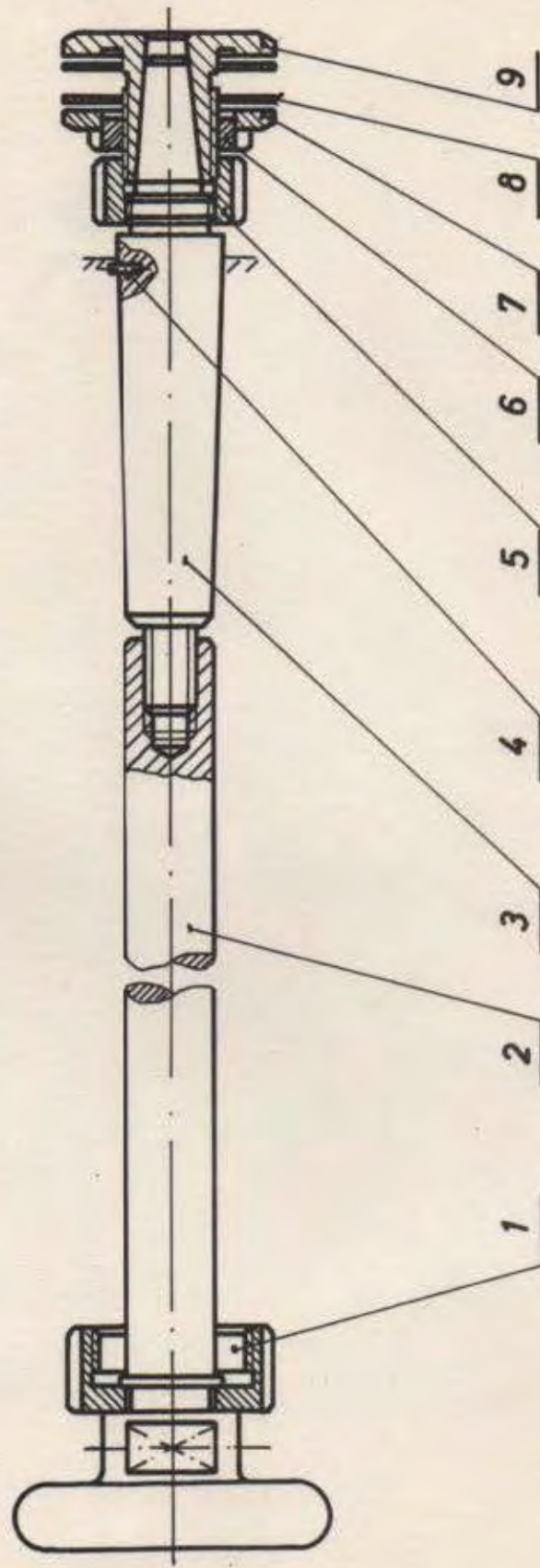
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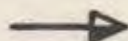
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GRINDING TECHNOLOGY

Selection of grinding wheels
Errors committed in grinding
Grinding of multi-edge cutting tools
Grinding with application of optional accessories
 Cylindrical grinding attachment
 Internal grinding attachment
 Vice for surface grinding
 Attachment for grinding between centres
 Attachment for grinding disc-type backed-off milling cutters
 Roughing reamer grinding attachment
 Attachment for grinding carbide-tipped tools
 Attachment for grinding twist drills ranging in diameter
 from 5 to 25 mm (0.19 to 0.98 in)
 Dust exhaust attachment
 Flat magnetic clamping plate
 Cooling equipment
 Radius grinding attachment
 Collet chuck equipment
 Attachment for radius wheel dressing
 Attachment for profile wheel dressing
 Attachment for grinding cutter heads
 Attachment for sharpening hobs
 Fixture for quick-action clamping of accessories -
 vertical type
 Fixture for quick-action clamping of accessories -
 horizontal type
 Clamping fixtures
 Equipment for hydraulically operated longitudinal
 traverse of table



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SPECIFICATION OF FIGURES

1. Table of "H" values for relief-grinding and sharpening of tools with straight cutting edges and tools with helical cutting edges /helix angle down to 20° /.
2. Table of "H" values for relief-grinding and sharpening of tools with helical cutting edges /helix angle above 20° /.
3. Internal grinding attachment - table of internal grinding spindles.
4. Radius grinding attachment - set for the grinding of radii ranging from 0 to 65 mm (0 to 2.55 in) on cutter heads ranging in dia. from 0 to 130 mm (0 to 5.11 in).
5. Radius grinding attachment - set for the grinding of radii ranging from 60 to 180 mm (2.36 to 7.08 in), on cutter heads ranging in dia. from 120 to 320 mm (4.72 to 12.59 in).
6. Radius grinding attachment - set for the grinding of radii on turning tools.
7. Radius grinding attachment - setting of the attachment for the required radius.
8. Hob sharpening attachment - procedure to be followed in setting the attachment.
9. Hob sharpening attachment - table showing angle of swivel of the guiding ruler /3 sheets/.
10. Hob sharpening attachment - nomograph showing angle of swivel of guiding ruler.
11. Equipment for hydraulically operated longitudinal traverse of table - modification of slide for accommodation of hydraulic cylinder.
12. Equipment for hydraulically operated longitudinal traverse of table - connection of the hydraulic power unit.
13. Equipment for hydraulically operated longitudinal traverse of table - instruction plate for control of hydraulic system.
14. Equipment for hydraulically operated longitudinal traverse of table - diagram of hydraulic system.

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SELECTION OF GRINDING WHEELS

The grinding wheel being assembled on the flange, it has to be dressed. The grinding wheels have to be dressed also during the grinding, ensuring thus their maximum cutting efficiency and high standard of surface finish obtained.

For precision jobs it is recommended to dress the grinding wheel with a diamond to be fixed in special holders. The dressing diamonds have to be procured by the machine user himself. They are not delivered along with the machine.

For the grinding of normal tools, it is recommended to use the following grinding wheels, which are delivered together with the machine:

Form	CSN	Dimensions	Note
58151 - 1015	22 - 4580	$\phi 100/\phi 20/12$	for tool steel
58151 - 1522	22 - 4580	$\phi 150/\phi 20/15$	"-
57151 - 1016	22 - 4550	$\phi 100/\phi 20/50$	"-
57551 - 0715	22 - 4552	$\phi 75/\phi 20/30$	"-
41151 - 2074	22 - 4510	$\phi 200/\phi 51/20$	"-
51151 - 1727	22 - 4521	$\phi 175/\phi 32/32$	"-
41151 - 1745	22 - 4510	$\phi 175/\phi 20/10$	"-
52141 - 1725	22 - 4501	$\phi 175/\phi 20/32$	for carbide tips
51141 - 0822	22 - 4520	$\phi 80/\phi 20/30$	"-

The rigidity of the bearings of the wheelhead spindle permits even the diamond wheels to be used.

In case the above specified grinding wheels do not suit a particular requirement, because of their grit, structure, hardness or bond, it is necessary to select some other wheels, in accordance with the following principles:

- finer grit - for harder and more brittle materials, for smaller stock removal and finer surface finish, for small contact area between wheel and tool ground
- coarser grit - for softer and more ductile materials, for larger stock removal and large contact area between grinding wheel and tool ground
- greater hardness - for softer materials and small contact area
- smaller hardness - for harder materials and large contact area

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The above stated principles governing selection of the grinding wheels are fundamental ones only. In selecting the grinding wheels, it is necessary to take into account also further invariable factors, such as abrasive material, its structure and bond. It is necessary to take into consideration also the variable factors, such as the surface speed of the grinding wheel and / or ground work, condition of the grinding machine, skill of the attendant, etc.

For more details on choice of the grinding wheels please refer to the catalogues and other literature supplied by the abrasive manufacturers.

ERRORS COMMITTED IN GRINDING

Poor surface finish - may be due to a badly balanced grinding wheel, incorrectly dressed or clogged grinding wheel, unsuitable surface speed of grinding wheel, incorrect hardness of grinding wheel, incorrectly set work rest, loose fixing screws, loose bearings of wheelhead spindle.

Geometrical inaccuracy - may be due to an incorrect assembly of work holding centres / or impurities between taper shank of work holding centre and taper bore of spindle or tailstock barrel /, defective centre holes provided in work, loose bearings of workhead spindle.

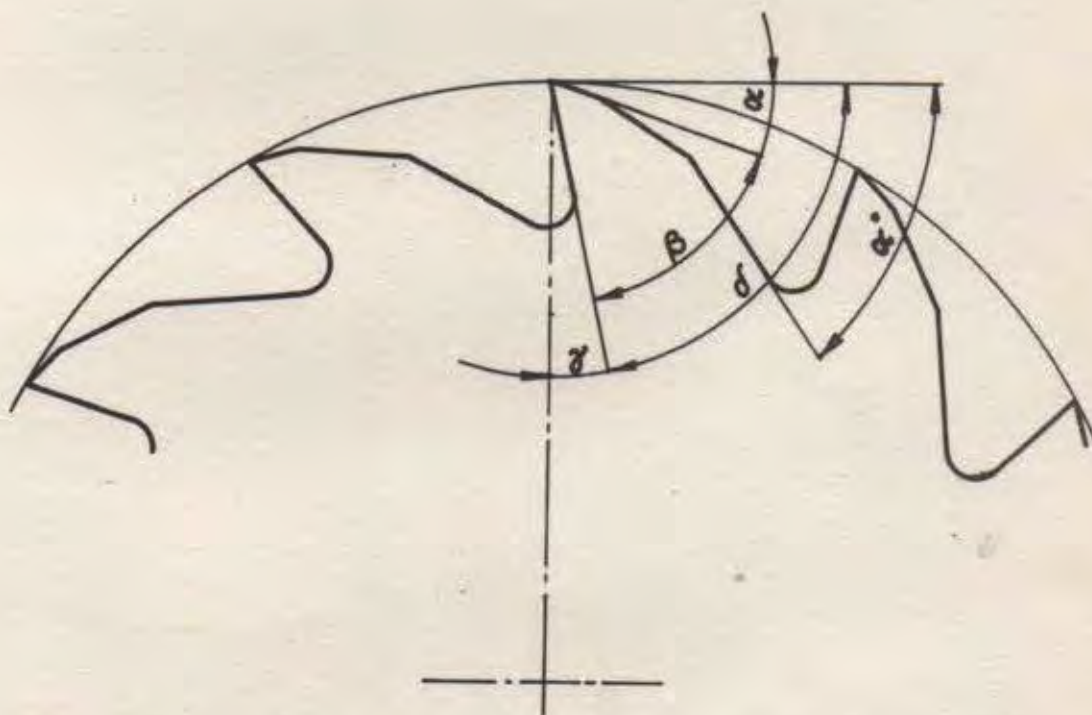
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GRINDING MULTI-EDGE CUTTING TOOLS

Illustration- Chapter 6, Fig. 1, 2

Efficiency of a cutting tool is dependent of correct cutting angles. On the multi-edge cutting tools with straight edges or helical edges, the following angles are distinguished:

- α - back rake angle
- α' - clearance angle
- β - lip angle
- γ - side rake angle
- δ - cutting angle
- λ - helix angle



Grinding of the tool back is called relief grinding, where as grinding of the tool face is called sharpening.

For correct setting of the back rake angle α there are at the disposal the calculated values "H", which determine the position of the toothed rest on the tool to be ground in respect of its centre-line, in grinding-with the face of a cup-shaped or pot-shaped grinding wheel, or which determine the position of the centreline of the grinding wheel in grinding with its periphery. The values "H" are given in Fig. 1 and 2.

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Chapter 6, Fig. 1 - the values given in this table are used for the relief grinding and sharpening of tools with straight cutting edges or with helical cutting edges, the helix angle λ of which does not exceed 20 deg.

Chapter 6, Fig. 2 - the values given in this table are used for the relief grinding and sharpening of tools with helical cutting edges, the helix angle λ of which is larger than 20 deg.

For the tools with straight cutting edges, the following back rake angles are selected:

- α = 5 deg. - for high-tensile steel and bronze
- α = 7 deg. - for steel and cast iron
- α = 10 deg. - for soft metals

Modes of setting back rake angle and side rake angle

Illustration - Chapter 6, Fig. 1

1. Setting the back rake angle α with the aid of the universal work rest to be fixed on the wheelhead with grinding being performed by face of the grinding wheel. The tooth /lip/ of the tool has to rest on the universal work rest to be adjusted by means of the centring gauge to the height of the work holding centres. The work rest has to be lowered by the value "H". This lowering is effected by turning the knob of the work rest - one complete revolution being equal to 1 mm long adjustment. The value "H" is fixed according to diameter of the tool.
2. Setting the back rake angle α by height adjustment of centre-line of the grinding wheel, with the help of the steady work rest located on the wheelhead and with grinding being performed by the face of the grinding wheel. The tooth /lip/ of the tool has to rest on the steady rest and by height adjustment of the wheelhead it has to be brought in alignment with the work holding centres, the height of which is determined by the centring gauge. The wheelhead with work rest has to be lowered by value "H".
3. Setting the back rake angle α by height adjustment of centre-line of the grinding wheel, with the help of the universal work rest mounted on the wheelhead and with grinding being performed by periphery of the grinding wheel. The tooth /lip/ of the tool has to rest on the universal work rest to be aligned with centre-line of the grinding wheel and by height adjustment of the wheelhead it has to be brought to height of the work holding centres. Height of the centres is determined by the centring gauge. By turning the respective knob, the work rest has to be lowered by the value "H". The

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latter value is selected according to diameter of the grinding wheel "D". This mode is used exclusively in relief grinding of back on the tapered tools.

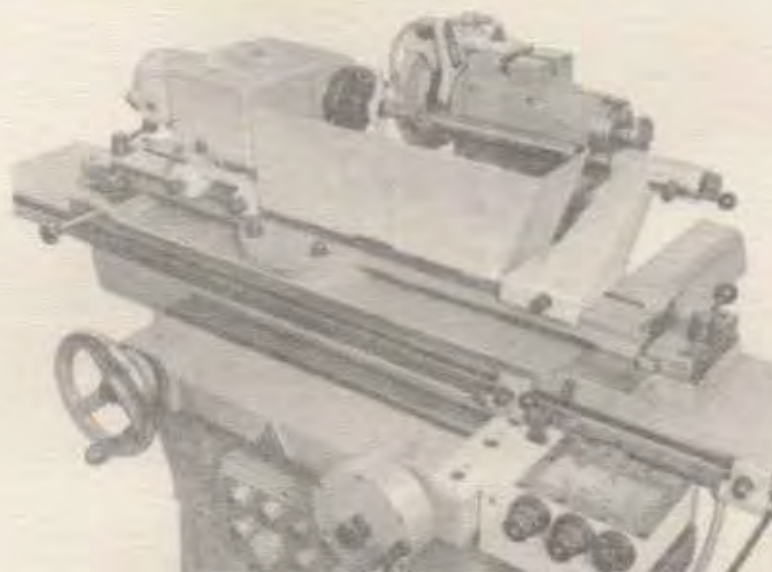
4. Setting the side rake angle γ in grinding by cup shaped grinding wheels. In sharpening taps or similar tools, the edge of the grinding wheel is set with the aid of a set square or special centring gauge /CSN 253871/ to be aligned with centre-line of the tool to be sharpened. Adjustment by the value "H" is accomplished by corresponding setting of the cross slide.
5. Setting the side rake angle α or lip angle β on tools clamped in the workhead.
With this mode of tool clamping, the angle α or β is set by swivelling the work spindle with reference to the respective graduated scale. Before hand, however, the graduated scale has to be set to "0".

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GRINDING WITH THE USE OF OPTIONAL ACCESSORIES
Cylindrical Grinding Attachment - Group 10



The attachment enables grinding of cylindrical or tapered surfaces, both external and internal, by longitudinal traversing or plunge cut, as well as face grinding. The work can be clamped between centres, in chuck and in using further optional accessories, also in collets or on magnetic clamping plate.

Main Specification

Maximum swinging diameter	mm	280
	in	11.02
Maximum swinging diameter in using raising blocks	mm	370
	in	14.56
Maximum distance between centres	mm	615
	in	24.20
Measurements of grinding wheel /dia. x face width x bore/	mm	200x 20 x 51
	in	7.87x0.78x2.00
Maximum weight of work	kg	15
	lb	33
Speed to workhead spindle	r.p.m.	100,160,250
Motor output	kW	0.18
	HP	0.24
Swivelling of workhead		360 deg.
Spindle bored taper		Morse No. 5
Tailstock bored taper		Morse No. 2

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The cylindrical grinding attachment consists of the workhead, tailstock, 125 mm (4.92 in) dia. three-jaw chuck with tapered arbor, driving plate with tapered arbor, two-point work rest, three carriers, distance insert, guard cover against splashing coolant, grinding wheel with flange and arbor and grinding wheel guard cover.

Setting-up and Grinding

The workhead has to be fixed on the left-hand side and the tailstock on the right-hand side of the upper table.

The arbor with assembled grinding wheel has to be fixed in the taper bore of the wheel spindle. The sleeve with the wheel guard cover has to be fixed on the wheelhead. To ensure a higher rigidity in grinding, it is recommended to fix the grinding wheel on the shorter end of the wheelhead.

Centre-line of the wheelhead spindle has to be aligned with centre-line of the workhead spindle by means of the centering gauge and the wheelhead is thus adjusted for height. It has to be secured in this position.

The grinding wheel is dressed by the diamond wheel dresser, which is delivered as standard equipment of the machine. However, it may be noted, that only the diamond holder is delivered /without diamond/.

The workhead is provided with its own motor. The latter motor is connected to power by inserting the respective plug into the socket provided on left-hand side of the machine stand and provided with corresponding instruction plate. The workhead has a gearbox providing three speed steps. Spindle run is started and stopped by a switch provided on the driving motor after the pushbutton /Chapter 5, Fig.1/27/ being depressed.

In using the cylindrical grinding attachment, both grinding by longitudinal traversing and plunge cut can be performed.

In the event of plunge grinding, the table with loaded work is stationary and does not perform any longitudinal movement. Feed into cut is actuated by the handwheel controlling the cross slide. In the event of grinding by longitudinal traversing, the table moves in the longitudinal direction. This movement is controlled either by hand, by handwheel and differential gearing, or hydraulically. However, the hydraulic longitudinal table traverse is enabled by the equipment which is delivered as an optional extra. Feed into cut is actuated by the handwheel controlling the cross slide.

Depending on mode of work clamping and grinding, the cylindrical grinding attachment can be used in conjunction with the following further optional extras:

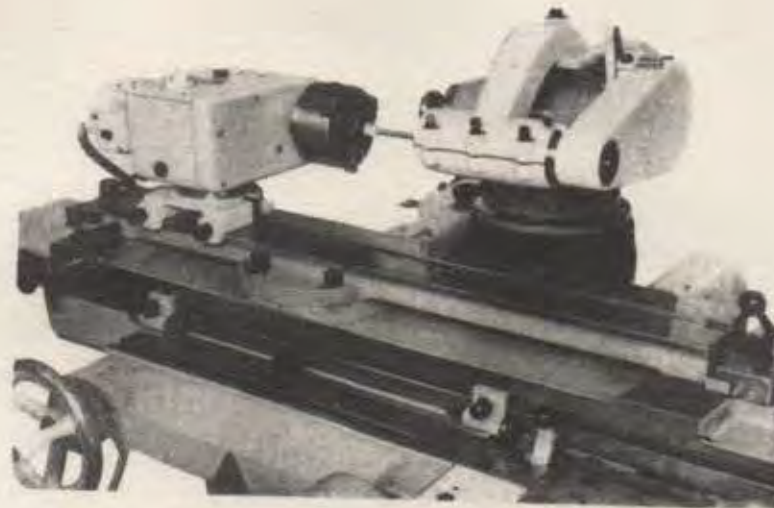
Internal grinding attachment	- group 11
Cooling equipment	- group 21
Collet chuck equipment	- group 23
Clamping fixtures	- group 29 a, c, e, h, i
Equipment for hydraulically operated table traverse	- group 30

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Internal Grinding Attachment - Group 11

Illustration - Chapter 6, Fig. 3



It is intended for grinding internal cylindrical or tapered surfaces, either by longitudinal traversing or plunge cut.

It is used mostly in conjunction with the cylindrical grinding attachment, which provides facility for work clamping.

Main Specification

Dia. of internal grinding spindle in holding sleeve	mm	70
	in	2.75
Length of sleeve holding internal grinding spindle	mm	175
	in	6.89
Min. diameter of bore ground with basic spindle IBC 70 225T	mm	8
	in	0.31
Max. length of bore ground with basic spindle IBC 70 225T	mm	85
	in	3.34

The internal grinding attachment consists of the arm, basic internal grinding spindle IBC 70 225T /incl. one exchangeable collet-type extension Fig. 3/1, two exchangeable extensions Fig. 3/2, three grinding wheels and one flat driving belt/, pulley, belt guard cover and three-point work rest.

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The internal grinding spindle IBC 70 250T /Fig. 3/ can be delivered on special order and against extra charge.

The internal grinding spindles rotate in the right-hand direction, viz., they rotate in the clockwise direction, in viewing them from the side of the driving pulley.

Setting-up and Grinding

The wheelhead has to be swivelled so that the centre-line of its spindle is parallel with the centre-line of the workhead /group 10/ to be fixed on the table.

The pulley has to be fixed in the taper bore on the right-hand - shorter - side of the wheelhead spindle.

The arm of the internal grinding attachment with assembled internal grinding spindle has to be fixed in the T-slot provided on the casing of the wheelhead. The flat belt has to be slid on the pulley and tensioned adjustment of the arm. Both the pulley and belt have to be covered by the respective guard cover.

Height of centre-line of the internal grinding spindle is set by height adjustment of the wheelhead so that it is aligned with centre-line of the workhead. For this purpose, use the centring gauge.

The work is clamped in the three-jaw chuck of the workhead. A longer work is clamped with the help of the three-point work rest. Grinding is performed by longitudinal traversing and in some cases by plunge cut. Longitudinal traversing of the table carrying the work can be hand operated or hydraulically operated.

An indispensable supplement to the internal grinding attachment is the cylindrical grinding attachment - group 10.

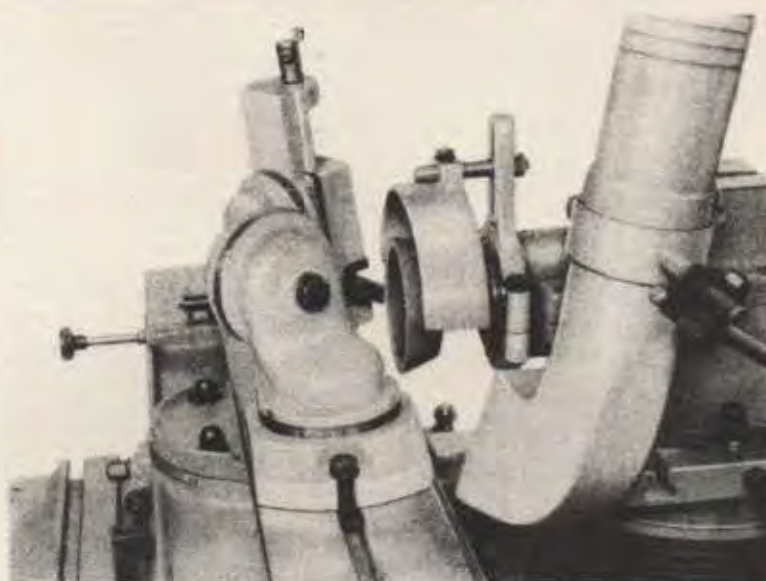
Depending on the operations involved, it is possible to use the following further attachments:

Dust exhaust attachment	- group 19
Cooling Equipment	- group 21
Clamping fixtures /chucks/	- group 29 a, c, e
Equipment for hydraulically operated longitudinal traverse of table	- group 30

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Vice for Surface Grinding - Group 12



It is intended for clamping the work to be surface ground. It enables the clamped work to be set in any desirable position in respect of the grinding wheel. Therefore, it proves especially advantageous for the grinding of turning tools, planing tools, straight thread chasers, gauges, templates, etc.

Main Specification

Width of jaws of vice	mm	100
	in	3.93
Height of jaws	mm	20
	in	0.78
Maximum opening of jaws	mm	65
	in	2.55
Swivelling of vice in horiz. plane	deg.	360
Swivelling of vice in vertical plane	deg.	360

Setting-up and Grinding

The vice has to be clamped on the upper table. Depending on the work handled, it is clamped on the basic clamping plate and two pedestals, or on the basic clamping plate and one pedestal, or direct on the basic clamping plate. Therefore, it is possible to disassemble it into three parts - the basic clamping plate, two swivelling pedestals and vice proper. Angular settings of the vice are read off the graduated scales provided on the vice, pedestals and basic clamping plate.

