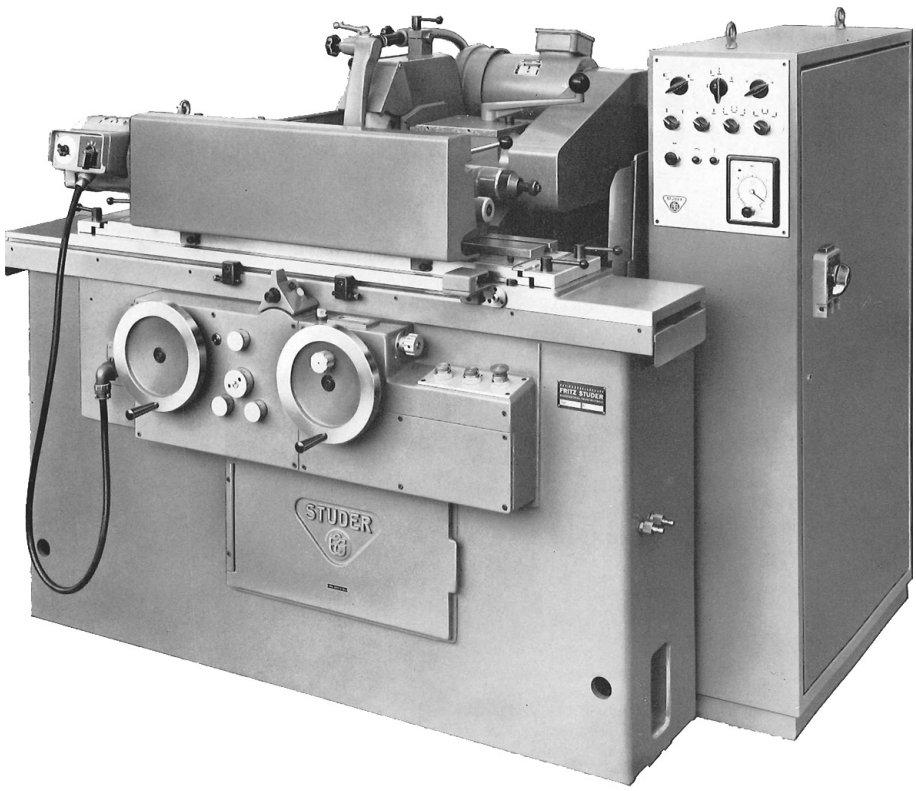
STUDER

# User‘s Manual

# RHU 500 / 100



1
2
4
7

# C O N T E N T S


| | Page |
|---|---|
| Main specification | 2.1 |
| **Transport and putting into service** | |
| Transport of machine | 3.1 |
| Suspending the machine | 3.2 |
| Siting the machine | 3.3 |
| Putting into service | 3.4-5 |
| Tool cabinet (Heigth of centres 100 mm - 4") | 848-2 |
| Tool cabinet (Heigth of centres 125/175 mm - 5/7") | 748-2 |
| **Function of the various controls** | |
| Control panel | 4.1 |
| Infeed controls | 4.2 |
| Electrical control panel | 4.3-10 |
| Swivelling work head | 4.11 |
| Table, swivelling table and tailstock | 4.12 |
| Cross slide - wheelhead | 4.13 |
| Base, hydraulic tank etc. | 4.14-15 |
| **Setting up instructions** | |
| Control elements | 5.1 |
| Setting up for plunge grinding | 5.2 |
| The work piece is tapered | 5.3 |
| The work piece is parallel | 5.3 |
| Insufficient material has been removed | 5.4 |
| The correct amount of material has been removed | 5.4 |
| Swivelling work head | 5.5 |
| Setting up taper angles with the rapid table setting device | 5.6 |
| Table for precision fast setting device of the table | 1808-13/1+2 |
| Table for precision fast setting device | 1808-8 /1+2 |
| Venting the table cylindre | 5.7 |
| **Grinding** | |
| Peripheral speed of the work piece | 6.1 |
| Peripheral speed of the grinding wheel | 6.1 |
| Dressing the wheel | 6.2 |
| Balancing the grinding wheel | 6.3-4 |
| Superfine and lap grinding | 6.5 |
| Speed of rotation of the work piece | D5-136 |
| Speed of rotation of the grinding wheel | D5-137 |
| Speed chart for internal grinding spindles | 860-8 |
| List of grinding wheels | 800-33b |
| Grinding faults and how to avoid them | 6.6-8 |

| Lubrication and maintenance | Page |
|---|---|
| Lubrication table | 7.1 |
| Lubrication regulator | 7.2 |
| Wheel head | 7.3 |
| Section drawing of wheel spindle | 872 |
| Cleaning the machine | 7.4 |
| DC motor on work head | 7.4 |
| Thermal overloads | 7.4 |
| Changing the bearings of the work head drive ring | 7.5 |
| Changing the bearings in the belt tension pulley | 7.5 |
| Removing the DC motor | 7.5 |
| Setting of the tailstock clamping | 7.6 |

| Fault finding and rectification | |
|---|---|
| Small faults and their remedies | 8.1-2 |
| Changing and setting the micro switches | 8.3-4 |
| Hydraulics diagramme | 1800-4 |
| Faults in the electronic control circuit | 8.5-7 |
| List of components in motor control circuit | 8.8-9 |
| Motor control diagramme | 860-140 |
| Electric diagramme of complete machine | |
| Diagramme of frequency converter | |

| Additional accessories | |
|---|---|
| Spring loaded steady (universal steady) | 10.1 |
| Hinged dressing device | 10.2 |
| Closed 3-jaw steady | 10.3 |
| Offset base for wheel head | 10.3 |
| Radius dresser | 10.4 |
| Table aligning device on wheel guard | 10.5 |
| Inclinable dresser | 10.5 |
| Fixed stop | 10.6 |
| Filtrox coolant unit | 10.7-9 |
| Lever operated collet draw bar | 10.10 |
| Static wheel balancing device | 10.10 |
| Steep taper grinding attachment | 10.11 |
| Length grinding equipment | 10.12 |
| Hinged internal grinding device | 10.12-13 |
| Oil mist unit | 10.14 |
| In-process size control equipment MOVOLIMIT/DELTALIMIT | 10.15 |
| Grinding wheel right | 10.16 |
| Flat belt drive for superfine and lap grinding | 10.17 |
| Three-jaw chuck BURNERD | 10.19 |
| Adjustable tailstock | 10.20-21 |
| Adjustment table | 860-32 |
| Coolant equipment "INTECLON" | 10.23-28 |
| Form dressing attachment | 10.29-34 |
| Steel template for profiling device | D9-23 |
| Template blank for profiling device | D9-24 |
| Intermediate plate for profiling device | 84449 |
| Diamond r 0,5 for profiling device | 844186 |
| Hydraulics diagramme for profiling device | 800-34 |
| Hydraulic pipes for profiling device | 1844-11 |

# M A I N  S P E C I F I C A T I O N

## Longitudinal slide

| | | | | |
|---|---|---|---|---|
| Heigth of centres ..... | mm | 100 | inch | 4 |
| Distance between centres ... | mm | 500 | inch | 20 |
| Table speed steplessly adjustable between ..... | m/min | 0.1-6 | ft/min | .33-20 |
| Minimum automatic table travel, approx. ..... | mm | 1.5 | inch | .06 |
| Maximum inclination of table, in either direction ..... | o | 12 | | 12 |
| Hand traverse of table: per rev. of handwheel .... | mm | 25 | inch | 1 |

## Work head

| | | | | |
|---|---|---|---|---|
| Inclination ..... | o | 90 | | 90 |
| Spindle speed, steplessly adjustable between ..... | r.p.m. | 40-650 | | 40-650 |
| Spindle nose, inner taper .. | Morse | 5 | | 5 |
| Collet capacity ..... | mm | 25 | inch | 1 |
| 3 jaw chuck diameter ..... | mm | 130 | inch | 5.12 |

## Wheel head

Main grinding wheel, L.H.:

| | | | | |
|---|---|---|---|---|
| Diameter ..... | mm | 400/300 | inch | 16/12 |
| Max. width ..... | mm | 50 | inch | 2 |
| Bore ..... | mm | 127 | inch | 5 |

Auxiliary grinding wheel R.H.:

| | | | | |
|---|---|---|---|---|
| Diameter ..... | mm | 250 | inch | 10 |
| Max. width ..... | mm | 20 | inch | .78 |
| Bore ..... | mm | 76 | inch | 3 |

Spindle speeds:

| | | | | |
|---|---|---|---|---|
| Grinding wheel Ø 400 | r.p.m. | 1450, 1650 1930, 2300 | | |
| Grinding wheel Ø 300 | r.p.m. | 1910, 2050 2200, 2390 | | |
| Rapid approach ..... | mm | 40 | inch | 1.57 |
| Infeed rate intermittent, stepless (on dia.) ..... | mm | 0.001-0.040 | inch | .000,04-.0016 |
| continuous, stepless (on dia.) ..... | mm/sec | 0.0002-0.050 | inch/sec | .000,01-.002 |
| Max. infeed (on dia.) ..... | mm | 1.7 | inch | .07 |

## Weight of machine

| | | | | |
|---|---|---|---|---|
| Net approx. ..... | kg | 1800 | lbs. | 4000 |
| Gross approx. ..... | kg | 2200 | lbs. | 4850 |

TRANSPORT UND INBETRIEBNAHME

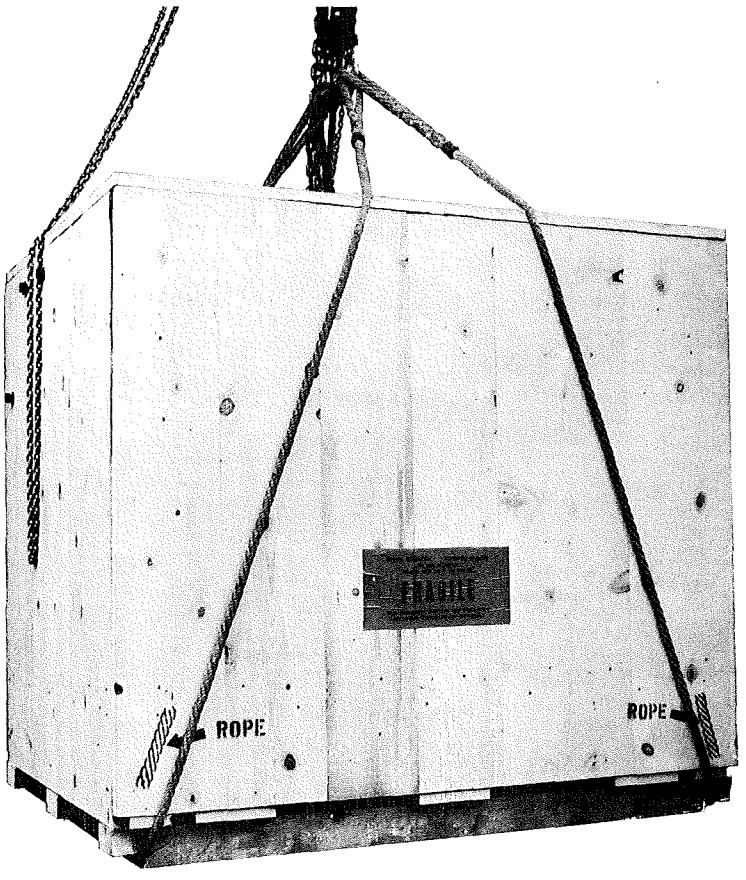
TRANSPORT ET MISE EN SERVICE

TRANSPORT AND PUTTING INTO SERVICE

## Transport der Maschine

## Transport de la machine

## Transport of machine




Die Kiste wird mit 2 Seilen aufgehängt. Die Maschine sollte vor dem Auspacken möglichst nahe an ihren endgültigen Standort gebracht werden.

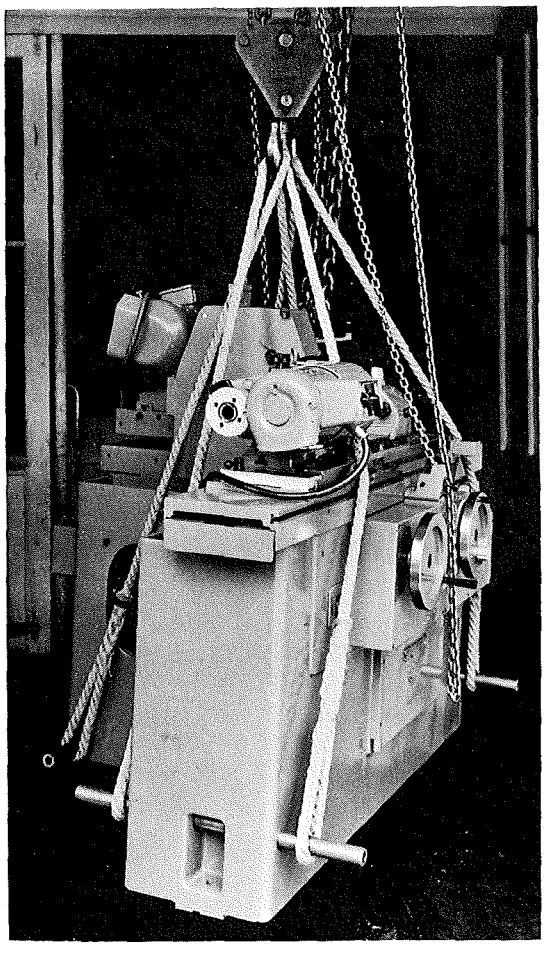
La caisse est suspendue par 2 cordes. Avant le déballage, transporter la machine aussi près que possible de son emplacement définitif.

The case is suspended on 2 ropes. Before unpacking the machine should be brought as near as possible to the final position.

Aufhängen der Maschine

Suspension de la machine

Suspending the machine



- Schutzblech wegnehmen.
- Stangen in die vorgesehenen Bohrungen einführen.
- Die Maschine mit 3 bis 6 Tauen aufhängen.
  ( Taue über das Kreuz anordnen )

  Berührungspunkte durch Filzunterlagen und Holzklötze schützen.

  VORSICHT ! Ruckweises Heben ist gefährlich.

- Remove guard
- Insert bars in the openings provided for them
- Suspend machine on 3 or 6 ropes. (Cross ropes)

  Points of contact to be protected by placing felt pads or wooden blocks.

  ATTENTION ! It is dangerous to jerk when lifting machine

- Démonter la tôle de protection
- Introduire des barres d'acier dans les trous
- Suspendre la machine à l'aide de 3 à 6 cordes (croiser celles-ci)

  Protéger les points de contact par des feutres et des calens en bois

  ATTENTION ! Pas de levage par à-coup

## AUFSTELLEN DER MASCHINE

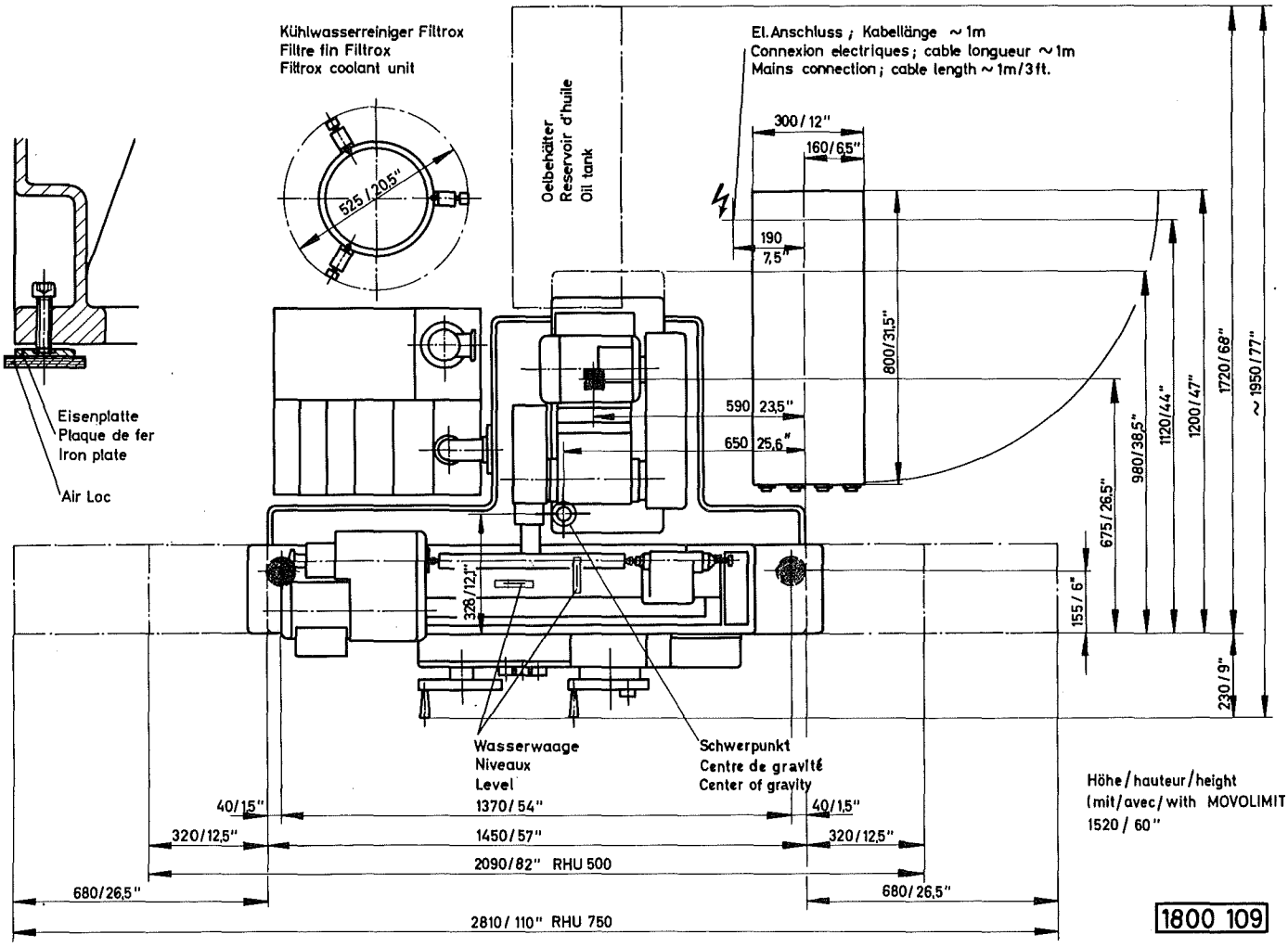
## MISE EN PLACE DE LA MACHINE

## SETTING THE MACHINE

Nachdem die Maschine auf den eingezeichneten 3 Punkten auf Eisenplatten oder zusätzlichen "AIR-LOC" - Unterlagen aufgestellt ist, wird sie mittels den 2 Richtschrauben (Schnitt A-A) einnivelliert. (0,02 mm auf 1 m Länge in beiden Richtungen)
Schwerpunkt im Plan eingezeichnet, wenn Längs- und Querschlitten in Mittelstellung.

La machine est placée aux trois points indiqués sur des plaques en fer, ou éventuellement sur des cales anti-vibrations "AIR-LOC" supplémentaires. Au moyen des deux vis de calage (coupe A-A), elle est ensuite nivelée dans une tolérance de 0,02 mm sur une longueur de 1 m, longitudinalement et transversalement.
Centre de gravité marqué sur le plan, si coulisses longitudinale et transversale en position médiane.

The machine is set up on iron plates at the indicated 3 points, or perhaps on "AIR-LOC" mounting pads, and then it is levelled with the aid of the two setting screws (section A-A) (0.02 mm / 0.000,7" over 1 m / 3.28 ft. length in both directions).
Center of gravity marked on Plan if longitudinal and cross slides in medium position.



# PUTTING INTO SERVICE

## Preparation and cleaning down

All parts on the machine painted red must be removed.

(Protection for transport for longitudinal and cross slide, as well as for oil tank. See also page 4.13)

Clean down whole machine and lightly oil all bright parts.

## Electrical connections

Before connecting the mains supply, check that the electrical equipment in the machine agrees with the supply voltage.

The supply is connected to the 5 terminals marked ⏚ O-R-S-T (see circuit diagram). The conduit must lead in from under the righthand side of the machine (see pos. 355 page 4.8).

If the grinding wheel rotates in the wrong direction, interchange two of the 3 phase wires on terminals R-S-T.

NOTE : The electrical system is designed for the 5 wire system. The fifth earthing wire ⏚ is connected to all motor housings.

## Oil tank

The oil tank is accessible by unscrewing the cover on the right of the stand, or through the door at the front.

- Protection for transport marked in red to be removed. Open cover on right hand side of the stand
- Fill with specified oil

  Type of oil according to lubrication chart page 7.1

  Oil infill 713, page 4.14 resp. 416
- Allow the pump to run a short while in order to fill the oil cooler.

## Lubrication

Every machine is lubricated before despatch from our factory. However, we recommend that this is repeated before the machine is put into operation.

If the lubricants listed on the lubrication table (page 7.1) are not available, lubricants having the identical specification as those listed must be used. The products listed on the lubrication table were tested by us. We cannot guarantee for other lubricants.

The motors are packed with grease and do not need further attention before operating the machine.

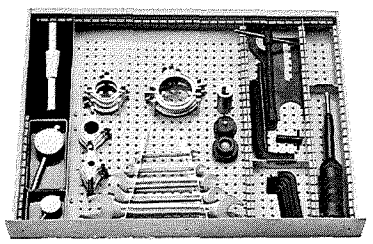
The longitudinal and cross slides are automatically lubricated with hydraulic oil. At the ends of the lubrication pipes 706÷709 (page 7.2) the lubrication can be checked. The oil should drip back from the lubrication points.

## Coolant tank

The coolant tank has a capacity of approx. 100 liters (22 imp. galls).

We recommend:

| | |
|---|---|
| CODOL 1,4-2% | - An American product manufactured by Stuart Oil Co.Ltd., Chicago; |
| ASEOL SP 63-5 2-5% | - A Swiss product obtainable from A. Schmids Successors Ltd., Berne |
| ~~FRIGOL~~ | - ~~A Swiss product obtainable from Industriebedarf, Zurich~~ |



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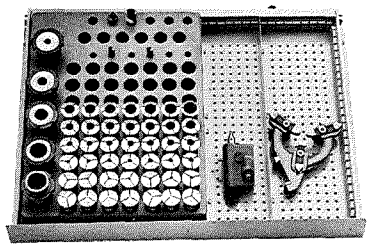

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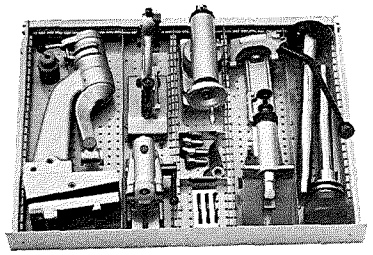

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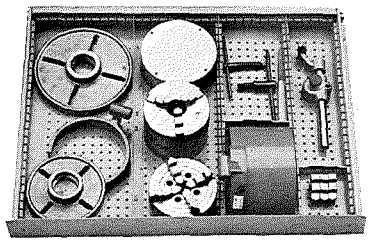

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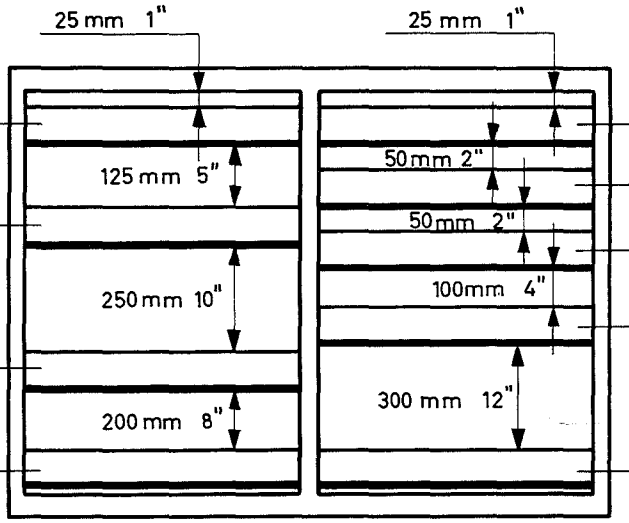


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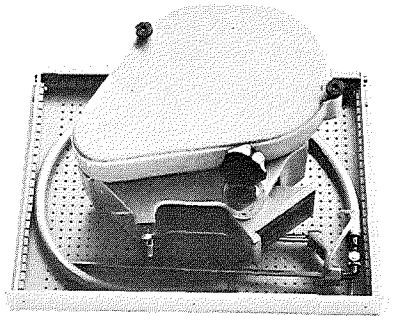

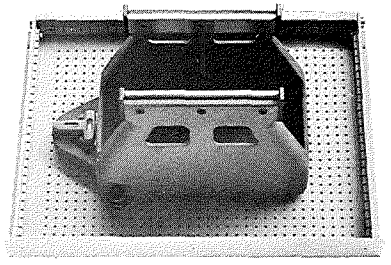

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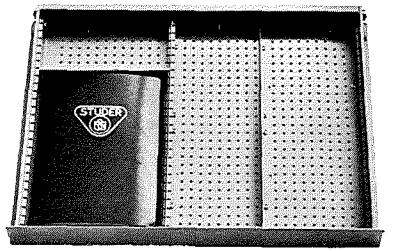

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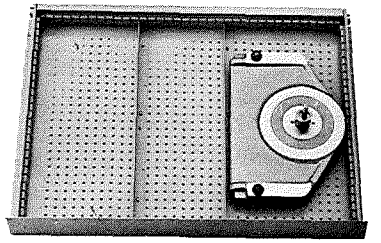

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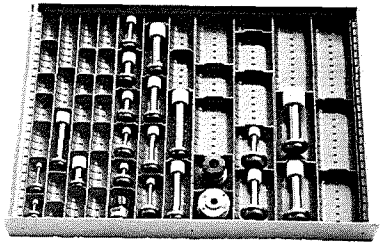

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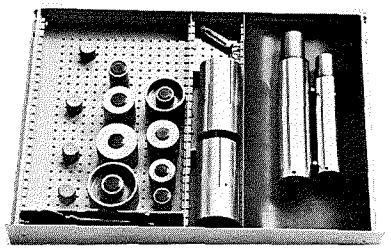

Werkzeugschrank
Armoire à outils
Tool cabinet

RHU 500 / 100

STUDER

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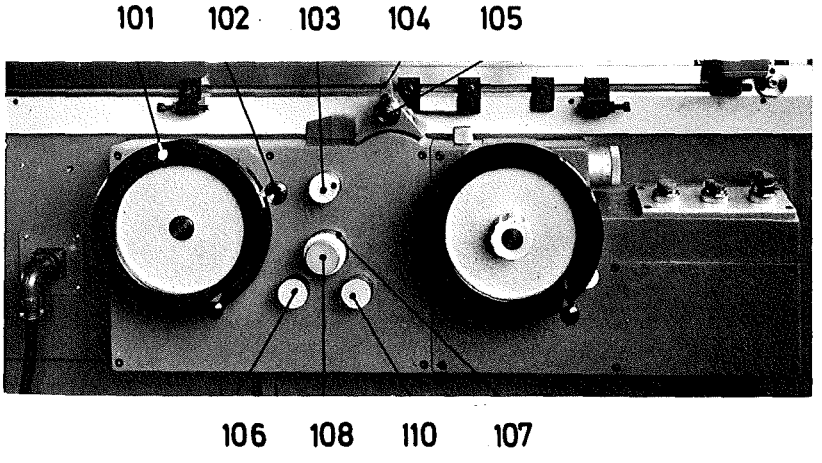
## FUNCTION OF THE VARIOUS CONTROLS

100 Control panel




101 Handwheel for longitudinal travel of table
(one revolution gives 25 mm (1") table travel)

102 Table reversal selector

- Turned to the left zero mark up: normal reversal stroke
- Turned to the right zero mark right: short reversal stroke

103 Dwell control valve for setting duration of dwell at ends of table stroke.
Dwell is set between 0 and 5. If table dwelling is not required the valve is set to 0 (specially important for programmes  ).