In case the crank of the vice hampers grinding operation, it can be removed after loosening the crank button.

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With the aid of the spacing insert belonging to the group 29j, the vice proper can be fixed to the fixture for quick-action clamping of accessories /group 28 a, b/ and together with the latter fixture it can be clamped in the workhead. The vice proper can be used also as a supplement to the radius grinding attachment, for the grinding of radii on cutting tools.

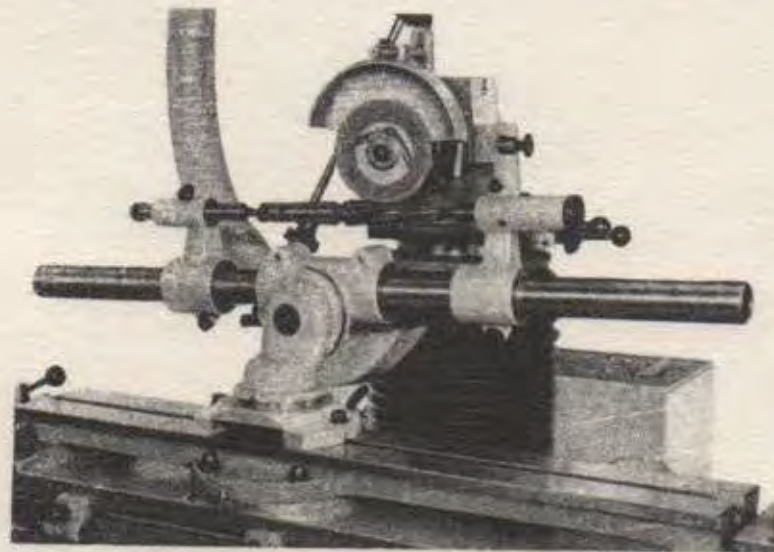
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Attachment for Grinding between Centres - Group 13



The attachment enables quick angular setting and sharpening long tapered tools, which, on account of their length, cannot be fixed in the workhead. Such tools include, for example, long tapered reamers, broaches, etc.

The attachment is manufactured and delivered with distance between centres of 800 mm (31.49 in).
Minimum length of tool that can be clamped is 120 mm (4.72 in).

Setting-up and Grinding

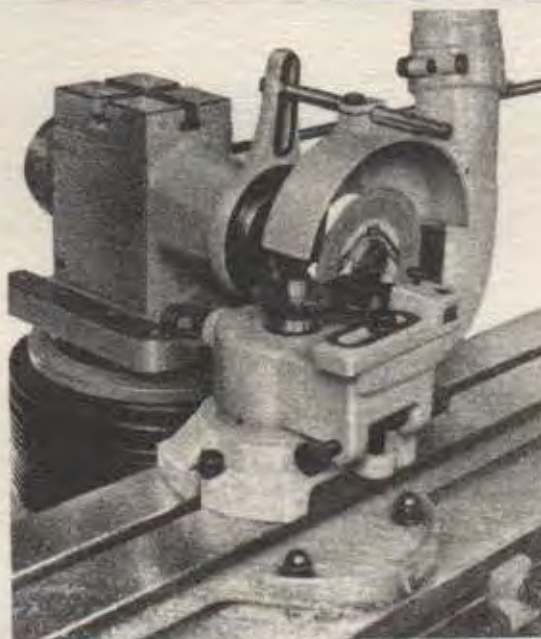
The attachment has to be fixed in the middle of the upper table. The tools to be ground are fixed between centres of the two tailstocks. The tailstocks are adjustable along an arm. The left-hand tailstock has a fixed centre, whereas the right-hand tailstock has a spring-loaded centre. The attachment can be swivelled both in the horizontal and vertical plane. The angle of swivel can be read off the graduated scales provided on the pedestal and base plate.

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Attachment for Grinding Disc-type, Backed-off Milling Cutter - Group 14



The attachment is intended for sharpening of face of disc-type, backed-off milling cutters of 150 mm maximum diameter. It serves to set the grinding wheel and tool to enable them to be sharpened with accuracy.

Main Specification

Max. diameter of disc-type milling cutter	mm	150
	in	5.90
Dia. of bore of milling cutter	mm	16, 22, 27, 32, 40
	in	0.62, 0.86, 1.06 1.25, 1.57

Setting-up and Grinding

The attachment has to be fixed to the upper table of the machine. The arbor with assembled plate-shaped grinding wheel has to be fixed in the right-hand - longer - spindle bore and the wheelhead has to be swivelled through 90 deg, in left-hand direction. The wheelhead has to be adjusted for height according to width of the respective milling cutter, so that centre-line of the wheel spindle is in alignment with middle plane of the milling cutter.

Prior to sharpening a new milling cutter, it is first necessary to modify the pitch distances by grinding the auxiliary flats provided at the rear of the individual teeth. To this end, it is necessary to mount the milling cutter on clamping pin of the

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attachment in reverse manner, so that the rear part of the teeth faces the grinding wheel. Face of the tooth has to rest on the work rest and by longitudinal traversing the auxiliary flats of all the teeth have to be successively ground. The milling cutter is indexed for grinding the next tooth after swinging away the work rest.

As the auxiliary flats are ground, the gauge mark on upper part of the attachment has to be set to 90 deg. /swivelling in respect of the base plate/ and the screws at the front of the attachment have to be adjusted up to the stop. The milling cutter has to be mounted on the clamping pin in such a manner that face of the tooth faces the grinding wheel. In case the milling cutter has a larger bore, should be used the reducing socket delivered along with the attachment. The centring gauge has to be swung down, height has to be set according to diameter of the milling cutter and face of the tooth has to be brought into contact with face of the centring gauge. Rear part of the tooth has to rest on the spring-loaded stop and the centring gauge has to be swung away. The milling cutter is thus ready for sharpening.

By adjusting the slide in cross direction, the attachment has to be advanced to the grinding wheel so that the latter wheel is brought into contact with face of the tooth. During the sharpening, the cross slide should not be adjusted any more. Further adjustment is allowed only to compensate for grinding wheel wear.

Feed into cut has to be actuated by means of the two screws located at the front of the attachment. Simultaneously, the milling cutter should rotate about its axis and face of the tooth should be continuously laid radially in respect of centre-line of rotation.

In grinding, each next tooth has to be secured in set position by the spring-loaded stop. Faces of the teeth are ground by longitudinal traversing of the table, while the milling cutter is continuously held against the spring-loaded stop.

Along with the attachment four reducing sockets are delivered. They enable milling cutters with bores of 16 mm (0.62 in), 22 mm (0.86 in), 23 mm (0.90 in) and 40 mm (1.57 in) to be clamped.

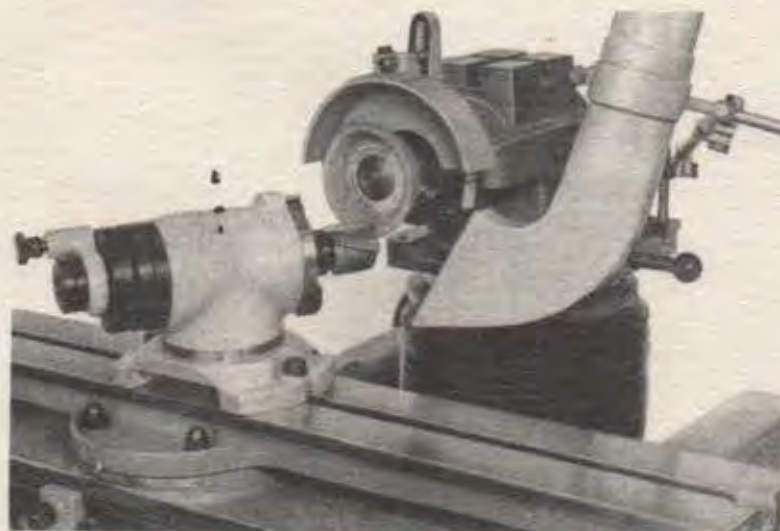
In conjunction with this attachment, the following further optional extra can be used:

Dust exhaust attachment - group 19.

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Attachment for Grinding Roughing Reamers - Group 15



The attachment is intended for relief grinding of roughing reamers /relief grinding of their tapered cutting portion/. The roughing reamers with taper shank are clamped either direct or with the aid of reducing sockets in the taper bore of the attachment. The shell roughing reamers are clamped on mandrels with taper shank 1:30. Four mandrels are available and they enable tools with bores of 13 mm (0.51 in), 16 mm (0.62 in), 19 mm (0.74 in) and 22 mm (0.86 in) to be clamped.

Main Specification

Maximum diameter of roughing reamer	mm	50
	in	1.96
Spindle bored taper		Morse No. 3

The roughing reamer grinding attachment consists of:

attachment proper, reducing sockets Morse 3/2 and Morse 3/1, clamping mandrels - Morse No. 1 for 13 mm (0.51 in) dia., Morse No. 2 for 16 mm (0.62 in) dia., Morse No. 2 for 19 mm (0.74 in) dia. and Morse No. 3 for 22 mm (0.86 in) dia.

Setting-up and Grinding

The arbor with assembled cup-shaped 100 mm (3.93 in) dia. grinding wheel has to be fixed on right-hand - longer - side of the wheelhead. The wheelhead has to be swivelled through 90 deg. in left-hand direction.

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The attachment has to be fixed on the table and with reference to the horizontal graduated scale swivelled through an angle corresponding to the required lip angle of the tapered cutting portion of the roughing reamer. With the aid of the respective graduated scale, the left-hand stop located on face of the attachment has to be adjusted according to diameter of the tool handled. The spindle of the attachment has to be swivelled so that the left-hand stop is in contact with the fixed stop.

The lip of tapered cutting portion of the roughing reamer has to be set in horizontal position and the wheelhead adjusted for height so that the grinding wheel is in contact with lowest portion of its face with the horizontal cutting edge of the tool. Thereafter, the right-hand stop on face of the attachment has to be secured in such a position that the grinding wheel could not damage the next tooth of the tool.

Longitudinal movement of the table has to be limited by the stops and the first tooth has to be sharpened. After the first tooth has been sharpened, the spindle of the attachment has to be turned to bear against the fixed stop and at this stage the roughing reamer has to be indexed by one tooth. It is accomplished by means of the respective hand crank, after previous release of a catch located on left-hand side of the attachment.

The other teeth have to be sharpened in the same way.

The graduated scale serving to adjust the attachment according to diameter of roughing reamers handled is selected for 60° angle of the tooth gap and 6° back rake angle.

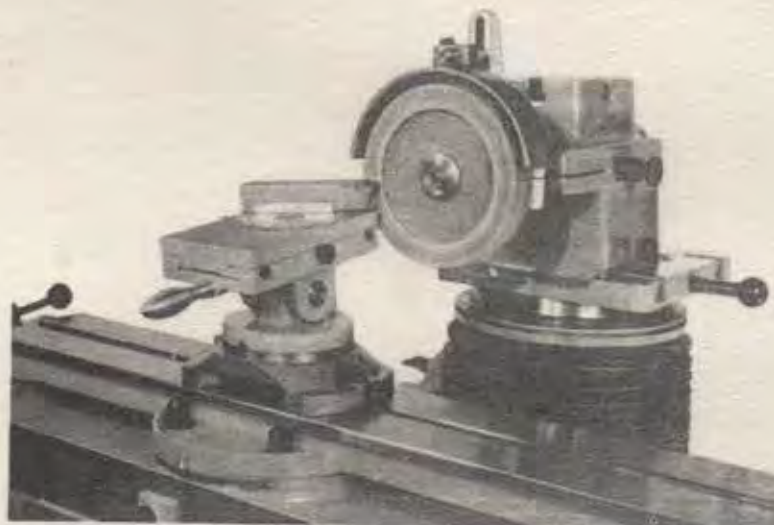
The attachment can be used in conjunction with the optional dust exhaust attachment - group 19.

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Attachment for grinding Carbide-tipped Tools - Group 16



The attachment is intended for sharpening individual and special turning tools. The attachment is not suitable for grinding in batches, as well as for grinding normal tools. For normal grinding of tools in shops, should be used special tool grinders. The capacity of the universal tool and cutter grinder is thus reserved for more accurate jobs.

By means of the attachment both the main and side cutting edges of the tools can be ground with silicium-carbide (Sic) or diamond grinding wheel.

Setting-up and Grinding

The attachment has to be fixed on the upper table of the machine and the grinding wheel in the bore of the wheelhead spindle. The tool has to be put on the support blade on the tilting table of the attachment and thereafter advanced by hand to the grinding wheel. The tool has to be held down by one hand, whereas the other hand has to grip the handle of the attachment and produce longitudinal traverse of the table.

The various angles on the tool are set by swivelling the support blade and tilting the table of the attachment.

Grinding is to be performed under continuous flow of coolant. The 175 mm (6.89 in) dia. grinding wheel serves to grind, whereas the 75 mm (2.95 in) dia. wheel serves to polish.

The standard equipment of the attachment includes a diamond holder, Sic grinding wheel of 175 mm (6.89 in) dia. x 32 mm (1.25 in) x 20 mm (0.78 in), grinding wheel of 75/46 mm (2.95/1.81 in) dia. x 30 (1.18 in) x 20 (0.78 in) and grinding wheel cover.

The attachment being in use, it is possible to use it in conjunction with cooling equipment - group 21.



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Twist Drill Grinding Attachment - Group 17



The attachment is intended for sharpening twist drills with right-handed helices. It permits twist drills ranging in diameter from 5 to 25 mm (0.19 to 0.98 in), with straight or taper shank, to be ground.

Along with the attachment, the 175 mm (6.89 in) dia. x 30 (1.18 in) x 32 (1.25 in) grinding wheel and arbor for grinding wheel with flange are supplied. The attachment includes also a diamond holder for wheel dressing. The latter holder is delivered, however, with the dressing diamond.

Setting-up and Grinding

The attachment has to be fixed on right-hand side of the upper table. The arbor with assembled grinding wheel has to be fixed on left-hand - shorter - end of the wheel spindle and the wheelhead has to be swivelled through 90 deg., in right-hand direction.

Before the twist drill is clamped and grinding started, it is necessary to dress the grinding wheel. For this purpose, along with the attachment is delivered a diamond holder to be assembled on the rod of the attachment, according to the following instructions:

after release of the small hand crank, the rod with the chucking equipment has to be taken out of the body of the attachment and the holder with dressing diamond has to be slid on right-hand end of the rod. The rod has to be fixed again in the body and secured by the small hand crank. The holder with dressing diamond has to be fixed on the rod by a screw.

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For dressing, the diamond should be traversed over face of the grinding wheel by longitudinal movement of the table. The diamond is fed into cut by turning the handwheel actuating cross feed to the slide.

The grinding wheel being dressed, the diamond holder has to be taken out. The rod with the chucking equipment has to be slid back into the attachment body, up to a gauge line determining the back rake angle of 6° .

The drill has to be gripped by the jaws of the chucking equipment controlled by a small lever. The drill has to be gripped on edges of the cutting lip and the drill shank has to be supported by the small arm provided with centre hole (pit). In chucking, the drill has to be swivelled so that the lip to be ground is in horizontal plane. Grinding has to be performed by face of the grinding wheel, on its right-hand side (when viewed from its centre-line), by pendulum motion of the chucking equipment. While grinding is in progress, the small lever of the chucking equipment has to be held down. This will avoid possible opening of the gripping jaws.

Feed into cut is actuated by handwheel controlling the cross feed. One side of the drill being sharpened, the vernier scale of the handwheel has to be set to "0", the drill withdrawn from the grinding wheel and re-clamped for sharpening its other side. Grinding procedure is the same. Feed into cut has to be actuated by the handwheel until the value "0" set for the grinding of the first side is reached.

The attachment can be used in conjunction with the following optional extra:

dust exhaust attachment - group 19

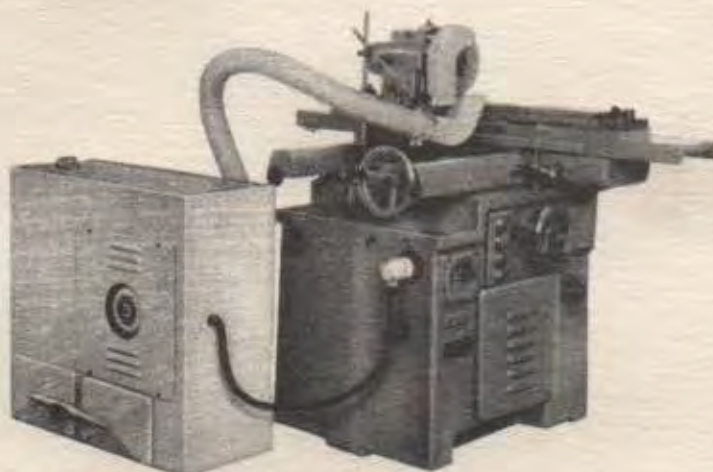
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Dust Exhaust Equipment - Group 19



The OZ 360 exhaust equipment is intended for exhausting grinding dust and metal particles in dry grinding. It forms a separate unit with individual motor.

Main Specification

Capacity	cu.m/hour	360
Motor output	kW	0.75
	HP	1.02
Fan speed	r.p.m.	2,780
Measurements /length x width x height/	mm	830 x 435 x 830
	in	32.67x17.12x32.67
Net weight	kg	90
	lb	198

The dust exhaust equipment consists of the power unit, two suction inlets of 1.250 mm (49.21 in) length, two suction mouth-pieces and articulated holder of the inlets.

Assembly and Connection

The dust exhaust equipment has to be located according to area available and grinding mode applied. As most advantageous location it is recommended to situate the equipment in the manner shown in the foundation drawing, in chapter 2 of this manual.

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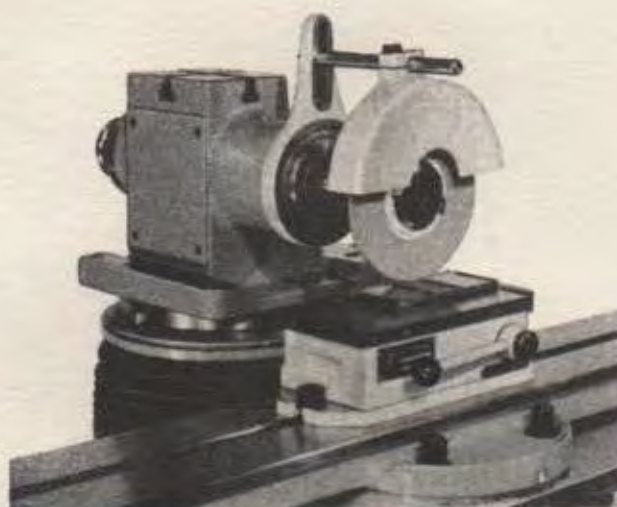
The exhaust mouthpiece has to be fixed on the wheelhead in such a position that exhausting proves most effective /in dependence on kind of grinding involved/.
The cable plug has to be slid into the socket at the rear of the machine stand, provided with instruction plate "Cooling, dust exhausting". Thereby, the equipment is connected to power. The equipment is started and stopped by the pushbutton located on the front control panel.

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Flat Magnetic Clamping Plate with Permanent Magnet - Group 20



It is used as a clamping fixture in surface grinding. Work is clamped with the aid of a permanent magnet. The clamping surface of the magnetic plate measures 110 by 200 mm (4.33 by 7.87 in).

Preparation for Use

The magnetic clamping plate has to be fixed on the upper table, the magnet released by means of the respective small lever and the guard cover removed.

In using the magnetic clamping plate for grinding, the following optional extras can be used:
cooling equipment and hydraulically operated longitudinal travel of table.

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Cooling Equipment - Group 21



It is used for inscreasing surface finish of ground surfaces and output.

Its use is indispensable in grinding cylindrical and tapered external as well as internal surfaces, in surface grinding and in grinding carbide-tipped tools with diamond grinding wheels.

Main Specification

Capacity of coolant pump	l/min	10
	Gal. US/min	2.64
Capacity of tank	l	15
	Gal. US	3.96

The cooling equipment consists of coolant tank with pump, hose, holder, cock, two mouthpieces and discharge channel.

Preparation for Use

The coolant tank has to be suspended from rear wall of the machine stand.

The cable plug has to be slid into socket at the rear of the machine stand, provided with instruction plate "Cooling, dust exhausting".

The pump motor is started and stopped by pushbuttons located on the front control panel. Prior to putting the cooling equipment into use, it is necessary to replace the stop pin of the cross slide by another one. The latter pin is delivered along with the cooling equipment. Thereby, length of stroke of the slide is reduced from 250 mm (9.84 in) to 230 mm (9.05 in). The discharge channel with pipe has to be fixed on the slide. The

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channel has to be screwed on both arms of the slide in such a manner that the discharge tube is directed to the left-hand discharge trough provided on the machine stand.

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Radius Grinding Attachment - Group 22

Illustration - Chapter 6, Fig. 4, 5, 6, and 7



The attachment is intended for grinding radii as existing on cutter heads and face milling cutters with small number of teeth, as well as for grinding radii of turning tools.

Main Specification

Maximum diameter of milling cutter	mm	315
	in	12.39
Maximum width of tool clamped in vice	mm	65
	in	2.55
Maximum weight of sharpened tool	kg	30
	lb	66

Adjustability of tool axis in respect of axis of attachment and angular settings are shown in Fig. 4, 5, 6 and 7.

Setting-up and Grinding

Depending on kind and measurements of tools, the following three modes of adaptation of the attachment can be used:

- 1) attachment with basic clamping plate and workhead /Fig. 4/
- 2) attachment with basic clamping plate, pedestal and workhead /Fig. 5/
- 3) attachment with basic clamping plate and vice belonging to the group 12 /Fig. 6/

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It is used for clamping flat tools. In place of the basic clamping plate, the quickaction clamping fixture belonging to the group 28a can be used.

The attachment has to be fixed on left-hand side of the upper table. When is used the vice, the attachment has to be fixed on right-hand side of the table.

The attachment has to be advanced with its centre-line to the grinding wheel. To this end, it is necessary either to swivel the wheelhead so that it is above the upper table or to remove the discharge channel and stop pin.

Rounding-off is performed according to the required back rake angle to be set by means of the toothed rest fixed on the wheelhead. The toothed rest is set to value "H" given in the respective table /chapter 6, Fig. 1/, in accordance with diameter of the grinding wheel.

Point of intersection of the face and periphery of the tool has to be set by means of the centring gauge of the attachment /Fig. 7/. The required amount of radius has to be set by means of the slides of the attachment. Periphery of the tool has to be advanced with cross table feed to the grinding wheel so that edge of the tool is in middle of face width of the grinding wheel. Longitudinal travel of the table has to be limited by the stops.

Angle of the radius /in respect of plane of cutting edge/ has to be set on the attachment by means of stops. By pendulum motion of the attachment, the radius has to be ground progressively until the grinding wheel touches the plane of the cutting edge. The first tooth being rounded off, its correct profile has to be checked by a radius caliper. Possible corrections have to be effected by the slides of the attachment, which, however, must no longer be moved in grinding the next radii.

The second grinding pass has to be taken in the same way. It is necessary only to adjust the toothed rest by the specified value "H".

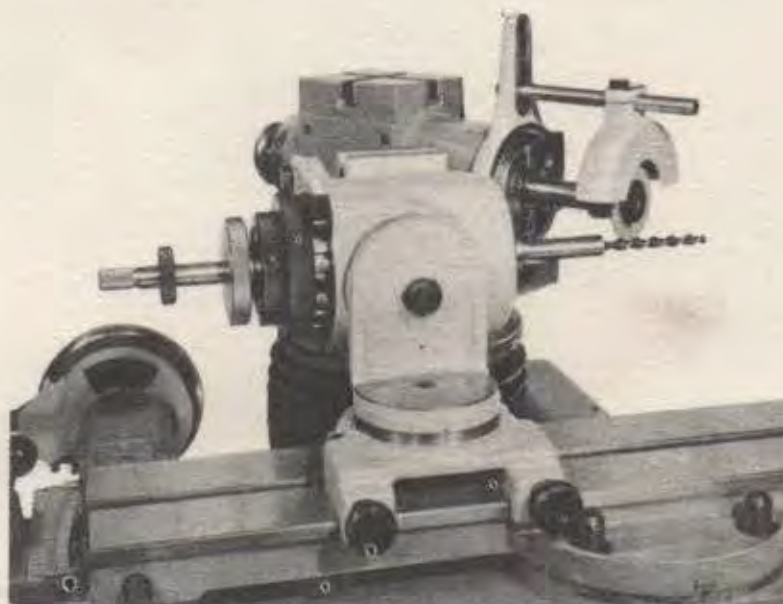
The attachment for radius grinding is used in conjunction with the workhead with base plate which is part of the standard equipment of the machine and the vice belonging to optional extra - group 12.

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Collet Chuck Equipment - Group 23



It is used for quick and precision chucking of small tools or other cylindrical components.

It is divided into:

1. Collet chuck equipment controlled from the rear - group 23 a. It permits collets for 3 - 20 mm (0.11 - 0.78 in) dia. to be used. It is delivered with 18 mm (0.70 in) dia. collet.
2. Collet chuck equipment controlled from the front - group 23b. It permits collets for 5 - 25 mm (0.19 - 0.98 in) dia. to be used. It is delivered with 18 mm (0.70 in) dia., collet.
3. Mandrel for clamping tools with Morse 1 taper - group 23c. It consists of the mandrel and stop ring. According to requirement, the mandrel is clamped in the collet chuck equipment 23a or 23b, or in a collet of 18 mm (0.70 in) dia.
4. Set of collets for the collet chuck equipment controlled from the rear - group 23d.
5. Set of collets - for the collet chuck equipment controlled from the front - group 23e.

According to operation involved, the collet chuck equipment can be clamped in the spindle bore of the workhead belonging to the standard equipment of the machine, or in the spindle bore of the workhead belonging to the optional cylindrical grinding attachment - group 10.

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Radius Wheel Dresser - Group 25 a



It is employed for producing external or internal radii on the grinding wheels.

The size of radius is set by means of gauge blocks, with reference to the base plate of the equipment. The axis of pivoting movement is 5 mm (0.196 in) distant from the base plate.

The equipment is loaded between centres of the tailstocks, or between the centre of the tailstock and centre of the work-head.

In dressing, the diamond must point against the centre-line of the grinding wheel.

The equipment is delivered without the dressing diamond.

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Profile Wheel Dresser - Group 25b



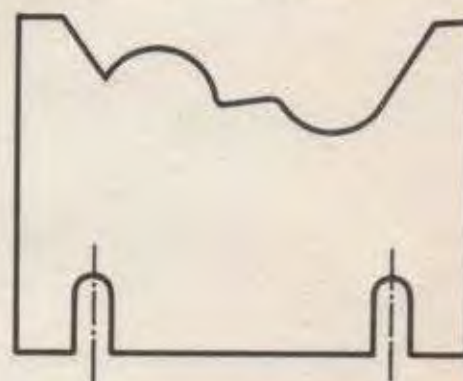
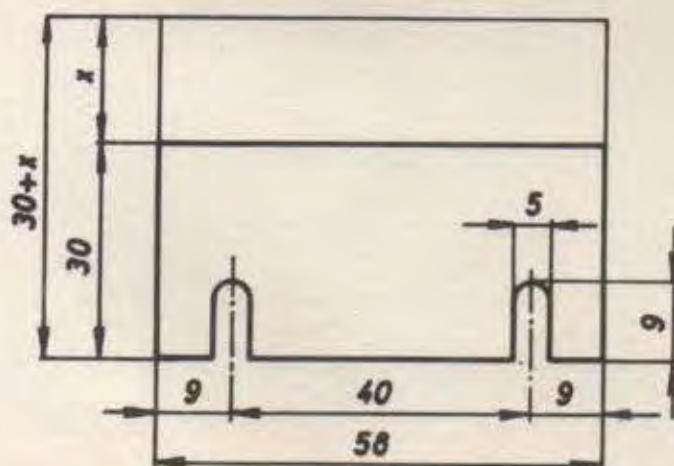
The equipment duplicates profile of a template in the grinding wheel. It is used for grinding profile tools in batches and in cases when the grinding wheel must have profile of projection of component to be machined by a profile-ground tool. In addition, the equipment is used for grinding negative copying templates.

It consists of the profile dressing equipment and base plate. The latter plate is fixed on the raising block delivered in the standard equipment of the machine and together with the block it is fixed on the upper table of the machine. The templates have to be clamped on the base plate of the equipment, on an area which is inclined at an angle nearest to the one at which the grinding should be carried out - 5, 10, 15 or 20 deg.

The equipment is delivered without the dressing diamond.

Blank of template

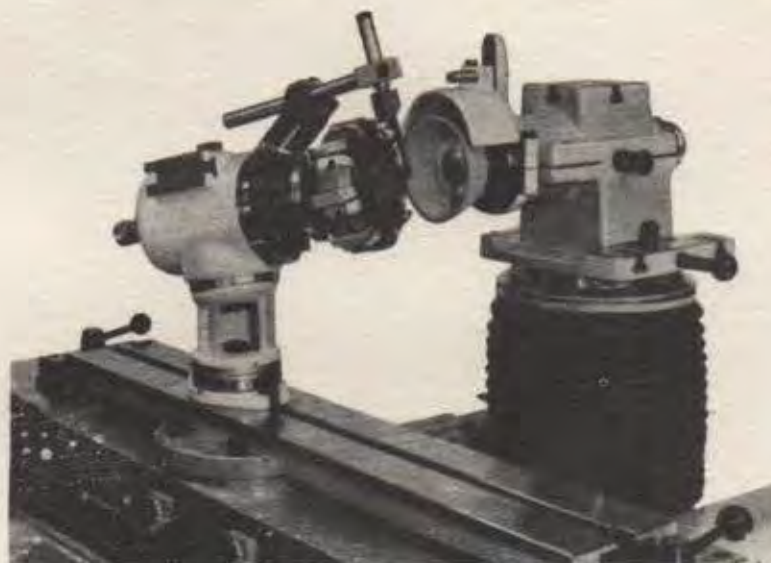
Sample of template



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Attachment for Grinding Cutter Heads - Group 26



It is intended for sharpening cutter heads of up to 380 mm (14.96 in) diameter, which, on account of their large diameter, cannot be sharpened with the aid of the normal workhead. On the cutter heads, the back rake angle and clearance angle are ground.

Setting-up and Grinding

The attachment has to be fixed on the table and on it the workhead belonging to standard equipment of the machine has to be assembled.

The angular bracket has to be swivelled on the base plate so that the "zero" line is at an angle of 90 deg. in respect of the base plate /i.e., in respect of axis of longitudinal movement of table/.

The tool has to be fixed in the workhead. The workhead has to be pivoted on the bracket at an angle corresponding to the required angle of back rake. The workhead has to be secured in position. The rotary vernier scale of the bracket has to be turned to the reset by the same number of degrees as preselected for the back rake angle. The base plate has to be released and the bracket pivoted back to slign with "zero" graduation of the vernier scale and secured in this position.

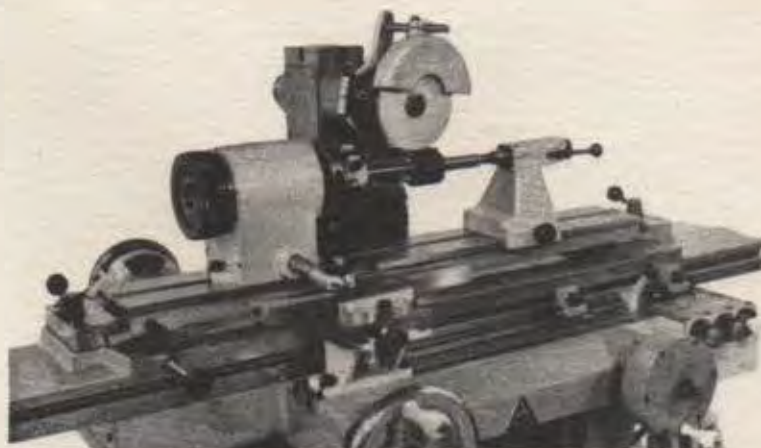
The required clearance angle /H/ is set by pivoting the bracket on the base plate:

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Hob Sharpening Attachment - Group 27

Illustration - Chapter 6, Fig. 8, 9



The attachment is intended for sharpening faces of a tooth / γ / of the hobs with accurate helix, without use of the toothed rest. The lead of the tool cutting edge is duplicated from an adjustable guide ruler /bar/.

Main Specification

Maximum diameter of tool	mm	250
	in	9.84
Maximum clamping length of tool	mm	450
	in	17.71
Minimum lead of ground helix	mm	200
	in	7.87
Length of guide ruler /bar/	mm	300
	in	11.81

The attachment consists of the following three main parts-work-head, tailstock and guide ruler /bar/.

Supply of the attachment includes 4 dividing plates, of which the basic one /24 teeth/ is assembled in the attachment.

Dividing plate	intended for number of divisions
z = 24	2, 3, 4, 6, 8, 12, 24
z = 18	2, 3, 6, 9, 18
z = 20	2, 4, 5, 10, 20
z = 28	2, 4, 7, 14, 28

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Setting-up and Grinding

The tool has to be fixed on a mandrel. Then it is clamped together with the mandrel between centres of the workhead and tailstock of the attachment. Swivel of the workhead spindle in grinding a helix is transmitted from the guide ruler /bar/ by a rack to the gearing and spindle. The tool is re-set for the grinding of the next tooth by hand, after bringing the snap out of mesh with the dividing plate.

In setting up the attachment, it is necessary to take into account whether it has been delivered by the manufacturing works together with the machine, or whether it has been delivered supplementarily, against a later order.

If the attachment has been delivered together with the machine, it can be assembled on the machine without any further adaptations.

If, on the other hand, the attachment has been delivered supplementarily /additionally/, it is necessary to make an adaptation as follows:

1. The workhead of the attachment has to be fixed on left-hand side and the tailstock on right-hand side of the upper table of the machine.
2. The bracket with the support blade has to be clamped in the first T-slot at the front of the cross slide. The rack of the workhead has to be out-travelled in the direction towards the bracket and the distance "x" /Fig. 6/8/ measured. The measured value "x" has to be added 0.5 mm (0.019 in) and the bracket has to be reduced on its bottom bearing surface by the value $x + 0.5$ mm (0.019 in). As such, clearance between the rack of the workhead and upper surface of the support blade will be 0.5 mm (0.019 in).
3. The guide ruler /bar/ - /Fig. 8/1/ has to be set to the "zero" position. This has to be done by trial. The "zero" position is set, if the spindle does not show any rotary motion while the table moves longitudinally. It is checked by a dial indicator to be fixed in the spindle. The distance between the support blade /Fig. 8/2/ and cylindrical contact of the limit gauge block /Fig. 8/3/ has to be measured. The measured value should be 60 mm (2.36 in). If the measured value does not correspond to this requirement, it has to be corrected by re-grinding the upper or lower surface of the support blade.

Whenever the attachment is assembled on the machine, it is necessary to check the value of 60 mm (2.36 in) and "zero" position.

The lead of the right-handed or left-handed helix of the tool "S" has to be set by means of end gauge blocks.

Length "L" of the end gauge blocks is selected according to the following formula:

$$L = k + 100 \cdot \sin \alpha \quad - \text{ for right-handed helix}$$

$$L = k - 100 \cdot \sin \alpha \quad - \text{ for left-handed helix}$$

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The values that are mostly used are given in the accompanying table /Fig. 9/, where

s = lead of helix of tool

α = angle of swivelling of guide ruler /bar/

k = constant measurement of 60 mm (2.36 in) /END GAUGE BLOCK/
 $100 \cdot \sin \alpha$ = length of end gauge blocks for setting of helix

For helices of a lead that is not given in the respective table, the angle has to be calculated with the aid of the following formula:

for lead given in mm

$$\operatorname{tg} \alpha = \frac{126,3321}{S \text{ /mm/}}$$

for lead given in inches

$$\operatorname{tg} \alpha = \frac{4,9737}{S \text{ /in/}}$$

The mandrel with assembled tool has to be clamped between centres, the snap of the dividing plate slid into the hole determining respective number of divisions and the tool centred with the aid of special carrier.

The wheelhead has to be swivelled through the respective angle /as a rule, it is given on face of the hob/. In principle, grinding is performed by convex side of the plate-shaped grinding wheel.

The grinding wheel has to be advanced in tooth gap of the tool, to required depth /this depth must not be change during grinding/. With the aid of the centring template for sharpening /Czechoslovak Standard Specification CSN 253871/, the grinding wheel has to be adjusted with cross traverse of the table so that its working surface /measured below centre-line of grinding wheel/ points against centre-line of the sharpened tool with precision. Thereby, the angle of tooth face /side rake angle/ γ is set to 0 deg. Starting from the above position, the positive side rake angle is set by withdrawal of the cross slide by value "H" given in the respective tables.

The screw of the snap holder has to be loosened in the dividing plate on the workhead, the hob swivelled so that the tooth face is in contact with the grinding wheel, the screw tightened again and sharpening started. After the first tooth has been sharpened, the snap of the dividing plate has to be engaged in the next hole of the plate. Circular feed of the tool into cut /indexing of tool/ is achieved by traverse of the slide of the attachment together with the guide ruler /bar/. One division of the graduated scale provided on the attachment is equal to infeed movement of 0.1 mm (0.0039 in) length, as measured on a diameter of 100 mm (3.93 in).

In using the attachment, great attention should be paid to cleanliness of the rack, its sliding surfaces and blade. The bearings and gearings located inside the attachment are provided with grease already at the manufacturing works. It is recommended to replace the grease after every two years of operation.

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Depending on operations involved, the hob grinding attachment /attachment for grinding tools with helical flutes/ can be used in conjunction with the following extras:

group 19 - dust exhaust attachment or

group 21 - cooling attachment

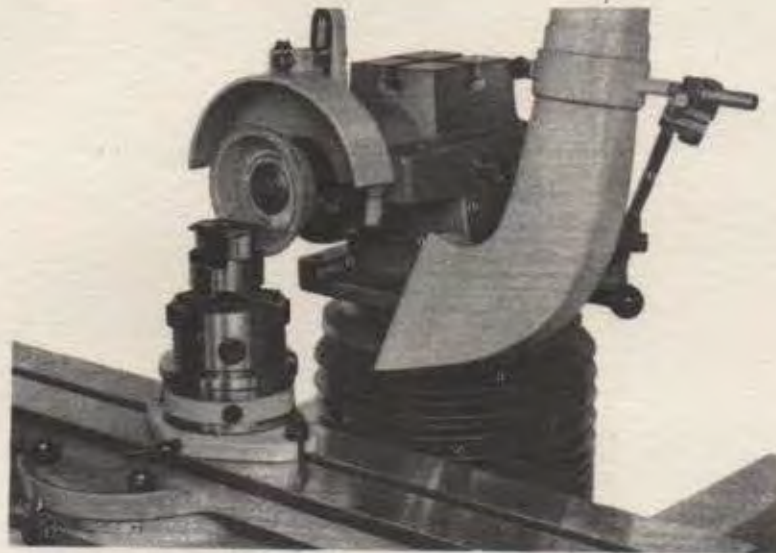
group 30. - equipment for hydraulically operated longitudinal table traverse.

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Quick-action Fixture for Vertical Clamping of Accessories -
Group 28a



This is intended for quick change of the following optional accessories:

group 12 - vice

group 29b - 160 mm (6.29 in) dia. three-jaw chuck with flange

group 29d - 125 mm (4.92 in) dia. four -jaw chuck with flange

group 29f - 100 mm (3.93 in) dia. three-jaw chuck with flange

The above optional accessories are fixed on the quick-action clamping fixture by means of an eccentric pin controlled by a small crank.

For fixing the vice belonging to group 12 on the quick-action clamping fixture, the vice has to be adapted by adding to it the spacing insert 29j.

The quick-action clamping fixture can be swivelled about its vertical axis through 360 deg. It is fixed on the upper table.

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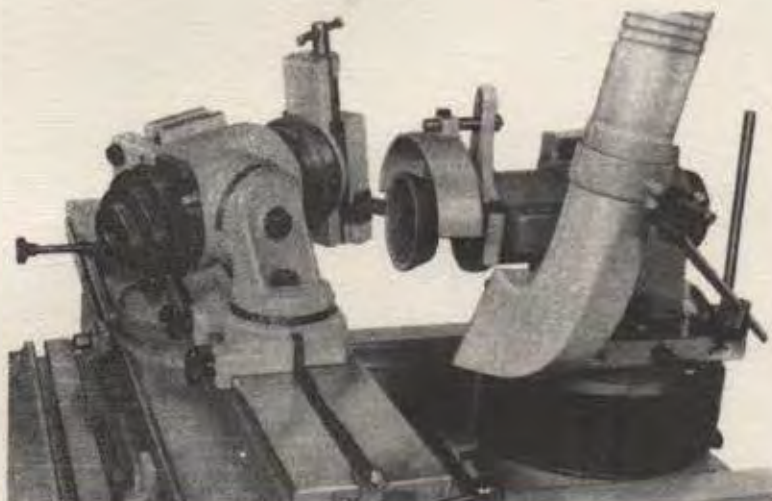
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**Quick-action Fixture for Horizontal Clamping of Accessories -
Group 28b**



Intended for fixing optional accessories on the workhead. The following accessories can be fixed with the quick-action fixture for horizontal fixing:

group 12 - vice

group 29b - 160 mm (6.29 in) dia. three-jaw chuck with flange

group 29d - 125 mm (4.92 in) dia. four-jaw chuck with flange

group 29f - 100 mm (3.93 in) dia. three-jaw chuck with flange

For fixing the vice belonging to group 12 on the quick-action clamping fixture, the vice has to be adapted by adding to, it the spacing insert 29j.

The quick-action clamping fixture is fixed in the spindle bore of the workhead belonging to the standard equipment of the machine.

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Clamping Fixtures - Group 29

The following clamping fixtures can be delivered:

- a/ 160 mm (6.29 in) dia. three-jaw chuck with Morse No. 5 taper shank. It is fixed in the taper bore of the workhead spindle - group 05 -, or in the the workhead belonging to group 10.
- b/ 160 mm (6.29 in) dia. three-jaw chuck with flange for the quick-action clamping fixture. It is fixed to the quick-action clamping fixtures 28a or 28b.
- c/ 125 mm (4.92 in) dia. four-jaw chuck with Morse. No. 5 taper shank. It is fixed in the workhead belonging to group 05, or in the workhead belonging to group 10.
- d/ 125 mm (4.92 in) dia. four-jaw chuck with flange for the quick-action clamping fixture. It is fixed to the quick-action clamping fixture 28a or 28b.
- e/ 100 mm (3.93 in) dia. three-jaw chuck with Morse No. 5. It is fixed in the workhead - group 05 -, or in the workhead belonging to group 10.
- f/ 100 mm (3.93 in) dia. three-jaw chuck with flange for the quick-action clamping fixture. It is fixed on the quick-action clamping fixture 28a or 28b.
- g/ 160 mm (6.29 in) dia. face plate with Morse No. 5 taper shank. It is fixed in the workhead of group 05, or in the workhead belonging to group 10.
- h/ Collet chuck for 3 - 16 mm (0.11 - 0.62 in) dia. with Morse No. 5 taper shank. It is fixed in the workhead of group 05, or in the workhead of group 10.
- i/ 160 mm (6.29 in) dia. magnetic clamping plate - with permanent magnet and Morse No. 5 taper shank. It is fixed in the workhead of group 05 or in the workhead of group 10.
- j/ Spacing insert intended for fixing the vice belonging to group 12 to the quick-clamping fixture 28b, or 28a.

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**Equipment for Hydraulically-operated Longitudinal Traverse
of Table - Group 30**

Illustration - Chapter 6, Fig. 11, 12, 13, 14



This is used to particular advantage in grinding external as well as internal surfaces, either cylindrical or tapered, and in surface grinding performed by longitudinal traversing. The attachment can be used also in sharpening hobs, by means of the hob sharpening attachment - group 27.

Main Specification

Max. length of longitudinal traverse of table	mm	510
	in	20,07
Rate of table traverse steplessly variable from - to	m/min.	0.1 - 5
	in/min	3.93-196.85
Table dwell at the reversals	sec.	0 - 5
Max. oil pressure	kp/sq.cm.	30
Operating pressure of oil	kp/sq.cm.	5
Viscosity of oil		3-4.5 ⁰ E/50 ⁰ C

The attachment consists of a hydraulic power unit, hydraulic distribution system and cylinder.

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Installation and Operation of Attachment

According to order, the attachment is delivered with the machine, or additionally, i.e., for a machine delivered earlier.

In case it is delivered together with the machine, it is assembled on the machine and set-up.

If the attachment is delivered additionally, the following adaptations have to be made:

1. Assembly of hydraulic cylinder.

First of all, the tables have to be removed. Holes according to Fig. 11 have to be drilled in the cross slide. These holes serve to fix the hydraulic cylinder. This cylinder has to be assembled to the clamping surfaces. It has to be ensured that axis of the cylinder is parallel with axis of the guide strip pieces and that the thread provided on the piston rod is on right-hand side. The holder of the piston rod has to be fixed to the machined boss on right-hand bottom side of the bottom table.

After the tables have been mounted on their ways, the piston rod has to be slid in the holder and by tightening respective nuts on the piston rod, the latter has to be firmly secured to the table.

All items required for connection of the attachment are delivered with the machine.

On left-hand head of the cylinder the reservoir with discharge tube has to be fixed. The discharge tube has to be directed in the discharge sump /Fig. 11/0/.

The reservoir serves to retain oil leaking around the piston rod.

2. Assembly of hydraulic distribution system.

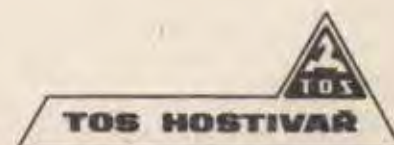
The cube of the hydraulic distribution system has to be fixed on the front machined surface of the slide and secured there by pins. The stop pins in the T-slot of the bottom table have to be adjusted in other positions and the fixed stop on the slide has to be dismantled.

3. It is recommended to locate the hydraulic power unit on the right-hand side of the machine stand, according to the layout shown in the foundation drawing, chapter 2, Fig. 2/2. The plug of the input cable has to be slid in the socket provided with the respective instruction plate. The power unit is started and stopped by pushbuttons located on the front control panel.

The hydraulic power unit serves as a source of pressure oil for the hydraulic circuit of the machine, to be fed with oils having viscosity of 20 - 50 c St. and at a pressure ranging up to 30 kp/sq.cm. Minimum temperature of ambient and oil is + 20°C.

Recommended oils: OT - T3, OT - T4, CSN 65 66 20, size of mechanical particles dispersed in oil should not exceed 0.03 mm (0.0011 in).

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The welded tank of the power unit /Fig. 12/ is dustproof. It is closed by a cover, on which the motor driving the gear pump housed in the tank is located. The pump delivers the oil through the cube provided with a relief valve, filter and pressure gauge and via the pipe /Fig. 12/1/ in the hydraulic circuit. Discharge oil from the relief valve passes through the filter back into the tank. Oil returns from the hydraulic circuit back into the tank via the pipe /Fig. 12/2/. Oil leaking from the cylinder head returns back into the tank via a pipe with an aperture /Fig. 12/5/.

Operation of Hydraulic Power Unit

The power unit being connected to power, the tank has to be filled with oil. The height of the oil level has to be checked with the gauge /Fig. 12/3/.

The hydraulic circuit has to be filled with oil and deserated by repeatedly starting and stopping the driving motor for a short while. Then oil has to be added in the tank so that its level reaches the line provided on the gauge, the motor started, the stop valve of the pressure gauge loosened and pressure set to the specified rate of 5 kp/sq.cm by means of the relief valve /Fig. 12/4/. After the working temperature of oil has stabilized, the pressure has to be checked again and the set rate of pressure secured by tightening the respective nut. The valve of the pressure gauge has to be closed.

When viewed from the side of the driving motor, the pump should rotate in clockwise direction.

Control Elements

Right-hand button:

- in pulled-out position /Fig. 13/4/ - hydraulic system is started
- in pushed-in position /Fig. 13/3/ - hydraulic system is stopped

Middle - front button:

- turned to the left /Fig. 13/5/ - lowest rate of table traverse is selected
- turned to the right /Fig. 13/6/ - highest rate of table traverse is selected

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Middle - rear - button:

- turned to the left /Fig. 13/2/ - table traverse is disengaged in either table reversal
- turned upwards /Fig. 13/2/ - table performs reciprocating movement, without stop
- turned to the right /Fig. 13/2/- table movement is reversed in right-hand reversal, whereas it is discontinued in left-hand reversal.