The range below zero serves for switching off dwelling at very high table speed. (e.g. internal grinding)

104 Table reversal lever

105 Table reversal pin, hydraulically operated (2 positions)

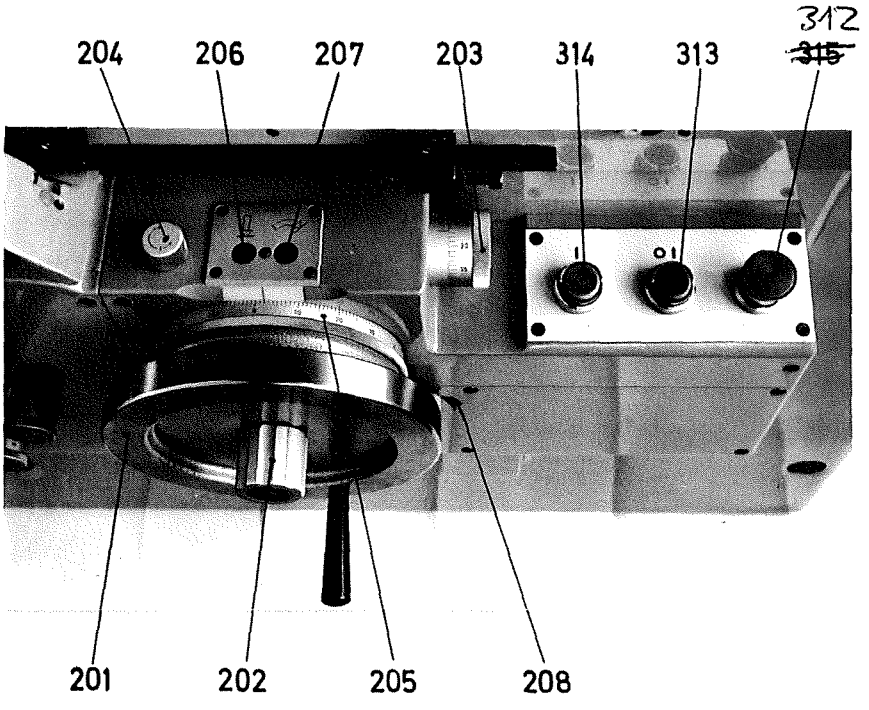
106 Valve for setting normal infeed speed

107 Valve for setting grinding speed of longitudinal slide

108 Valve for setting dressing speed of longitudinal slide

110 Valve for setting the creep infeed i.e. the second infeed speed

200 Infeed controls




201 Infeed hand wheel — 1 rev. = 2 mm (.1") on dia.

202 Clutch — servo drive engaged; servo drive disengaged

203 Fine infeed knob — 1 div. = 1 micron (0.001 mm) (.000.05") on dia.

204 Selector knob — neutral; material allowance setting 0 - 1.7 mm (0 - .o7") on dia. (long arrow); creep setting 0 - 0,1 mm (0 - .005") on dia. (short arrow)

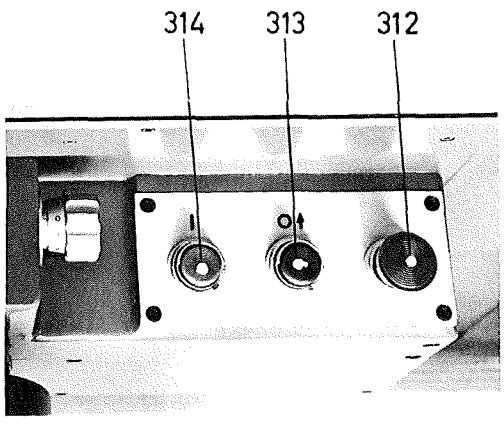
205 Graduated ring — fully adjustable: 1 div. = 0.01 mm (.000.5") on dia.

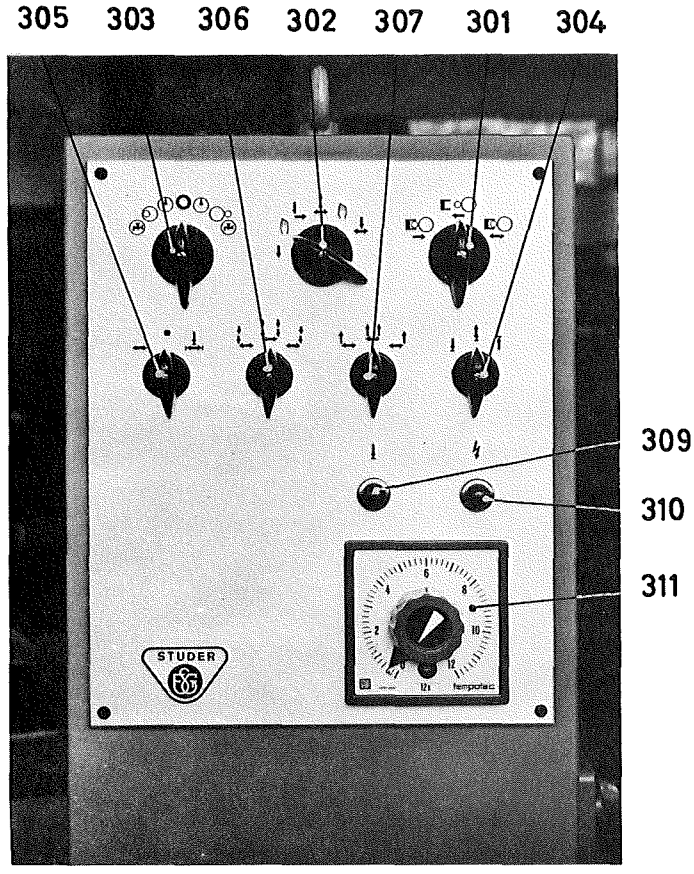
206 Control lamp (green) — alights if rapid approach in front final position

207 Control lamp (green) — alights if plunge infeed in final position

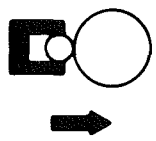
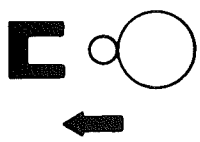
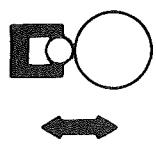
208 Setting knob — Hydraulic bypass switched off; Hydraulic bypass switched on. Allows easier manual feed to fixed stop.

## 300 Electrical control panel




## 301 Selector switch for measuring head

| Approach measuring head | Retract measuring head | Automatic cycle |
|---|---|---|
|  |  |  |
| Grinding with indication of in-process measuring equipment; machine not controlled. | For grinding without in-process measuring control this selector switch must be set to this position. | Machine is controlled by in-process measuring and control equipment. |

302 Cycle selector switch

Various cycles, with the exception of setting up and dressing, can be set to operate automatically. The cycle is made up from the following individual functions:

- rapid approach of cross slide
- start of work head
- table travel (except at ⬇ )
- infeed at 2 preset rates
- spark out by preset time switch or in-process measuring and control equipment
- end of cycle (rapid retraction of wheel head, automatic return of infeed mechanism to start position, table and work head stopped).

⬇ Infeed table remains stationary, but can be moved by handwheel 101.

Manual - setting up or dressing

Infeed then traverse After infeeding to depth the table traverse to left or right is engaged up to the end of the set stroke.

Intermittent infeed with table traverse

The wheel head infeed is effected at the left or right or at both ends of the table traverse (set by knob 306 see below)

"End of cycle" is effected at the end of the table stroke after spark out (at the left, or right, or at end of next traverse - set by knob 307, see below. Knob 102 must be turned to the left.)

Continuous infeed with table traverse

"End of cycle" is effected immediately the time set on the time switch has elapsed.

303 Motor selector switch

| Internal grinding | | External grinding | |
|---|---|---|---|
|  | off |  | off |
|  | hydraulic pump |  | hydraulic pump |
|  | internal grinding wheel |  | grinding wheel |
|  | coolant pump |  | coolant pump |

304 Selector switch for cross slide position

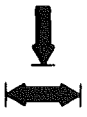
- During grinding cycle the cross slide is in front position of hydraulic rapid retraction; after cycle end or cycle stop in rear position.
- Specifical programme for external grinding.
- Motor selection "internal grinding" does not operate.

- Cross slide remains in rear position of hydraulic rapid approach.
- External and internal grinding possible.

- Cross slide remains in front position of hydraulic rapid approach
- Specifical programme for internal grinding

305 Cycle interruptor

 no function

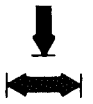


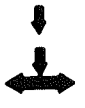
infeed and table traverse interrupted. Handwheel 101 automatically engaged.

Example:

When grinding with table traverse the infeed and table movement may be stopped shortly before reaching size, e.g. for face grinding.

Tip switch serves for starting the table traverse for setting up or dressing. The cross slide must be at front or rear (according to selection with knob 304), i.e. when the green lamp alights.

Stop of table traverse by turning switch on  or pressing button 312.

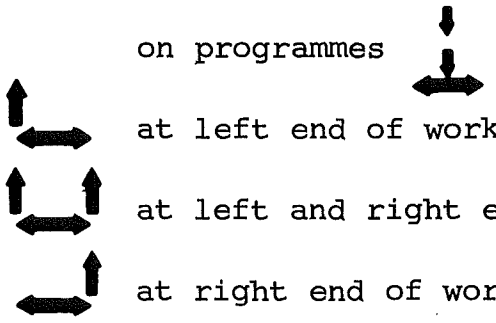
306 Feed selector switch used only with programme 

 feed at left end of work piece

 feed at right end of work piece

 feed at right end of work piece

307 "End of cycle" selector switch - only operative



on programmes

at left end of work piece

at left and right end of work piece

at right end of work piece

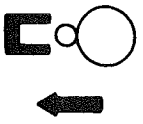
309 Green lamp

Alight when the rapid approach and infeed are in one of the end positions selected by knob 304

310 Control lamp alight when main switch 315 switchend on.

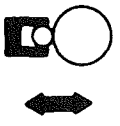
311 Time relay (Range 0,3 Sec ..... 12 h)

Used for setting the spark out period.

(Selector switch 301 on  ),

or

for setting the measuring head retraction delay

(Selector switch 301 on  ).

The time unit can be selected by screw beneath rotary knob.

312 EMERGENCY stop button immediately stops all machine movements.

313 Stop cycle  Pushbutton

If cycle selector switch 302 is set at "manual-setting up or dressing" then this pushbutton has the following function:

a) push halfway down: rapid retraction of wheel head, infeed remains at zero;

b) push whole way down: rapid retraction of wheel head with resetting of infeed mechanism.

If cycle selector switch 302 is set at any of the 4 automatic grinding cycles, then this pushbutton has the following functions:

rapid retraction of wheel head, reset infeed mechanism to zero, stop work head and table traverse.

When internal grinding the rapid approach unit keeps the wheel head at the forward position.

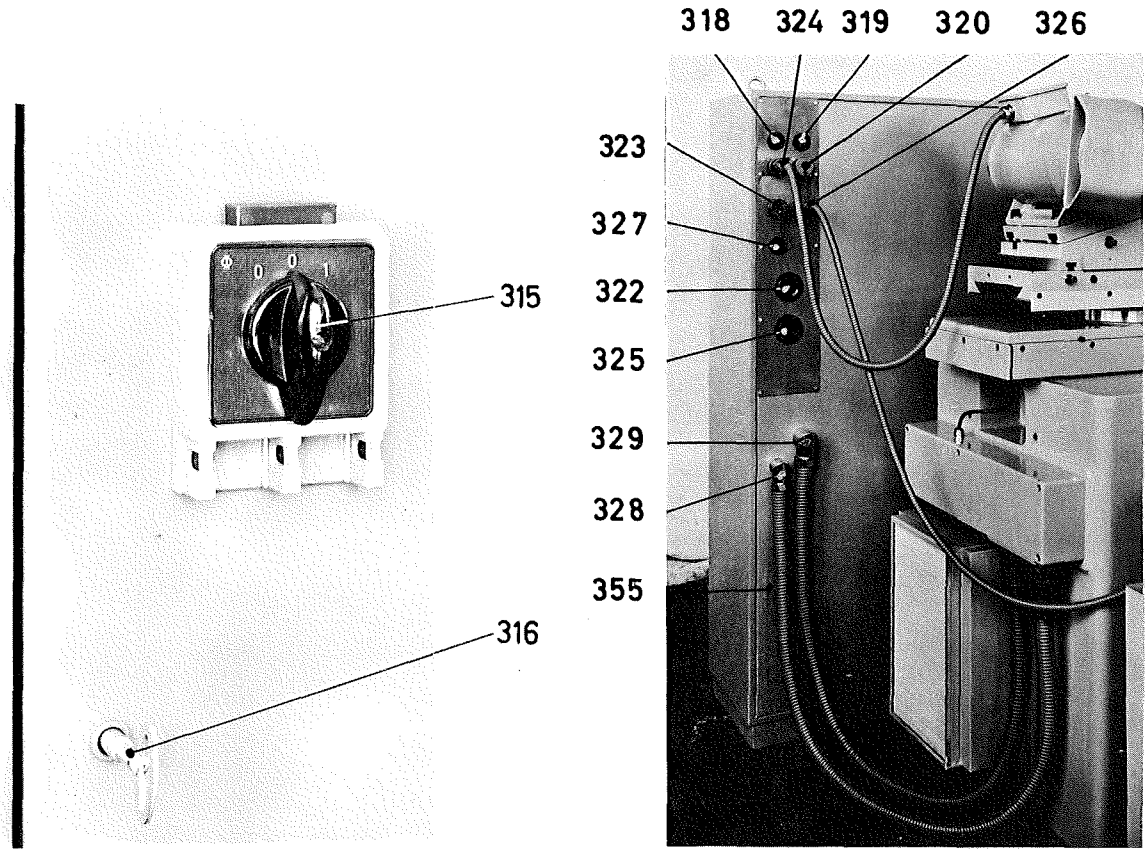
314 Start cycle  pushbutton

If cycle selector switch 302 is set at "manual-setting up or dressing" then this pushbutton has the following function:

rapid approach of wheel head and infeed at max. speed to front position. One press is sufficient to operate the rapid approach of the wheel head. To obtain infeed the pushbutton must be held down until green lamp 309 lights.

Rapid approach can only be engaged if plunge infeed set to allowance selected by knob 204. Set back plunge infeed with cycle stop pushbutton 313.

If the cycle selector switch 302 is set to one of the four grinding cycles, the cycle is engaged by an impulse of the start pushbutton.




315 Main switch

Shuts down the electrical supply to every part of the machine.

1. Position **0** left off

   In this position the door can only be opened after turning the lock 316.

2. Position **0** middle off

   The door cannot be opened.
   The switch can in this position be secured by a max. of 3 padlocks.

3. Position **1** right on

316 Mechanical door lock

317 - 329 Electrical connections for

317

318 Servo box

319 Longlimit control

320 Movolimit mains socket

321

322 Machine lamp 36V (max. 75W)

323 Internal grinding attachment

324 Grinding wheel drive

325 Fine-balancing equipment BALANTRON 220V (max. 150W)

326 Coolant pump

327 Socket for frequency converter,
(when placing the converter, care should be taken that transmission of vibrations to the machine is avoided)
or for special plug.
(This special plug may only be used with the 50/60 Hz drive)

328 Motor cable

329 Control cable

330 Relay CA

331 Relay RA

332

333 Relay RC

334

335 Relay RF

336 Relay RG

337 Spark quenching combination FL

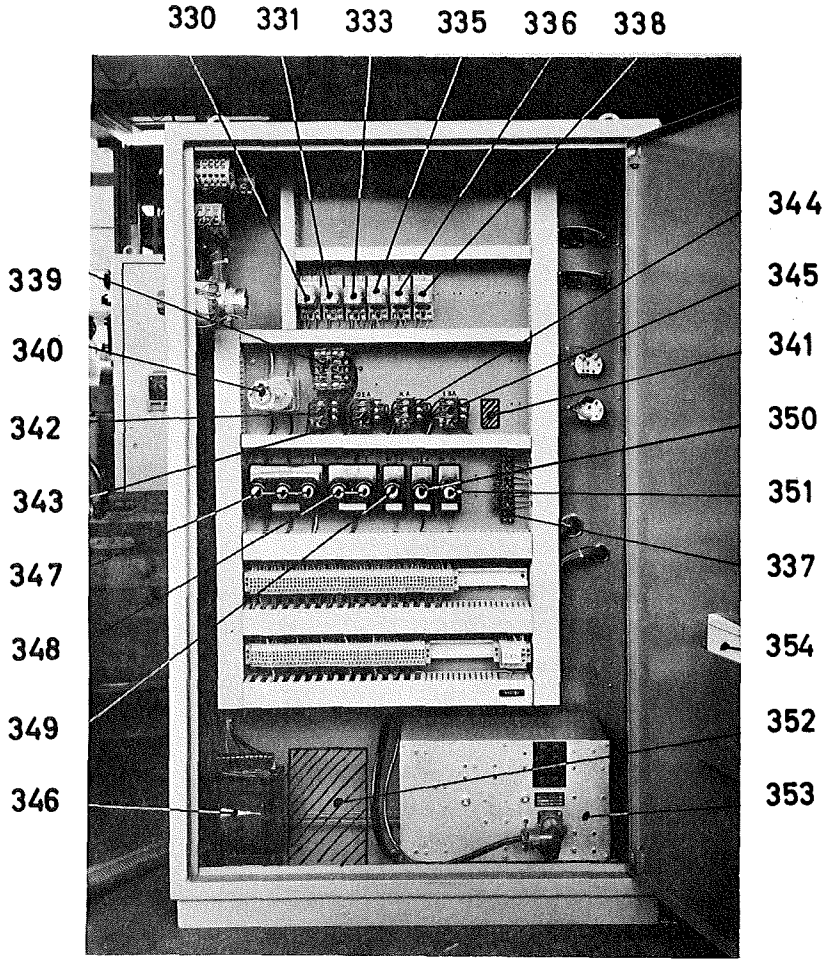
338 Relay RH

339 Motor contactor MO

340 Main switch S

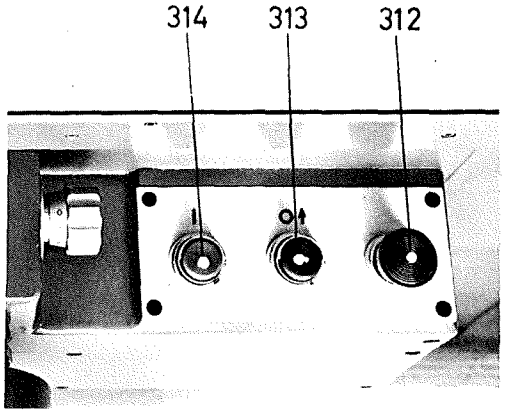
341 Thermal overload FUA (Additional)

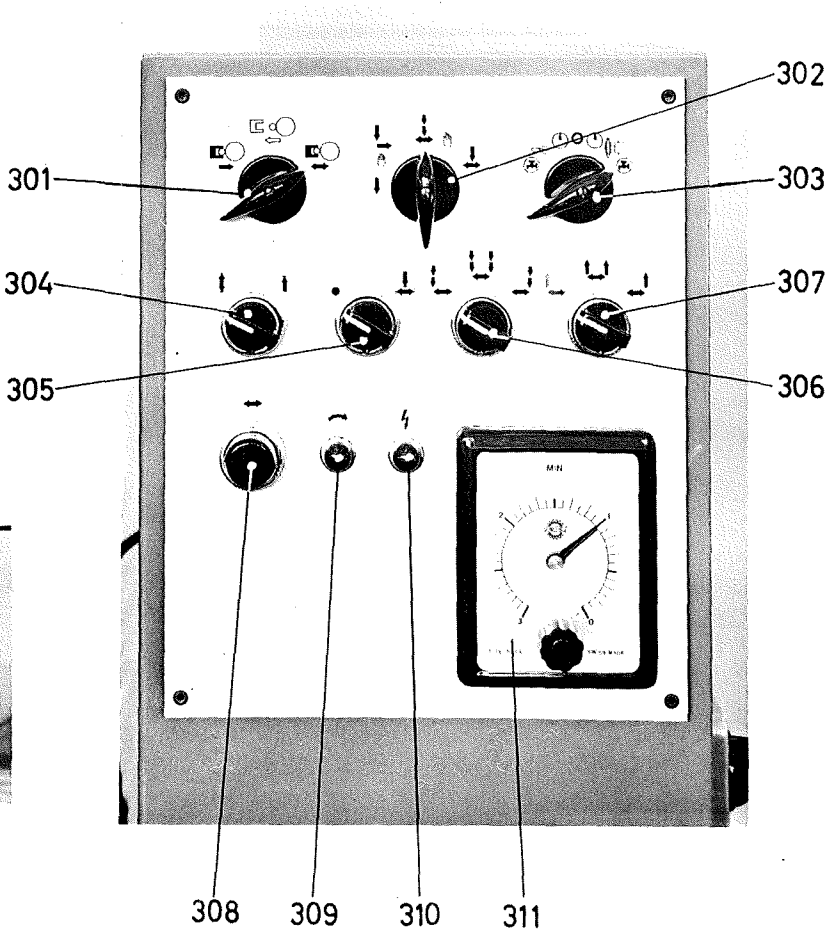
342 Thermal overload SPA



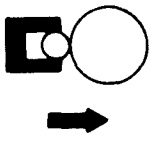
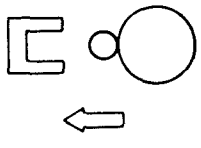
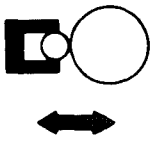

343 Thermal overload OEA
344 Thermal overload KA
345 Thermal overload ISA
346 Control transformer
347 Main fuse
348 Control fuse primary
349 Fuse for Movolimit
350 Control fuse secondary
351 Fuse for machine lamp
352 Transformer for electronic power pack
(for tension 220 or 380 Volt no transformer is used)
353 Electronic power pack for stepless work drive
354 Electric diagramme
355 Mains (see page 4.8)

## 300 Electrical control panel




## 301 Selector switch for Movolimit measuring head

| Approach measuring head | Retract measuring head | Automatic cycle |
|---|---|---|
|  |  |  |

For grinding without Movolimit this selector switch must be set to this position

302 Cycle selector switch

Various cycles, with the exception of setting up and dressing, can be set to operate automatically. The cycle is made up from the following individual functions:

- rapid approach of cross slide
- start of work head
- table travel (except at ⬇ )
- infeed at 2 preset rates
- spark out by preset time switch
- end of cycle (rapid retraction of wheel head, automatic return of infeed mechanism to start position, table and work head stopped).

⬇ Infeed table remains stationary, but can be moved by handwheel 101.

Manual - setting up or dressing

Infeed then traverse After infeeding to depth the table traverse to left or right is engaged up to the end of the set stroke.

Intermittent infeed with table traverse

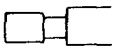
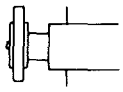
The wheel head infeed is effected at the left or right or at both ends of the table traverse (set by knob 306 see below)

"End of cycle" is effected at the end of the table stroke after spark out (at the left, or right, or at end of next traverse - set by knob 307, see below. Knob 102 must be turned to the left.)

Continuous infeed with table traverse

"End of cycle" is effected immediately the time set on the time switch has elapsed.

303 Motor selector switch

| Internal grinding | | External grinding | |
|---|---|---|---|
|  | off |  | off |
|  | hydraulic pump |  | hydraulic pump |
|  | internal grinding wheel |  | grinding wheel |
|  | coolant pump |  | coolant pump |

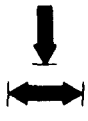
304 Selector switch

Rapid infeed effected normally

Rapid infeed remains at back position (serves for dressing the wheel and for face grinding).

305 Cycle interruptor

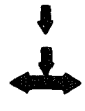
no function



infeed and table traverse interrupted. Handwheel 101 automatically engaged.

Example:

When grinding with table traverse the infeed and table movement may be stopped shortly before reaching size, e.g. for face grinding.

306 Feed selector switch used only with programme 

feed at left end of work piece

feed at right end of work piece

feed at right end of work piece

307 "End of cycle" selector switch - only operative

on programmes 

 at left end of work piece

 at left and right end of work piece

 at right end of work piece

308 Table traverse pushbutton 

This pushbutton is used to start the table traverse when setting up and dressing.

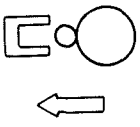
Table traverse can only be started when the rapid approach are in the forward position. If table traverse is required with the wheel head in the retracted position, selector switch 304 must be set to 

309 Green lamp

 Alight when the rapid approach and infeed are at the front position.

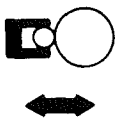
310 Control lamp alight when main switch 315 switched on.

311 Time relay Used for setting the spark out period.

(Selector switch 301 on  ),

or

for setting the measuring head retraction delay

(Selector switch 301 on  ).

312 EMERGENCY stop button immediately stops all machine movements.

313 Stop cycle  Pushbutton

If cycle selector switch 302 is set at "manual-setting up or dressing" then this pushbutton has the following function:

a) push halfway down: rapid retraction of wheel head, infeed remains at zero;

b) push whole way down: rapid retraction of wheel head with resetting of infeed mechanism.

If cycle selector switch 302 is set at any of the 4 automatic grinding cycles, then this pushbutton has the following functions:

rapid retraction of wheel head, reset infeed mechanism to zero, stop work head and table traverse.

When internal grinding the rapid approach unit keeps the wheel head at the forward position.