Left-hand - front - button:

- turned to the left /Fig. 13/6/ - minimum dwell in table reversals
- turned to the right /Fig. 13/6/- maximum dwell in table reversals

Left-hand - rear - button:

- turned to the left /Fig. 13/1/ - without damping of movement in table reversals
- turned to the right /Fig. 13/1/- maximum rate of damping of movement in table reversals selected.

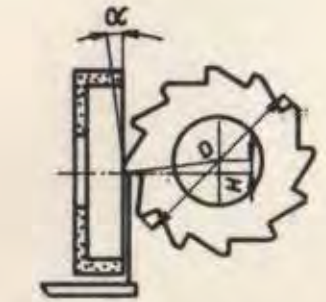
From the above description it follows that installation of the equipment for hydraulically operated table traverse in longitudinal direction imposes high requirements on technical skill. For this reason, it is recommended to order the equipment simultaneously with the machine, or to ask for the services of our specialist to assemble the equipment on the machine delivered earlier.

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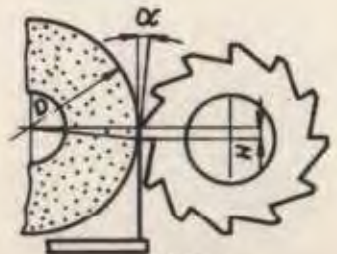


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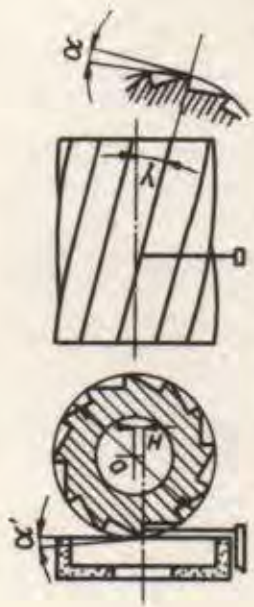
		H mm								
		α (°)	3°	4°	5°	6°	7°	10°	12°	15°
D mm	6	0,16	0,21	0,26	0,31	0,37	0,52	0,62	0,78	1,02
	8	0,21	0,28	0,35	0,42	0,49	0,69	0,83	1,04	1,36
	10	0,26	0,35	0,44	0,52	0,61	0,87	1,04	1,30	1,71
	12	0,31	0,42	0,52	0,63	0,73	1,04	1,25	1,56	2,05
	14	0,37	0,49	0,61	0,73	0,85	1,22	1,46	1,81	2,39
	16	0,42	0,56	0,70	0,84	0,98	1,39	1,66	2,07	2,74
	18	0,47	0,63	0,78	0,94	1,10	1,56	1,87	2,34	3,07
	20	0,52	0,70	0,87	1,05	1,22	1,74	2,08	2,59	3,42
	22	0,58	0,77	0,96	1,15	1,34	1,90	2,29	2,85	3,76
	25	0,65	0,87	1,09	1,31	1,52	2,17	2,60	3,24	4,27
	28	0,73	0,98	1,22	1,46	1,71	2,43	2,91	3,63	4,78
	32	0,84	1,12	1,39	1,67	1,95	2,78	3,33	4,14	5,47
	36	0,94	1,26	1,57	1,88	2,19	3,13	3,74	4,66	6,16
	40	1,05	1,40	1,74	2,09	2,44	3,46	4,16	5,20	6,83
	45	1,18	1,57	1,96	2,35	2,77	3,90	4,68	5,82	7,70
	50	1,31	1,75	2,18	2,61	3,05	4,34	5,20	6,48	8,54
	56	1,47	1,95	2,44	2,93	3,41	4,86	5,82	7,25	9,58
	63	1,65	2,20	2,75	3,29	3,84	5,47	6,55	8,15	10,8
	70	1,83	2,44	3,05	3,66	4,27	6,07	7,28	9,07	12,0
	75	1,96	2,62	3,27	3,92	4,57	6,50	7,80	9,70	12,8
	80	2,09	2,79	3,49	4,18	4,88	6,93	8,32	10,4	13,7
	85	2,22	2,97	3,71	4,44	5,18	7,37	8,84	11,0	14,5
	90	2,35	3,14	3,92	4,70	5,49	7,80	9,36	11,6	15,4
	95	2,48	3,32	4,14	4,96	5,79	8,23	9,88	12,3	16,2
	100	2,62	3,49	4,36	5,23	6,10	8,67	10,4	13,0	17,1
105	2,75	3,66	4,58	5,49	6,40	9,12	10,9	13,6	18,0	
110	2,88	3,84	4,80	5,75	6,70	9,50	11,4	14,2	18,8	
120	3,14	4,19	5,23	6,27	7,31	10,4	12,5	15,5	20,5	
125	3,27	4,36	5,45	6,53	7,62	10,9	13,0	16,2	21,4	
130	3,40	4,54	5,67	6,79	7,92	11,3	13,5	16,8	22,3	
140	3,66	4,89	6,10	7,32	8,53	12,1	14,6	18,1	24,0	
150	3,92	5,24	6,54	7,84	9,14	13,0	15,6	19,4	25,6	
160	4,18	5,58	6,98	8,36	9,75	13,9	16,6	20,7	27,4	
170	4,45	5,93	7,41	8,88	10,4	14,8	17,7	22,0	29,1	
180	4,71	6,28	7,85	9,41	11,0	15,6	18,7	23,3	30,8	
190	4,97	6,63	8,28	9,93	11,6	16,5	19,8	24,6	32,5	
200	5,23	6,98	8,72	10,5	12,2	17,4	20,8	25,9	34,2	
210	5,50	7,32	9,15	11,0	12,8	18,2	21,8	27,2	35,9	
220	5,76	7,67	9,59	11,5	13,4	19,1	22,9	28,5	37,6	
240	6,28	8,37	10,5	12,5	14,6	20,8	24,9	31,1	41,0	
250	6,54	8,72	10,9	13,1	15,2	21,7	26,0	32,4	42,8	



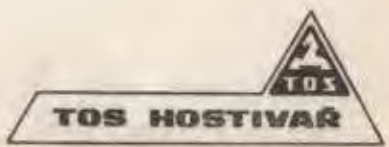


H mm

λ	20°								30°								45°							
	3°	4°	5°	6°	7°	8°	3°	4°	5°	6°	7°	8°	3°	4°	5°	6°	7°	8°	3°	4°	5°	6°	7°	8°
α	2°49'	3°46'	4°02'	5°38'	6°35'	7°31'	2°36'	3°28'	4°20'	5°12'	5°04'	5°56'	2°07'	2°50'	3°32'	4°15'	4°58'	5°40'						
6	0.15	0.20	0.21	0.29	0.34	0.39	0.14	0.18	0.23	0.27	0.32	0.36	0.11	0.15	0.18	0.22	0.26	0.30	5°					
8	0.20	0.26	0.28	0.39	0.46	0.52	0.18	0.24	0.30	0.36	0.42	0.48	0.15	0.20	0.25	0.30	0.34	0.39	8°					
10	0.25	0.33	0.41	0.49	0.57	0.65	0.23	0.30	0.38	0.45	0.53	0.60	0.18	0.25	0.31	0.37	0.43	0.45	10°					
12	0.30	0.39	0.49	0.59	0.69	0.78	0.27	0.36	0.45	0.54	0.63	0.72	0.22	0.30	0.37	0.44	0.52	0.59	12°					
14	0.34	0.46	0.57	0.69	0.80	0.92	0.32	0.40	0.53	0.63	0.74	0.84	0.26	0.35	0.43	0.52	0.61	0.69	14°					
16	0.39	0.53	0.65	0.78	0.92	1.05	0.36	0.48	0.60	0.72	0.85	0.97	0.29	0.40	0.49	0.60	0.69	0.79	16°					
18	0.44	0.59	0.74	0.88	1.03	1.18	0.41	0.54	0.68	0.82	0.95	1.09	0.33	0.44	0.55	0.67	0.78	0.89	18°					
20	0.49	0.66	0.82	0.98	1.15	1.31	0.45	0.60	0.75	0.91	1.06	1.21	0.37	0.49	0.62	0.74	0.87	0.99	20°					
22	0.54	0.72	0.88	1.08	1.26	1.44	0.50	0.67	0.84	1.00	1.16	1.33	0.41	0.54	0.68	0.82	0.95	1.09	22°					
24	0.61	0.82	0.88	1.23	1.43	1.64	0.57	0.76	0.94	1.13	1.32	1.51	0.46	0.62	0.77	0.93	1.08	1.23	24°					
26	0.69	0.92	0.98	1.37	1.61	1.83	0.64	0.85	1.06	1.27	1.48	1.69	0.52	0.69	0.86	1.04	1.20	1.38	26°					
28	0.79	1.05	1.13	1.57	1.83	2.09	0.73	0.97	1.21	1.45	1.69	1.92	0.59	0.79	0.99	1.19	1.38	1.58	28°					
30	0.88	1.18	1.27	1.77	2.06	2.35	0.82	1.08	1.36	1.63	1.90	2.17	0.66	0.89	1.11	1.33	1.55	1.78	30°					
36	0.98	1.31	1.64	1.96	2.29	2.62	0.91	1.21	1.51	1.81	2.11	2.41	0.74	0.99	1.23	1.48	1.73	1.97	36°					
40	1.10	1.48	1.84	2.20	2.58	2.94	1.02	1.36	1.70	2.04	2.38	2.72	0.83	1.11	1.38	1.67	1.95	2.22	40°					
45	1.23	1.64	2.05	2.45	2.87	3.27	1.13	1.51	1.89	2.26	2.64	3.02	0.92	1.24	1.54	1.85	2.16	2.47	45°					
50	1.38	1.84	1.97	2.75	3.21	3.60	1.27	1.69	2.12	2.54	2.96	3.38	1.03	1.38	1.73	2.08	2.41	2.76	50°					
56	1.55	2.07	2.22	3.09	3.61	4.12	1.43	1.90	2.38	2.85	3.33	3.80	1.16	1.56	1.94	2.33	2.71	3.11	56°					
63	1.72	2.30	2.87	3.83	4.02	4.58	1.59	2.12	2.64	3.17	3.70	4.22	1.29	1.73	2.15	2.59	3.03	3.45	63°					
70	1.84	2.46	3.07	3.68	4.30	4.90	1.70	2.27	2.83	3.40	3.96	4.53	1.38	1.85	2.31	2.78	3.24	3.70	70°					
80	1.96	2.63	3.28	3.93	4.58	5.23	1.81	2.42	3.02	3.63	4.23	4.83	1.48	1.98	2.46	2.97	3.46	3.95	80°					
85	2.09	2.79	3.48	4.17	4.87	5.56	1.93	2.57	3.21	3.85	4.49	5.13	1.57	2.10	2.62	3.15	3.68	4.19	85°					
90	2.21	2.96	3.69	4.42	5.16	5.88	2.04	2.72	3.40	4.08	4.76	5.43	1.66	2.22	2.77	3.33	3.89	4.44	90°					
95	2.33	3.12	3.89	4.66	5.44	6.21	2.15	2.87	3.59	4.31	5.02	5.73	1.75	2.35	2.92	3.52	4.11	4.69	95°					
100	2.46	3.28	4.09	4.91	5.73	6.54	2.27	3.02	3.78	4.53	5.28	6.04	1.84	2.47	3.08	3.71	4.33	4.93	100°					
105	2.58	3.45	4.29	5.15	6.02	6.87	2.38	3.17	3.97	4.76	5.55	6.34	1.94	2.60	3.24	3.89	4.53	5.18	105°					
110	2.70	3.61	4.51	5.40	6.30	7.19	2.50	3.33	4.15	4.98	5.82	6.64	2.03	2.72	3.39	4.08	4.76	5.43	110°					
120	2.84	3.94	4.92	5.88	6.88	7.85	2.73	3.63	4.53	5.43	6.34	7.24	2.21	2.97	3.69	4.45	5.19	5.92	120°					
125	3.07	4.12	5.14	6.14	7.17	8.18	2.84	3.78	4.72	5.66	6.61	7.54	2.31	3.09	3.85	4.63	5.38	6.17	125°					
130	3.19	4.27	5.33	6.38	7.45	8.50	2.95	3.93	4.91	5.89	6.87	7.85	2.40	3.21	4.00	4.82	5.63	6.42	130°					
140	3.44	4.60	5.74	6.87	8.02	9.16	3.18	4.23	5.29	6.34	7.40	8.45	2.58	3.46	4.31	5.19	6.06	6.91	140°					
150	3.68	4.93	6.14	7.36	8.60	9.81	3.41	4.53	5.66	6.80	7.93	9.05	2.77	3.71	4.61	5.56	6.49	7.40	150°					
160	3.94	5.25	6.55	7.85	9.17	10.47	3.63	4.83	6.04	7.25	8.46	9.65	2.95	3.95	4.92	5.93	6.93	7.90	160°					
170	4.18	5.58	6.97	8.34	9.75	11.12	3.86	5.14	6.42	7.70	8.99	10.26	3.14	4.20	5.23	6.30	7.36	8.39	170°					
180	4.42	5.92	7.37	8.83	10.33	11.77	4.08	5.44	6.80	8.15	9.52	10.86	3.32	4.45	5.54	6.67	7.79	8.88	180°					
190	4.67	6.24	7.78	9.32	10.90	12.43	4.31	5.74	7.18	8.61	10.04	11.47	3.51	4.69	5.85	7.04	8.22	9.38	190°					
200	4.91	6.57	8.19	9.83	11.46	13.08	4.54	6.05	7.56	9.06	10.57	12.07	3.69	4.94	6.16	7.41	8.66	9.87	200°					
210	5.15	6.90	8.60	10.31	12.04	13.74	4.77	6.35	7.93	9.51	11.10	12.67	3.87	5.19	6.46	7.78	9.09	10.37	210°					
220	5.40	7.23	9.02	10.80	12.61	14.39	4.99	6.65	8.31	9.97	11.63	13.28	4.06	5.43	6.77	8.15	9.52	10.86	220°					
240	5.90	7.88	9.44	11.78	13.76	15.70	5.44	7.26	9.07	10.88	12.68	14.49	4.42	5.93	7.40	8.89	10.32	11.85	240°					
250	6.14	8.21	9.79	12.27	14.23	16.35	5.67	7.56	9.45	11.33	13.21	15.09	4.62	6.18	7.70	9.26	10.75	12.34	250°					

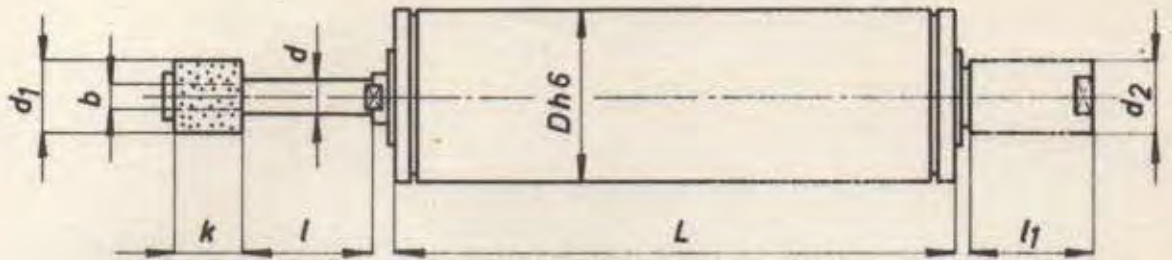


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3



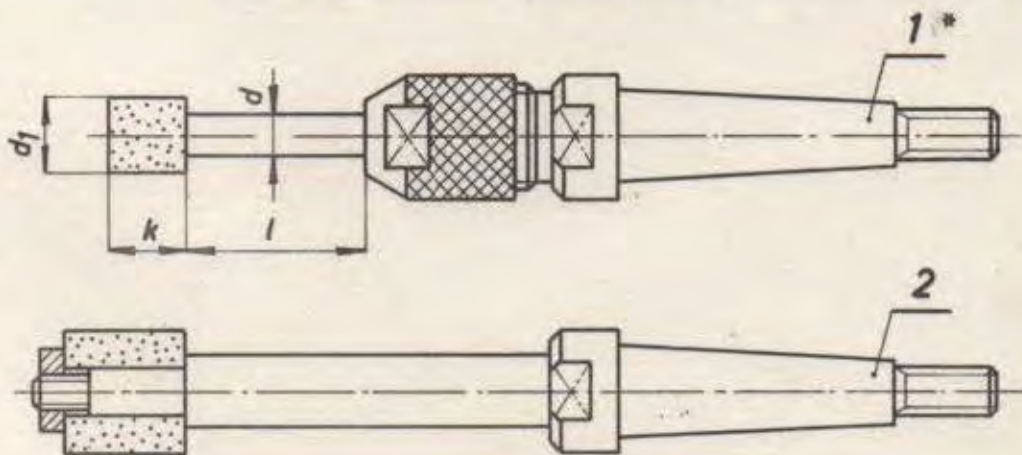
mm

	D h6	L	d	l	d ₁	k	b	d ₂	l ₁
IBC 70 225 T	70	225	6*	25*	10*	10*	-	32	50
			10	48	16	16	6		
			14	70	25	25	10		
IBC 70 250 T	70	250	14	60	25	25	10	40	60
			17	85	32	32	13		

inch

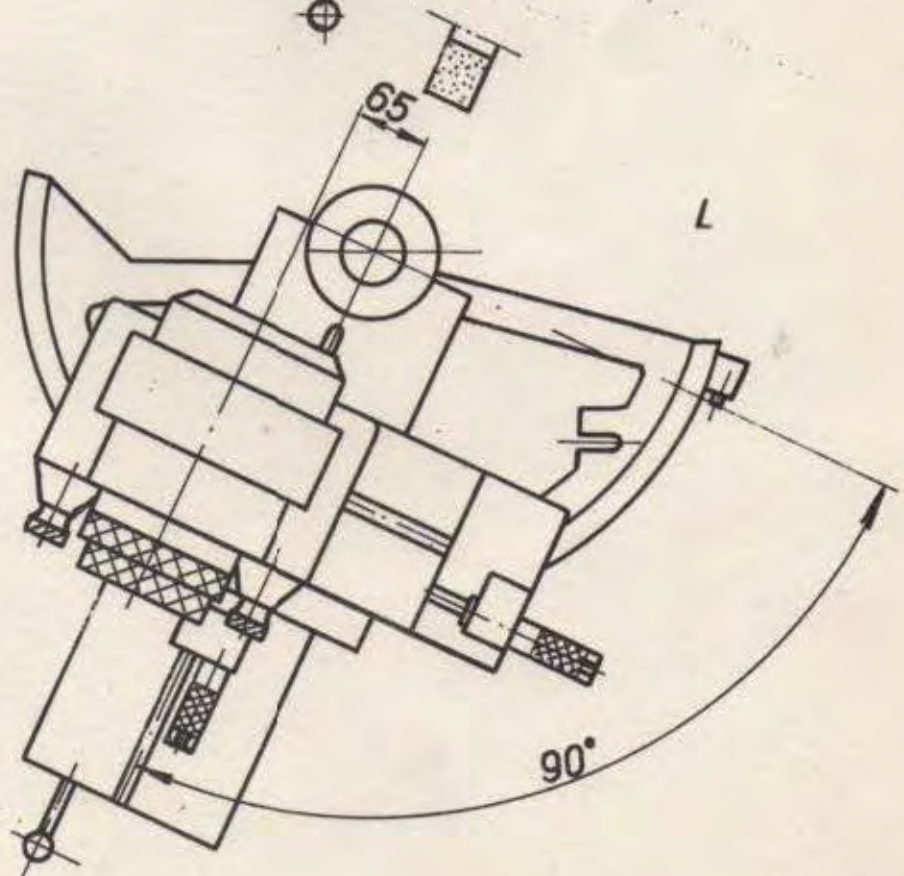
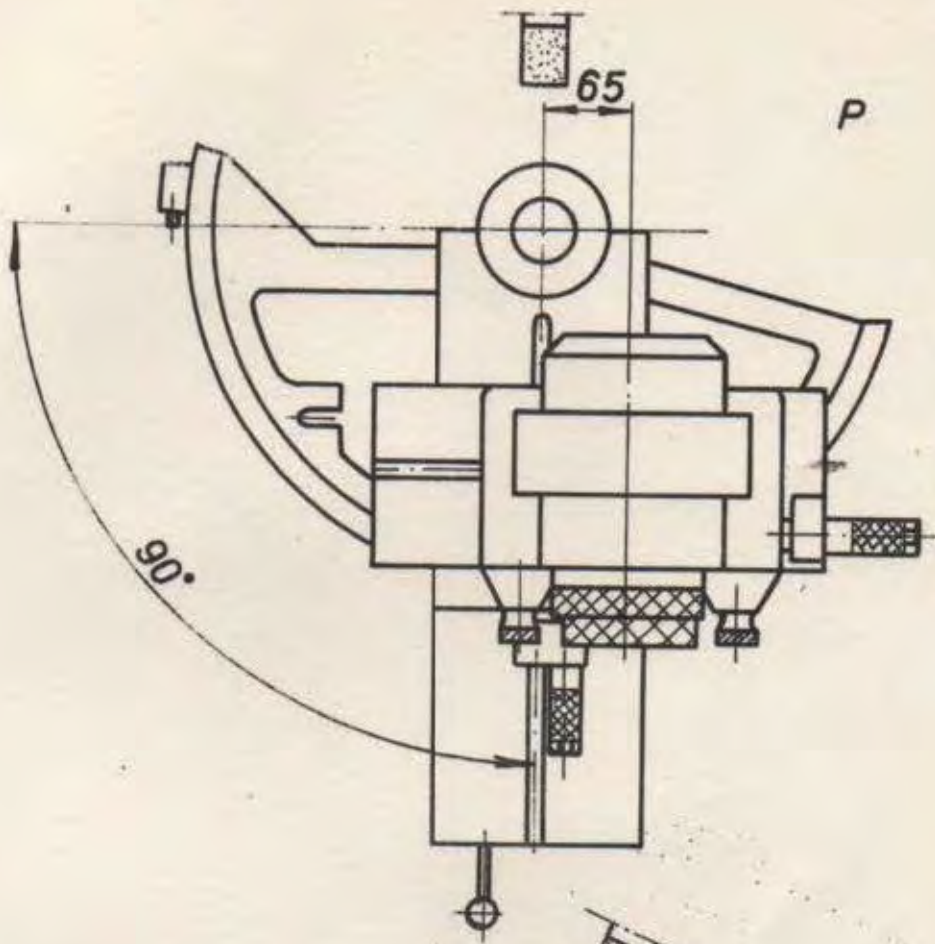
	D h6	L	d	l	d ₁	k	b	d ₂	l ₁
IBC 70-225 T	2,75	8,85	0,23	0,98	0,39	0,39	-	1,25	1,96
			0,39	1,88	0,62	0,62	0,23		
			0,55	2,75	0,98	0,98	0,39		
IBC 70 250 T	2,75	9,84	0,55	2,36	0,98	0,98	0,39	1,57	2,36
			0,66	3,34	1,25	1,25	0,51		

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BN102B





4

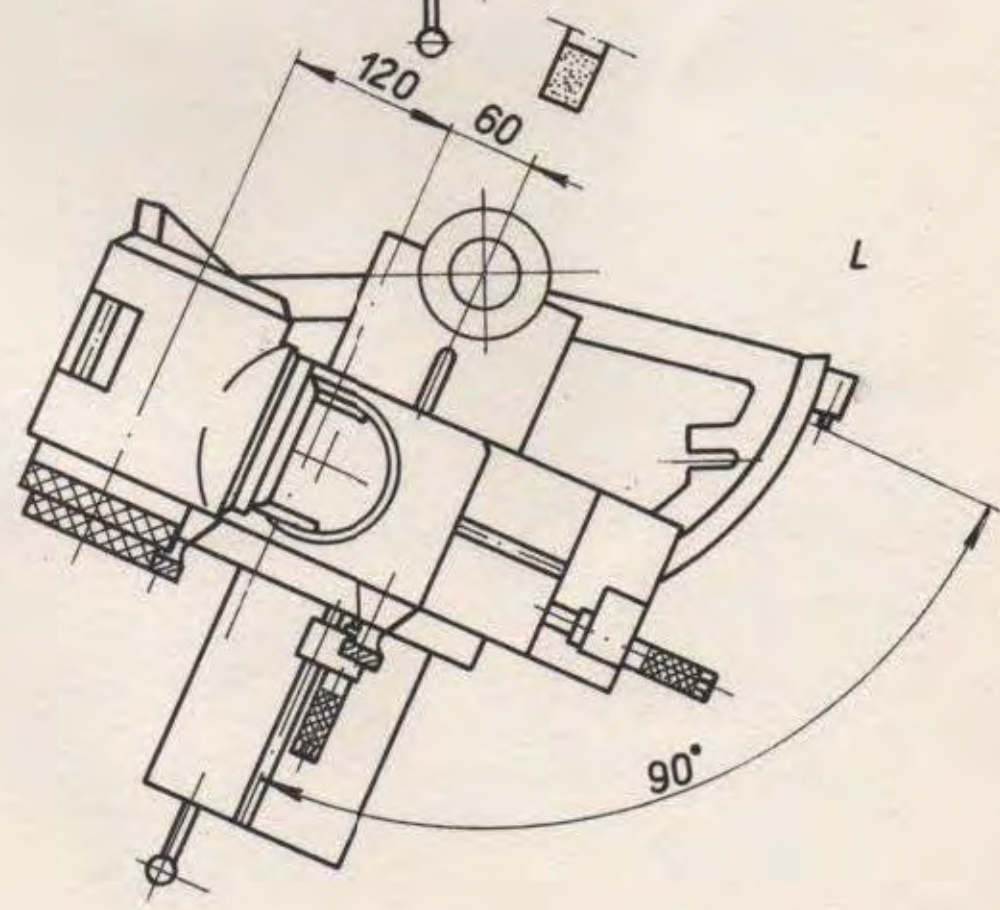
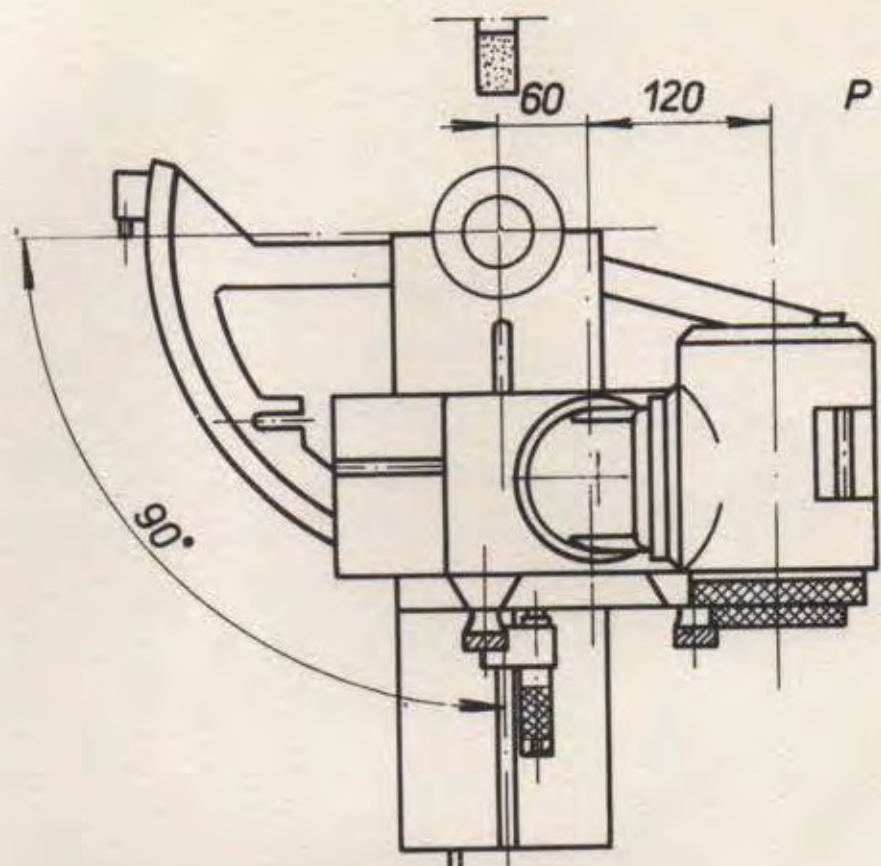


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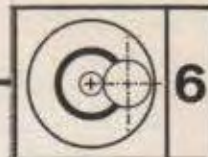




5

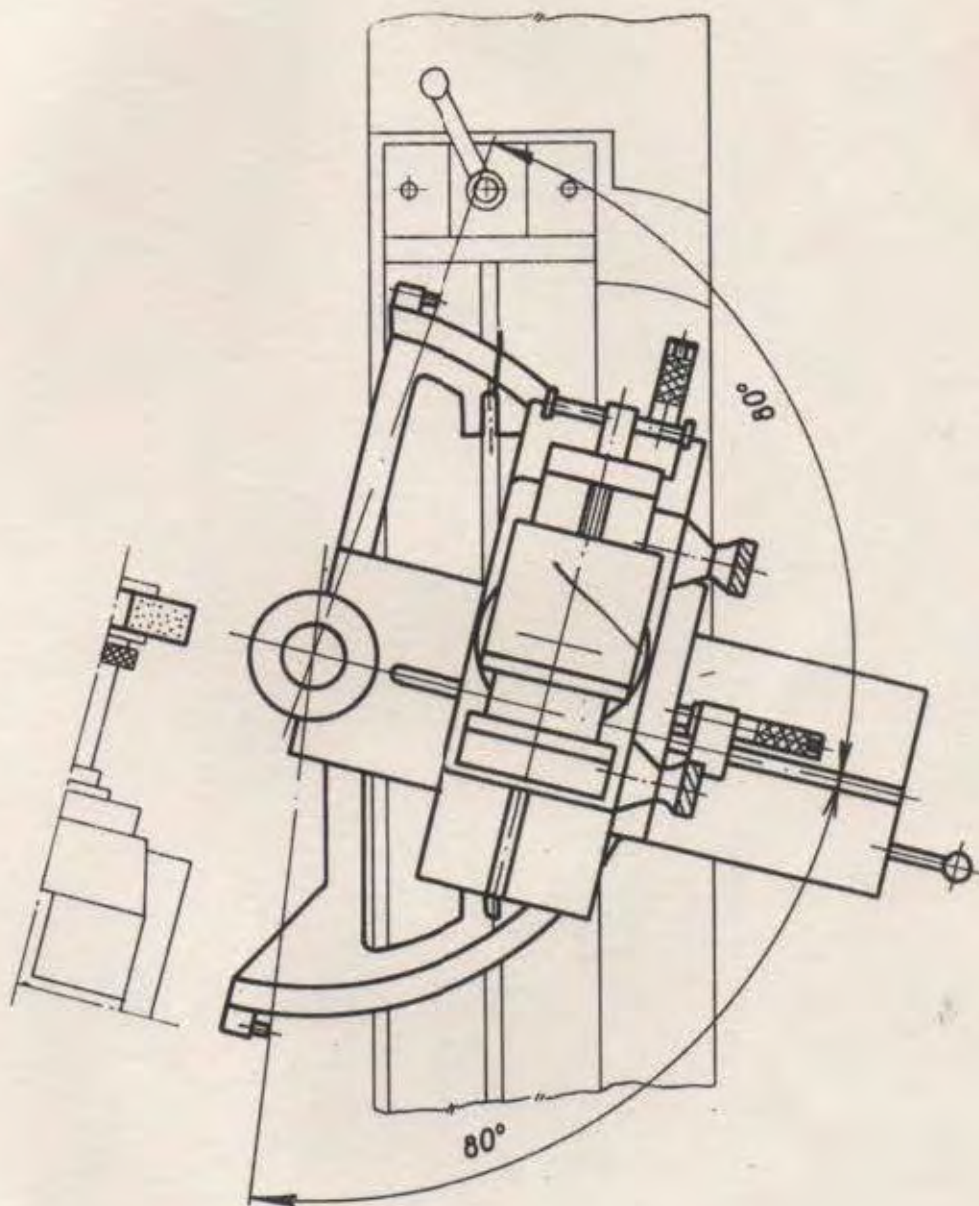


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6

6



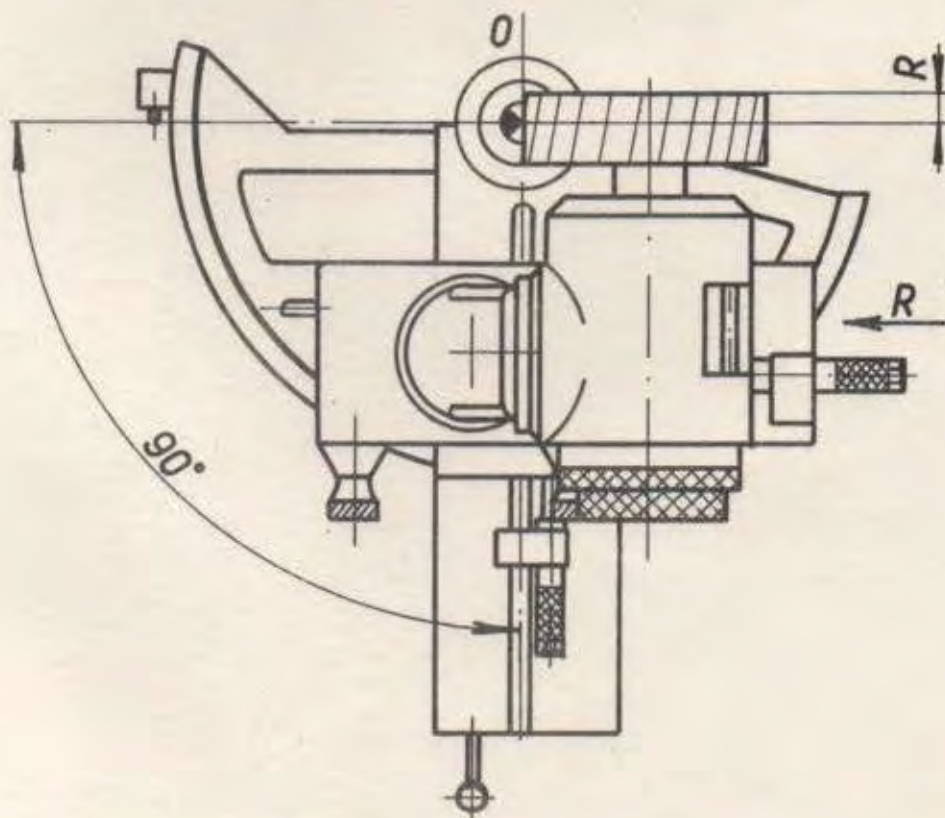
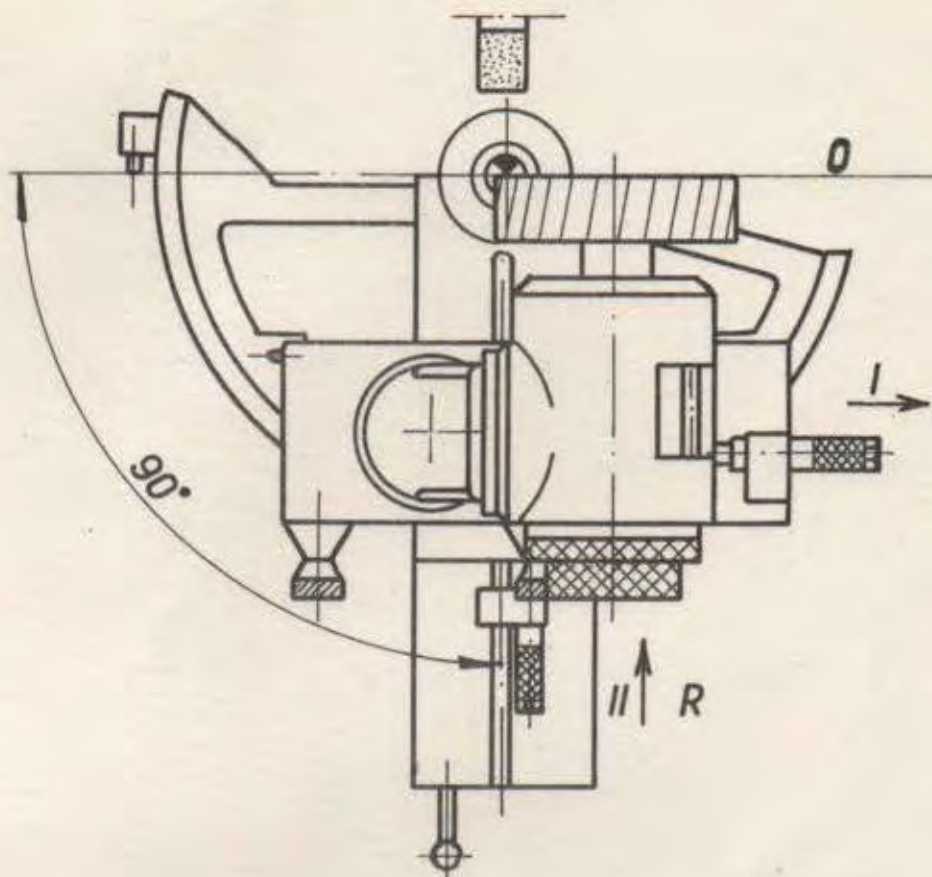
415

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415
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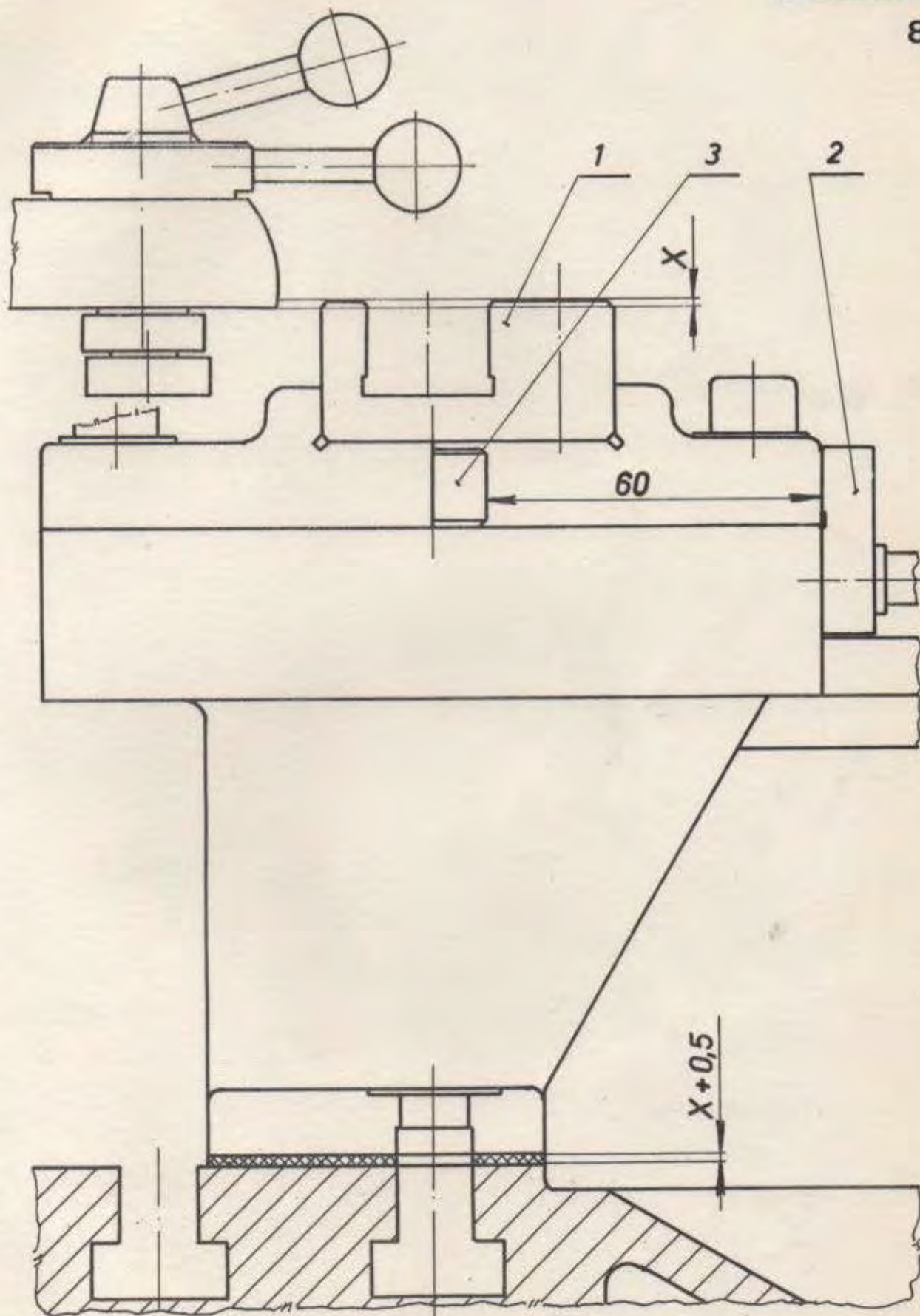
TOS HOSTIVAR

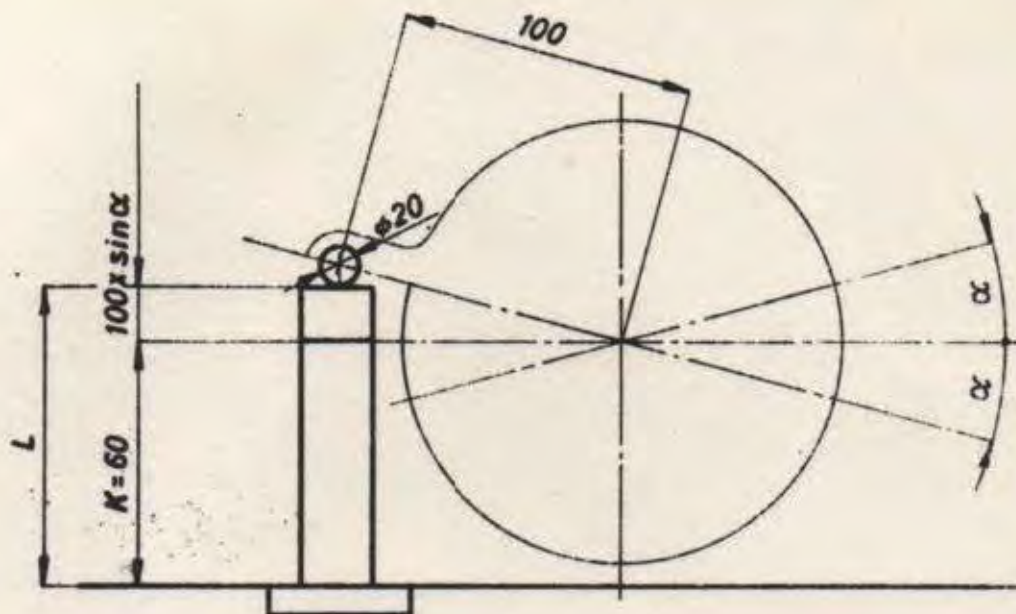


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8





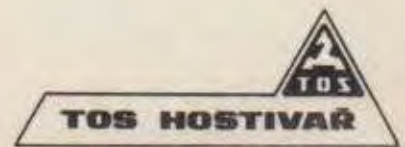
s	α	$100 \cdot \sin \alpha$	s	α	$100 \cdot \sin \alpha$
200	32° 16' 44"	53,404	600	11° 53' 24"	20,603
225	29 18 47	48,958	625	11 25 29	19,807
250	26 48 31	45,101	650	10 59 55	19,078
275	24 40 25	41,744	675	10 36 03	18,396
300	22 50 11	38,810	700	10 13 49	17,760
325	21 14 30	36,230	725	9 53 05	17,166
350	19 50 51	33,952	750	9 33 41	16,610
375	18 37 05	31,926	775	9 15 30	16,088
400	17 31 40	30,116	800	8 58 25	15,598
425	16 33 23	28,496	825	8 42 22	15,136
450	15 40 53	27,088	850	8 27 14	14,701
475	14 53 38	25,703	875	8 12 51	14,287
500	14 10 47	24,496	900	7 59 25	13,900
525	13 31 48	23,395	925	7 46 38	13,532
550	12 56 10	22,386	950	7 34 29	13,181
575	12 23 29	21,459	975	7 22 58	12,820

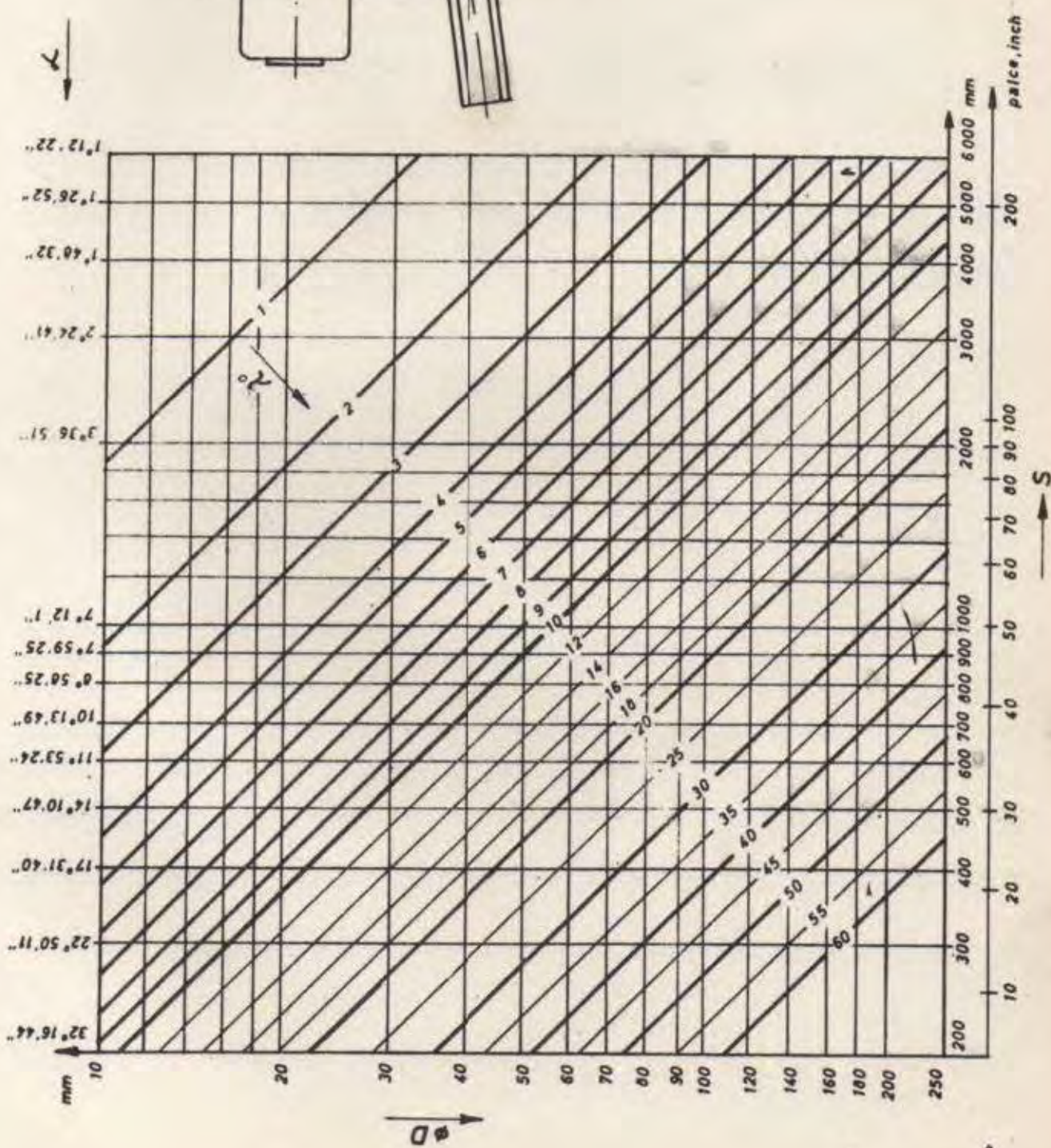
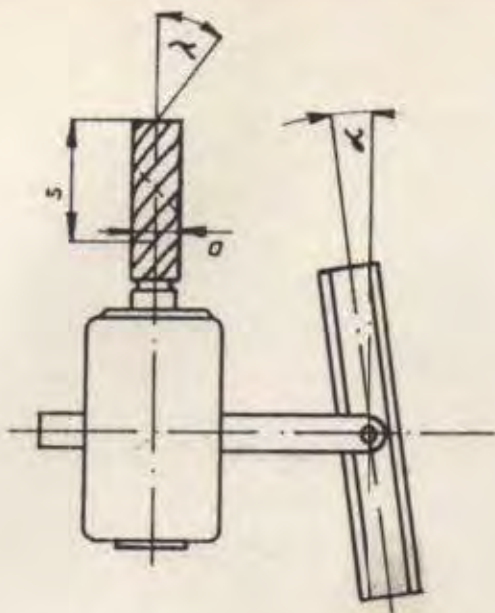
418
BN102B