314 Start cycle  pushbutton

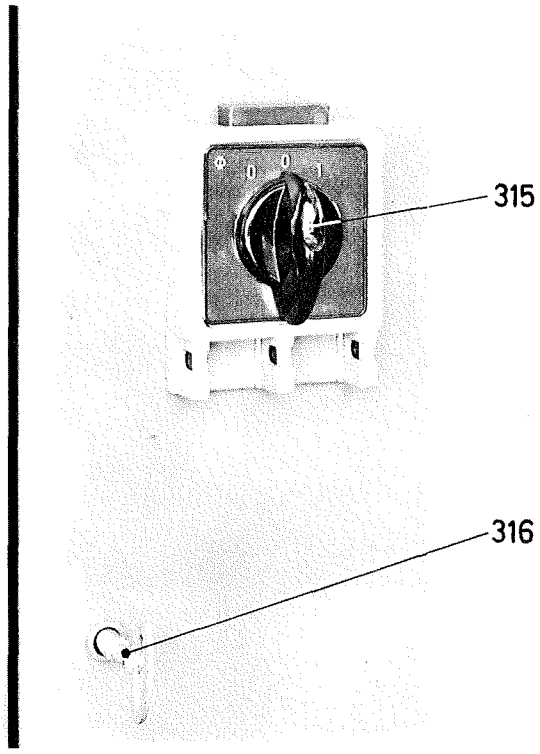
If cycle selector switch 302 is set at "manual-setting up or dressing" then this pushbutton has the following function:

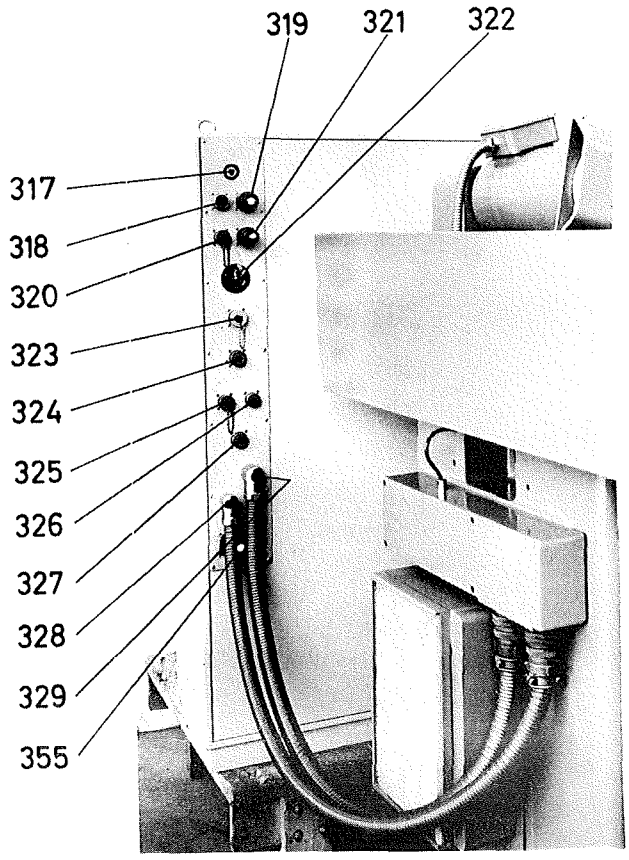
rapid approach of wheel head and infeed at max. speed to front position. One press is sufficient to operate the rapid approach of the wheel head. To obtain infeed the pushbutton must be held down until green lamp 309 lights.

Rapid approach cannot be engaged when the infeed is at zero. It must be retracted by pushbutton 313, or manually by hand wheel 201.

If cycle selector switch 302 is set at any of the 4 automatic grinding cycles then this pushbutton has the following function:

One press starts the whole preselected automatic cycle.




315 Main switch

Shuts down the electrical supply to every part of the machine.

1. Position 0 left off

   In this position the door can only be opened after turning the lock 316.

2. Position 0 middle off

   The door cannot be opened.
   The switch can in this position be secured by a max. of 3 padlocks.

3. Position 1 right on

316 Mechanical door lock

317 - 329 Electrical connections for

317 Cam grinding attachment

318 Servo box

319 Longlimit control

320 Movolimit mains socket

321 Movolimit control

322 Machine lamp

323 Internal grinding attachment

324 Grinding wheel drive

325 Magnetic filter

326 Coolant pump

327 Socket for frequency converter or for spec. plug.
(This special plug may only be used with the 50/60 Hz drive).

328 Motor cable

329 control cable

330 Contactor CA

331 Contactor RA

332 Contactor RB

333 Contactor RC

334 Contactor RE

335 Relay RF

336 Relay RG

337 Spark quenching combination FL

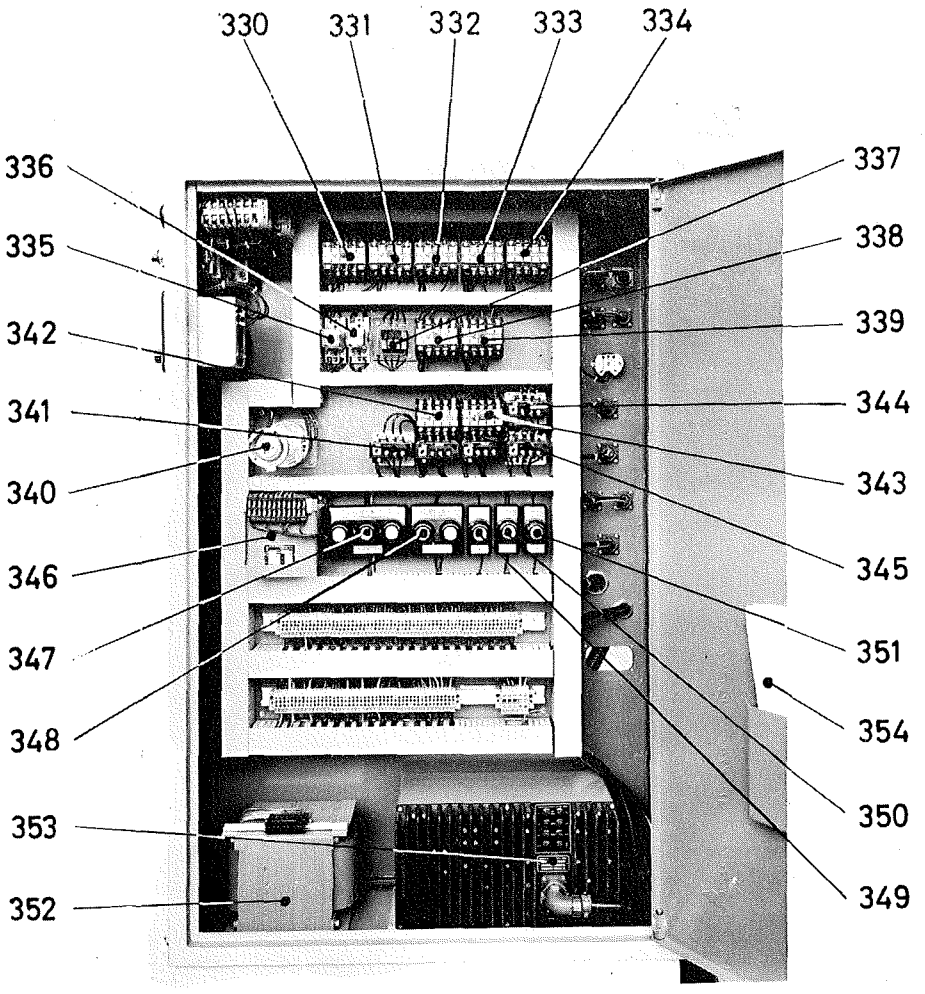
338 Contactor RH

339 Contactor RI

340 Main switch S

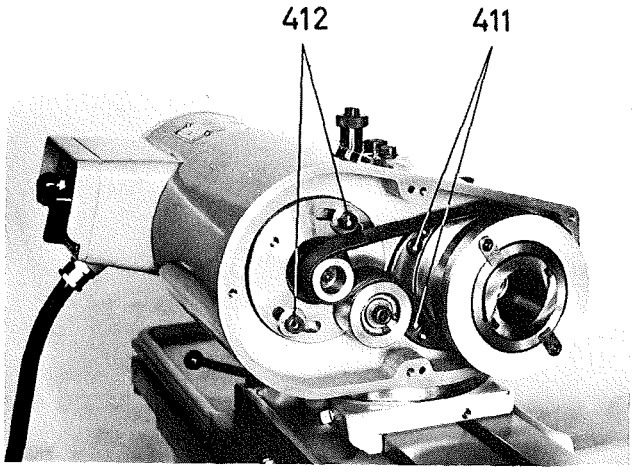
341 Thermal overload FUA

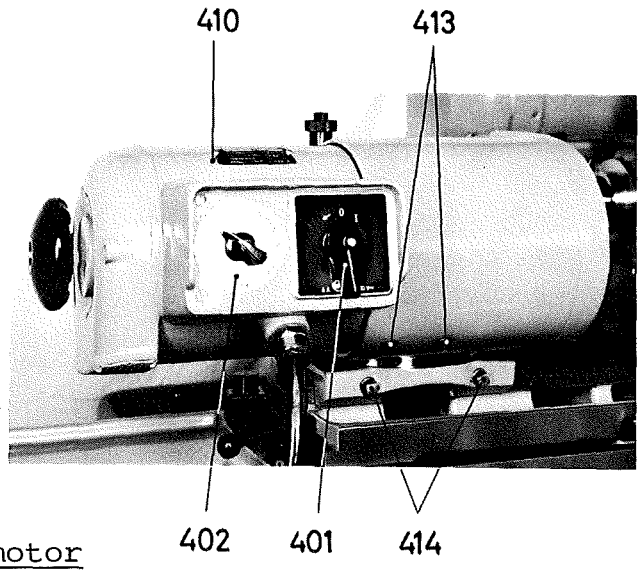
342 Motor contactor SP with thermal overload SPA




343 Motor contactor OE with thermal overload OEA
344 Thermal overload KA
345 Thermal overload ISA
346 Control transformer
347 Main fuse
348 Control fuse primary
349 Fuse for Movolimit
350 Control fuse secondary
351 Fuse for machine lamp
352 Transformer for electronic power pack
(for tension 220 or 380 Volt no transformer is used)
353 Electronic power pack for stepless work drive
354 Electric diagramme
355 Mains (see page 4.8)

400 Swivelling work head (type 869)




401 Selector switch for work head motor

inch | off (also with ref. to auto cycle) | on

402 Potentiometer for setting spindle speed between 40 and 650 rpm.

403 Sight glass

404 Bearing clearance lever used in conjunction with scale 405.

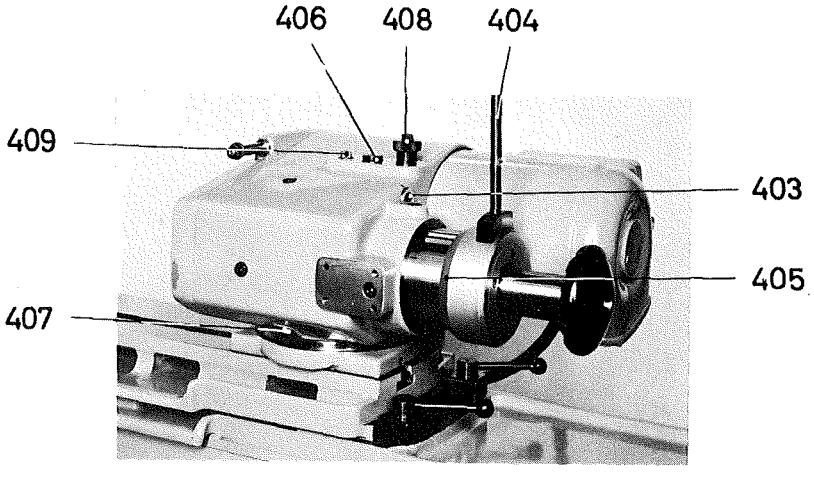
405 Scale for setting bearing clearance
1 div. = 1 micron (.000,04") bearing clearance.

406 Oil filler plug

407 Oil drain plug

408 Location plunger for $0^{o}$ position of swivelling head.

409 Nut to clamp swivelling motion of work head.




410 DC motor

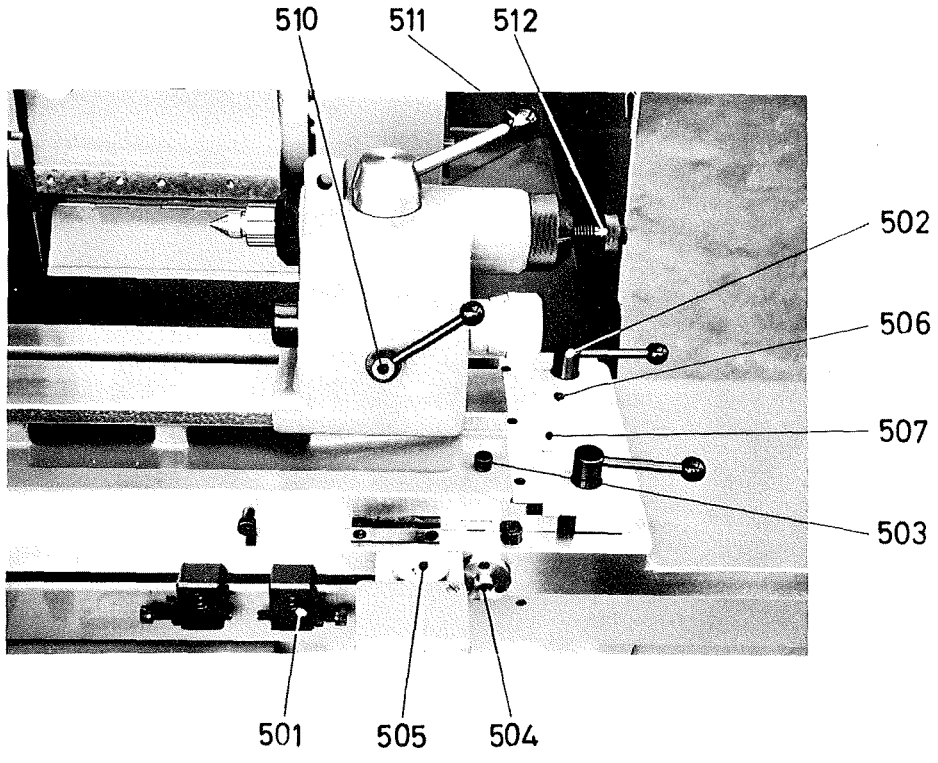
411 Fixing screws for work drive ring to ball bearing flange.

412 Clamp screws for belt tension pulley.

413 Mounting screws for DC motor.

414 Clamp screws for work head to table.

500 Table, swivelling table and tailstock




501 Reversal dog for table travel

502 Clamping levers

503 Clamping screws

504 Fine adjustment knob for swivelling motion

505 Dial indicator gauge

506 Scale in % graduation

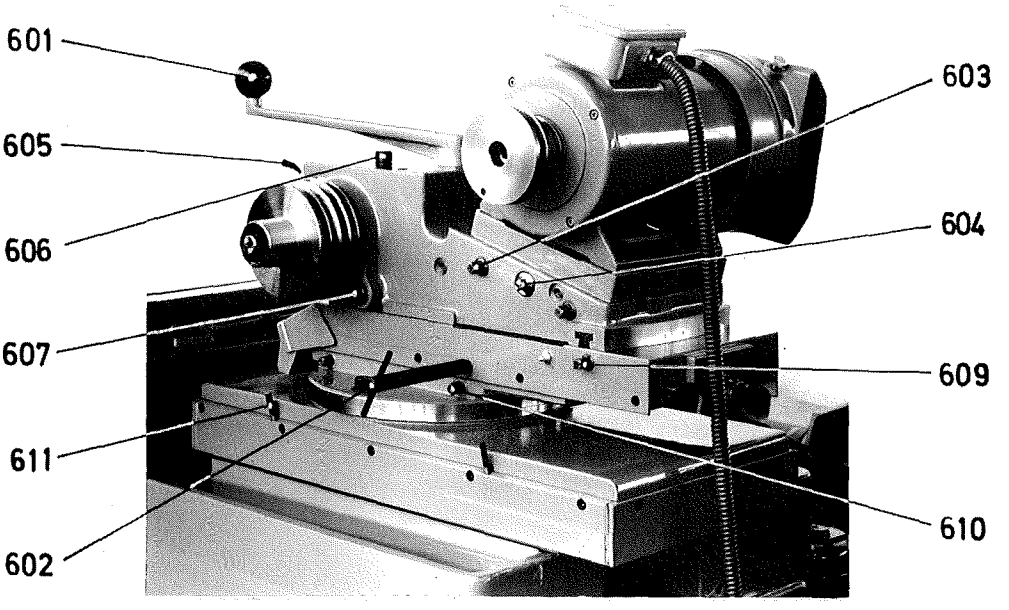
507 Scale in degree graduation

510 Lever for clamping tailstock to table

511 Tailstock retraction lever

512 Adjustment screw for tailstock barrel pressure

600 Wheelhead - cross slide




601 Lever for rapid adjustment of top slide

602 Clamp screw for top slide

603 Motor slide clamp

604 Pinion adjustment of motor slide for belt tensioning

605 Oil sight glasses

606 Oil filler plug

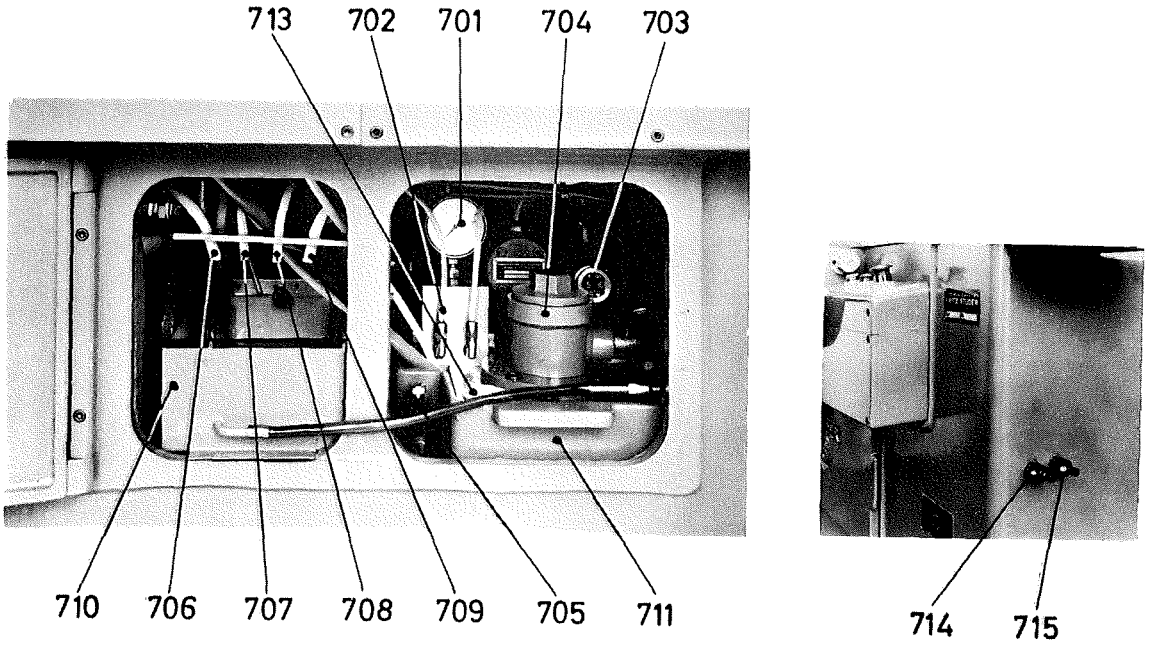
607 Oil drain plug

609 Clamp for wheelhead - intermediate slide

610 Clamp for intermediate slide - cross slide

611 Protection for transport (4 pieces) to be removed prior to putting into service and to replace by the 4 locking screws

700 Base, hydraulic tank etc




701 Pressure gauge (with pressure of valve 703 set to 7 atmos./100 psi)

702 Lubrication regulator (see also page 7.2)

703 Pressure regulating valve

704 Magnetic filter

705 Oil sight glass

Return leads of longitudinal and cross guideways lubrication

706 Lubrication of longitudinal slide left

707 Lubrication of cross slide left

708 Lubrication of cross slide right

709 Lubrication of longitudinal slide right

710 Settling tank

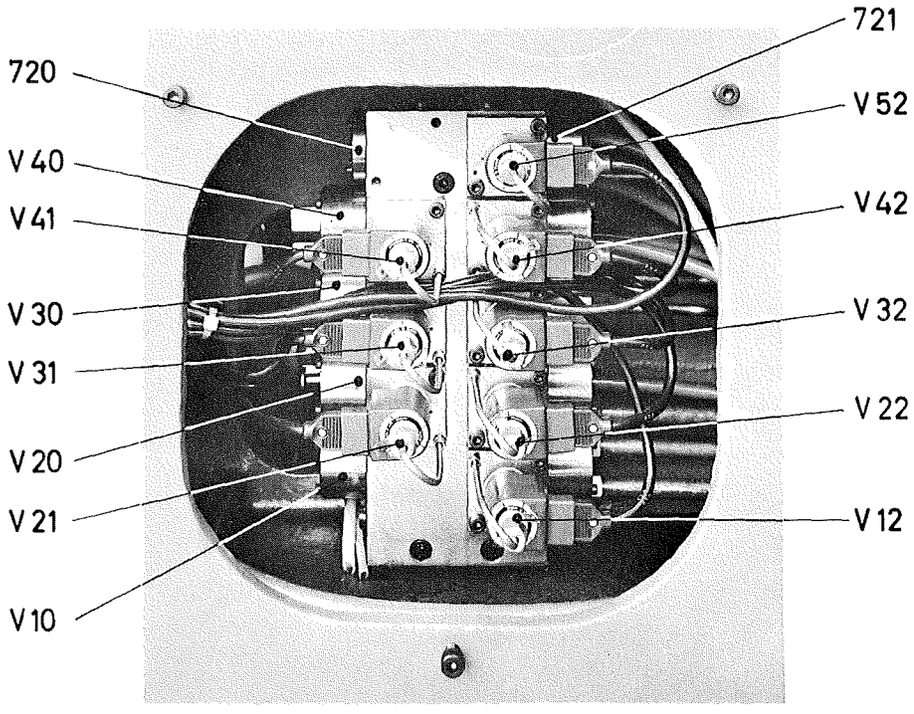
711 Oil tank

712 Nozzles (see page 7.2)

713 Oil infill

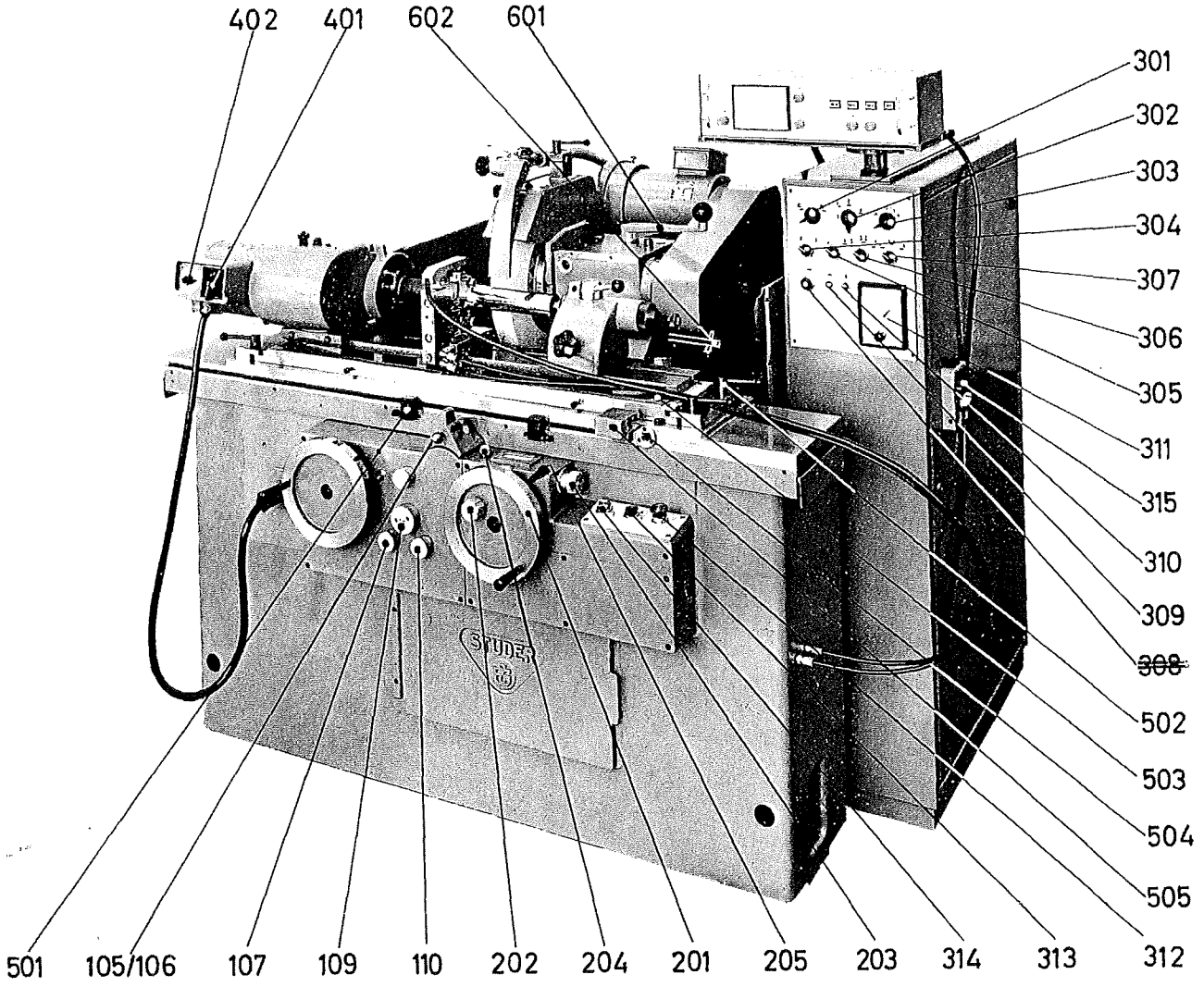
714 Connection R for measuring head

715 Connection A for measuring head




| | | |
|---|---|---|
| 720 | Pressure relief valve | 4 atm. / 59 psi. (By - pass) |
| 721 | Pressure relief valve | 9 atm. /132 psi. (Safety valve) |
| | Gate valve V 10 | Table movement, handwheel release |
| | Gate valve V 20 | rapid approach |
| | Gate valve V 30 | throttle selection |
| | Gate valve V 40 | plunge infeed |
| | Valve V 12 | Control valve for V 10 |
| | Valves V 21 and V 22 | Control valves for V 20 |
| | Valves V 31 and V 32 | Control valves for V 30 |
| | Valves V 41 and V 42 | Control valves for V 40 |
| | Valve V 52 | Control valve for Movolimit |

## Control elements




105 Table reversal pin

106 Locking screw

107 Normal infeed speed control valve

109 Table speed control valve

110 Control valve for setting the creep infeed i.e. the second infeed speed.

201 Infeed hand wheel 1 rev. = 2 mm (.1") on dia.

202 Clutch servo drive engaged

servo drive disengaged

203 Fine infeed knob 1 div. = 1 micron (0.001 mm) (.000,05")

204 Selector knob

neutral

material allowance setting
0 - 1,7 mm (0 - .07") on dia.
(long arrow)

creep setting
0 - 0,1 mm (0 - .005") on dia.
(short arrow)

205 Graduated ring — fully adjustable - 1 div. = 0.01 mm (.000,5") on dia.

301 Selector switch for Movolimit measuring head
302 Cycle selector switch
303 Motor selector switch
304 Selector switch
305 Cycle interruptor
306 Feed selector switch
307 "End of cycle" selector switch
~~308 Table traverse pushbutton~~
309 Green lamp
310 Control lamp
311 Time relay
312 EMERGENCY stop button
313 Stop cycle pushbutton
314 Start cycle pushbutton
315 Main switch

401 Selector switch for work head motor
402 Potentiometer

501 Reversal dog for table travel
502 Clamping levers
503 Clamping screws
504 Fine adjustment knob for swivelling motion
505 Dial indicator gauge

601 Lever for rapid adjustment of top slide
602 Clamp screw for top slide

## SETTING UP THE MACHINE

These instructions should be followed step by step on the machine. (The loading and unloading of the work and control of the coolant tap have been omitted from these instructions).