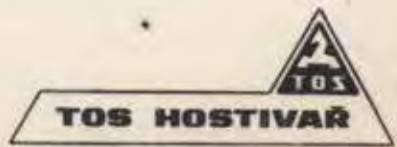
s	α	100 . sin α	s	α	100 . sin α
3800	1° 54' 15"	3,328	4800	1° 30' 27"	2,631
3850	1 52 46	3,280	4850	1 29 31	2,605
3900	1 51 19	3,237	4900	1 28 36	2,577
3950	1 49 55	3,197	4950	1 27 43	2,551
4000	1 48 32	3,157	5000	1 26 52	2,527
4050	1 47 12	3,118	5100	1 25 08	2,476
4100	1 45 53	3,079	5200	1 23 30	2,429
4150	1 44 37	3,042	5300	1 21 55	2,383
4200	1 43 22	3,006	5400	1 20 25	2,339
4250	1 42 09	2,971	5500	1 18 57	2,296
4300	1 40 58	2,937	5600	1 17 32	2,255
4350	1 39 49	2,903	5700	1 16 10	2,215
4400	1 38 48	2,874	5800	1 14 52	2,178
4450	1 37 34	2,838	5900	1 13 37	2,141
4500	1 36 31	2,807	6000	1 12 22	2,100
4550	1 35 26	2,776			
4600	1 34 23	2,745			
4650	1 33 24	2,717			
4700	1 32 22	2,687			
4750	1 31 25	2,659			

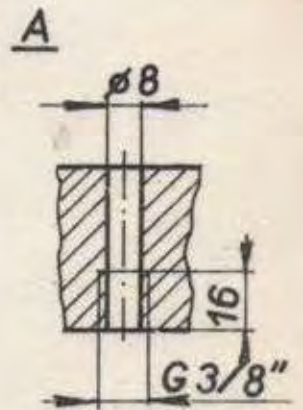
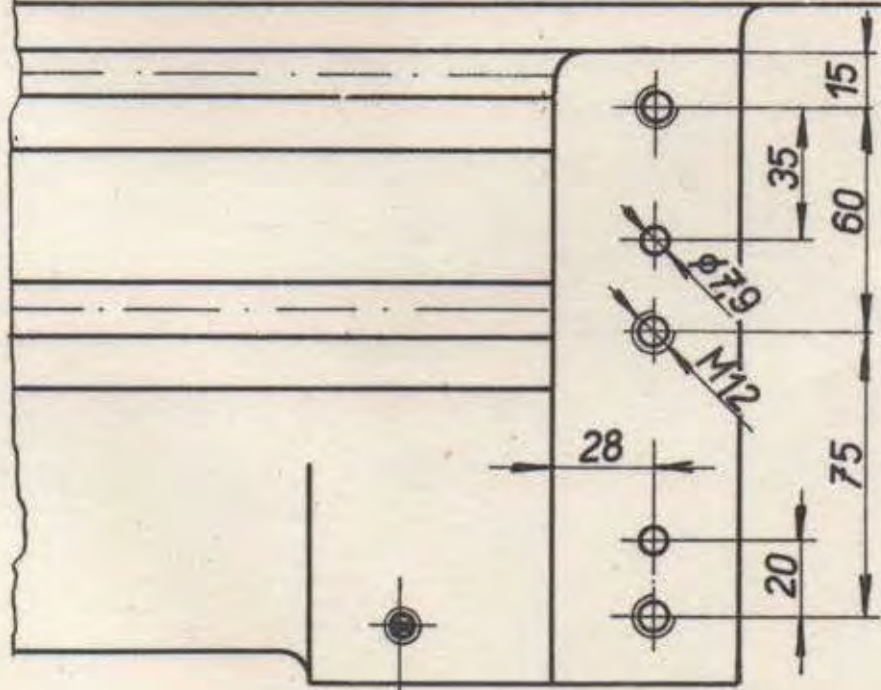
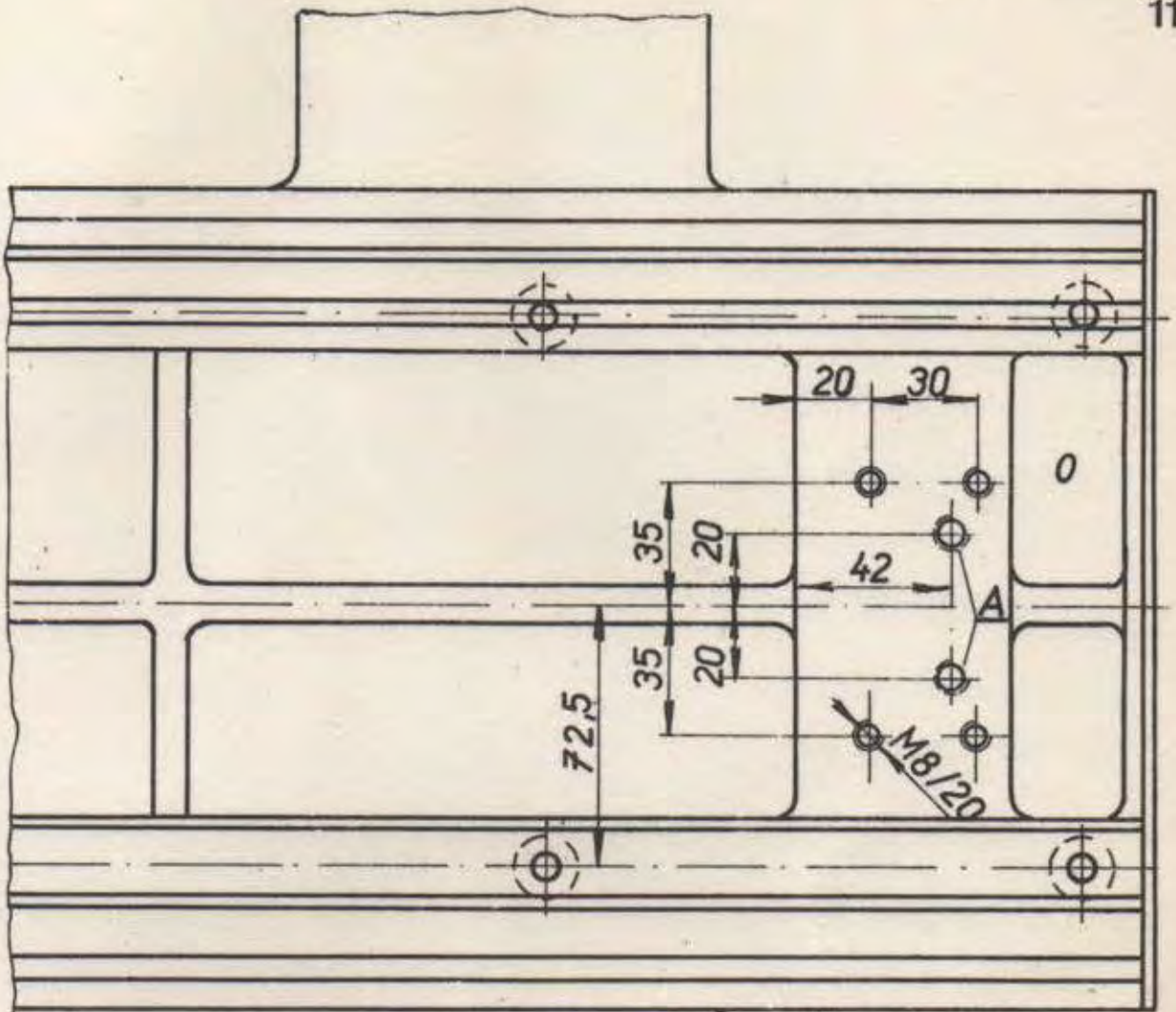
420
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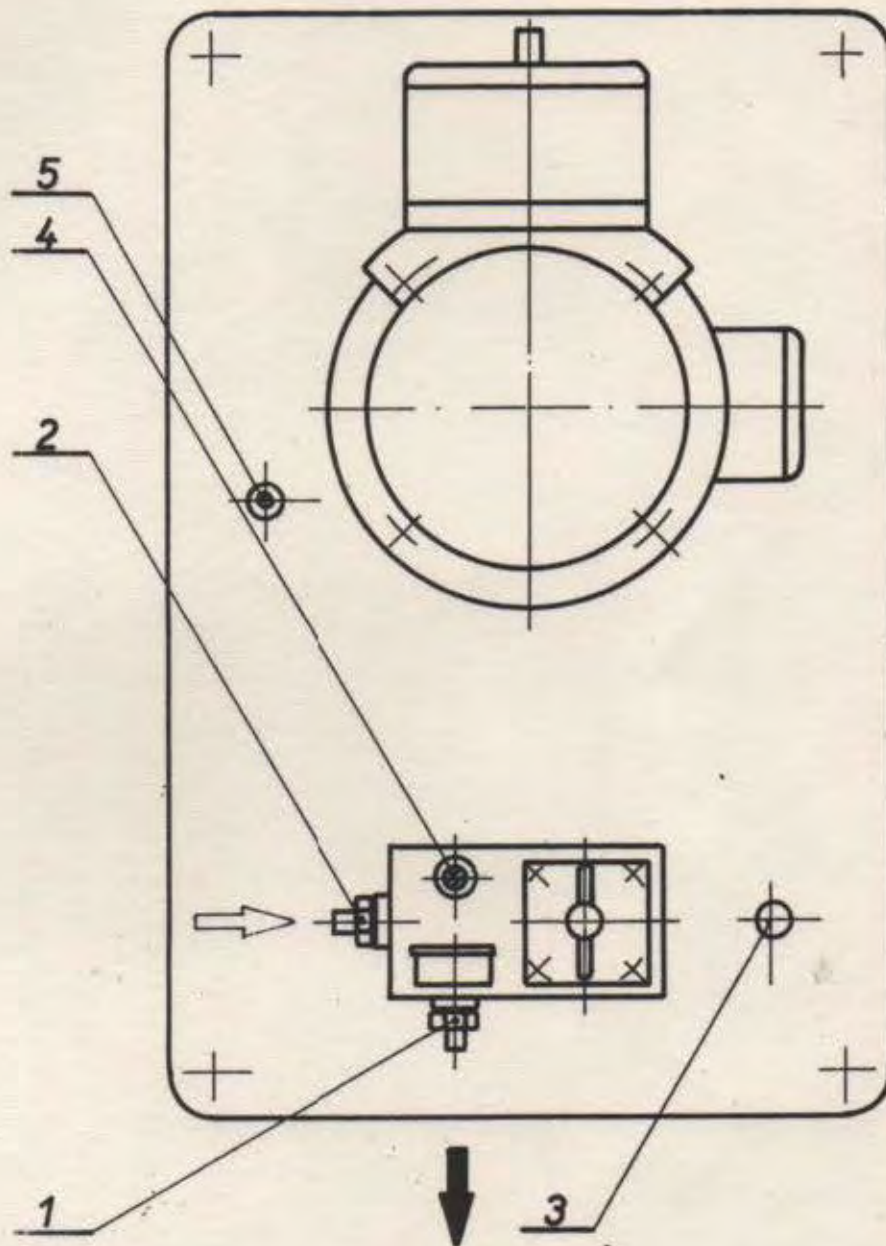
421
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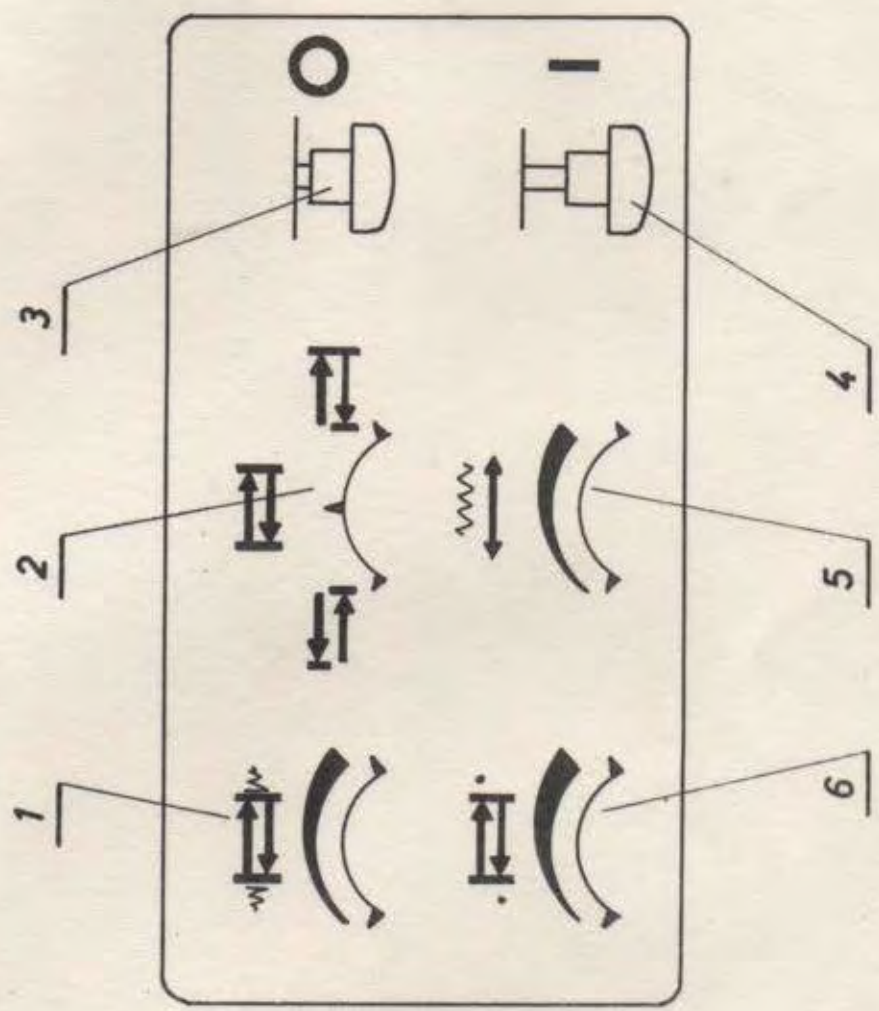


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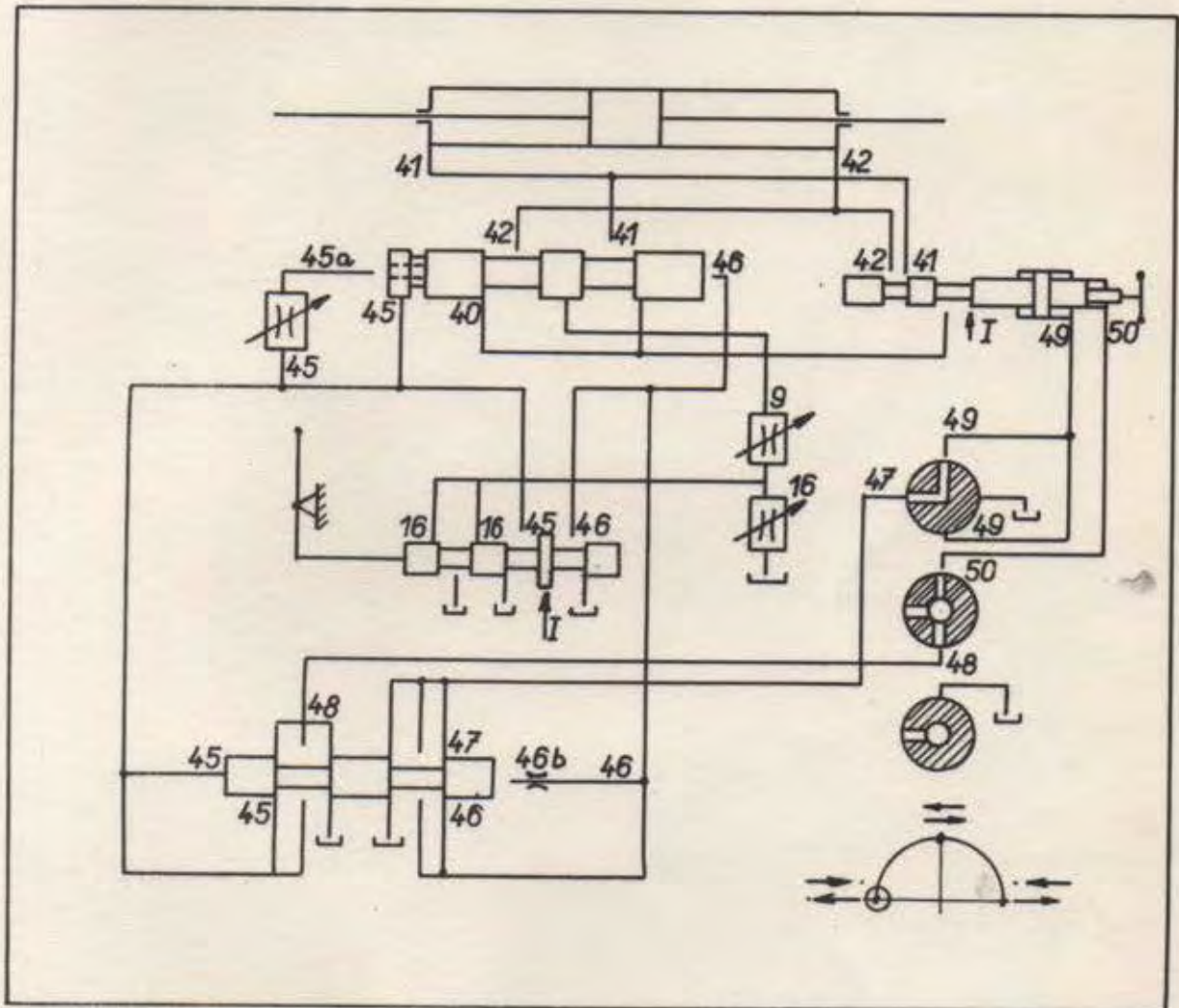


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MAINTENANCE

Instructions for correct handling and maintenance of machine
Machine lubrication
Conversion table of lubricants for grinders
Instructions for ordering replacement parts

SPECIFICATION OF FIGURES

1. Review of lubrication points
2. Leadscrew - replacement part
3. Leadscrew nut - replacement part



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HANDLING AND MAINTENANCE OF MACHINE

To ensure continuous and trouble-free operation of the machine, the following instructions and principles have to be complied with:

1. The entire machine has to be cleared of dust and impurities before the commencement of each shift.
2. The machine has to be lubricated regularly and correctly at specified points and with the specified sort of lubricant.
3. The rotating machine parts must be thoroughly clamped and balanced.
4. Steel and cast iron swarf must be carefully removed in the course of the working shift and must not accumulate on the guideways, from where it might be pressed in between the sliding ways and other contact areas causing scratches and excessive wearing of the machine.
5. Tools must not be put on the guideways of the machine.
6. In machining cast iron, the machine guideways and especially the sliding ways must be protected by covers because mixture of cast iron dust and oil has a detrimental effect on them.
7. The machine must never be cleaned with compressed air because compressed air drives minute chips between the movable machine parts, thus hampering the smooth run of the machine and threatening its accuracy and cutting down considerably the length of its life.
8. Great care must be devoted to strict adherence to the operation instructions given in this manual.
9. Daily inspection, cleaning and lubrication of the machine must become the basic duty of the responsible machine attendant.
10. At the end of each work shift, especially before a holiday, the machine has to be cleaned with care and everything put in order.

If these instructions and hints are strictly followed, the machine will work to your full satisfaction. Moreover, you will thus avoid unnecessary damage that might disturb its function and/or put it out of operation altogether.

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MACHINE LUBRICATION

Illustration- Chapter 7, Fig. 1

The bearings of the wheelhead are lubricated with SP 2 grease. The machine being run on two shifts per day, this grease need not be replaced earlier than after one year. The first grease is charged in the bearings in the manufacturing works. After one year of operation, it is recommended to dismount the bearings, wash them in petrol, clean them dry, charge them with fresh grease and assemble them again. In assembling them, care has to be taken that the bearings and respective distance rings are not interchanged. It may be noted that they are set with precision.

In the event of an abnormal loading of the machine, it is recommended to replace the grease after six months of operation. After the bearings have been cleaned and fresh grease charged, the spindle should be run-in and its temperature checked us the same way as when replacing the spindle bearings.

Note: it is advisable to study the part of the manual headed "Wheelhead", in chapter 1, before dismounting the spindle bearings.

The bearings of the motors are lubricated with V3 grease. It is recommended to clean them and charge them with fresh grease once a year.

The other antifriction bearings, such as the bearings of the workhead, etc., are lubricated with V3 grease as well. The life of the grease filling is long.

The sliding surfaces are lubricated with oil S-4.7°E/50°C. It is recommended to lubricate them before the commencement of every shift. Lubrication is effected by a pressure lubricator. The lubrication points are marked in red.

Antifriction ways of tables

The prismatic and flat ways of the tables are lubricated from an oil reservoir in the slide, by means of wicks. The machine is delivered by the manufacturer without the respective oil filling. It is recommended to charge the reservoirs with oil before assembling the antifriction ways of the tables. At the same time, it is necessary to form an oil film on the guide ways.

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For lubrication S-4.7⁰E/50⁰C oil is used. The oil filling has to be checked and oil added once a month. In addition, it is recommended to take off the tables once a year, to clean the ways and rollers with petrol, to dry them, to provide a new oil film and to assemble all the parts again.

Wheelhead bearings	grease SP 2	once a year
Motor bearings	grease V 3	once a year
Other antifriction bearings	grease V 3	long-term lubrication
Sliding surfaces and plain bearings	oil S	each working shift
Antifriction ways of tables	oil S	once a month

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Lubricant Type, Application	RENFINA - CSSR	MOBILLOIL	SHELL	BP	ESSO
Spindle oil, extra light, special oiliness quality	1.3-1.5°E 20°C				
Plain bearings of the wheelhead spindle /for bearings of plane surface grinding machines to be diluted with kerosene if necessary, approx. 1:1/	PO 3.9-6.2 c St 20°C JO 2.6-3.8 c St 100°F 35-38.5 SUS 100°F	VELOCITE No.3	TELLUS 11	ENERGOL HP 0 ENERGOL HP 1	SPINESSO 28
Spindle oil light	1.4-1.8°E 50°C				
Plain bearings of the wheelhead spindle /with greater clearance/ Plain bearings of the workhead spindle - antifriction bearings of internal grinding spindles	J1 5.9 c St 50°C 7-13.5 c St 100°F 49-72 SUS 100°F	VELOCITE No.6	TELLUS 15	ENERGOL HP 3	SPINESSO 34
Spindle oil regular	2.3-2.9°E 50°C				
Antifriction bearings of the workhead spindle Antifriction bearings of the wheelhead spindle of tool and cutter grinding machines	J2 15-20 c St 50°C 24.5-34 c St 100°F 117-159 SUS 100°F	VACTRA L DTE L VELOCITE C	VITREA 21 TELLUS 23	ENERGOL HP 10 ENERGOL HL 65	MILLCOT 42 TERESSO 43
General purpose machine oil	4.5-5°E 50°C				
Gear box sliding surfaces and other lubricating points	J4 33-37 c St 50°C 60-69 c St 100°F 280-320 SUS 100°F	VACTRA HM DTE HM	VITREA 33 TELLUS 33	ENERGOL HP 20 ENERGOL HL 100	MILLCOT 48 TERESSO 52
Hydraulic oil light	2.3-2.9°E 50°C				
Hydraulic system	J2 15-20 c St 50°C 24.5-34 c St 100°F 117-159 SUS 100°F	DTE L VELOCITE C	TELLUS 23	ENERGOL HL 65	TERESSO 43
Hydraulic oil medium	2.9-3.5°E 50°C				
Hydraulic system with hydromotor circulation system /for centreless grinders model BB 6, BB 10, BBJ 6/	T3C 20-25 c St 50°C 34-44 c St 100°F 159-204 SUS 100°F	DTE M	TELLUS 27	ENERGOL HL 80	TERESSO 47
Way lubricant light, special oiliness and anti-stick-slip quality	4.2-5°E 50°C				
Sliding surfaces of table and slide	P4 31-37 c St 50°C 56-69 c St 100°F 260-320 SUS 100°F	VACTRA No.2	TOMNA 33	ENERGOL HP 20-0	FEBIS K 53
Way lubricant heavy, special oiliness and anti-stick-slip quality	9.5-10°E 50°C				
Sliding surfaces of table /if heavily loaded/	P8 72-76 c St 50°C 148-158 c St 100°F 686-732 SUS 100°F	VACTRA No.4	TOMNA 72	ENERGOL HP 60-C	FEBIS K 73
General purpose grease	Lubricant grease V 2				
Antifriction bearings, e.g. of motors, etc.		MOBILUX GREASE No.2	ALVANIA 2	ENERGREASE LS 2	BEACON No.2

RECOMMENDED LUBRICANTS FOR GRINDING MACHINES





INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS

In case of a break-down of the grinder due to unexpected damage to some of the working parts, your orders for replacement parts should be addressed to the sales department of the manufacturing works.



1. In your order for replacement parts please state:
 - a) name of the machine and its type designation
 - b) production number of the machine
 - c) number of parts required, their denomination and position numbers as given in the present catalogue.
2. When ordering the replacement electrical instruments, please state - in addition to the denomination and type designation of the instruments - the operating voltage and frequency. It is recommended to give the data given on the respective name plates.
3. If you require parts that are not included in the present catalogue, it is advisable to state the number stamped on the part, or to make a small sketch of the part, adding to it the main dimensions and application of the part.

Technically clear orders will facilitate and speed up the prompt delivery of replacement parts and will avoid unpleasant misunderstandings.

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SPARE PARTS RECOMMENDED FOR 2-YEAR'S OPERATION

Illustration - Chapter 7, Fig. 2, 3

Machine Group	Name and Pos. No. of Part	Illustration	Weight kg	Q-ty
Wheelhead	Flat belt 1 02 09 049	30x0,5x2100	0.05	1
Slide-column	Leadscrew 1 03 04 020		5	1
Slide-column	Leadscrew nut 1 03 04 021		2	1

SELECTED AND MOSTLY USED PARTS OF STANDARD EQUIPMENT

Name and dimensions of part	Pos. No.
Arbor of grinding wheel - dia. 15 x 5 mm (0.59 x 0.19 in)	1 03 07 005
Arbor of grinding wheel - dia. 16 x 65 mm (0.62 x 2.55 in)	1 03 07 006
Arbor of grinding wheel - dia. 15 x 125 mm (0.59 x 4.92 in)	1 03 07 007
Nut for fixing flanges of grinding wheels	1 03 07 004
Clamping fixture of arbors - complete	1 03 07 001
Flange of grinding wheel - dia. 20/40 mm - compl. (0.78/1.57 in)	1 03 07 011
Flange of grinding wheel - dia. 20/45 mm - compl. (0.78/1.77 in)	1 03 07 012
Flange of grinding wheel - dia. 20/60 mm - compl. (0.78/2.36 in)	1 03 07 013
Screw for fixing tools with ISA taper - complete	1 03 07 082
Reducing socket Morse 5/4	1 03 05 019
Reducing socket Morse 5/3	1 03 05 020
Reducing socket Morse 5/2	1 03 05 021
Reducing socket ISA 50/40	1 03 05 022

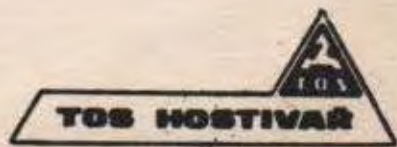
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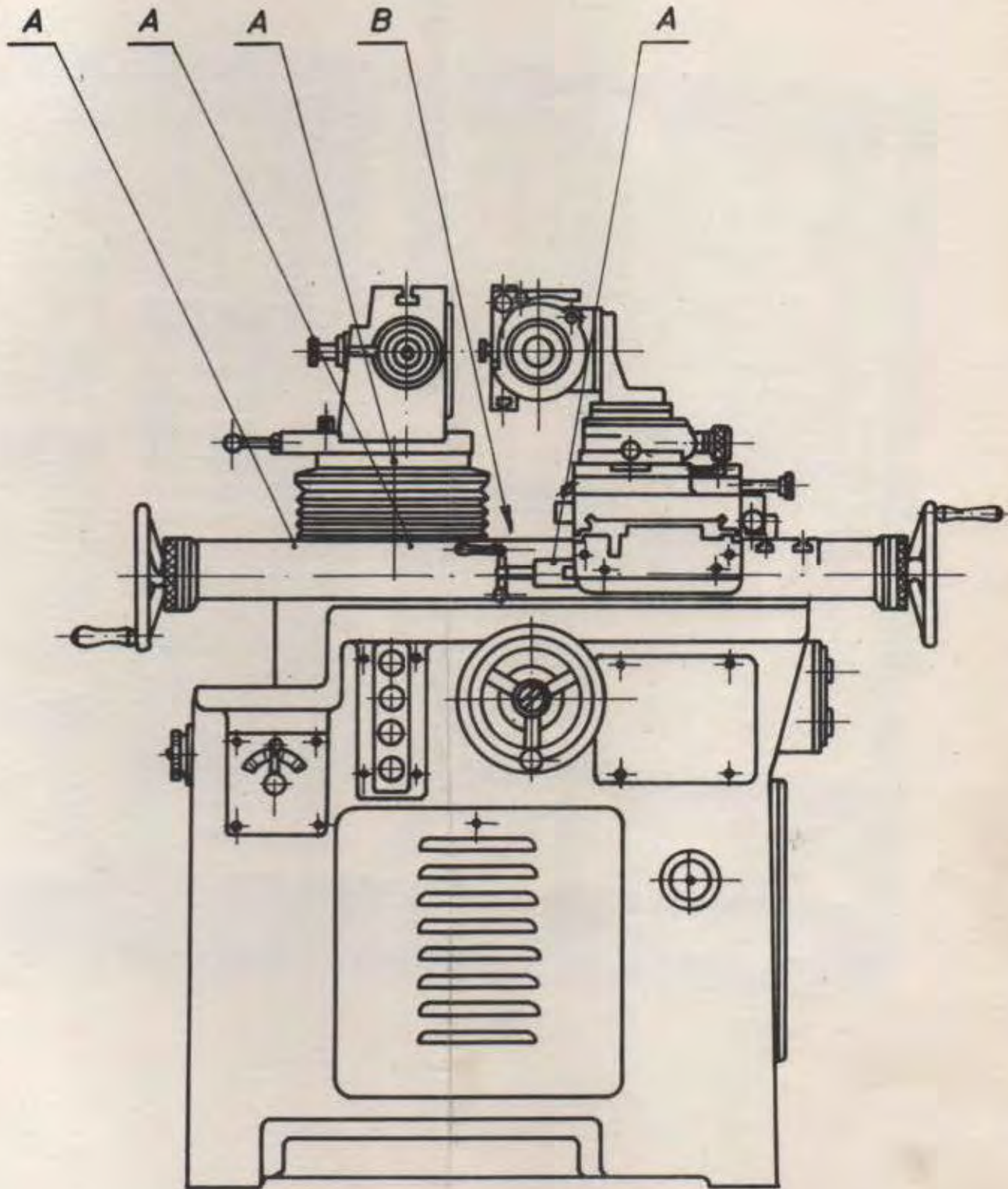
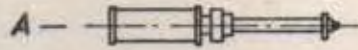


BEARINGS

Machine Group	Bearing Number		Quantity
	CSN, SKF	GOST	
Wheelhead	A 7207 AT	GPZ 36207	4
Slide - tables	6204	GPZ 204	1
Slide - tables	51105	GPZ 8105	2
Workhead	A 6015	GPZ 115	2
Cylindrical grinding attachment - workhead	A 6015	GPZ 115	2
	6005	GPZ 105	1
	6004	GPZ 104	3
	6001	GPZ 101	1
	6000	GPZ 100	1
Radius grinding attachment	EL 4	GPZ 24	2
	6008	GPZ 108	2
Attachment for grinding tools with helical flutes (hob sharpening attachment)	EL 8	GPZ 18	1
	R 7	GPZ 27	1
	6003	-	1
	6004	GPZ 104	1
	A 6015	GPZ 115	2

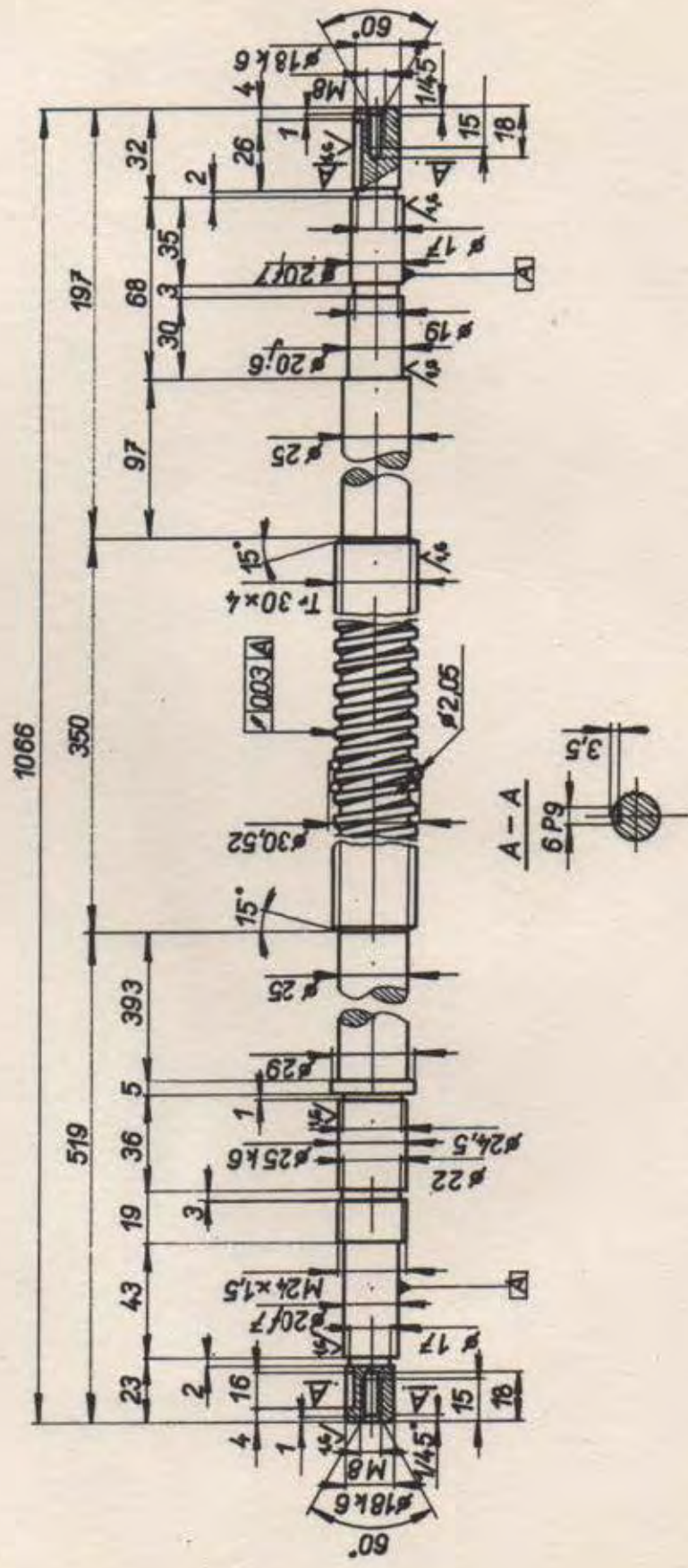
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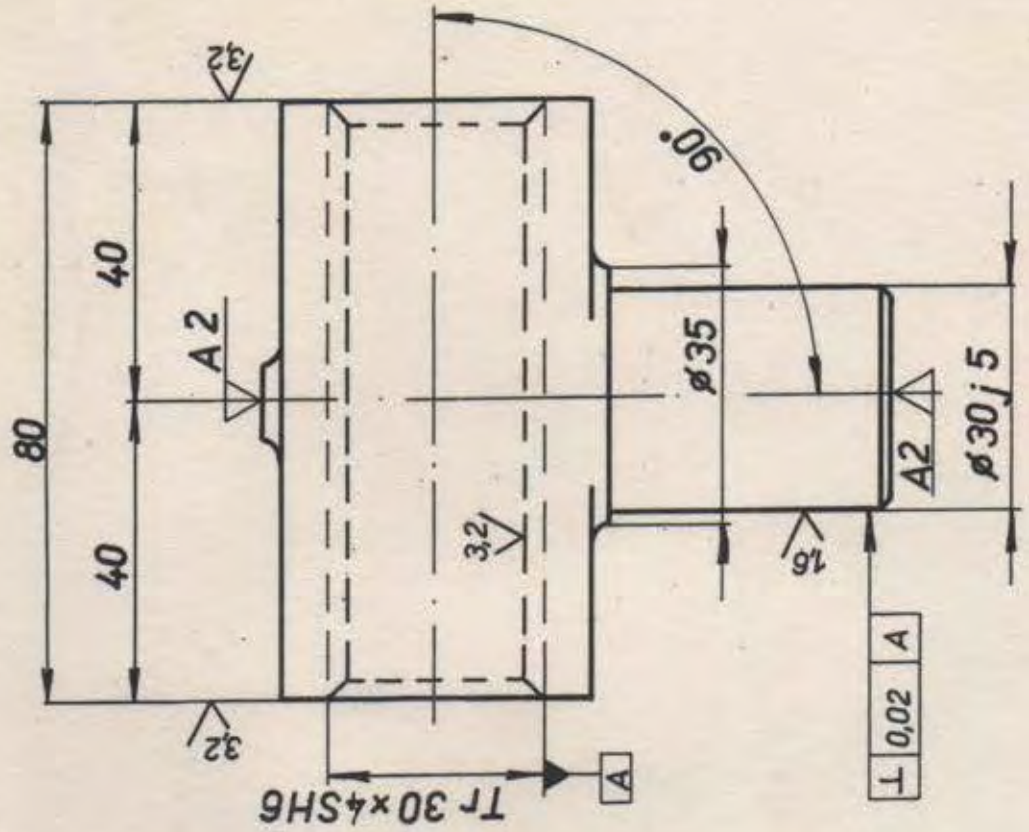


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Registration No:

TEST CHART

for Tool and Cutter Grinders

048726

Serial No:

TOS Středokluky

Factory:

Commission No: **4-19-113-2-77.073**

BW 102 B

Type and Mark:

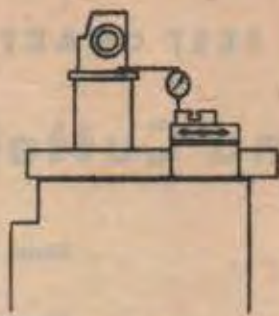
Order No:

# EZ	Test to be applied:	Deviation mm:	
		permissible	measured
1	Work table: Table parallel with wheel spindle	0,02 per 300 mm	0,02
2	Transverse movement of table parallel with table surface	0,01 per 100 mm	0,01
3a	Longitudinal movement of table parallel with upper surface of table	0,01 per 300 mm	0,01
3b	Ditto, with front surface of table	0,01 per 300 mm	0,01
4	Pillar: Guide for pillar square with table in plane through longitudinal axis of table	0,03 per 100 mm	0,03
5	Ditto, in plane perpendicular to said plane	0,03 per 100 mm	0,02
6	Universal head and right hand tailstock: Taper of work head spindle runs true; maximum amount by which mandrel 100 mm long (about 4 in.) runs out of truth	0,01	0,01
7a	Tailstock spindle parallel with table in vertical plane	0,01 per 100 mm	0,01
7b	Ditto, in horizontal plane	0,01 per 100 mm	0,01
8a	Tailstock axis in line with work head axis in vertical plane (work head previously to be set parallel with table and T-slot)	0,02	0,02
8b	Ditto, in horizontal plane	0,02	0,02
9a	Left Hand Tailstock: Tailstock spindle parallel with table in vertical plane	0,01 per 100 mm	0,01
9b	Ditto, in horizontal plane	0,01 per 100 mm	0,01
10a	Tailstock axes in line with each other in vertical plane	0,02	0,02
10b	Ditto in horizontal plane	0,02	0,02
11a	Wheel spindle: Wheel spindle for true running	0,01	0,01
11b	Wheel spindle for axial slip	0,01	0,01
12a	Center gauge and wheel spindle axis at same distance with respect to upper surface of wheel head	0,1	0,1
12b	Center gauge and tailstock axis at same height with respect to table surface	0,1	0,1

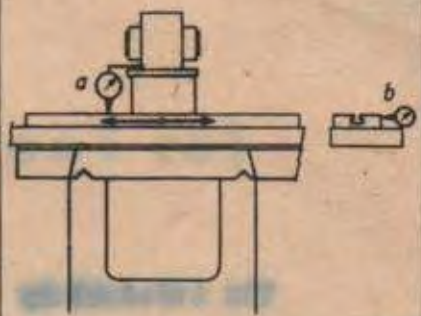
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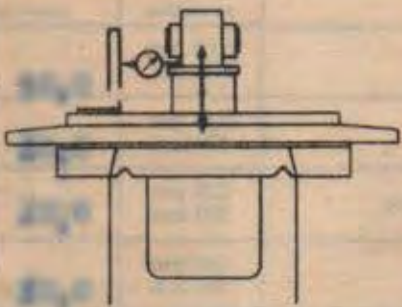
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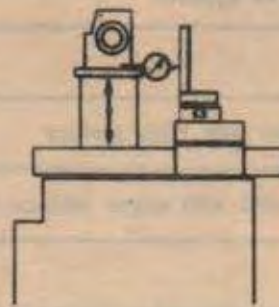
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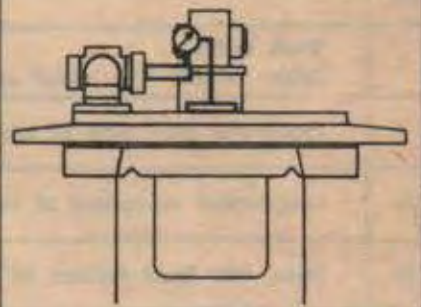
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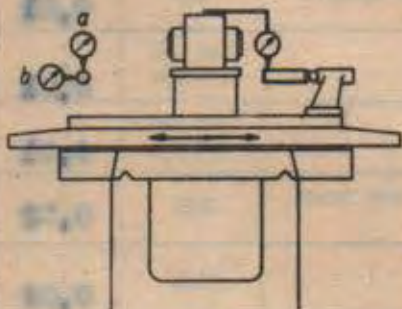
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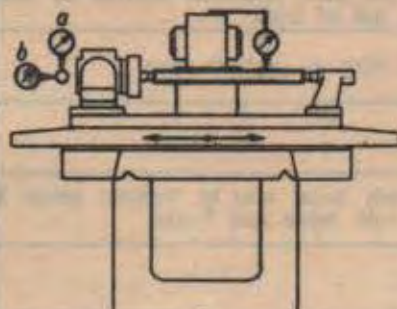
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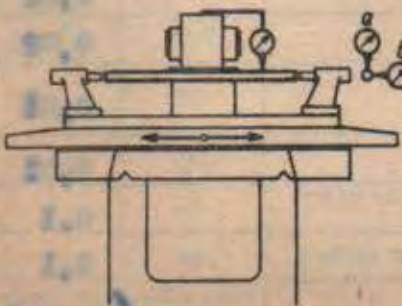
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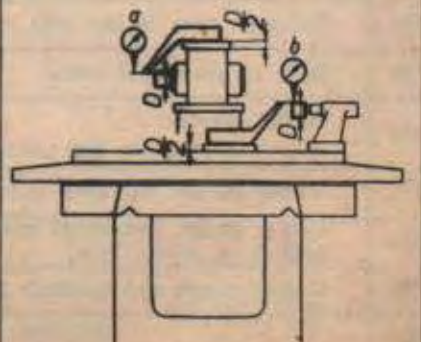
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BELT-DRIVE SPINDLES



INSTRUCTION MANUAL

I N S T R U C T I O N M A N U A L

BELT-DRIVE

SPINDLES



This instruction manual is intended in the first place for the workers entrusted with the maintenance of spindles and for the operators of grinding machines equipped with the spindles concerned.

We are continually improving our products and for this reason the descriptions, illustrations and any other data given herewith are not binding and may differ from actual spindle specification.

**CZECH MOTORCYCLE WORKS NATIONAL CORPORATION
STRAKONICE**

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Lubrication	4
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Preparing the bearings for fitting	5
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INTRODUCTION

The standard lines of belt-drive, internal grinding spindles type IBB, IBC, IBE and IBD, are intended for grinding holes within a wide range of diameters and lengths. The spindles are built into models and sizes enabling a suitable type to be selected for applications in both lot and piece production. The speed range allows economical grinding at the most favourable surface cutting speed. The spindles have been designed with a view to a high grinding efficiency and a high precision of the ground bore.

DESCRIPTION OF SPINDLES

The spindle shaft is supported in high-precision, high-speed, angular-contact ball bearings. The bearing clearance is eliminated by the action of a spring. Although the spindle construction is simple and the bearing change relatively easy, it is not recommended to change the bearings in your shop. The installation of bearings requires special skill and for that reason it is recommended to send the grinding spindle for repair to the manufacturing works.

An economical grinding process is contingent on the correct choice of the spindle type and size. The size of both the grinding spindle and the wheel extension should be the largest possible and the length should be small so that the highest rigidity of the whole is obtained. The spindles as delivered are right-handed (running clockwise when viewed from the belt sheave end).

The direction of rotation is indicated by an arrow on the spindle casing. Left-handed spindles are available on special order.

SPINDLE OPERATION

Setting into Operation:

Prior to inserting the grinding spindle into the holder, clean the holder bore and the spindle surface thoroughly. Remove the M 10 x 1 screw plug of oil mist-lubricated spindles only when installing the latter and attach the oil mist inlet line immediately on mounting the spindle into the holder. The lubrication port must never be left unprotected. When mounting the spindle, do not tighten excessively the holder nor the sleeve in order to prevent the spindle casing becoming distorted.

Prior to starting the operation of the spindle, leave the oil mist lubrication working for about 10 minutes. Check the spindle running direction which should be as indicated by an arrow on the casing. **Starting in the incorrect direction might cause the wheel or the belt sheave to work loose.**

The spindle must not be operated at a speed exceeding the speed rating given on the casing. The spindle sheave sizes have been calculated for a motor speed $n = 2865$ rpm, and for a motor sheave diameter $D = 220$ mm. The spindle will run at the correct speed if the above conditions are adhered to. The motor sheave diameter for motors with other than the specified speed can be calculated from the formula

$$D = \frac{630,000}{n}$$

Axial Preloading:

Should the spindle running become unsatisfactory, loosen the thrust screw 32 and the two set screws 33 and pushing against the sheave end while at the same time revolving the shaft, spring the latter axially several times. In this way, the bearing clearance is eliminated and the spring restores the required axial preloading of the bearings. Then retighten the two screws 33 and slightly tighten the oblique screw 32. If no improvement is obtained by this procedure, it is necessary to change the bearings.

Drive:

The spindle drive is effected by means of woven or plastic flat belts. The flat belt must be of high quality with a uniform cross section and minimum seam.

The belt tension should be just high enough to transmit the required motor power. It is necessary to retension the driving belt since it stretches owing to warming up while running. When it is envisaged that the spindle will be left non-operating for a longer period of time, it is necessary to remove the belt as it would otherwise strain the spindle owing to contraction. To remove the belt, slacken it first by shifting the driving motor or the spindle holder, as the case may be. When withdrawn sideways, the belt twists and will no longer run smoothly. Utilization of high-grade belts extend the service life of the spindles and improves their running, thus influencing directly the precision of the ground bore and the surface finish.

Special attention should be paid to the driving motor. For routine grinding, motors complying with the standard ON 35 0336, quality grade Q II, will do. These motors, however, show too high a vibration rate for precision grinding. It is, therefore, necessary to have the motors dynamically balanced or to utilize the MB-line, precision electric motors as made by the CZM at Strakonice.

It is necessary to take care even how the motor is mounted on the machine. It is not advisable to put resilient pads under the motor base. It is better to provide a perfect seating of the base by scraping, if necessary.

LUBRICATION

The belt-drive spindles are lubricated with oil mist or with lubrication grease. Oil mist lubrication is effected by means of the MP3 mist producer constructed by ČZM Strakonice. The operation of the device is fully described in a special instruction manual. The spindles should be lubricated with high-grade bearing oil of a viscosity of 15–20 cSt at 50 °C, as, e. g. grade OL–J2 ČSN 65 6610.