Setting up for plunge grinding

- Switch on main switch 315 - Check that mains indicator lamp 310 lights.
- Set selector switch 302 on setting up or dressing
- Turn clutch knob 202 to the right (Servo system disengaged).
- Turn feed handwheel 201 to the left up to the spring loaded stop. Then turn 5 revs to the right.
- Mount dressing diamond in tailstock (for other types of dressers see additional equipment page 10.2).
- Start hydraulic pump, grinding wheel and coolant pump from selector switch 303.
- Unclamp wheelhead top slide (602). If necessary adjust wheel position with lever 601. There must be at least 50 mm (2") between wheel and diamond.
- Press green pushbutton 314 until green lamp 309 lights.
- Using rapid adjustment lever 601, bring wheel to within 1 mm (.04") of diamond. Clamp top slide with screw 602.
- Set table reversing dog 501 to suit position of diamond and retract table reversal pin 105 (release locking screw 106 and turn pin 105 to the right).
- Start table traverse with pushbutton ~~308~~. 305
- Set table traverse speed with valve 109.
- Bring grinding wheel towards diamond with hand wheel 201.
- The dressing cycle is described in detail on page 6.2.
- Stop cycle with pushbutton 313.
- Load work in machine.
- Start work rotating - set switch 401 at I.
- Set required work rpm on potentiometer 402 (see table D5-136 for recommended work speeds).
- Set table traverse to approx. the required position.
- Reset wheel slide via lever 601 if required, to give a minimum distance between wheel and work of 50 mm (2").
- Press green pushbutton 314 until green lamp 309 lights.
- Unclamp top slide with screw 602.
- Use lever 601 to bring wheel to within 1 mm (.04") of the work.
- Reclamp screw 602.
- Set traverse dogs. 501.

- Using infeed handwheel 201, grind work until cleaned up.
- Depress stop cycle pushbutton 313 half way down.
- Switch off work head (switch 401 to 0).
- Measure taper of work piece.

If work piece is tapered

- Depress stop cycle pushbutton 313 fully.
- Rotate infeed handwheel 201 1 rev. to the left.
- Release the 4 table clamping levers 502.
- Tighten screw 503.
- Read the amount of table adjustment required from correction table (1808-8, 808-8 or 760-8).
- Set top swivelling table via knob 504 to the required reading on dial gauge 505 (to eliminate any play in the pivotting axis of the table, always finally approach the table towards the dial gauge).
- Reclamp table with the 4 levers 502.
- Restart work head (switch 401 at I).
- Press green pushbutton 314 until green lamp 309 lights.
- Using infeed hand wheel 201, grind work until a new clean surface is established.
- Depress stop cycle pushbutton 313 half way down.
- Switch off work head (switch 401 at 0).
- Measure taper of work piece - if it is not yet sufficiently parallel repeat above steps.

If the work piece is parallel

- Measure diameter of work.
- Engage clutch via knob 202.
- Set amount of stock to be removed on scale 205.
- Disengage clutch via knob 202.
- Set infeed handwheel 201 to read 0 on scale.
- Engage clutch via knob 202.
- Set cycle selector switch 302 to ⬇ infeed. The infeed will then be automatically applied until the pre-set amount of stock has been removed (the main scale shows approx. 0.1 mm (.004") more material allowance than has actually been set).

If insufficient material has been removed

- Clamp selector knob 204 lightly in its clockwise direction.

  Rotate infeed handwheel 201 clockwise. After approx. 0.1 mm (.004") knob 204 will automatically be engaged.

  Hold knob 204. Take back infeed handwheel slightly more than the required amount of stock to be removed, then in the 0 direction, set the new stock removal. Set knob 204 in its neutral position (rotate anti-clockwise).

- The setting of the change over point from normal to creep feed is effected in approx. the same way except that knob 204 must be turned anti-clockwise (setting range 0 - 0.1 mm (.005").

- Depress stop cycle push-button fully.

If the correct amount of material has been removed

- Load work piece.

- Set infeed speed valves 107, 110 each at position 1.

- Set required spark out time on time relay 311.

- Press green start cycle pushbutton 314.

- Carefully adjust infeed speed of valve 107.

- After the automatic change over to creep speed carefully adjust valve 110.

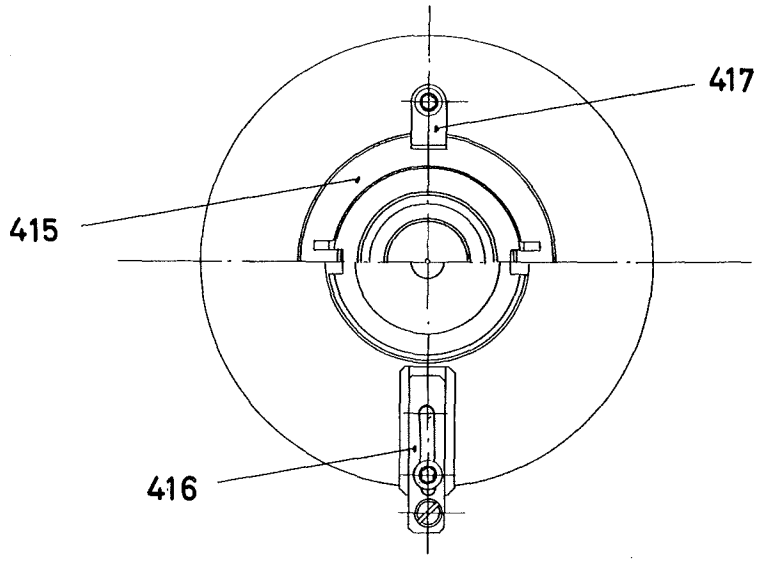
- The machine will automatically complete its cycle.

- Measure work piece, make any necessary small adjustment on fine infeed knob 203 (1 div. = 1 micron (.000,05") on diameter then repeat whole cycle.

Swivelling work head (type 869)

1. Setting up for between center grinding

- Completely remove bearing clearance by lever 404.
- Replace driver 417 and driver ring 415 by driver 416.




2. Setting up for live spindle grinding

- Replace driver 416 by driver 417 and driver ring 415.
- The driver members must be quite clean and ring 415 must be free in its slots and tongues.

3. Adjust the bearing clearance

- Set lever 404 to read approx. 20 mm below 0. (.08")
- Move lever 404 until spindle and driver can be rotated by the thumbs.
- When the spindle has reached its working temperature or if it should bind, reset the clearance.

  Note: The diameter of the spindle will slightly increase at high revs., approx. 0.1 mm (.004") at 600 rpm. Grinding should not be performed at work head speeds below 50 rpm in order to avoid bearing wear.

4. Face grinding

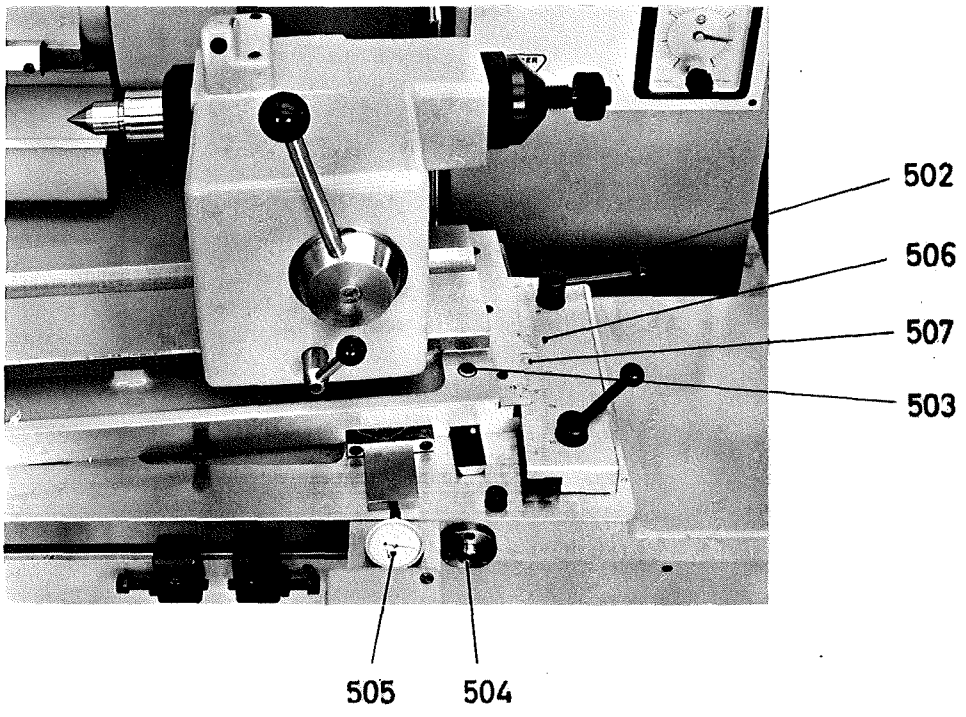
- Set bearing clearance at 3 as above.
- If a work flatness better than .000,5 mm (.000,02") ist required, adjust bearing as follows:

  a) set required spindle spead

  b) with spindle rotating set a dial gauge to read on the front face of the spindle and decrease the clearance by lever 404 until a reading of .01 mm (.000,4") is obtained on the dial gauge.

  Warning: If the spindle speed is altered, the bearing clearance must be reset.

Setting up taper angles within the table inclination range, using the rapid table setting device.

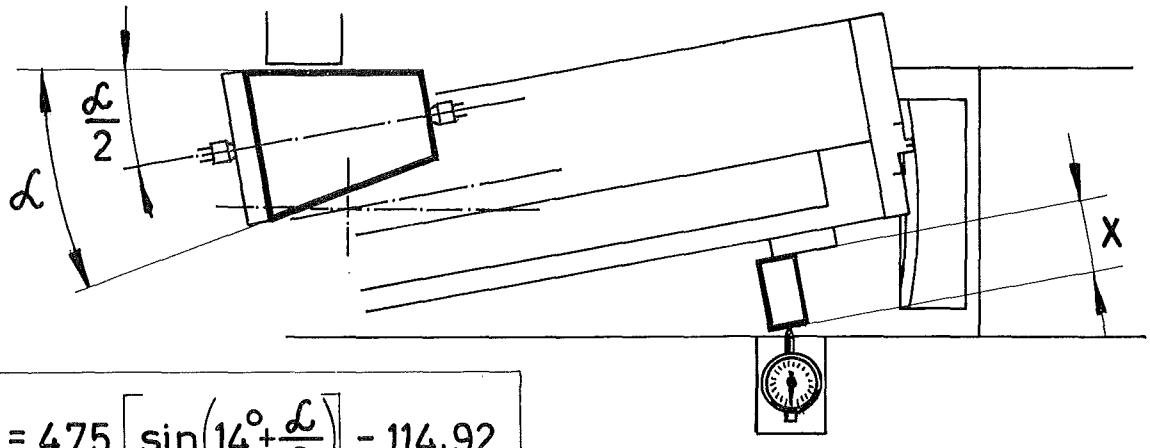



This equipment facilitates the rapid setting of a taper angle after a piece has been cylindrically ground.

- After the cylindrical grinding operation, set the dial gauge to read 0.
- Rough set the table to the required angle from scale 506 on the end of the table (release the 4 clamps 502 and the clamp screw 503).
- Tighten screw 503.
- Using table 1808-13, sheet 1, determine dimension X.
- Place slip gauge in position.
- Using fine adjusting knob 504 set table so that dial gauge again reads 0 (if the exact length of slip gauge is not available the difference can be set on the dial gauge).
- If the required angle is not exactly correct it may be adjusted according to the dimensions given in table 1808-8, sheet 2.

In order to eliminate any effect of play in the pivoting axis of the table, always make adjustments to the table approaching from the same direction. This of course applies to both when setting for parallelism and when setting a taper.

Präzisions-Schnell-Einstellvorrichtung
Régleur rapide de précision
Precision fast setting device for the table




$$X = 475 \left[ \sin\left(14^\circ + \frac{\alpha}{2}\right) \right] - 114{,}92$$

| Konus | ▷ in° | ▷ in % | X |
|---|---|---|---|
| Morse No. 0 | 2° 58' 54" | 5,205 | 11,945 |
| Morse No. 1 | 2° 51' 26" | 4,988 | 11,448 |
| Morse No. 2 | 2° 51' 40" | 4,995 | 11,463 |
| Morse No. 3 | 2° 52' 32" | 5,020 | 11,521 |
| Morse No. 4 | 2° 58' 30" | 5,194 | 11,918 |

| Konus | ▷ in° | ▷ in % | X |
|---|---|---|---|
| Morse No. 5 | 3° 00' 46" | 5,263 | 12,069 |
| Morse No. 6 | 2° 59' 12" | 5,214 | 11,965 |
| Metr. | 2° 51' 52" | 5 | 11,477 |
| Brown+Sharpe | 2° 23' 12" | 4,167 | 9,567 |
| American Standard | 16° 35' 40" | 29,167 | 65,300 |

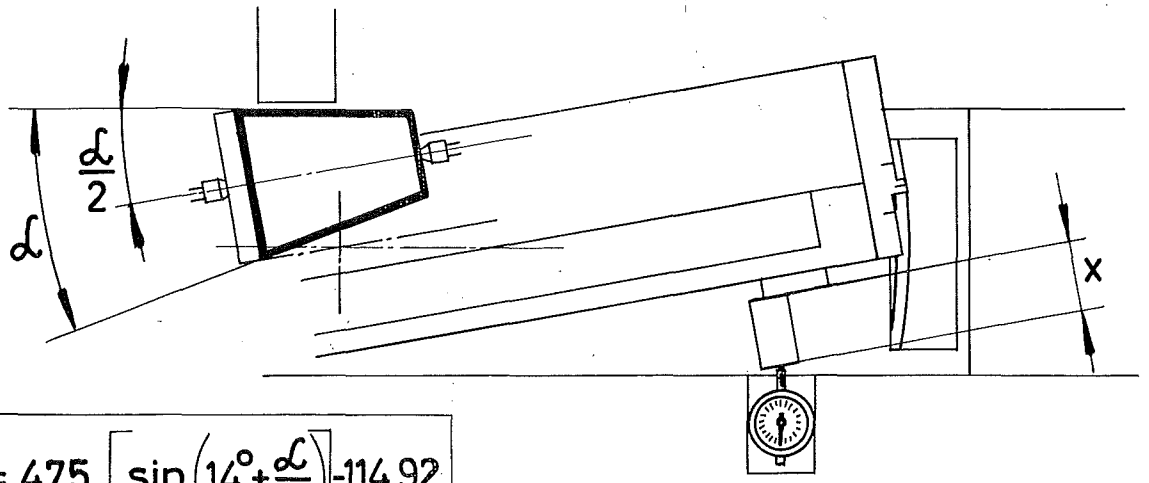
| α/2 in° | X |
|---|---|
| 30' | 4,010 |
| 45' | 6,016 |
| 1° | 8,019 |
| 1° 15' | 10,020 |
| 1° 30' | 12,018 |
| 1° 45' | 14,014 |
| 2° | 16,008 |
| 2° 15' | 17,999 |
| 2° 30' | 19,987 |
| 2° 45' | 21,973 |
| 3° | 23,957 |
| 3° 15' | 25,938 |
| 3° 30' | 27,915 |
| 3° 45' | 29,890 |
| 4° | 31,863 |
| 4° 15' | 33,833 |
| 4° 30' | 35,800 |
| 4° 45' | 37,764 |
| 5° | 39,725 |
| 5° 15' | 41,683 |

| α/2 in° | X |
|---|---|
| 5° 30' | 43,638 |
| 6° | 47,540 |
| 6° 30' | 51,428 |
| 7° | 55,305 |
| 7° 30' | 59,168 |
| 8° | 63,018 |
| 8° 30' | 66,854 |
| 9° | 70,677 |
| 9° 30' | 74,486 |
| 10° | 78,280 |
| 10° 30' | 82,059 |
| 11° | 85,824 |
| 11° 30' | 89,573 |
| 12° | 93,306 |
| 12° 30' | 97,024 |
| 13° | 100,725 |
| 13° 30' | 104,411 |
| 14° | 108,079 |
| 14° 30' | 111,731 |
| 15° | 115,365 |

| ▷ in % | X |
|---|---|
| 1 % | 2,295 |
| 2 % | 4,594 |
| 3 % | 6,891 |
| 4 % | 9,182 |
| 5 % | 11,475 |
| 6 % | 13,761 |
| 7 % | 16,043 |
| 8 % | 18,322 |
| 9 % | 20,595 |
| 10 % | 22,864 |
| 11 % | 25,130 |
| 12 % | 27,391 |
| 13 % | 29,645 |
| 14 % | 31,896 |
| 15 % | 34,141 |
| 16 % | 36,376 |
| 17 % | 38,614 |
| 18 % | 40,843 |
| 19 % | 43,067 |
| 20 % | 45,283 |

| ▷ in% | X |
|---|---|
| 21 % | 47,494 |
| 22 % | 49,697 |
| 23 % | 51,897 |
| 24 % | 54,087 |
| 25 % | 56,270 |
| 26 % | 58,450 |
| 27 % | 60,620 |
| 28 % | 62,786 |
| 29 % | 64,938 |
| 30 % | 67,091 |
| 31 % | 69,232 |
| 32 % | 71,366 |
| 33 % | 73,493 |
| 34 % | 75,611 |
| 35 % | 77,720 |
| 36 % | 79,823 |
| 37 % | 81,917 |
| 38 % | 84,002 |
| 39 % | 86,080 |
| 40 % | 88,148 |

## Precision fast setting device for the table




$$X = 475 \left[ \sin\left(14^\circ + \frac{\alpha}{2}\right) - 114{,}92 \right]$$

| Konus | in° | in % | X |
|---|---|---|---|
| Morse No. 0 | 2° 58' 54" | 5,205 | 0,4703 |
| Morse No. 1 | 2° 51' 26" | 4,988 | 0,4507 |
| Morse No. 2 | 2° 51' 40" | 4,995 | 0,4513 |
| Morse No. 3 | 2° 52' 32" | 5,020 | 0,4536 |
| Morse No. 4 | 2° 58' 30" | 5,194 | 0,4692 |

| Konus | in° | in % | X |
|---|---|---|---|
| Morse No. 5 | 3° 00' 46" | 5,263 | 0,4752 |
| Morse No. 6 | 2° 59' 12" | 5, 14 | 0,4711 |
| Metr. | 2° 51' 52" | 5 | 0,4519 |
| Brown+Sharpe | 2° 23' 12' | 4,167 | 0,3767 |
| American Standard | 16°35' 40 | 29,167 | 2,5709 |

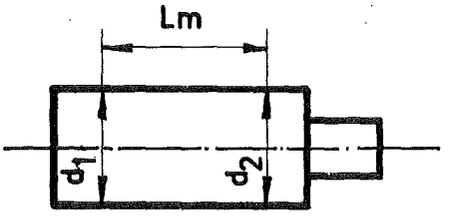
| α/2 in° | X |
|---|---|
| 30' | .1579 |
| 45' | .2369 |
| 1° | .3157 |
| 1° 15' | .3945 |
| 1° 30' | .4732 |
| 1° 45' | .5517 |
| 2° | .6302 |
| 2° 15' | .7086 |
| 2° 30' | .7869 |
| 2° 45' | .8651 |
| 3° | .9432 |
| 3° 15' | 1.0212 |
| 3° 30' | 1.0990 |
| 3° 45' | 1.1768 |
| 4° | 1.2545 |
| 4° 15' | 1.3320 |
| 4° 30' | 1.4094 |
| 4° 45' | 1.4868 |
| 5° | 1.5640 |
| 5° 15' | 1.6411 |

| α/2 in° | X |
|---|---|
| 5° 30' | 1.7180 |
| 6° | 1.8717 |
| 6° 30' | 2.0247 |
| 7° | 2.1774 |
| 7° 30' | 2.3294 |
| 8° | 2.4810 |
| 8° 30' | 2.6321 |
| 9° | 2.7826 |
| 9° 30' | 2.9325 |
| 10° | 3.0819 |
| 10° 30' | 3.2307 |
| 11° | 3.3789 |
| 11° 30' | 3.5265 |
| 12° | 3.6735 |
| 12° 30' | 3.8198 |
| 13° | 3.9656 |
| 13° 30' | 4.1107 |
| 14° | 4.2551 |
| 14° 30' | 4.3989 |
| 15° | 4.5419 |

| in % | X |
|---|---|
| 1 % | .0904 |
| 2 % | .1809 |
| 3 % | .2713 |
| 4 % | .3615 |
| 5 % | .4518 |
| 6 % | .5418 |
| 7 % | .6316 |
| 8 % | .7213 |
| 9 % | .8108 |
| 10 % | .9001 |
| 11 % | .9894 |
| 12 % | 1.0784 |
| 13 % | 1.1671 |
| 14 % | 1.2557 |
| 15 % | 1.3441 |
| 16 % | 1.4321 |
| 17 % | 1.5202 |
| 18 % | 1.6080 |
| 19 % | 1.6956 |
| 20 % | 1.7828 |

| in % | X |
|---|---|
| 21 % | 1.8698 |
| 22 % | 1.9566 |
| 23 % | 2.0432 |
| 24 % | 2.1294 |
| 25 % | 2.2154 |
| 26 % | 2.3012 |
| 27 % | 2.3866 |
| 28 % | 2.4718 |
| 29 % | 2.5566 |
| 30 % | 2.6414 |
| 31 % | 2.7257 |
| 32 % | 2.8097 |
| 33 % | 2.8934 |
| 34 % | 2.9768 |
| 35 % | 3.0598 |
| 36 % | 3.1426 |
| 37 % | 3.2251 |
| 38 % | 3.3072 |
| 39 % | 3.3890 |
| 40 % | 3.4704 |

**Korrekturtabelle**
**Table de correktion**
**Correction table**




$$\Delta d = d_1 - d_2$$

$$X = \frac{\Delta d}{2} \cdot \frac{460,89}{Lm}$$

Verstellwerte - in µm - nach Messuhr einstellen.
Valeurs à déplacer - en µm - è l' aide du comparateur.
Set adjustment values - µm - according to dial indicator readings.

Δd Gemessener Fehler in µm/ø
Erreur messurée en µm/ø
Ascertained error to µm/ø

Lm Messlänge in mm / Longueur de la mesure en mm / Measuring length in mm

| | 1 | 2 | 4 | 6 | 8 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 23 | 46 | 92 | 138 | 184 | 230 | 461 | 691 | 922 | 1152 | 1383 | 1613 | 1844 |
| 20 | 12 | 23 | 46 | 69 | 92 | 115 | 230 | 346 | 461 | 576 | 691 | 807 | 922 |
| 30 | 8 | 15 | 31 | 46 | 61 | 77 | 154 | 230 | 307 | 384 | 461 | 538 | 615 |
| 40 | 6 | 12 | 23 | 35 | 46 | 58 | 115 | 172 | 230 | 288 | 346 | 403 | 460 |
| 50 | 5 | 9 | 18 | 28 | 37 | 46 | 92 | 138 | 184 | 230 | 277 | 323 | 369 |
| 60 | 4 | 8 | 15 | 23 | 31 | 38 | 77 | 115 | 154 | 192 | 230 | 267 | 307 |
| 70 | 3 | 7 | 13 | 20 | 26 | 33 | 66 | 99 | 132 | 165 | 198 | 230 | 263 |
| 80 | 3 | 6 | 12 | 17 | 23 | 29 | 58 | 86 | 115 | 144 | 172 | 202 | 230 |
| 90 | 3 | 5 | 10 | 15 | 20 | 26 | 51 | 77 | 102 | 128 | 154 | 179 | 205 |
| 100 | 2 | 5 | 9 | 14 | 18 | 23 | 46 | 69 | 92 | 115 | 138 | 161 | 184 |
| 150 | 2 | 3 | 6 | 9 | 12 | 15 | 31 | 46 | 61 | 77 | 92 | 108 | 123 |
| 200 | 2 | 2 | 5 | 7 | 9 | 12 | 23 | 35 | 46 | 58 | 69 | 81 | 92 |
| 250 | 1 | 2 | 4 | 6 | 7 | 9 | 18 | 28 | 37 | 46 | 55 | 65 | 74 |
| 300 | 1 | 2 | 6 | 5 | 6 | 8 | 15 | 23 | 31 | 38 | 46 | 54 | 61 |
| 350 | 1 | 1 | 3 | 4 | 5 | 7 | 13 | 20 | 26 | 33 | 40 | 46 | 53 |
| 400 | 1 | 1 | 2 | 3 | 5 | 6 | 12 | 17 | 23 | 29 | 35 | 40 | 46 |
| 450 | 1 | 1 | 2 | 3 | 4 | 5 | 10 | 15 | 20 | 26 | 31 | 36 | 41 |
| 500 | 0,00 | 1 | 2 | 3 | 4 | 5 | 9 | 14 | 18 | 23 | 28 | 32 | 37 |

## Correction table

**Set adjustment values - .0001 inch - according to dial indicator readings**

**Ascertained error to .0001 inch/ø**

| Lm Measuring length in inches | 1 | 2 | 4 | 6 | 8 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2 | 18 | 36 | 73 | 109 | 145 | 182 | 363 | 545 | 726 | 908 | 1089 | 1271 | 1452 |
| 1 | 9 | 18 | 36 | 54 | 73 | 91 | 182 | 272 | 363 | 454 | 545 | 635 | 726 |
| 1 1/2 | 6 | 12 | 24 | 36 | 48 | 61 | 121 | 182 | 242 | 303 | 363 | 424 | 484 |
| 2 | 5 | 9 | 18 | 27 | 36 | 45 | 91 | 136 | 182 | 227 | 272 | 318 | 363 |
| 2 1/2 | 4 | 7 | 15 | 22 | 29 | 36 | 73 | 108 | 145 | 182 | 218 | 254 | 290 |
| 3 | 3 | 6 | 12 | 18 | 24 | 30 | 61 | 91 | 121 | 151 | 182 | 212 | 242 |
| 3 1/2 | 3 | 5 | 10 | 16 | 21 | 26 | 52 | 78 | 104 | 130 | 156 | 182 | 207 |
| 4 | 2 | 5 | 9 | 14 | 18 | 23 | 45 | 68 | 91 | 113 | 136 | 159 | 182 |
| 4 1/2 | 2 | 4 | 8 | 12 | 16 | 20 | 40 | 61 | 81 | 101 | 121 | 141 | 161 |
| 5 | 2 | 4 | 7 | 11 | 15 | 18 | 36 | 54 | 73 | 91 | 109 | 127 | 145 |
| 6 | 2 | 3 | 6 | 9 | 12 | 15 | 30 | 45 | 61 | 76 | 91 | 106 | 121 |
| 7 | 1 | 3 | 5 | 8 | 10 | 13 | 26 | 39 | 52 | 65 | 78 | 91 | 104 |
| 8 | 1 | 2 | 5 | 7 | 9 | 11 | 23 | 34 | 45 | 57 | 68 | 79 | 91 |
| 9 | 1 | 2 | 4 | 6 | 8 | 10 | 20 | 30 | 40 | 50 | 61 | 71 | 81 |
| 10 | 1 | 2 | 4 | 5 | 7 | 9 | 18 | 27 | 36 | 45 | 54 | 64 | 73 |
| 11 | 1 | 2 | 3 | 5 | 7 | 8 | 17 | 25 | 33 | 41 | 50 | 58 | 66 |
| 12 | 1 | 2 | 3 | 5 | 6 | 8 | 15 | 23 | 30 | 38 | 45 | 53 | 61 |
| 13 | 1 | 1 | 3 | 4 | 6 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 |
| 14 | 1 | 1 | 3 | 4 | 5 | 7 | 13 | 19 | 26 | 32 | 39 | 46 | 52 |
| 15 | 1 | 1 | 2 | 4 | 5 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
| 16 | 1 | 1 | 2 | 3 | 5 | 6 | 11 | 17 | 23 | 28 | 34 | 40 | 45 |
| 17 | 1 | 1 | 2 | 3 | 4 | 5 | 11 | 16 | 22 | 27 | 32 | 37 | 43 |
| 18 | 1 | 1 | 2 | 3 | 4 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| 19 | 0 | 1 | 2 | 3 | 4 | 5 | 10 | 14 | 19 | 24 | 29 | 33 | 38 |
| 20 | 0 | 1 | 2 | 3 | 4 | 5 | 9 | 14 | 18 | 23 | 27 | 32 | 36 |

## Venting the table cylindre

After every long working interruption the table cylindre should be vented as follows:

- Programme selector switch 302 on  . Bring the grinding wheel to the front by actuating button 314.