The attending of grease-lubricated spindles is largely simplified. The grease filling will last the entire bearing service life. The grease-lubricated spindles are identified by a capital T after the spindle type designation.

The CZ belt-drive spindles are lubricated with Shell Alvania R3 grease. Another suitable grease is Klüber Isoflex LDS 18 Super.

Procedure of bearing lubrication with Shell Alvania R3 grease:

- treat the bearings as indicated in the paragraph „Preparing of Bearings for Fitting“;
- let oil drip out of the bearings at a dustfree place (make sure that no oil left between the cage and the races);
- fill as much as a fourth or a third part of the bearing inner space with Shell Alvania R3 grease. Force the grease between the balls along the whole cage periphery and rotate the bearing to bring the grease on the raceways;
- rub all parts of the spindle with bearing (OL–J2) oil;
- fill the labyrinth grooves in the nuts underneath the end caps entirely with the same grease as used in the bearings.

When utilizing the Klüber Isoflex LDS 18 Super grease for bearing lubrication, proceed in the same manner as in case of the Shell Alvania R3 grease but be more careful that the oil drips out perfectly from the bearing. The recommended grease for filling of the labyrinths in the nuts is the Shell Alvania R3 or any similar water-resisting grease.

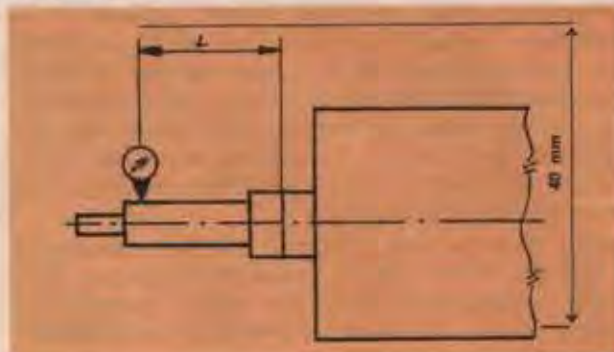
Bearings lubricated in the manner described above do not require additional lubrication in the course of operation.

WHEEL EXTENSIONS OF IBC SPINDLES

The grinding wheel extensions for the IBC spindles are available as optional equipment. A survey of sizes is given in the folder on belt-drive spindles.

If the customer himself makes special extensions, it is recommended that the matching dimensions and the overall length of the extensions correspond with those given in the folder. If a longer extension is required, it is necessary to apply to the manufacturer or even to submit a specimen to him for testing. There is a risk of extension vibration and of damage to the spindle if the maximum length is exceeded. The grinding quality is affected to a considerable extent by the precision of the extension. The radial run-out of the extension should not exceed the values given in the table below, according to ČSN 20 0315.

Test method:



Distance	Run-out in mm
L = 25 mm	0.010
L = 50 mm	0.015
L = 100 mm	0.025

The grinding wheel is mounted on the extension by means of a nut or of a screw or it can be cemented with a suitable adhesive. The wheel mounting proper must comply with the standard ČSN 20 1524.

MOUNTING OF WHEELS IBE AND IBD SPINDLES

The wheel is mounted on the IBE and IBD spindles by means of a collet which is fitted direct to the tapered end of the shaft. The collet must comply with the specification given in the standard ČSN 20 1524. Since the grinding wheels used with these spindles are of larger size they must be balanced. Usually, the wheel including collet is balanced only statically by means of balancing blocks in the collet and by using an arbor and a balancing stand. The arbor and the stand are both included in the optional equipment of the spindles. This balancing method, however is usually not satisfactory for grinding at very high precision. A statically balanced wheel may show a rest unbalance in spite of a perfect balancing procedure. Thus statical balancing should be supplemented with additional balancing direct on the machine at the working speed.

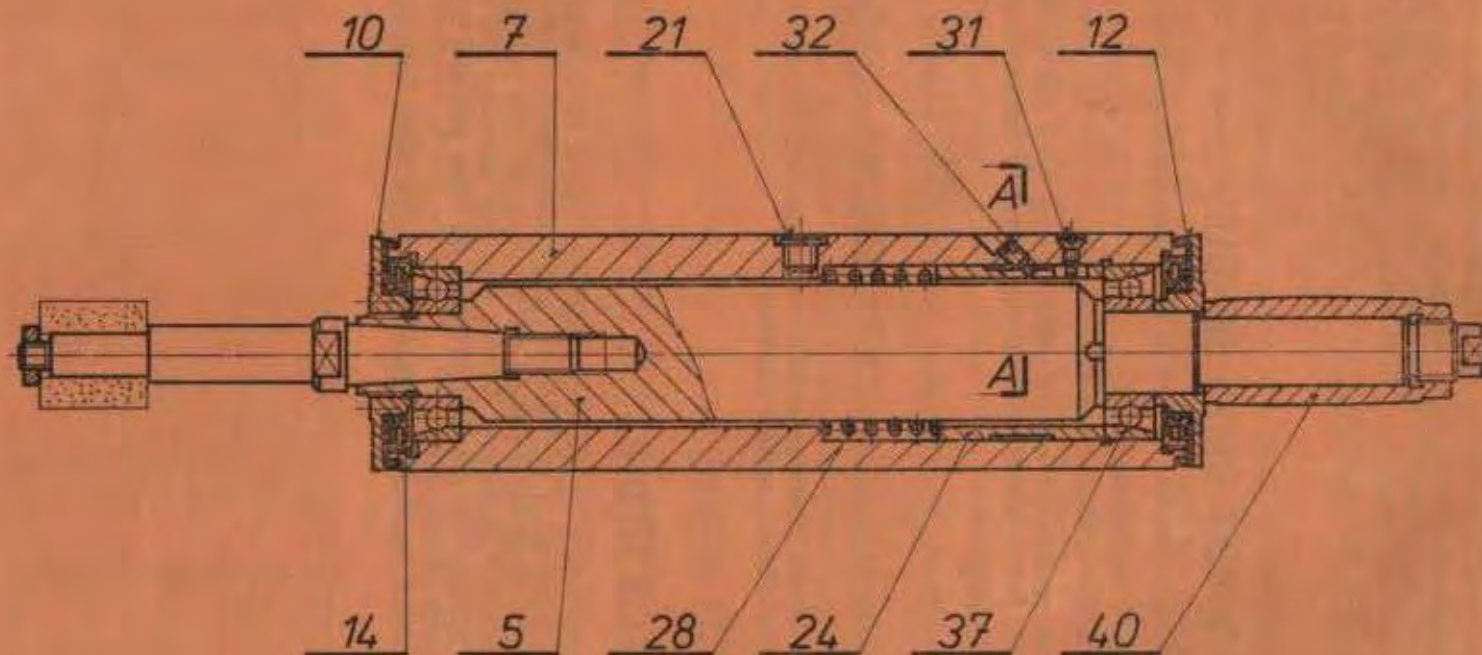
CHANGING OF BEARINGS IN BELT-DRIVE SPINDLES

To ensure the correct operation of a repaired spindle, adhere to the following instructions:

- entrust bearing changing to the care of a skilled worker,
- the repair must be carried out in a clean and dustfree environment,
- the dismantling and reassembling work must be carried out without using force and by means of appropriate tools and assembling jigs (available as optional equipment of the spindles),
- follow this instruction manual when working,
- fit into the spindle solely specified bearings or corresponding foreign-made bearings with conformable precision and clearance,
- the bearings specified for use in the spindles are of the 72 BTB series, P4 precision grade, either single or in pairs,
- should it not be possible to ensure the above conditions, it is recommended to entrust the spindle repair to the care of the manufacturer's service department.

PREPARING OF BEARINGS FOR FITTING

Wash the bearings first in commercial gasoline or in another cleaning agent to remove the preservation grease or oil. Then clear the bearings of any foreign matter while revolving them in several baths. Upon drying, immerse the bearings for a period of one hour at least into OL-J2 oil (or the oil that is to be used for spindle lubrication). In this way, the bearings are ready to be fitted into an oil mist-lubricated spindle. For grease-lubricated spindles, proceed to treat the bearings as described in the paragraph „Lubrication”. When cleaning the bearings, follow the safety regulations applying to work with inflammable matter.



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ЧАСТИЧ. РАЗРЕЗ А-А

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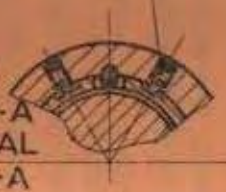
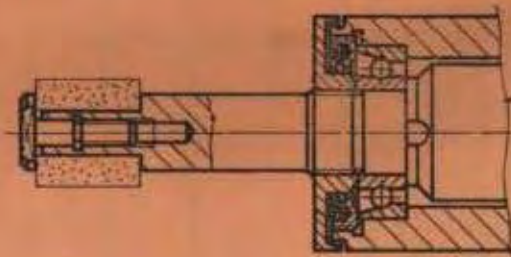
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SECTION A-A

PART. SECTION A-A

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SECTIONAL VIEW OF IBB AND IBC SPINDLES

DISMANTLING AND REASSEMBLING OF IBB AND IBC SPINDLES

Dismantling Procedure:

1. Clean the spindle of dirt and grinding dust. Unscrew the extension, and remove the wheel from IBB spindle. To facilitate dismantling and assembling work, place the spindle in a V-block made best of wood.
2. Unscrew the screws 32 and 33, hold the shaft 5 by its flats, unlock and withdraw the sheave 40 and the front end cap 10 using a pin wrench (R. H. threads on right-hand spindles).
3. Remove the rear end cap 12, unscrew two nuts 14 using a pin wrench.
4. Push the shaft 5 rearward from the front bearing and out of the casing 7.
5. Remove the rear bearing from the shaft 5 by means of a bearing puller, and force out the front bearing from the casing 7 by means of a bearing extractor.
6. Withdraw the sleeve 24 and the spring 28 upon removal of the screw 31.

Clean perfectly all parts. Polish them after drying and rub with OL-J2 oil. This work as well as the assembling work proper must be carried out in a clean and dustfree room. Prior to fitting, treat the bearings as instructed in the paragraph „Preparing the Bearings for Fitting“. Grease-lubricated bearings should be greased as recommended in the paragraph „Lubrication“.

Assembling Procedure:

1. Introduce into the casing 7 the spring 28 and the sleeve 24, secure the latter upon depressing it by means of the screw 31. Use the screw 32 in small-diameter spindles where there is no screw 31.
2. Fit the front bearing on the shaft 5 (at the wheel end) while pushing against the inner race so that the marked face of the bearing points toward the spindle inside.
3. Introduce the shaft 5 including the front bearing into the casing 7 and lock the bearing in position by means of the nut 14.
4. Abutting the front end of the shaft, fit the rear bearing into the spindle while pushing against the inner race so that the marked face points towards the spindle inside. Screw home the nut 14 and fit the rear end cap 12.
5. Close the front end by means of the cap 10 which at the same time retains the front bearing on the shaft.
6. Screw home the sheave 40 and tighten firmly to lock the rear bearing on the shaft.
7. Push against the sheave end to make the shaft spring axially several times and thus to check the correct axial preloading of the bearings.
8. Let the spindle run-in, at no load for 3 hours at least. Following the running-in, lock axially the sleeve 24 to avoid shaft vibration. Tighten first the two screws 33, then tighten slightly the oblique screw 32.

DISMANTLING AND REASSEMBLING OF IBE SPINDLES

Dismantling Procedure:

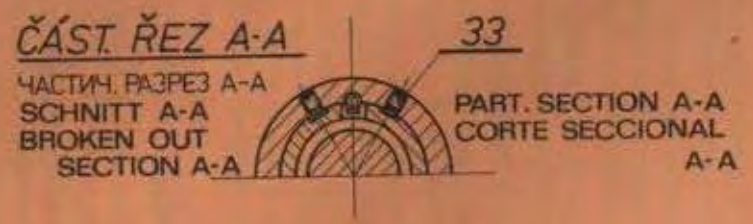
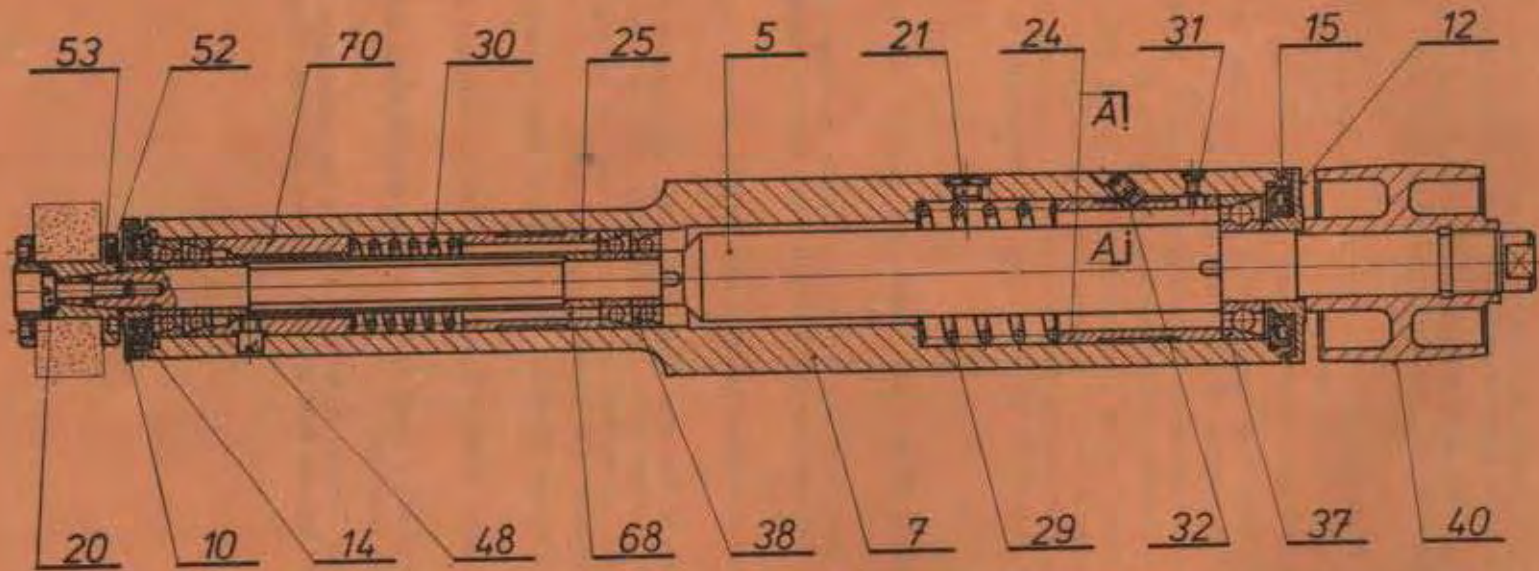
1. Clean the spindle from dirt and grinding dust. Remove the grinding wheel collet 53. To facilitate dismantling and assembling work, place the spindle into a V-block made best of wood.
2. Unscrew the screws 32 and 33, hold the shaft 5 by its flats, unlock and remove the sheave 40 (the sheave is mounted on tapered shaft end in larger spindles and shall be withdrawn by means of the wheel collet puller).
3. Remove the cap 10 and the cap 12 using a pin wrench (the cap has L. H. thread in spindles with taper-mounted sheave) and unscrew two nuts 14.
4. Push the shaft 5 rearwards from the front bearings and out of the casing 7.
5. Remove the rear bearings from the shaft 5 by means of a bearing puller, and force out the front bearings from the casing 7 by means of a bearing extractor.
6. Unscrew the screw 31 and remove the sleeve 24 including the spring 28. Ensure that the sleeve 24 is preloaded, hold it in position while removing the screw 31.

Clean perfectly all parts. Polish them after drying and rub with OL-J2 oil. This work as well as the assembling work proper must be carried out in a clean and dustfree room.

Prior to fitting, treat the bearings as instructed in the paragraph „Preparing the Bearings for Fitting“. Grease-lubricated bearings should be greased as recommended in the paragraph „Lubrication“.

Assembling Procedure:

1. Introduce into the casing 7, the spring 28 and the sleeve 24, depress the latter and secure by means of the screw 31.
2. Fit the front bearing pair on the shaft 5 (at the wheel end) while pushing against the inner race so that the marked faces of the bearings point towards the spindle inside. Watch correct order of the paired bearings as marked.
3. Introduce the shaft 5 including the front bearings into the casing 7 and lock the bearings in position by means of the nut 14.
4. Abutting the front end of the shaft, fit the rear bearings into the casing while pressing against the inner race so that the marked faces point towards the spindle inside. Watch correct order of the paired bearings, as marked. Screw home the nut 14 and fit the cap 12 (the cap 12 has L. H. thread in spindles with taper-mounted heave).
5. Close the front end by means of the cap 10 which at the same time retains the front pair of bearings on the shaft.
6. Screw home the sheave 40. On large spindle types, the sheave is mounted on a shaft taper and retained by means of a screw.
7. Push against the sheave end to make the shaft spring axially several times and thus to check the correct axial preloading of the bearings.
8. Let the spindle run-in at no load for 3 hours at least. Following the running-in, lock axially the sleeve 24 to avoid shaft vibration. Tighten first the two screws 33, then tighten slightly the oblique screw 32.



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SECTIONAL VIEW OF IBD SPINDLE – SHORT MODEL

DISMANTLING AND REASSEMBLING OF IBD SPINDLES - SHORT MODEL

Dismantling Procedure:

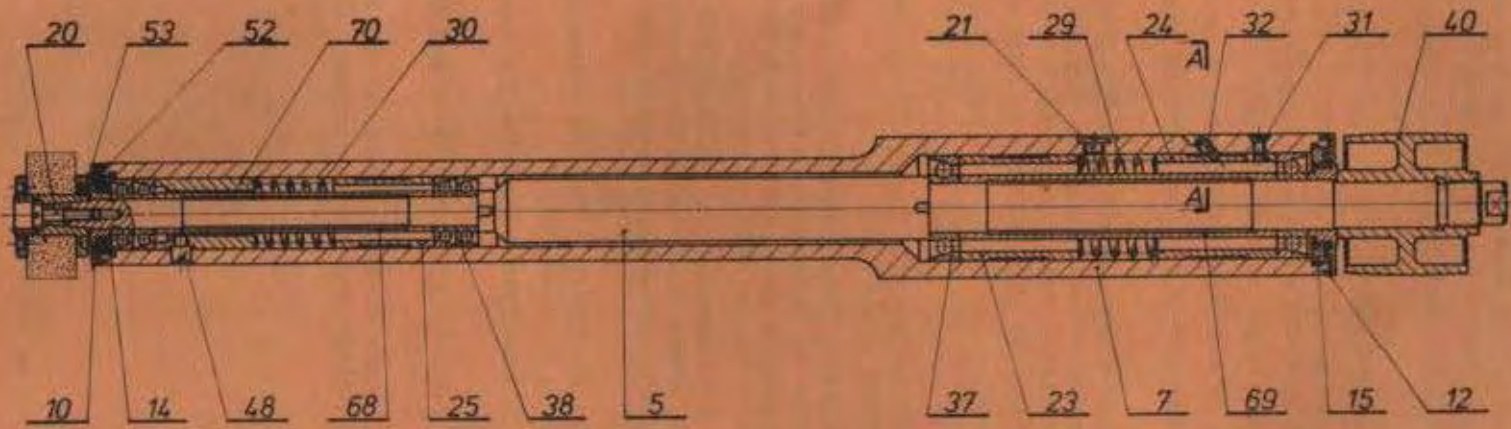
1. Clean the spindle from dirt and grinding dust. Remove the grinding wheel collet 53. To facilitate dismantling and assembling work, place the spindle into a V-block best made of wood.
2. Unscrew the screws 32, 33 and 31, hold the shaft 5 by its flats, unlock and remove the sheave 40 and the cap 12.
3. Unscrew the cap 10 and the nut 15 using a pin wrench.
4. Push out from the casing 7 towards the sheave end the shaft 5 including the rear bearing, sleeve 24, spring 29, middle pair of bearings, sleeve 25, spring 30 and tube 68.
5. Unscrew the nut 14 (L. H. thread) using a pin wrench. Unscrew the screw 48 as well.
6. Push out from the casing 7 the sleeve 70 including the front pair of bearings.
7. Remove the rear bearing and the middle pair of bearings from the shaft 5 by means of a puller.

Clean perfectly all parts. Polish them upon drying and rub with OL-J2 oil. This work as well as the assembling work proper must be carried out in a clean and dustfree room.

Prior to fitting, treat the bearings as instructed in the paragraph „Preparing the Bearings for Fitting“. Grease-lubricated bearings should be greased as recommended in the paragraph „Lubrication“.

Assembling Procedure:

1. Introduce the spring 29 and the sleeve 24 into the casing 7 from the sheave end, depress the sleeve and lock in position by means of the screw 31.
2. Introduce into the wheel end of the casing 7 the sleeve 25, spring 30 and sleeve 70, lock the latter in position by means of the screw 48. Then put into the casing the front pair of bearings so that the marked faces point towards the spindle inside (watch correct order of bearings as marked) and lock by means of the nut 14 (L. H. thread).
3. Fit upon the sheave end of the shaft 5 the rear bearing (its marked face pointing towards the spindle inside) and upon the front end of the shaft, the middle pair of bearings so that their marked faces point towards the grinding wheel (watch correct order of bearings as marked) and further the tube 68.
4. Introduce the preassembled shaft into the casing 7 from the sheave end and lock in position by means of the screwed-in cap 10, using a pin wrench.
5. Screw home the nut 15, fit the cap 12 and tighten the latter by screwing home the sheave 40.
6. Push against the sheave end to make the shaft spring axially several times and thus to check the correct axial preloading of the bearings.
7. Let the spindle run-in at no load for 3 hours at least. Following the running-in, lock axially the sleeve 24 to avoid shaft vibration. Tighten first the two screws 33, then tighten slightly the oblique screw 32.



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SECTIONAL VIEW OF IBD SPINDLE – LONG MODEL

DISMANTLING AND REASSEMBLING OF IBD SPINDLE - LONG MODEL

Dismantling Procedure:

1. Clean the spindle from dirt and grinding dust. Remove the grinding wheel collet 53. To facilitate the dismantling and assembling work, place the spindle into a V-block best made of wood.
2. Unscrew the screws 32, 33 and 31, hold the shaft 5 by its flats, unlock and remove the sheave 40 and the cap 12.
3. Unscrew the cap 10 and the nut 15 using a pin wrench.
4. Push out towards the sheave end the shaft 5 including the rear bearing, sleeve 24, spring 29, sleeve 23, spacing tube 69, second rear bearing, middle pair of bearings, sleeve 25, spring 30 and spacing tube 68.
5. Unscrew the nut 14 (L. H. thread) using a pin wrench. Unscrew the screw 48 to unlock the sleeve 70, push the latter including the front pair of bearings out from the casing 7 towards the grinding wheel.
6. Remove the tube 68 and the middle pair of bearings from the front end of the shaft 5. Pull from the rear the rear bearing, sleeve 24, spring 29, sleeve 23, tube 69 and the second rear bearing.

Clean perfectly all parts. Polish them upon drying and rub with OL-J2 oil. This work as well as the assembling work proper must be carried out in a clean and dustfree room.

Prior to fitting, treat the bearings as instructed in the paragraph „Preparing the Bearings for Fitting“. Grease-lubricated bearings should be greased in the paragraph „Lubrication“.

Assembling Procedure:

1. Introduce from the grinding wheel end into the casing 7 the sleeve 25, spring 30 and sleeve 70, lock the latter by means of the screw 48. Then push into the casing the front pair of bearings so that the marked faces point towards the spindle inside (watch the bearing order according to the pairing marks) and secure by means of the nut 14 (L. H. thread).
2. Fit on the wheel end of the shaft 5, the middle pair of bearings so that the marked faces point towards the grinding wheel (watch the bearing order according to pairing marks) and further the tube 68. Fit on the sheave end the second rear bearing with the marked face pointing towards the sheave, and the tube 69.
3. Introduce the preassembled shaft into the casing 7 from the sheave end and lock in position by means of the screwed-in cap 10, using a pin wrench.
4. Insert into the casing the sleeve 23, spring 29 and sleeve 24, lock the latter by means of the screws 31.
5. Insert the rear bearing so that its marked face points towards the spindle inside, screw home the nut 15 and fit the cap 12, locking the latter by screwing home the sheave 40.
6. Push against the sheave end to make the shaft spring axially several times and thus to check the correct axial preloading of the bearings.
7. Let the spindle run-in at no load for 3 hours at least. Following the running-in, lock axially the sleeve 24 to avoid shaft vibration. Tighten first the two screws 33, than tighten slightly the oblique screw 32.

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