- Pull out table reversal pin 105 and tighten with locking screw 106. Retract the wheel sufficiently with the coarse adjustment 601.

- Start the longitudinal slide with interruptor 305 and let traverse several times.

- Switch off the longitudinal slide at the right hand stroke with the aid of the cycle interruptor 305.

- Move the longitudinal slide by hand to the left (handwheel 101).

- Start the longitudinal slide with interruptor 305 and let traverse several times.

- Stop the longitudinal slide at the left end of the stroke with the cycle interruptor.

- Move longitudinal slide by hand to the right.

- Start the longitudinal slide with interruptor 305 and let traverse several times.

- Check if the longitudinal slide moves smoothly. If the longitudinal slide still moves jerky the above procedure must be repeated.

GRINDING

Pheripheral speed of work piece (see table D5-136)

External grinding: Steel and cast-iron

| | | | |
|---|---|---|---|
| roughing | 22-26 m/min. - | 72-85 | ft./min. |
| finishing | 18-22 m/min. - | 59-72 | ft./min. |

Hardened steel

| | | | |
|---|---|---|---|
| roughing | 20-22 m/min. - | 65-72 | ft./min. |
| finishing | 15-18 m/min. - | 49-59 | ft./min. |

Bronze, etc.

| | | | |
|---|---|---|---|
| roughing | 26-30 m/min. - | 85-98 | ft./min. |
| finishing | 22-24 m/min. - | 72-79 | ft./min. |

Internal grinding: Steel and cast-iron

| | | | |
|---|---|---|---|
| roughing | 35-40 m/min. - | 115-131 | ft./min. |
| finishing | 30-35 m/min. - | 98-115 | ft./min. |

Hardened steel

| | | | |
|---|---|---|---|
| roughing | 30-35 m/min. - | 98-115 | ft./min. |
| finishing | 20-25 m/min. - | 65- 82 | ft./min. |

Bronze, etc.

| | | | |
|---|---|---|---|
| roughing | 50-60 m/min. - | 165-200 | ft./min. |
| finishing | 40-50 m/min. - | 130-165 | ft./min. |

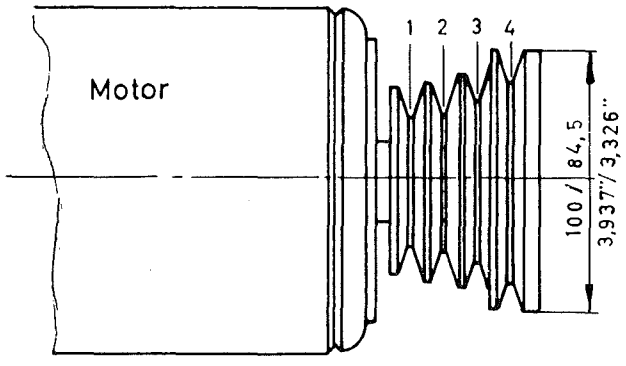
For top precision work the peripheral speed should be reduced.

Peripheral speed of the grinding wheel (see table D5-137)

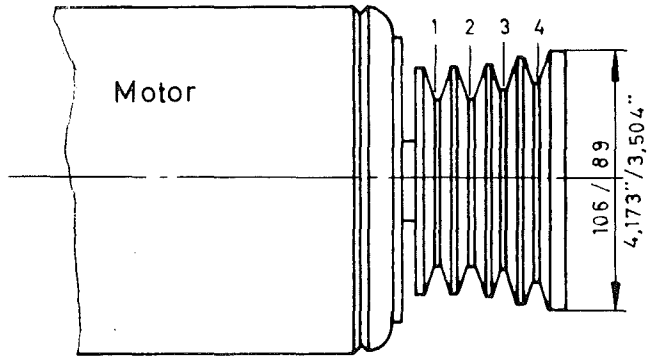
The effective hardness of the grinding wheel comes not only from its actual hardness but also from its peripheral speed. The higher the peripheral speed the higher the effective hardness of the wheel and vice-versa.

A wheel which rotates too slowly or which is in itself too soft soon wears. A grinding wheel must be selected for the material to be ground and should have a peripheral speed of 28-30 m/sec. (90-100 ft./sec.). In order to maintain this peripheral speed as the wheel wears down in diameter, the machine is fitted with a vee-belt pulley having 4 steps which can be used for the following grinding wheel diameters:

Standard Execution
Grinding wheel Ø 400 mm




Special Execution
Grinding wheel Ø 300 mm




| Step | Dia of grinding wheel in mm | rpm |
|---|---|---|
| 1 | 400-350 (16"-14") | 1450 |
| 2 | 350-300 (14"-12") | 1650 |
| 3 | 300-250 (12"-10") | 1930 |
| 4 | 250-220 (10"- 9") | 2300 |

| Step | Dia of grinding wheel in mm | rpm |
|---|---|---|
| 1 | 300-280 (12" -11" ) | 1910 |
| 2 | 280-260 (11" -10¼") | 2050 |
| 3 | 260-240 (10¼"- 9½") | 2200 |
| 4 | 240-220 ( 9½"- 8½") | 2390 |

Step 4 for righthand grinding wheel

Grinding wheel (see table 800-33b)

Choose the grinding wheel to suit the material to be ground. For hard and soft steel select standard aluminium oxide (artificial corundum), for cast-iron, aluminium, nitrided steel, bronze etc., select silicon carbide (carborundum).

Grit and hardness:

The grit is selected to produce the required finish on the work and the hardness to suit the hardness of the work piece material. The harder the work piece the softer the wheel and vice-versa except for certain material such as nitrided steel. Hollow work pieces require softer wheels than solid work pieces to avoid ovality caused by irregular heating. For hardened steel we recommend:

| | | | | |
|---|---|---|---|---|
| for roughing | grit | 36 - 46 | hardness | L or K |
| for finishing | " | 60 - 100 | " | K or J |
| for fine grinding | " | 120 - 300 | " | J or H |
| | | | | (Norton scale) |

Dressing the wheel

It is important to use a good diamond of approx. 1.5 carat for wheels Ø 400 mm/16" and approx. 1 carat for wheels Ø 300 mm/12" having a number of sharp cutting edges. A worn diamond must be reset so as to present new sharp faces to the grinding wheel.

For small internal grinding wheels and lap grinding wheels use a diamond impregnated dresser having a grit size approx. equal to the grit size of the wheel.

| Grinding operation | Grit of the wheel to be dressed | Recommended grit size for dressing tool |
|---|---|---|
| External cylindrical grinding | | |
| Fine grinding | Grit 300 to 320 | Grit 30 or 50 |
| Super fine grinding<br>Lap grinding | Grit 500 to 600 )<br>Grit 800 to 1000 ) | Grit 100 or 150 |
| Internal cylindrical grinding | | |
| Finishing | Grit 60 to 100 | Grit 30 |
| Fine grinding | Grit 120 to 200 | Grit 50 |
| Super fine grinding | Grit 350 to 400 | Grit 100 |

Feed the diamond very carefully and in small increments. For a coarse wheel the maximum dressing pass should not exceed 0.1 mm (.004") and for a fine wheel should not exceed 0.01 - 0.02 mm (.000,4 - .001,2"). Flood both diamond and wheel with coolant; on no account allow an interrupted flow of coolant on the diamond as this may cause fractures in the diamond.

A tailstock mounted diamond holder is included in the standard equipment of the machine.

## Grinding wheel balancing

### Grinding wheel adaptors with balance weights on both sides of the wheel (additional accessory)

Terminology

Static balancing = balancing in one plane

(A statically balanced wheel is not necessarily in dynamic balance).

Dynamic balancing = balancing in two planes

(A dynamically balanced wheel is also in static balance).

Where stringent accuracies are not specified, it suffices to carefully statically balance the wheel using the balancing arbor and balancing attachment.

If fine surface finishes and close roundness tolerances are required, it is recommended that an additional static balance be carried out on the machine using the "BALANTRON" electronic fine balancing equipment. For ultra precision and especially when using wide grinding wheels this instrument can be used for dynamic balancing.

1. Static balancing

   - Space the balance weights on both sides evenly $120^{o}$ apart. To avoid creating a dynamic out of balance the weights on either side should be set directly opposite each other.

   - Rough dress the wheel on the machine. Switch off the coolant before stopping the wheel.

   - Mount the wheel and adaptor on the balancing arbor and statically balance on the balancing attachment by adjusting the balance weights. Always move the weights on opposite sides by an equal amount.

2. Fine balancing on the machine with the "BALANTRON" fine balancing equipment

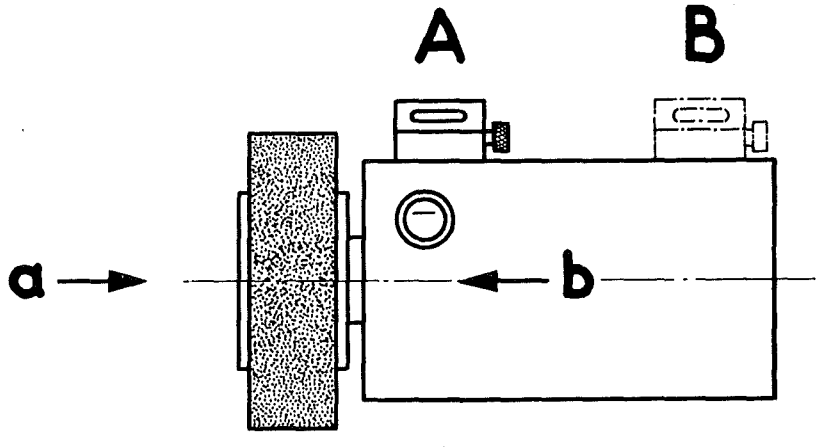
   Set up and tune the equipment as described in the "BALANTRON" instructions.

a. Static

- Pre-balance as described in section 1.
- Fine balance by removing the out of balance with the dressing tool. See also the "BALANTRON" operating instructions.

b. Dynamic

- Pre-balance as described in section 1.
- Fine balance: As opposed to static fine balancing where the vibration pick-up is placed in a set position on the wheel-head, two measurements are required for dynamic fine balancing to determine the application side for the dressing tool.




Place the pick-up at points A and B in turn and note the readings on the indicator instrument.

- If the reading is larger at A than B, place the pick-up at A and apply the dressing tool to the left hand side of the wheel (a ➡ ).
- If the reading is larger at B, place the pick-up at B and apply the dressing tool to the right hand side of the wheel ( ⬅ b).

The dressing tool should only be applied long enough to reduce the indicated out-of-balance by a half. Repeat the check readings above and re-apply the dressing tool to the appropriate side of the wheel, again reducing the indicated reading by a half. Repeate this procedure until the dynamic out-of-balance has been reduced to a minimum.

## Superfine and lap grinding

For superfine and lap grinding we recommend the use of special flat-belt pulleys and flat belts because of the smooth running. These pulleays are available as additional accessories (order No. 892)

For superfine and lap grinding the peripheral speed of the wheel must not exceed 12-18 m/sec. (39-59 ft./sec.). This low circumferential speed is obtained by use of the flat belt drive code No. 892 (see page 10.17). The peripheral speed of the work should be 6 - 7 m/min. (20-23 ft./min.) and the table speed approx. 0.5 m/min. (1.5 ft./min.) for superfine grinding and 0.2 m/min. (0.5 ft./min.) for lap grinding.

When superfine grinding we recommend a wheel grit of 500-600 and when lap grinding use a special lap grinding wheel (which we stock).

The wheels are always dressed with a diamond impregnated dressing stick having a grit of 80-100 (use a feed of 0.005-0.01 mm) (.000,2 - .000,4"). After dressing the face of the wheel, lightly round the corners of the wheel by hand using a similar dressing stick.

During grinding keep the wheel well supplied with coolant and after grinding clean the wheel with a brush.

The coolant must be very finely filtered and for this purpose we offer the Filtrox unit, which should be used in addition to the standard filter.

Drehzahlen des Werkstückes
Nombre de tours de la pièce en travail
Speed of rotation of the workpiece

$$n = \frac{v \cdot 1000}{d \cdot \pi}$$

STUDER

| ⌀ d in/en mm | v = Umfangsgeschwindigkeit des Werkstückes in m/min. Vitesse circonférentielle de la pièce en travail en m/min. Peripheral speed of the workpiece m/min | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 8 | 10 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 35 | 40 | 45 | 50 |
| 2 | 955 | 1274 | 1592 | 1910 | 2388 | 2866 | 3343 | 3821 | 4298 | 4776 | 5572 | 6368 | 7164 | 7960 |
| 3 | 636 | 848 | 1060 | 1272 | 1590 | 1908 | 2226 | 2544 | 2862 | 3180 | 3710 | 4240 | 4770 | 5300 |
| 4 | 478 | 637 | 796 | 955 | 1194 | 1433 | 1672 | 1911 | 2149 | 2388 | 2786 | 3184 | 3582 | 3980 |
| 5 | 382 | 510 | 636 | 764 | 956 | 1148 | 1338 | 1530 | 1720 | 1912 | 2230 | 2548 | 2870 | 3180 |
| 6 | 318 | 425 | 531 | 636 | 797 | 956 | 1113 | 1272 | 1432 | 1593 | 1856 | 2124 | 2390 | 2650 |
| 7 | 273 | 364 | 455 | 546 | 683 | 819 | 956 | 1092 | 1230 | 1365 | 1593 | 1820 | 2050 | 2275 |
| 8 | 239 | 318 | 400 | 478 | 597 | 716 | 836 | 955 | 1075 | 1194 | 1393 | 1592 | 1791 | 1990 |
| 9 | 212 | 283 | 354 | 425 | 530 | 636 | 743 | 850 | 955 | 1060 | 1240 | 1415 | 1590 | 1770 |
| 10 | 191 | 255 | 318 | 382 | 478 | 574 | 669 | 765 | 860 | 956 | 1115 | 1274 | 1435 | 1590 |
| 12 | 159 | 212 | 265 | 318 | 398 | 478 | 556 | 636 | 716 | 796 | 928 | 1060 | 1195 | 1325 |
| 14 | 136 | 182 | 228 | 273 | 341 | 410 | 478 | 546 | 615 | 682 | 796 | 910 | 1025 | 1136 |
| 16 | 119 | 159 | 199 | 239 | 298 | 358 | 418 | 478 | 538 | 597 | 696 | 796 | 896 | 995 |
| 18 | 106 | 142 | 177 | 212 | 265 | 318 | 372 | 425 | 478 | 530 | 620 | 708 | 795 | 885 |
| 20 | 96 | 128 | 159 | 191 | 239 | 287 | 335 | 383 | 430 | 478 | 558 | 637 | 716 | 795 |
| 24 | 80 | 106 | 133 | 159 | 199 | 239 | 277 | 318 | 358 | 398 | 464 | 530 | 598 | 663 |
| 28 | 68 | 91 | 114 | 137 | 171 | 205 | 239 | 273 | 307 | 341 | 398 | 455 | 512 | 568 |
| 32 | 60 | 80 | 100 | 119 | 149 | 179 | 209 | 239 | 269 | 298 | 348 | 398 | 448 | 498 |
| 36 | 53 | 71 | 88 | 106 | 133 | 159 | 186 | 214 | 239 | 265 | 310 | 354 | 398 | 442 |
| 40 | 48 | 64 | 80 | 95 | 119 | 143 | 167 | 191 | 215 | 239 | 278 | 318 | 358 | 398 |
| 45 | 43 | 57 | 71 | 85 | 106 | 127 | 149 | 170 | 191 | 214 | 248 | 283 | 318 | 354 |
| 50 | 38 | 51 | 64 | 76 | 96 | 115 | 134 | 153 | 172 | 191 | 223 | 255 | 287 | 318 |
| 55 | 35 | 46 | 58 | 69 | 87 | 104 | 122 | 139 | 156 | 174 | 203 | 231 | 260 | 289 |
| 60 | 32 | 42 | 53 | 64 | 80 | 96 | 111 | 127 | 143 | 159 | 186 | 212 | 239 | 265 |
| 65 | 29 | 39 | 49 | 59 | 74 | 88 | 103 | 118 | 132 | 147 | 171 | 196 | 220 | 245 |
| 70 | 27 | 36 | 45 | 55 | 68 | 82 | 96 | 109 | 123 | 136 | 159 | 182 | 205 | 227 |
| 75 | 25 | 34 | 42 | 51 | 64 | 76 | 89 | 102 | 115 | 127 | 148 | 170 | 191 | 212 |
| 80 | 24 | 32 | 40 | 48 | 60 | 72 | 84 | 96 | 107 | 119 | 139 | 159 | 179 | 199 |
| 85 | 22 | 30 | 38 | 45 | 57 | 68 | 79 | 90 | 100 | 113 | 132 | 150 | 169 | 188 |
| 90 | 21 | 28 | 35 | 42 | 53 | 64 | 74 | 85 | 96 | 106 | 124 | 142 | 159 | 177 |
| 95 | 20 | 26 | 33 | 40 | 50 | 61 | 70 | 81 | 91 | 100 | 117 | 134 | 151 | 168 |
| 100 | 19 | 25 | 31 | 38 | 48 | 57 | 67 | 76 | 86 | 96 | 111 | 127 | 143 | 159 |
| 110 | 17 | 23 | 29 | 35 | 43 | 52 | 61 | 69 | 78 | 87 | 101 | 116 | 130 | 145 |
| 120 | 16 | 21 | 26 | 32 | 40 | 48 | 55 | 64 | 72 | 80 | 93 | 106 | 120 | 133 |
| 130 | 15 | 20 | 24 | 29 | 37 | 44 | 51 | 59 | 66 | 74 | 86 | 98 | 110 | 123 |
| 140 | 14 | 18 | 23 | 27 | 34 | 41 | 48 | 55 | 61 | 68 | 80 | 91 | 102 | 114 |
| 150 | 13 | 17 | 21 | 25 | 32 | 38 | 44 | 51 | 57 | 64 | 74 | 85 | 95 | 106 |
| 160 | 12 | 16 | 20 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 70 | 80 | 90 | 99 |
| 170 | 11 | 15 | 19 | 23 | 29 | 34 | 40 | 46 | 52 | 57 | 67 | 75 | 86 | 95 |
| 180 | 10 | 14 | 18 | 21 | 27 | 32 | 38 | 42 | 47 | 53 | 63 | 71 | 81 | 90 |
| 190 | 10 | 14 | 17 | 20 | 26 | 30 | 36 | 40 | 44 | 51 | 59 | 67 | 76 | 85 |
| 200 | 9 | 13 | 16 | 19 | 24 | 29 | 34 | 38 | 43 | 48 | 56 | 64 | 72 | 79 |
| 220 | 9 | 13 | 15 | 18 | 23 | 27 | 32 | 35 | 40 | 44 | 51 | 59 | 66 | 73 |

Drehzahlen der Schleifscheibe
Nombre de tours de la meule
Speed of rotation of the grinding wheel

$$n = \frac{v \cdot 1000 \cdot 60}{d \cdot \pi}$$

STUDER

| ϕ d in/en mm | v = Umfangsgeschwindigkeit der Schleifscheibe in m/sek. Vitesse circonférentielle de la meule en m/sec. Peripheral speed of the grinding wheel m/sec. | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| 3 | 63661 | 95493 | 127324 | 159155 | 190985 | 222816 | 254647 |
| 4 | 47746 | 71620 | 95492 | 119366 | 143239 | 167112 | 190985 |
| 5 | 38197 | 57296 | 76394 | 95493 | 114591 | 133690 | 152788 |
| 6 | 31831 | 47746 | 63662 | 79577 | 95493 | 111408 | 127324 |
| 8 | 23873 | 35810 | 47746 | 59683 | 71626 | 83556 | 95493 |
| 10 | 19099 | 28648 | 38197 | 47746 | 57296 | 66845 | 76394 |
| 12 | 15915 | 23873 | 31831 | 39789 | 47746 | 55704 | 63662 |
| 15 | 12732 | 19099 | 25465 | 31831 | 38197 | 44563 | 50929 |
| 20 | 9549 | 14324 | 19099 | 23773 | 28648 | 33425 | 38197 |
| 25 | 7693 | 11459 | 15279 | 19099 | 22918 | 26738 | 30558 |
| 30 | 6366 | 9549 | 12732 | 15916 | 19099 | 22282 | 25465 |
| 35 | 5457 | 8185 | 10913 | 13642 | 16370 | 19099 | 21827 |
| 40 | 4775 | 7162 | 9549 | 11937 | 14324 | 16712 | 19099 |
| 45 | 4244 | 6366 | 8488 | 10610 | 12732 | 14854 | 16976 |
| 50 | 3820 | 5730 | 7630 | 9549 | 11459 | 13369 | 15279 |
| 55 | 3472 | 5209 | 6945 | 8681 | 10417 | 12154 | 13890 |
| 60 | 3183 | 4775 | 6366 | 7958 | 9549 | 11141 | 12732 |
| 65 | 2938 | 4407 | 5876 | 7346 | 8815 | 10284 | 11753 |
| 70 | 2728 | 4093 | 5457 | 6821 | 8185 | 9549 | 10913 |
| 75 | 2546 | 3820 | 5093 | 6366 | 7639 | 8913 | 10186 |
| 80 | 2387 | 3581 | 4775 | 5968 | 7162 | 8356 | 9549 |
| 90 | 2122 | 3183 | 4244 | 5305 | 6366 | 7427 | 8488 |
| 100 | 1910 | 2865 | 3820 | 4775 | 5730 | 6685 | 7639 |
| 110 | 1736 | 2604 | 3472 | 4341 | 5209 | 6077 | 6945 |
| 120 | 1592 | 2387 | 3183 | 3979 | 4775 | 5570 | 6366 |
| 130 | 1469 | 2205 | 2938 | 3673 | 4407 | 5142 | 5876 |
| 140 | 1364 | 2046 | 2728 | 3410 | 4093 | 4775 | 5457 |
| 150 | 1273 | 1910 | 2547 | 3183 | 3820 | 4460 | 5093 |
| 160 | 1194 | 1790 | 2387 | 2984 | 3581 | 4178 | 4775 |
| 170 | 1123 | 1685 | 2247 | 2809 | 3370 | 3932 | 4494 |
| 180 | 1061 | 1592 | 2122 | 2653 | 3183 | 3704 | 4244 |
| 190 | 1005 | 1508 | 2063 | 2513 | 3016 | 3518 | 4021 |
| 200 | 955 | 1432 | 1910 | 2377 | 2865 | 3343 | 3820 |
| 210 | 909 | 1364 | 1819 | 2274 | 2728 | 3183 | 3638 |
| 220 | 868 | 1302 | 1736 | 2170 | 2604 | 3038 | 3472 |
| 230 | 830 | 1246 | 1661 | 2076 | 2491 | 2906 | 3321 |
| 240 | 796 | 1194 | 1592 | 1989 | 2387 | 2785 | 3183 |
| 250 | 764 | 1146 | 1528 | 1910 | 2292 | 2674 | 3056 |
| 275 | 694 | 1042 | 1389 | 1736 | 2083 | 2431 | 2778 |
| 300 | 637 | 955 | 1273 | 1592 | 1910 | 2228 | 2547 |
| 350 | 546 | 819 | 1091 | 1364 | 1637 | 1910 | 2183 |
| 400 | 478 | 716 | 955 | 1194 | 1432 | 1672 | 1910 |

# RHU 500/750

**Innenschleifspindel - Drehzahlen U/min.**
**Broche á rectifier les intérieurs - nombre de tours t/min.**
**Internal grinding spindle - speed r.p.m.**

| Bau-Gruppe / Ordre / Order | | 1815 - 1 | | | | 1815 - 101 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Frequenz - Umformer / Convertisseur de fréqience / Frequency converter | | | |
| Frequenz / Fréquence / Frequency | | 50 | | 60 | | 150 (50) | | 180 (60) | |
| Motor - Drehzahl U/Min. / Nbr. de tr. du moteur t/min. / Speed of motor r.p.m. | | 2800 | | 3360 | | 8500 | | 10200 | |
| Riemenscheibe auf Motor / Poulie sur moteur / Pulley on motor ø | | 250 | 160 | 250 | 160 | 120 | 52 | 120 | 52 |
| Spindel / Broche / Spindle / Type | Riemenscheibe / Poulie / Pulley ø | | | | | | | | |
| UJ 40 | 25 | 28000 | ----- | 33600* | ----- | 40800* | ----- | ----- | ----- |
| | 30 | 23400 | ----- | 28000 | ----- | 34000* | 14800 | 40800* | 17700 |
| | 40 | 17500 | ----- | 21000 | ----- | 25500 | 11000 | 30600* | 13200 |
| | 50 | 14000 | 9000 | 16800 | 10700 | 20400 | 8800 | 24500 | 10600 |
| | 60 | 11700 | 7500 | 14000 | 9000 | 17000 | 7400 | 20400 | 8800 |
| UJ 50 | 32 | 21900 | ----- | 26300* | ----- | 31900* | 13800 | ----- | 16600 |
| | 38 | 18400 | ----- | 22100 | ----- | 26800* | 11600 | 32200* | 14000 |
| | 48 | 14600 | ----- | 17500 | ----- | 21200 | 9200 | 25500* | 11000 |
| | 60 | 11700 | 7500 | 14000 | 9000 | 17000 | 7400 | 20400 | 8800 |
| | 75 | 9300 | 6000 | 11200 | 7200 | 13600 | 5900 | 16300 | 7100 |
| UJ 60 | 40 | 17500 | ----- | 21000* | ----- | 25500* | 11000 | ----- | 13200 |
| | 46 | 15200 | ----- | 18200 | ----- | 22100* | 9600 | 26600* | 11500 |
| | 60 | 11700 | ----- | 14000 | ----- | 17000 | 7400 | 20400* | 8800 |
| | 75 | 9300 | 6000 | 11200 | 7200 | 13600 | 5900 | 16300 | 7100 |
| | 90 | 7800 | 5000 | 9400 | 6000 | 11300 | 4900 | 13600 | 5900 |
| UJ 70 | 50 | 14000 | ----- | 16800* | ----- | 20400* | 8800 | ----- | 10600 |
| | 58 | 12000 | ----- | 14500 | ----- | 17600* | 7600 | 21100* | 9100 |
| | 75 | 9300 | 6000 | 11200 | 7200 | 13600 | 5900 | 16300* | 7100 |
| | 90 | 7800 | 5000 | 9300 | 6000 | 11300 | 4900 | 13600 | 5900 |
| UJ 80 | 60 | 11700 | 7500 | 14000 | 9000 | 17000* | 7300 | ----- | 8800 |
| | 70 | 10000 | 6400 | 12000 | 7700 | 14500* | 6300 | 17500* | 7500 |
| | 85 | 8200 | 5700 | 9900 | 6300 | 12000 | 5200 | 14400* | 6200 |

*) Nur mit Oelnebel-Schmierung.
Graissage uniquement avec brouillard d'huile. With oil mist lubrication only.

(ab Serie 88)

# RHU 500/750

## Grinding wheel selection chart

Wheel diameter 400/300mm (16"/12") - Bore 127mm (5") - Shape A3

| Wheel width | ∅ 400/16" ∅ 300/12" | 50 mm / 2" 30 mm / 1.2" | 40 mm / 1.6" 25 mm / 1" | 30 mm / 1.2" 25 mm / 1" | 25 mm / 1" 20 mm / .8" | 25 mm / 1" 20 mm / .8" |
|---|---|---|---|---|---|---|
| Wheel peripheral speed | m/s | 28 - 31 | 28 - 31 | 28 - 31 | 12 - 18 | 12 - 18 |
| Material allowance | mm | 0.2 - 0.5 | 0.02 - 0.1 | 0.01 - 0.02 | 0.001-0.003 | 0.001-0.002 |
| Wheel pressure | mm | | | 0.003-0.006 | 0.002-0.01 | 0.005-0.01 |
| Grinding operation | | Roughing | Finishing | Fine grinding | Super-fine grinding | Lap grinding |
| Alloyed and non alloyed steel, hardened and case hardened, oil and water hardened | | VITORUBIN 46 K-10 | VITORUBIN spec. 80 K-10 80 J-10 | DGS EK 320 B5 DGS SC 320-3 | VITODURUM 500 III-3 | ALOXITE Resinoid AF 3 NB |
| Nitriding steel | | VITOCARBON 46 K | VITOCARBON 60 K / 120 H | DGS EK 320 B5 | VITORUDUR 600 III-3 | " |
| Hard chrome | | VITOBORUND 46 L-10 | VITOBORUND 80 L-10 | DGS EK 320 B5 | VITORUDUR 600 III-3 | " |
| High alloy 13 - 18 % chrome steel | | VITORUBIN 46 K-10 | VITORUBIN spec. 80 J-10 VITOBOREX 80 L-10 | DGS SC 320-3 | VITORUDUR 600 III-3 | " |
| High speed steel 18.4.11 | | VITORUBIN 46 K-10 VITOLUMA 46 K-10 | VITORUBIN spec. 80H-10/80J-10 VITOLUMA 60 K-10 | DGS SC 320-2 | VITORUDUR 600 III-3 | " |
| Carbide | | VITOCARBON 46 J | VITOCARBON 60 H | | | |
| | | Diamond wheel, metal bonded, grit: D 70 | D 50 | D 15 | D 7 | |
| Soft steel | | VITOCARBON 46 K VITORUBIN 46 L-10 VITOBOREX 46/60 L-10 | VITOCARBON 60 K / 120 H VITORUBIN spec. 80 L-10 | DGS EK 320 B5 | VITODURUM 500 III-3 | |
| Stainless steel | | VITOCARBON 46 K | VITOCARBON 60 K / 120 H | VITOCARBON 320 J | VITODURUM 500 III-3 | |
| Cast iron, bronze, brass, cupro-nickel, light metal, rubber, plastic | | VITOCARBON 46 K | VITOCARBON 60 K / 120 H | Grinding wheel, right: ∅ 250 x 20 x 76,2 mm ( 10" x.8" x 3" ) VITOBORUND 80 M | | |

Important for super-fine and lap grinding:
Reduce peripheral speed of both wheel and work by approx. 50 %. Use a diamond dressing stick having a grit of 100 - 150. Use of FILTROX fine filter is essential.

## Grinding faults and how to avoid them

### 1. Chatter marks on the work piece

This is probably the most frequent fault on cylindrical grinding work and may be caused by the following:

a) Induced vibration Check the foundations of the machine and ensure no vibration is being received from a neighbouring machine. Check the motors of the wheel head, work head and hydraulic-pump - if necessary rebalance them.

b) Badly balanced wheel A wheel must be rebalanced from time to time. Turn off coolant before switching off wheel. Dress wheel both before and after balancing.

c) Excessive wheel spindle play Readjust as laid down in this instruction book.

d) Poor centres - or insufficient lubrication on centres. If necessary regrind centres of the machine and superfine grind the centers in the work piece.

e) Badly dressed wheel Sometimes insufficient care in dressing causes vibration. Dress wheel carefully according to instructions on page 6.2.

f) Wheel too hard Check that wheel suits the work to be ground.

g) Incorrect speed ratio between wheel and work.

h) Steady required. Long work pieces often require a steady. If a steady is used check that the jaws are giving a firm support to the work.

i) Insufficient centre pressure Check that the tailstock is exerting sufficient axial pressure on the work to stop it floating radially due to the wheel pressure.

k) Faulty belt An irregular belt thickness or a slipping belt will give chatter marks.

### 2. Rough surface on work and wheel pattern transmitted to work

The dressing diamond has left marks in the surface of the wheel caused by too rapid dressing. Such marks will be removed if the last dressing pass is carried out without feeding the diamond.

### 3. Well ground surface spoilt by fleck marks and irregular scratches

This is caused by dirty coolant. Clean out coolant tank and settling tanks frequently. Clean inside of grinding wheel guard every time a wheel is changed. Use an efficient fine filter such as the Filtrox filter.

### 4. Work surface has irregular pattern

A loosely seated diamond may be the cause of this.

5. Work has spiral feed marks

which are at the same pitch as the table feed. This is caused by bad dressing of the wheel, or inaccurate setting of the work head relative to the tailstock, or inaccurate setting of the work head relative to the work. When a really good finish is required it is advisable to round the corners of the wheel (by hand).

6. Hairline cracks in surface

These may originate from excessive heating by the grinding wheel due to:
- too hard wheel
- too much wheel pressure on work
- untrue grinding wheel
- clogged grinding wheel
- bad dressing of wheel.

The wheel will not be correctly dressed if the diamond has too little feed and insufficient depth of cut. This condition will give a glazed surface to the wheel with insufficient "bite".

Hairline cracks may also be shown up by stresses from previous operations being released by the grinding operation. If the work piece is dipped in hot oil, carefully dried and then lightly covered with lime, the hairline cracks will show up as thin dark lines.

7. Work tolerance cannot be held

Generally bad machine centres or bad work centres are the cause. Today's tolerances demand that considerable care be given to this point. Carbide tipped centres are strongly recommended. Use centres with as short an overhang as possible. When changing centres ensure that both shank and bore are absolutely clean and burr free. It is often necessary to superfine grind the work piece centres.

8. Work not round

One or more of the following may be the cause:

a) Dirt on machine centres or in work centres.

b) Different angle on machine centres and work centres, possibly caused by distortion due to hardening. Regrind or even lap centres.

c) Machine centres worn due to insufficient lubrication. Use carbide tipped centres.

d) Long slender work not supported by steady.

e) Irregular heating of work due to irregular flow of coolant.

f) Out of balance work piece. Try either a lower work head speed or add a counter balance weight to the work head.

g) Bearings in workhead or tailstock out of order. If necessary remachine the spindle and adjust or replace bearings; clamp tailstock barrel.

h) Work rotating irregularly. Check work head drive.

9. Work barreled convex

To much steady pressure or no steady pressure. Loose jaws in steady.

10. Work barreled concave

a) On short work pieces - grinding wheel surface not parallel to work.

b) On long work pieces - table not traversing in a straight line - (table ways need rescraping by an expert to original factory tolerances).

c) Too much steady pressure.

11. Rough surface finish on shoulders

a) Too much axial play in spindle. Adjust as laid down in this instruction book.

b) Wheel not dressed on the side face. The wheel must be dressed on the front face and dressed convex or tapered on the side face.

c) Wheel too hard or too fine (or both), as it has a larger area of contact than when just cylindrically grinding. Increase work speed, increase grit size, use softer wheel or a wheel with a more open structure.

12. Bell mouthed bores when internal grinding

Too much grinding pressure due to too hard or too fine a wheel. Use a softer or coarser wheel or use a higher or lower wheel speed.

13. Wheel wear too rapidly

a) Wheel too soft.

b) Wheel speed too low.

c) Wheel unbalanced.

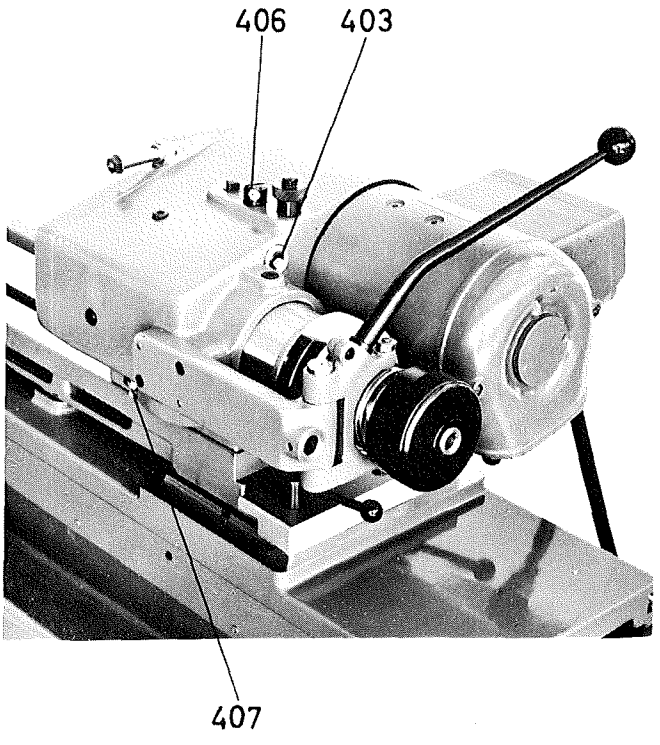
d) Wheel spindle bearings too loose - readjust.

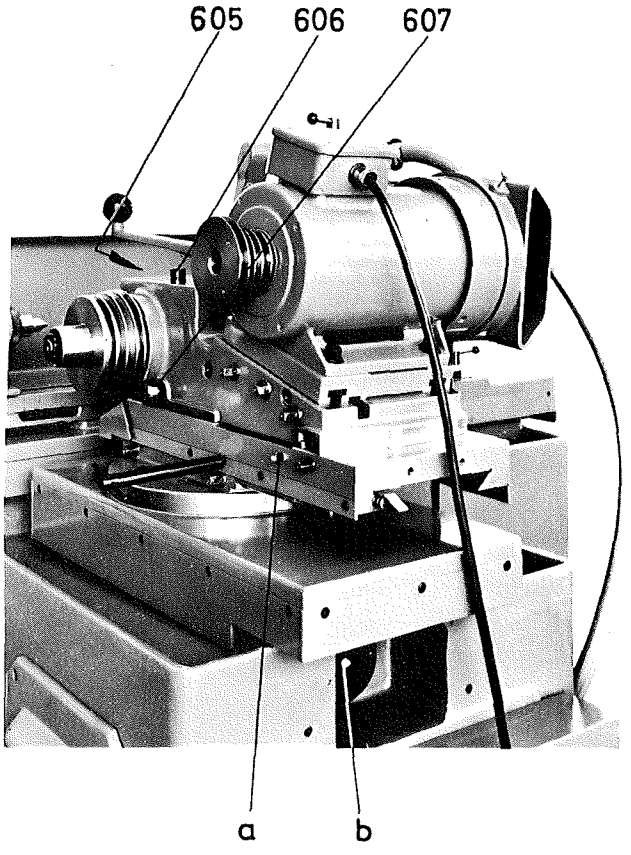
e) Work piece whipping because too long or too thin - use steady.

f) Insufficient coolant.

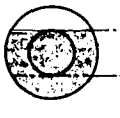
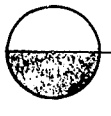
14. Wheel becoming glazed or clogged

Wheel too hard or too fine or work speed too low.



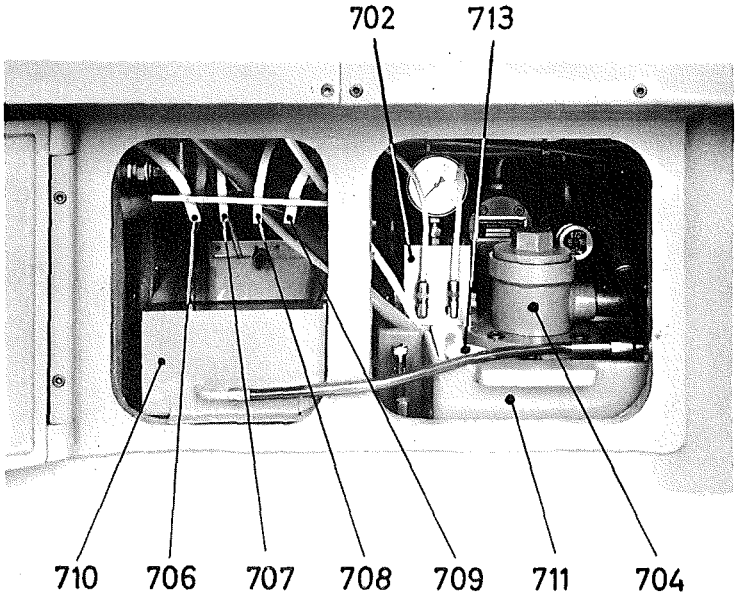




Additional accessories see special instructions

| Weekly lubrication | | |
|---|---|---|
| Position | Type of lubrication | Type of lubricant |
| a upper slide<br>b feed screw<br>oil tank (cont. 28 litres 6.2 imp. gall.) | 2 strokes<br>4 strokes<br>fill as required | Mobil Vactra Oil 2<br>5,2°E / 50° C |
| wheelhead (606) | fill as required<br>(see sight glass 605)<br>  max<br>mini | Mobil Velocite Oil 3<br>1,2°E / 20° C |
| workhead (406) | fill as required<br>(see sight glass 403)<br>  max | Mobil Velocite Oil 10<br>2,16°E / 50° C |

Lubricate tailstock barrel every two years with a good ball bearing grease (Mobilux Grease No. 2).

Drain and refill oil in oil tank 711,(Oil infill 713) in wheelhead and workhead yearly.

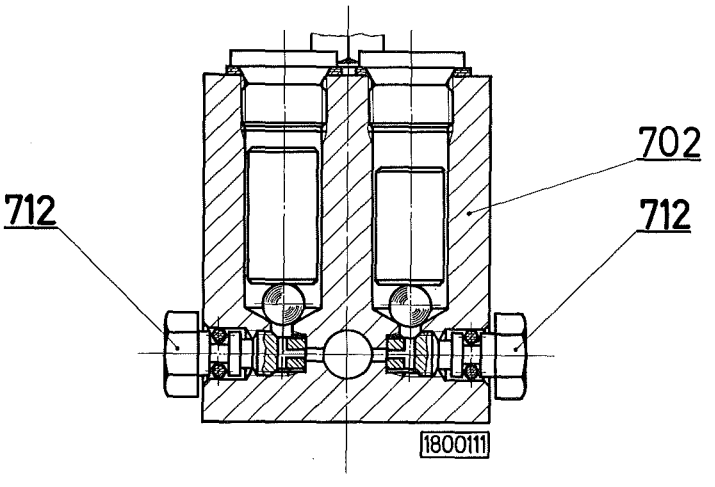



The settling tank should be emptyed and cleaned every two months.

At the ends of the lubrication pipes 706 ÷ 709 the lubrication can be checked. The oil should drip back from the lubrication points.

The magnetic filter 704 should be cleaned once a month

Lubrication regulator




If lubrication out of order the two nozzles 712 must be cleaned first.

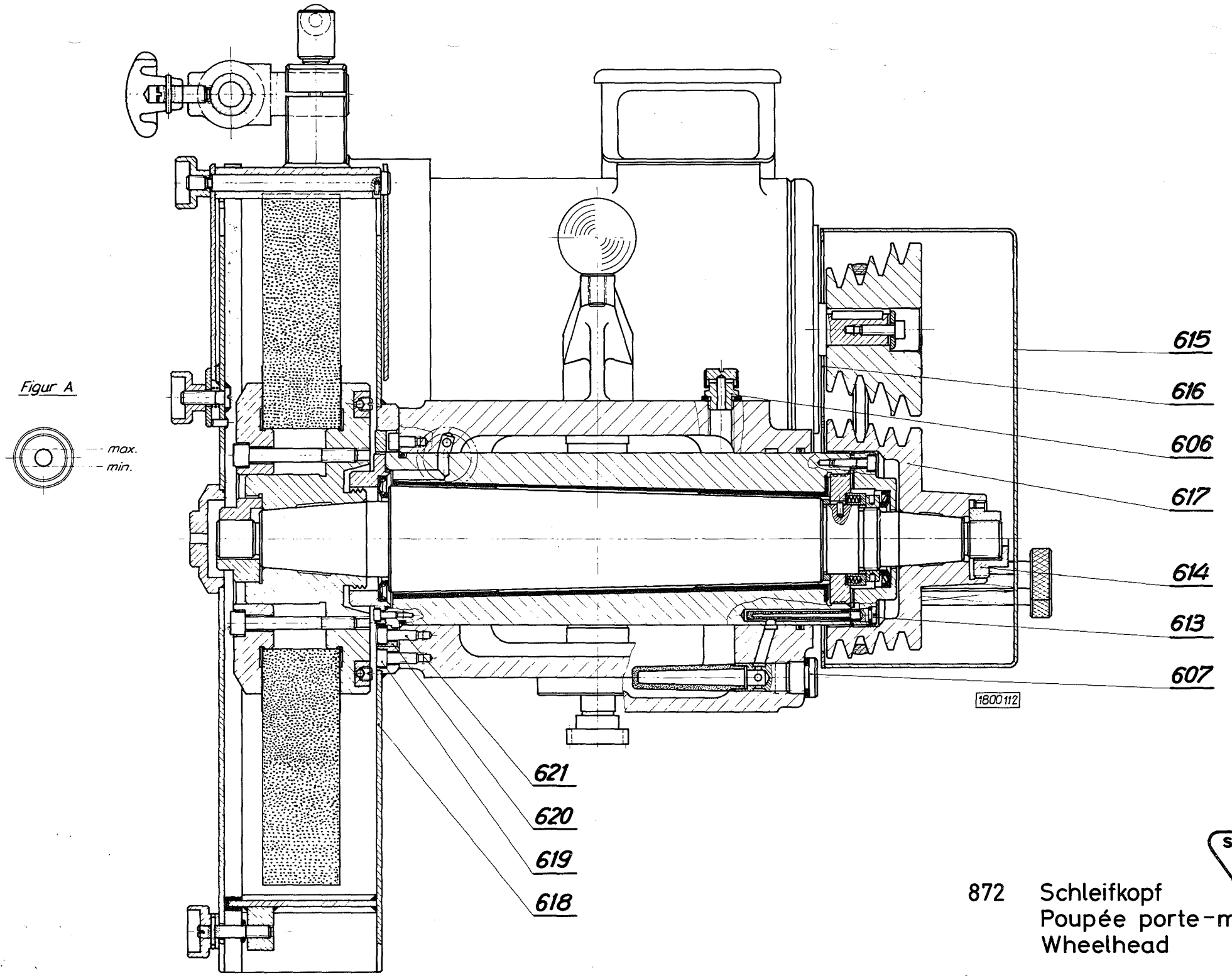
## Wheelhead (type 872)

- The wheelspindle bearing is set at our works and needs no further adjustment.
- Oil is supplied to the wheelspindle by an oil circulation system.
- Oil circulation and oil level in the wheelhead can be checked through the sight glass 605.
- The oil level should be kept within the zone indicated on the sight glass drawing 872, Fig. A.
- When refilling the oil (see lubrication table page 7.1) the oil filter 613 built in the oil drain plug 607 and in the spindle bearing sleeve must be removed and cleaned with benzine and then blown out.
- To remove the oil filter 613 the belt pulley 617 must be removed with the aid of extractor nut 614.
- To remove the oil drain plug 607 the belt quard 615 must be removed. Following this the cover 616 is removed by loosening the two support screws.
- If the oil circulation is interrupted, which can be checked through oil sight glass 605 whilst the spindle is running, the spindle drive must be stopped immediately. Both oil filters must be removed as shown above, cleaned thoroughly and then refitted.

## Dismantling the wheel spindle sleeve

( Attention: Perform in cold condition only)

- Drain spindle oil by removing screw 607.
- Pull away vee-velt pulley 617 from the spindle end.
- Remove left grinding wheel from the taper.
- Loosen 3 screws 619 and remove lefthand wheel guard 618 from ring 620.
- Loosen screws 621 and remove clamp ring 620.
- Spindle sleeve can be pulled out of the wheelhead towards the lefthand side.
- When refitting take care that the automatic lubrication is being vented. For this loosen locking screw 613 when refilling spindle oil till oil comes out.




872 Schleifkopf
Poupée porte-meule
Wheelhead

## Cleaning the machine

The machine will maintain its accuracy much longer if it is well looked after.

It should be superficially cleaned daily and all ground or polished parts dried off thoroughly, so that coolant cannot start to cause rust formation.

Once a week the machine should be cleaned down with paraffin and all bright parts lightly oiled.

Before mounting any equipment on the table, carefully clean both contacting surfaces.

The settling tanks in the coolant tank should be cleaned out at least once a week. The coolant tank itself must be drained off, flushed and cleaned once a month. Filter the coolant before returning it to the tank.

## DC motor on work head

Check the brushes once a month for wear and smooth running.

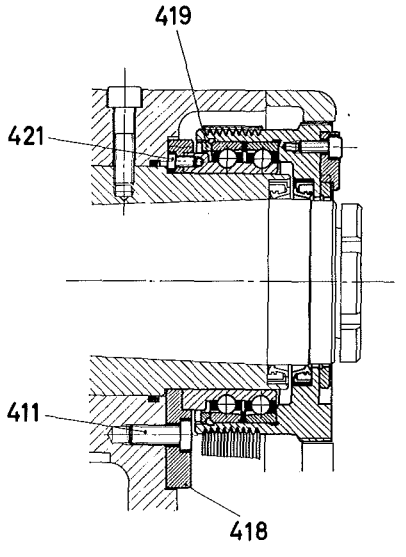
## Thermal overloads

Each thermal overload is set to suit its motor. If a thermal overload is triggered off the cause of the motor overloading must first of all be established. If no reason can be found, wait one to two minutes before resetting with button 341, 342, 343, 344 or 345.

## Changing the bearings of the workhead drive ring

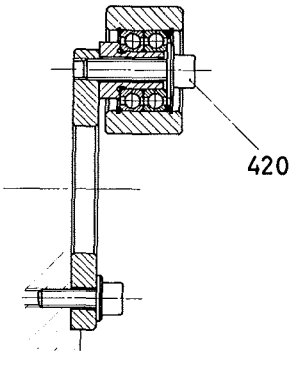
(on workhead type 869)

- The bearing flange 418 with built-on drive ring can be disassembled by removing fixing screws 411.
- Remove the screws.
- The drive ring can now be removed from the ball bearing.




- Take care to keep all parts clean and dust free when reassembling.

## Changing the bearings in the belt tension pulley




- Remove screw 420 to take off complete pulley.
- Remove centre bush and circlips.
- Replace bearing and re-assemble.

## Removing the DC motor

- By slackening screws 413 the motor can be removed.

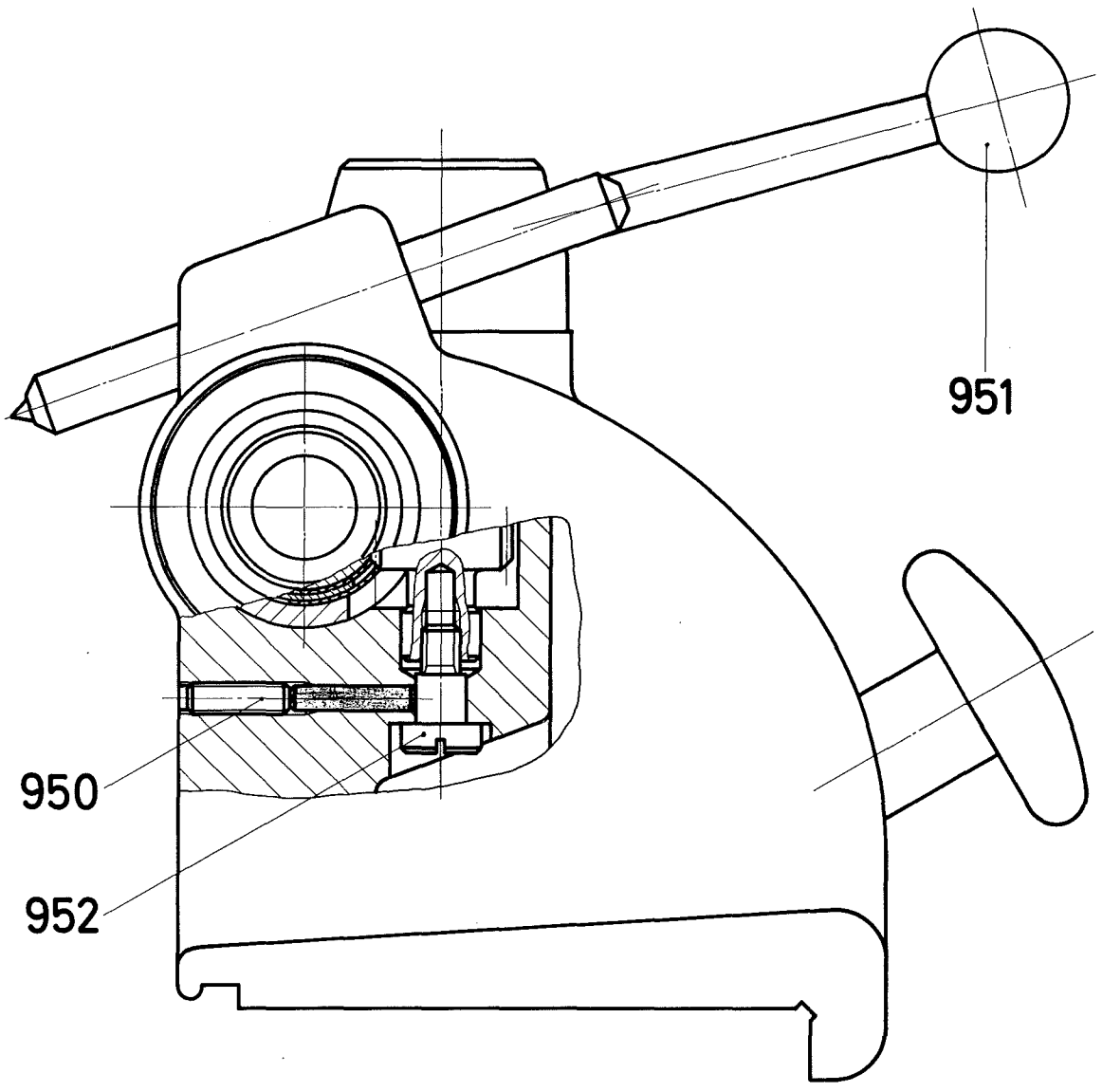
Setting of the tailstock clamping

The tailstock spindle is clamped in its retracted position.

After continuous use the clamping elements are subject to wear and the spindle is then retracted too far and the lever moved through more than $90^{o}$.

Resetting the required position of lever 951 is effected as follows:

- Loosen pin 950 with hexagon
- Retract spindle and set lever in the required position
- Tighten screw 952 from below using a screwdriver
- Lock the screw by tightening pin 950.



# FAULT FINDING AND RECTIFICATION

## Small faults and their remedies

| Fault | Remedy |
|---|---|
| Table or cross slide travers irregular | - vent table<br>- top up oil level if necessary<br>- clean magnetic filter if necessary<br>- check if pump is sucking in air |
| Table or cross slide lubrication not operating | - clean nozzles 712<br>- check oil pressure |
| Machine cycle does not function | - cycle interruptor switch 305 is set to interrupt infeed and table traverse<br>- rapid approach override switch 304 is set to dressing and face grinding position<br>- motor selector switch 303 in wrong position<br>- the selector switch 301 is in the wrong position |
| Longitudinal slide moves too slow | - Table reversal selector 102 on short stroke |

Should this switch-cam ring be too often and too easily out of adjustment, contact service agent.

The machine will not function and all above points are in order

- check appropriate micro switch (see page 8.3 onwards)
- check that the appropriate valves are receiving electric current at the appropriate time. Remove plugs and check with voltmeter or 36 V check lamp.

  If no current is reaching the valve then the fault lies in the electrical control equipment.

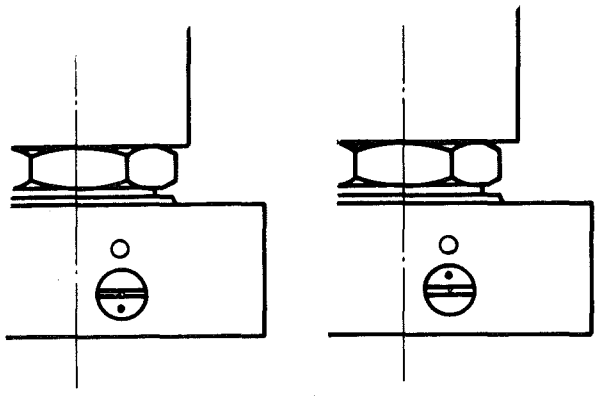
- Check if the valves and gate valves in question operate correctly. This is effected as follows:

  a) Replace the valve in question.

  b) Check if plunger of the valve or gate valve moves.

  c) Actuate valve by hand; open valve socket sideways with eccentric screw to check the hydraulic function of the plunger. Attention: after checking the screw must absolutely be turned back to allow the electrical function of the valve plunger.

  d) The gate valves in question may be checked by removing the lid. Correct position of the plunger can then be seen. The plungers can also be moved manually (Cover of gate valve V 20).



open normal position

If the valve or the gate valve operate correctly, the fault must be traced in the hydraulic or mechanical controls.

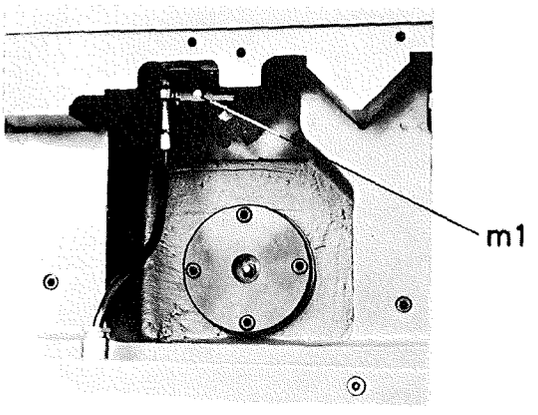
The intermittent feed, infeed then traverse or disengagement at the end of the stroke do not operate.

- The table reversal lever 104 was not actuated sufficiently.

- Using the handwheel, the table reversal lever 104 must also be actuated by moving the table sufficiently.
- If dwelling is not required the dwell control valve must nevertheless be set that the table reversal lever is actuated. (Dwell control valve set between 0 and 5).

## Changing and setting the micro switches

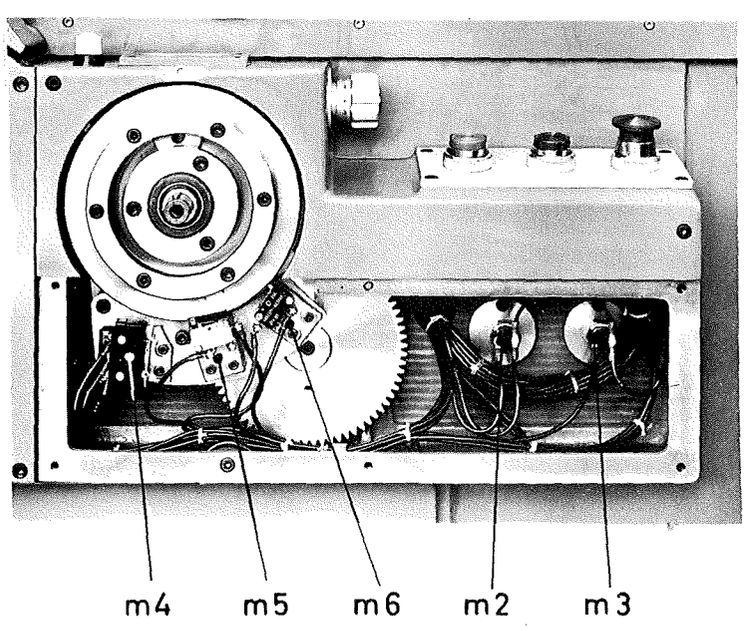
### Setting micro switch m1




This switch starts the infeed after the rapid approach stroke. It must be set to operate approx. 0.3 mm (.01") before the end of the rapid approach stroke. The switch may be adjusted by loosening the 2 allen screws on the outside of the housing.

### Replacing switches m2 and m3

If a switch breaks down it must be replaced as it cannot be adjusted. Firstly switch off hydraulic pump. The switch can then be removed with an allen key. When replacing the switch, do not tighten it right up until the air has been bled from the hydraulic system (operate table reversal lever a few times).



Micro switch m4 - fixed stop

This micro switch starts the time relay shortly before the feed is interrupted by the fixed stop.

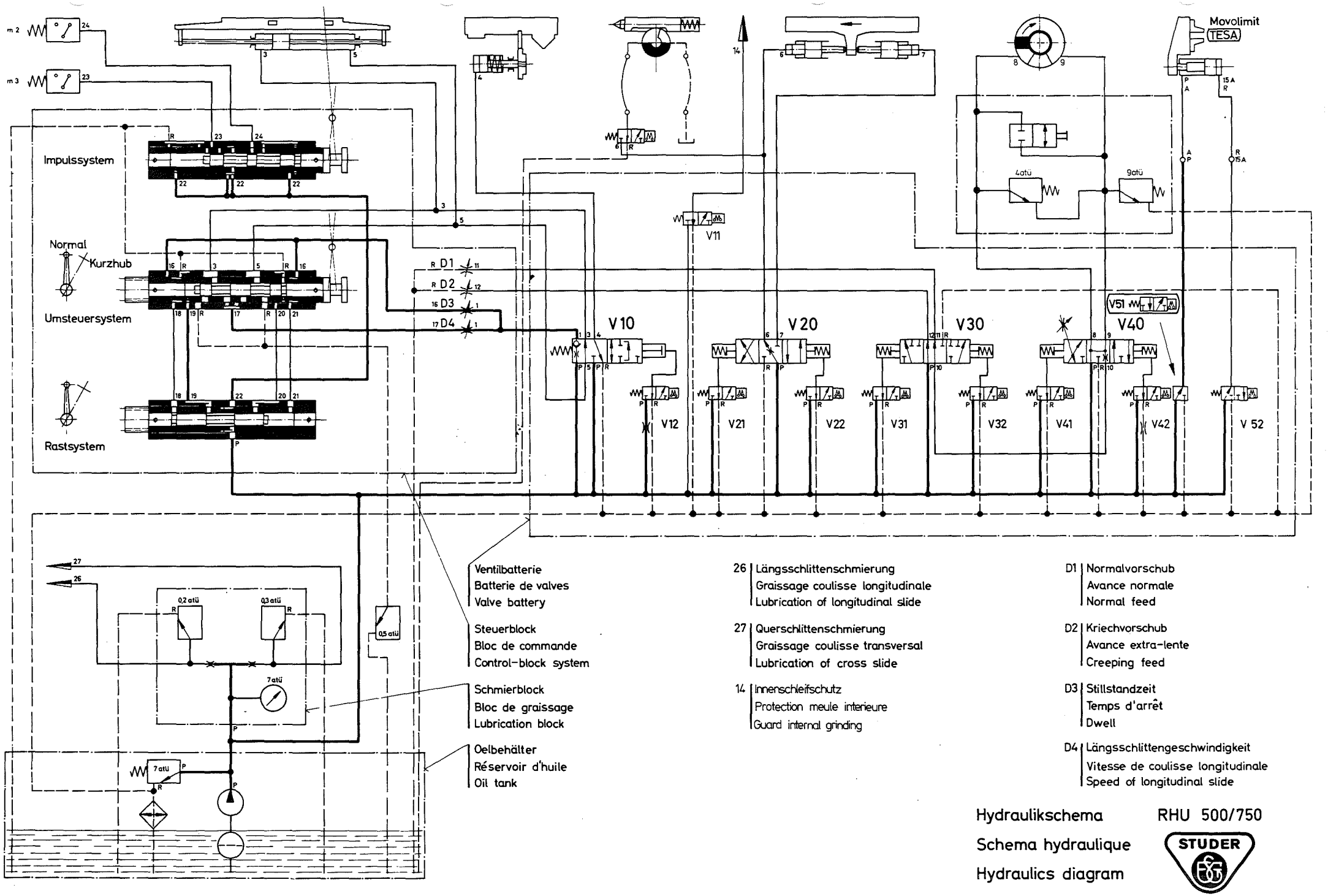
Micro switch m5 - material allowance setting

This micro switch limits the return stroke of the infeed to suit the material allowance. When setting this micro switch remember that the infeed mechanism must return approx. 0.1 mm (.004") more than that actually set on the material allowance control. The grinding wheel approaching in rapid will take up this difference and this is an intentional part of the design to take up the inevitable play in the gearing. The setting of this micro switch is best carried out as follows:

- roughly set the micro switch so that it operates when the handwheel is turned
- set a material allowance of 0.2 mm (.008") by rotating the handwheel in a clockwise direction
- set feed on handwheel 201 to 0
- start hydraulic pump with switch 303
- set cycle selector switch 302 to infeed
- set infeed speed control valve 107 to 1
- press "start cycle" push button
- switch off motors. Set cycle selector switch 302 to "manual"
- if main scale 206 reads for example 22 then the switch is wrongly set by 2 divisions
- turn feed handwheel 201 clockwise until the switch operates (if necessary use a circuit tester)
- the main scale 206 will now read for example 27. In this case the handwheel i.e. scale will read an error of for example .02 and must therefore be set to 25
- without moving handwheel 201, the switch must now be set to switch at this position
- then turn handwheel to check that is does switch at this point
- set cycle selector switch to "infeed" and check if the infeed starts at 20.

Micro switch m6 (change over to creep feed)

Using knob 204 and handwheel 201 set a creep feed of 0.02 mm (.000,8") (rotate handwheel in anticlockwise direction). Set micro switch m6 so that it switches on two divisions before 0.



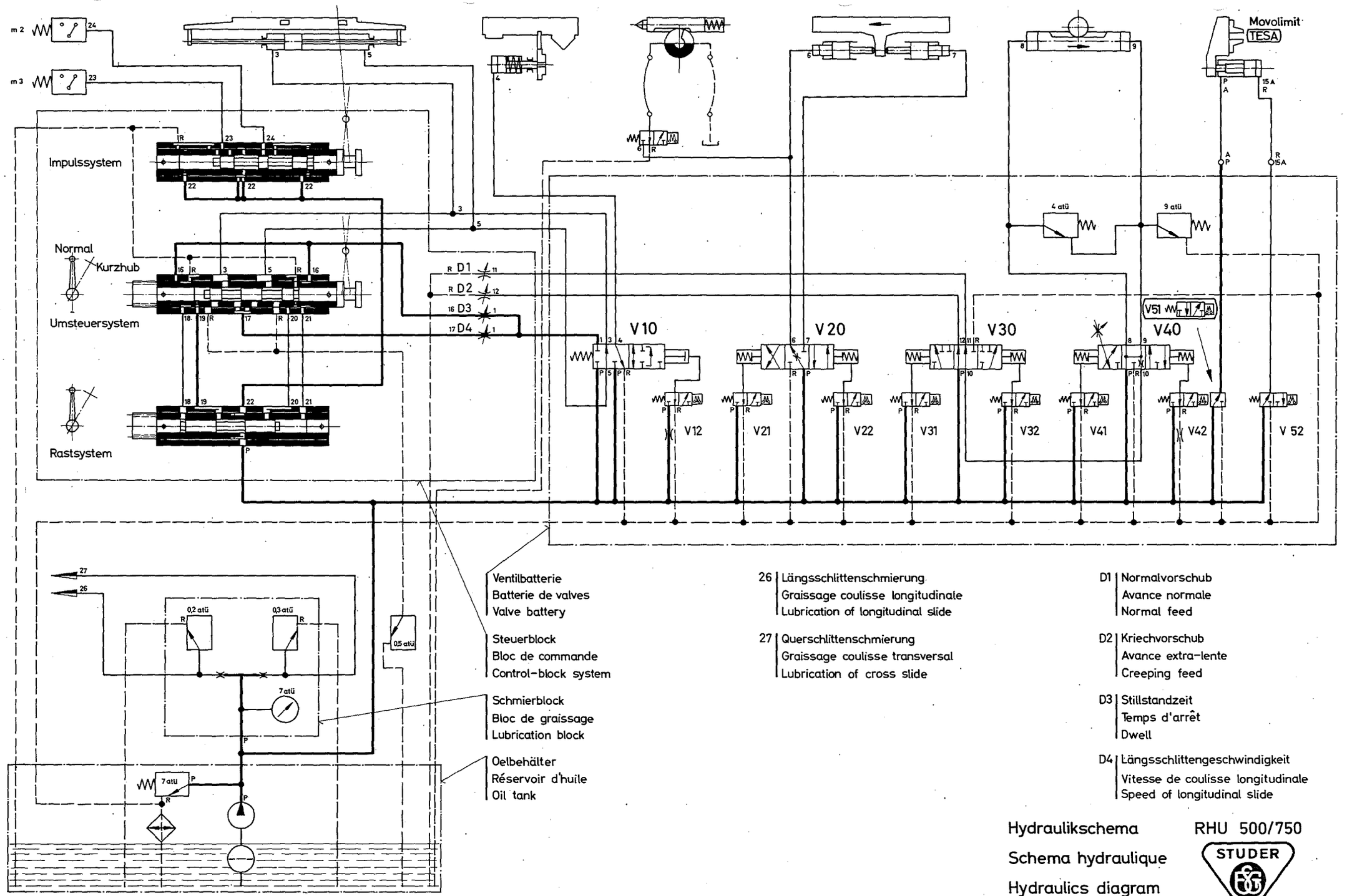

Hydraulikschema RHU 500/750

Schema hydraulique

Hydraulics diagram

STUDER

1800-4/92




26 Längsschlittenschmierung
Graissage coulisse longitudinale
Lubrication of longitudinal slide

27 Querschlittenschmierung
Graissage coulisse transversal
Lubrication of cross slide

D1 Normalvorschub
Avance normale
Normal feed

D2 Kriechvorschub
Avance extra-lente
Creeping feed

D3 Stillstandzeit
Temps d'arrêt
Dwell

D4 Längsschlittengeschwindigkeit
Vitesse de coulisse longitudinale
Speed of longitudinal slide

# Hydraulikschema
# Schema hydraulique
# Hydraulics diagram

RHU 500/750

STUDER

1800-4/70

## Faults in the electronic control circuit

### I. General

The electronic power pack (see page 4.10) comprises components which will not wear out in normal use except for a relay. It is constructed solely with the most modern silicon semiconductors (Zenerdiodes and control rectifiers). The working life of these components is practically limitless, so periodically replacement is not required.

The only large condensor (1000 µ F, 250 V), used for smoothing the motor current, is of the plug in type and can be expected to give a long working life.

### Warning

It is perfectly safe to use this unit whilst it is in its proper place and earthed. Earthing is effected by the earth pin in the plug.

However if it is necessary to investigate the inside of the unit, even if it has been switched off for some time, it can be extremely dangerous to touch the internal parts with the body or with tools. Therefore before opening the unit:

- remove supply plug
- earth out sockets F and N of the multi pole socket

If the unit must be examined under power then:

- carry out the work in a dry room
- ensure that the operator stands on a properly insulated flooring
- two people must be present
- parts which conduct electricity must not be touched with the body or with tools.

Sockets F and N must not be earthed out whilst the unit is in operation.

### General hints on fault location

1) Firstly make quite sure whether the fault lies inside or outside the unit. If a replacement unit is available, plugging this in will be the fastest way of proving this point.

2. Faults are often caused by electrical overload of the components. In this case they are usually overheated and change colour, smell or smoke so that this is a good guide to locating the faulty part.

3) A plug in relay is provided for braking the motor and switching off the electrical supply. If it is faulty it can quickly be replaced.

4) The electronic control amplifier and all small components such as resistors, diodes etc. are on plug in printed circuit boards so that any suspect boards can quickly be replaced.

5) The silicon semi-conductors are protected against overload by 2 gas discharge spark arresters.

## II. Most probable faults and their remedies

Note: First always check fine fuses of control unit 353 (page 4.10)

1) Motor does not rotate.

   a) Potentiometer 402 for setting the spindle speed is set at 0.
   It is also possible that the knob is loose on its shaft.

   b) The fuses in the electronic power pack 353 have blown.

   c) There is nil or insufficient voltage reaching the power pack.

   d) One of the components in the motor control circuit is defective. Check relay. Clean contacts. Replace relay.

   e) No electrical supply to motor stator. Check DC amps at terminals J and K on terminal block at the work head motor. There should be 0.32 - 0.38 A.

   f) Broken supply to motor rotor. Check voltage at terminals A and B on the terminal block at the work head motor with motor and mains connected. With potentiometer 402 at its off position, and motor switch 401 at "I" there should be 180 - 220 V at these terminals.

2) Motor does not rotate at either "inch" or "on" position of switch 401.

   a) Motor switch faulty

   b) Relay in power pack faulty

3) Motor runs in wrong direction.

   a) resistance 106 or 107 faulty (see schematic diagram).

4) Motor does not respond to speed control potentiometer and runs at top rpm.

   a) potentiometer 402 faulty (see page 4.11)

5) Motor runs irregularly or intermittently.

   a) heavy voltage variation due to external causes or loose contact in supply circuit.

6) Insufficient torque to motor.

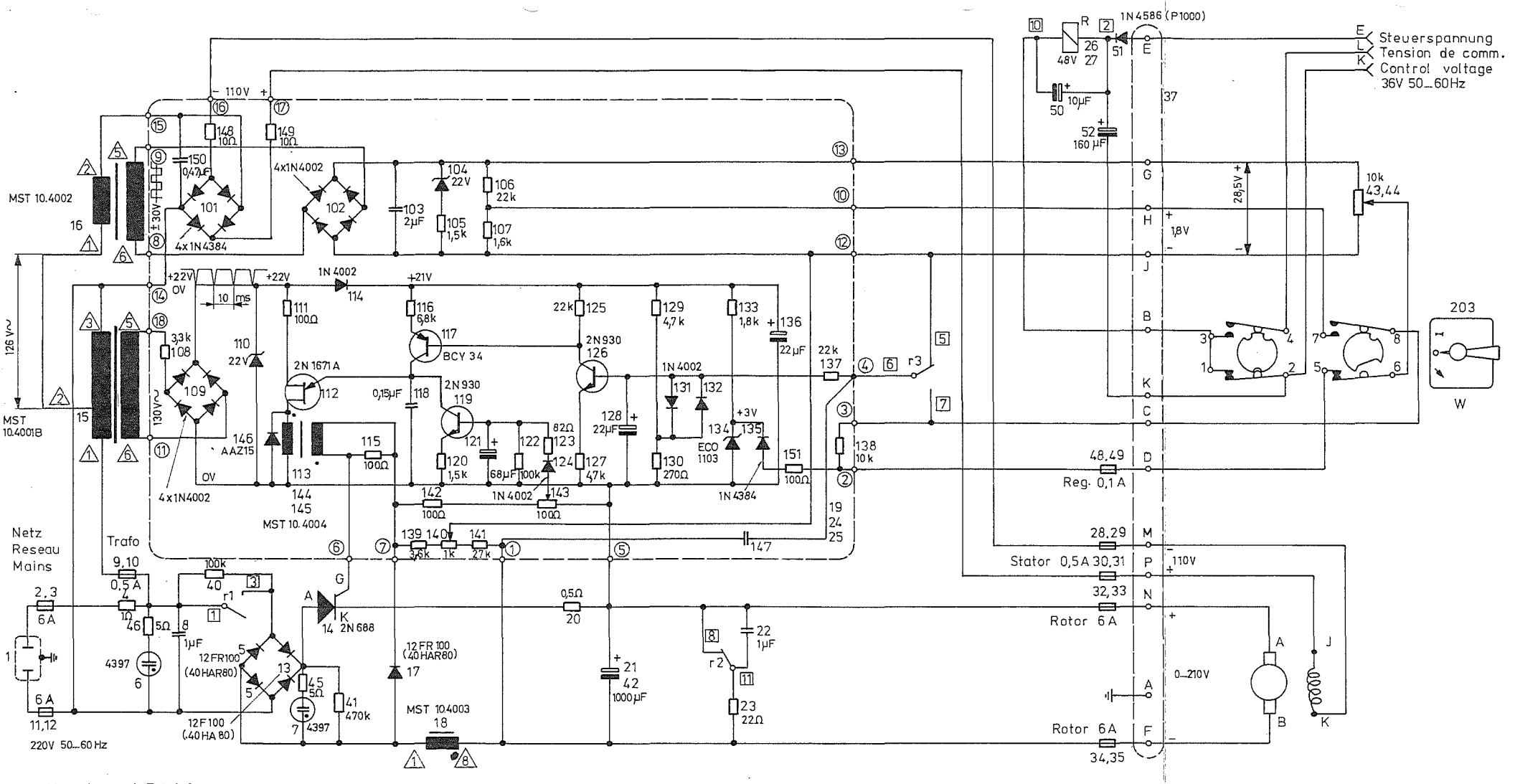
   a) see 3) a.

Note: Faults must be rectified by putting the equipment back into original condition and not by making alterations to the circuit.

Damaged switches should be replaced. Usually it does not pay to try and repair them.

| Pos. Pos. Item no. | Stk. Pce. Qty. | Benennung Désignation Description | Bestellnummer Numéro de commande Order number |
|---|---|---|---|
| 1 | 1 | Apparatestecker | Xamax Nr. 22133 |
| 2 | 1 | Sicherungshalter | FEP 704 M/ 709 |
| 3 | 1 | Sicherung | SP 900/6 A |
| 4 | 1 | Widerstand 1 Ohm/25W | 9-261-010 |
| 5 | 2 | Si - Dioden | MTR 80 |
| 6 | 1 | Ueberspannungsabl. | 4397 |
| 7 | 1 | do. | 4397 |
| 8 | 1 | MP Kondens. 10 µF | KO/MP 45/10 D 220/1 |
| 9 | 1 | Sicherungshalter | FEP 704 M/709 |
| 10 | 1 | Sicherung | SP 900/0,5 A |
| 11 | 1 | Sicherungshalter | FEP 704 M/709 |
| 12 | 1 | Sicherung | SP 900 / 6 A |
| 13 | 2 | Si - Dioden | MT 80 |
| 14 | 1 | Thyristor | 2N688 Toff = 10 us |
| 15 | 1 | Netztrafo | Nach BV MST 10.4001 |
| 16 | 1 | Referenztrafo | Nach BV MST 10.4002 |
| 17 | 1 | Si - Diode | MTR 80 U min. 900 V |
| 18 | 1 | Drossel | Nach BV MST 10.4003 |
| 19 | 2 | Endstück m. Bügel | 4332.026.02600 Philips |
| 20 | 1 | Widerstand 0,50 | IRC 2 C-0,5 20 W |
| 21 | 1 | Elko 1000 µF | Elko B 43815 A 1000/250 |
| 22 | 1 | MP Kondens. 2 µF | KO/MP 25/2 G 630/1 |
| 23 | 1 | Widerstand | 2322.321.26229 Philips |
| 24 | 1 | Steckerleiste | n. Montageblatt 88933/013518 |
| 25 | 1 | Geätzte Platte | Zeichnung MST - 2.3002/B Epoxyharz 1,6 mm, Kontakte vergoldet |
| 26 | 1 | Relais | CAD 14 D 10/48 |
| 27 | 1 | Fassung zu Relais | Steckfassung 11 polig |
| 28 | 1 | Sicherungshalter | FEP 704 M / 709 |
| 29 | 1 | Sicherung | SP 900 / 0,5 A |
| 30 | 1 | Sicherungshalter | FEP 704 M / 709 |
| 31 | 1 | Sicherung | SP 900 / 0,5 A |
| 32 | 1 | Sicherungshalter | FEP 704 M / 709 |
| 33 | 1 | Sicherung | SP 900 / 6 A |
| 34 | 1 | Sicherungshalter | FEP 704 M / 709 |
| 35 | 1 | Sicherung | SP 900 / 6 A |
| 37 | 1 | Amphenolkupplung | MS 3102 A-22-19S |
| 40 | 1 | Widerstand | 2322.63104 Philips |
| 41 | 1 | do. | 2322.63474 Philips |
| 42 | 1 | Ringschelle zu Elko | B 44030 RIS 65 isol. |
| 43 | 1 | Drahtpot. | 2322.001.21103 Philips Mech. Drehwinkel 270° Elektr. Drehwinkel 252° |
| 44 | 1 | Drehknopf | Nr. 2037 Bohrung Ø 6 |
| 45 | 1 | Widerstand | IRC 1A 5 E |
| 46 | 1 | Widerstand | IRC 1A 5 E |
| 48 | 1 | Sicherungshalter | FEP 704 M/709 |
| 49 | 1 | Sicherung | FSF 5031 / 0,1 A |
| 50 | 1 | Elyt. Kondensator | EB 100/70 (160 µF 64 V) |
| 51 | 1 | Diode | 1N 4002 (Motorola) |
| 52 | 1 | Elyt. Kondensator | EB 100/70 (10 µF 64 V) |

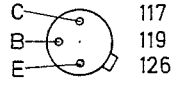
| Pos. / Pos. / Item. no. | Stk. / Pce. / Qty | Benennung / Désignation / Description | Bestellnummer / Numéro de commande / Order number |
|---|---|---|---|
| 101 | 4 | Si - Dioden | 1 N 4384 |
| 102 | 4 | Si - Dioden | 1 N 4002 |
| 103 | 1 | Kondensator | 2222.341.89205 Philips |
| 104 | 1 | Zenerdiode | ECO 1322 ± 5% |
| 105 | 1 | Widerstand | 2322.101.43152 Philips |
| 106 | 1 | do. | 2322.101.43223 " |
| 107 | 1 | do. | 2322.113.51602 " |
| 108 | 1 | do. | 2322.320.02332 " |
| 109 | 4 | Si - Dioden | 1 N 4002 |
| 110 | 1 | Zenerdiode | ECO 1322 ± 5% |
| 111 | 1 | Widerstand | 2322.101.43101 Philips |
| 112 | 1 | Unijunction Trans. | GE 2 N 1671 A |
| 113 | 1 | FXC Tranfo | Nach BV MST 10.4004 |
| 114 | 1 | Si - Diode | 1 N 4002 |
| 115 | 1 | Widerstand | 2322.101.43101 Philips |
| 116 | 1 | do. | 2322.101.43682 " |
| 117 | 1 | Si - Transistor | BCY 34 |
| 118 | 1 | Kondensator | 2222.341.89154 Philips |
| 119 | 1 | Si npn Transistor | 2 N 930 |
| 120 | 1 | Widerstand | 2322.101.43152 Philips |
| 121 | 1 | Trockentantal Kond. | ETS - 68 µF/ 15 V |
| 122 | 1 | Widerstand | 2322.101.43104 Philips |
| 123 | 1 | do. | 2322.101.43829 " |
| 124 | 1 | Si - Diode | 1 N 4002 |
| 125 | 1 | Widerstand | 2322.101.43223 Philips |
| 126 | 1 | Transistor | 2 N 930 |
| 127 | 1 | Widerstand | 2322.101.43472 Philips |
| 128 | 1 | Trockentantal Kond. | ETS - 22 µF/ 15 V |
| 129 | 1 | Widerstand | 2322.101.43472 Philips |
| 130 | 1 | do. | 2322.101.43271 " |
| 131 | 1 | Si - Diode | 1 N 4002 |
| 132 | 1 | do. | " |
| 133 | 1 | Widerstand | 2322.101.43182 Philips |
| 134 | 1 | Zenerdiode | ECO 1103± 10% |
| 135 | 1 | Si - Diode | 1 N 4384 |
| 136 | 1 | Trockentantal Kond. | ETS - 22 µF/ 35 V |
| 137 | 1 | Widerstand | Corning C-42 2 W / 22 K ± 5% |
| 138 | 1 | do. | 2322.320.32103 Philips |
| 139 | 1 | do. | Rs x 5 / 3,6 K ± 5% |
| 140 | 1 | Draht - Pot. | RIL Typ 400/1 1 K |
| 141 | 1 | Widerstand | 2322.320.12273 Philips |
| 142 | 1 | Widerstand | 2322.101.43101 " |
| 143 | 1 | Draht - Pot. | RIL Typ 400/1 100 E |
| 144 | 1 | Zyl.-Schr. | VSM 12124 M 3 x 15 Kunststoff |
| 145 | 1 | 6kt. Mutter | VSM 12707 M 3 x 0,8d verzinkt |
| 146 | 1 | Diode | AAZ 15 Philips |
| 147 | 1 | Kondensator | C 281 AD/P68K Philips (68000pF) |
| 148 | 1 | Widerstand | 2322.320.31109 Philips |
| 149 | 1 | do. | 2322.320.31109 " |
| 150 | 1 | Kondensator | 2222.341.59474 " |
| 151 | 1 | Widerstand | 2322.101.43101 " |
| 203 | 1 | Schalter Spez. | nach P 8 - 1264 (Studer) |
| | 1 | Netzsteckdose 2 P + E | 3 - 925 - 0 |
| | 1 | Netzkabel | 4 - 14030 - 40 - 4 |
| | 1 | Steuerungskabel | 4 - 1759 |

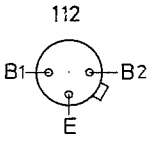


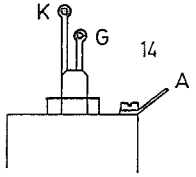

Kontakte auf Relaisfassung
□ Contacts sur armature du relais
Contacts on relay frame

Kontakte auf Steckerleiste der gedr. Schaltung
○ Contacts sür la liste à fiches du circuit imprime
Contacts on plug rail of printet circuit

Lötoesen auf Trafos und Drossel
△ Cosses à souder sur trafo et self de filtrage
Soldering eyes on trafo and throttle




# Schema der elektronischen Motorsteuerung

## Schéma de la commande electronique du moteur

## Diagram of electronic motor control

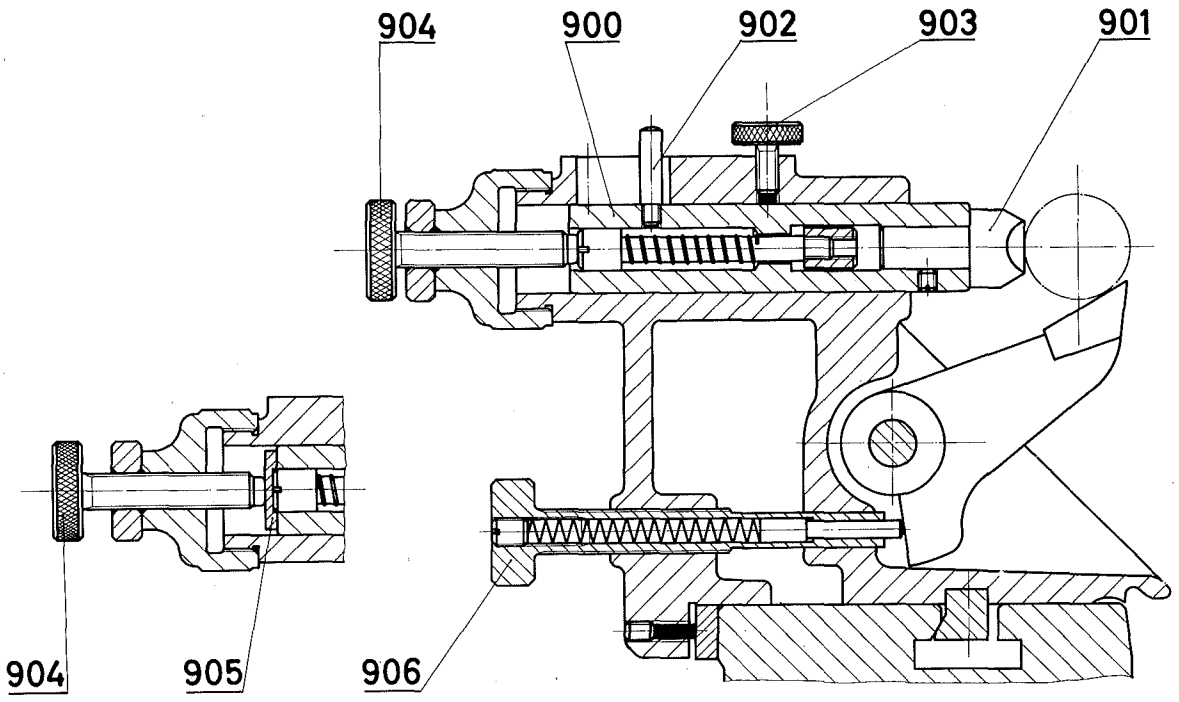
| Typ | Z. No. |
|---|---|
| RHU 500 | MST-6.3001.D |

860 - 140 D

ADDITIONAL ACCESSORIES

Spring loaded steady (type 811)

The spring loaded steady is used to give support when grinding relatively long and slender work pieces.




900 Barrel

901 interchangeable jaw in barrel. The larger jaw is for 3-42 mm (.12 - 1.6") dias., the shorter for 30-70 mm (1.2 - 2.75") dias. Both sizes of jaw can be supplied with carbide tips.

902 Pin for retracting barrel.

903 Screw to clamp barrel.

904 Adjusting screw.

905 Bearing washer.

906 Adjusting screw.

Rough grinding slender work pieces

- Set spring pressure with screw 904 (loosen and tighten lock ring).
- Set spring pressure of lower jaw with screw 906.

Finish grinding slender work pieces

- Insert bearing washer 905.
- Lightly clamp barrel with screw 903.
- Set jaw 901 to suit finished dia. of work with the aid of screw 904.

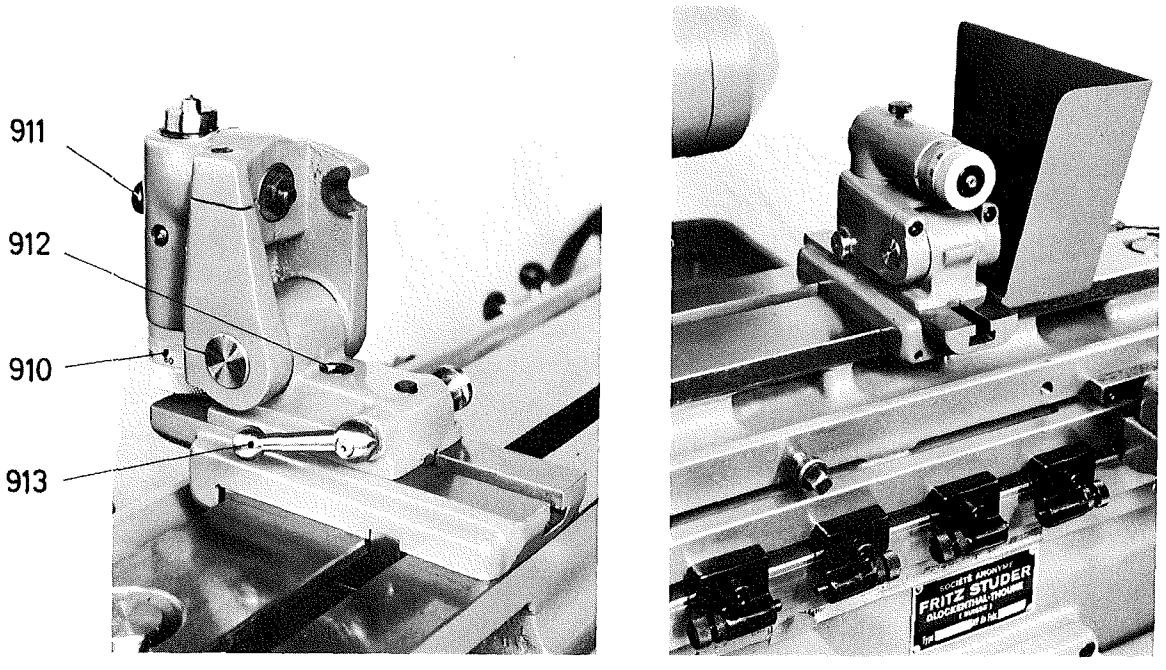
Example: Work piece reads 0 on both ends but + 0.006 mm (.000.25") in the centre.

Set jaw 901 via screw 904 so that work piece is deflected 0.003 mm (.000.12") using the dial indicator gauge mounted on the wheel guard.

- Clamp barrel with screw 903.
- Bring up lower jaw to contact work using screw 906.

Hinged diamond dresser (type 813)

Dressing device 813 is hinged so that it may be mounted between the headstock and tailstock without getting in the way of the work.




910 Fine feed screw for diamond.

911 Clamp screw for barrel.

912 Clamp screw for rough positioning.

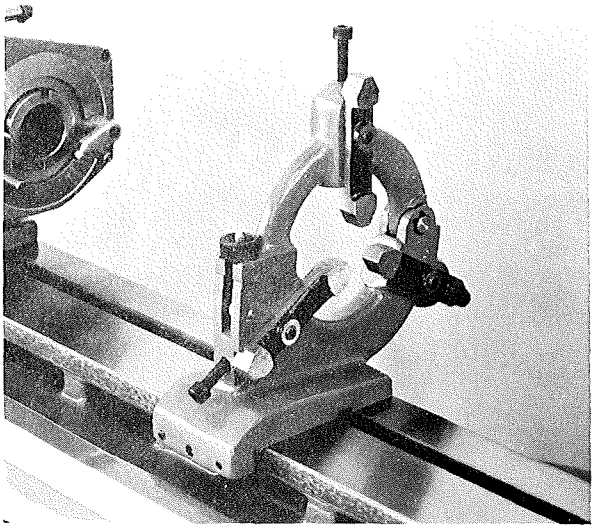
913 Clamp lever for top slide.

The diamond is set to the finished size of the work piece and then the wheel is approached to the dresser via the infeed hand-wheel. In this way the finished diameter of the work remains unchanged after the dressing operation. If the finished work diameter is incorrect then the position of the diamond is adjusted accordingly.

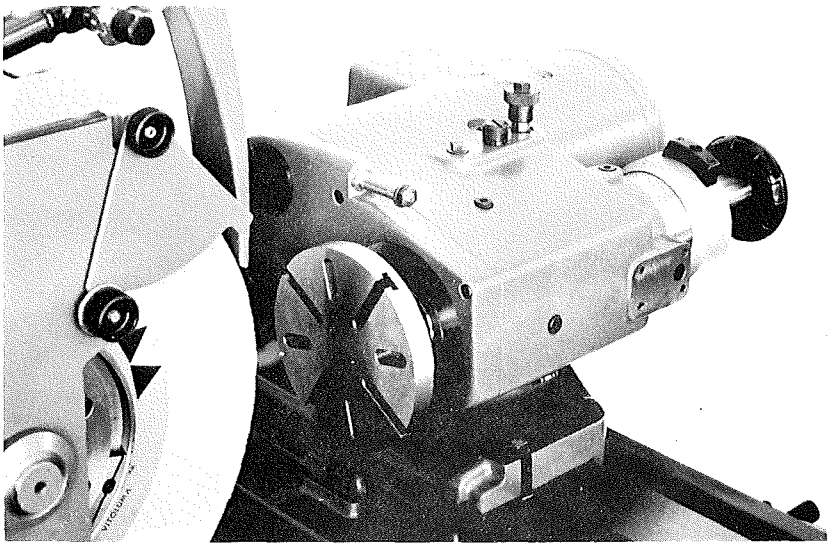
## Closed 3 jaw steady ( type 814 )

The 3 jaw steady has a diameter capacity of 5 - 80 mm (.2 - 3.2")

The jaws can be supplied with carbide tips if required.



## Offset base for work head ( type 883 )



This is used when face grinding long work pieces. The gain in space as compared with the standard base is 60 mm (2.36").

B. Hydraulically controlled dresser (type 1819-21)

This attachment designed for specially stringent requirements regarding surface finish (ball bearing races etc.) can be fitted to the table same as the manually operated sttachment. For setting the dressing radius the same setting bush 930 is used, only the dressing movement is automatically controlled with constant speed set on the control unit 934.

931 Packing piece for centre height 175 mm/7"

932 Hydraulic return connection R

933 Hydraulic pressure connection P

934 Control unit

935 Switch for dressing movement

936 Regulating knob for dressing speed

937 Connections for pressure lines 940

938 Cables for end switches m 11 and m 12 (connections at rear of control unit 934)

939 End switches m 11 and m 12

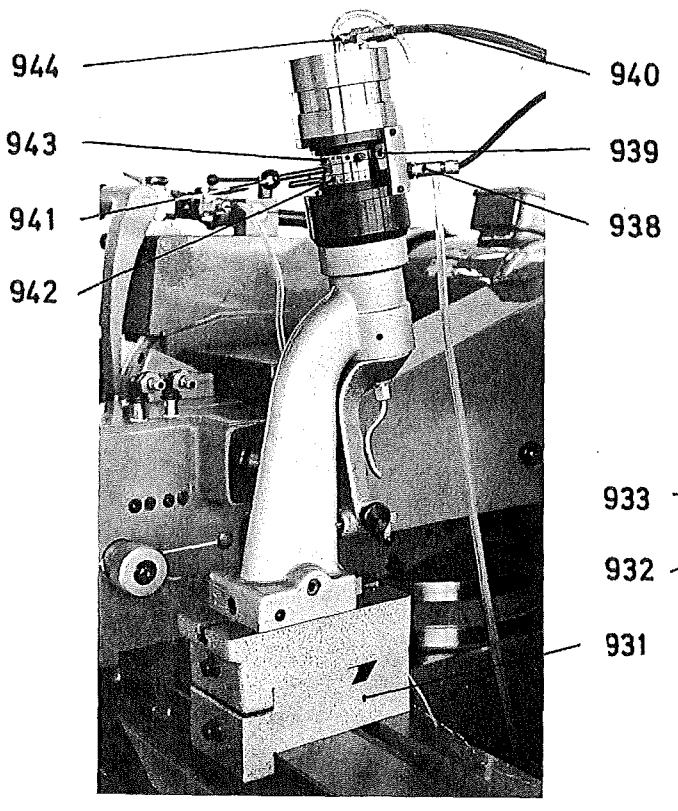
940 Pressure lines

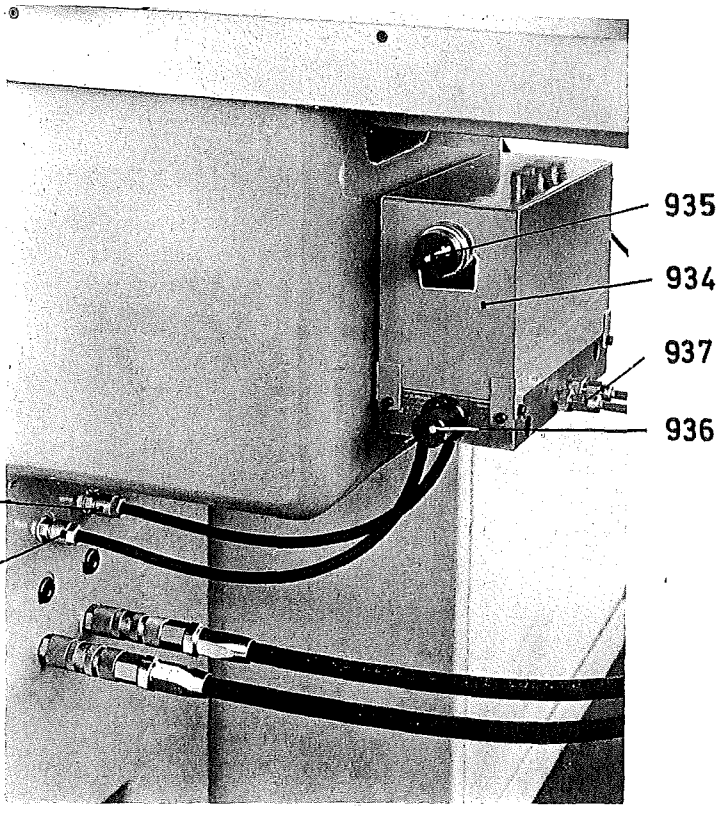
941 Hand lever for dressing movement

942 Lower stop ring, adjustable, with stop for limiting dressing movement, left

943 Upper stop ring, adjustable, with stop for limiting dressing movement, right

944 Coolant connection



## Radius dresser

### A. Attachment for manual operation (type 1819-1)

With this attachment convex and concave raddi up to 18 mm (.7") may be dressed into the wheel. After dressing the wheel this dresser can be removed from the base plate. The base plates can be supplied for 100 mm/4" and 125 mm/5". The centre height 175 mm/7" is reached with the aid of a packing piece 931.

For dressing internal grinding wheels an adaptor plate 928 is fitted. The centre height is set by moving the support according scale 929.

920 Lever for swivelling the diamond

921 Stop to limit swivelling angle

922 Bearing adjustment screw

923 Clamping screw for diamond holder

924 Tensioning screw for loosening the support

925 Clamping screw for securing the adaptor plate

926 Stop

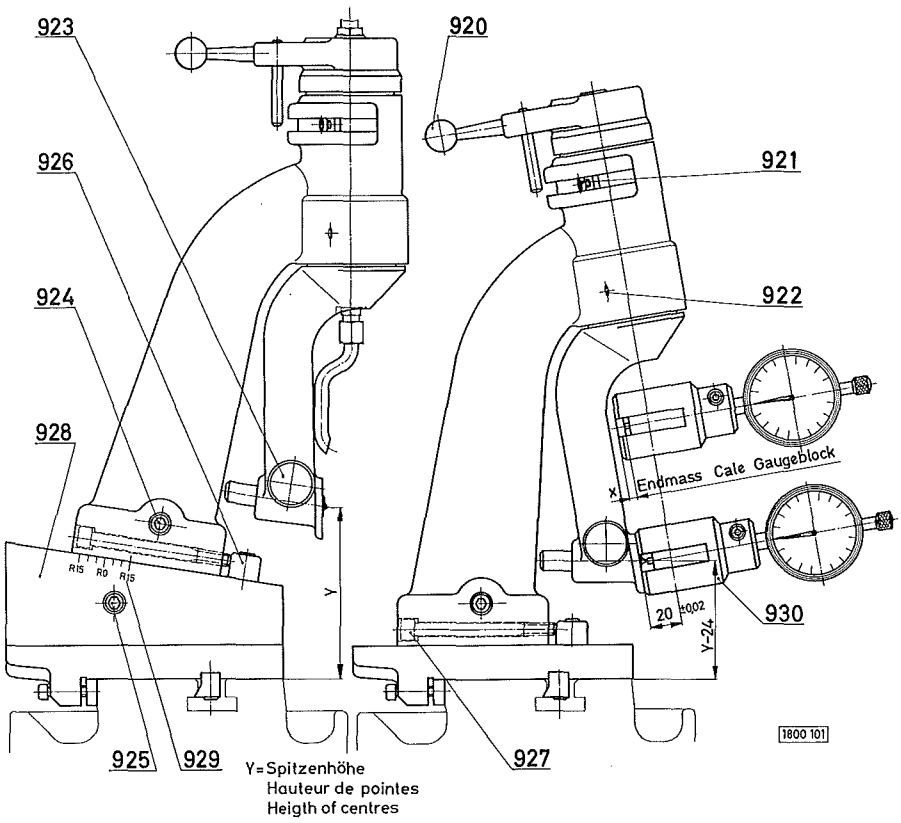
927 Stop adjustment screw

928 Adaptor plate - for dressing internal grinding wheels

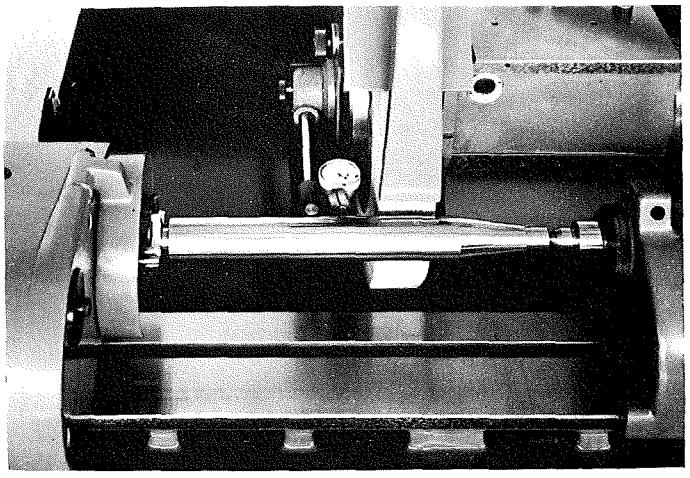
929 Scale for setting the centre height depending on the radius

930 Setting bush for diamond. The dimension X of the slip gauge is determined as follows:

Internal radii X = 20 + R (Radius)
External radii X = 20 - R

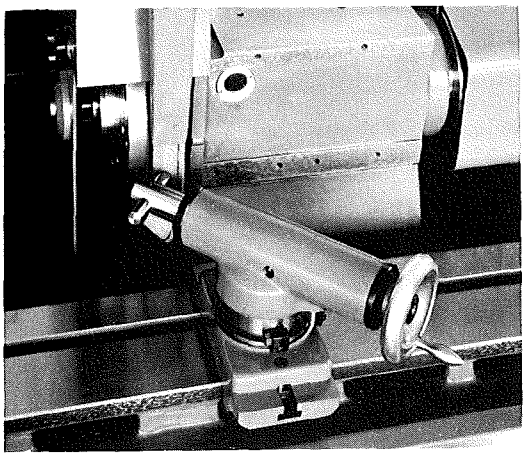


## Table aligning device on wheel guard (type 823)



When work has to be aligned to the table travel i.e. when regrinding a work piece or setting up for a taper from a gauge, this dial gauge accessory is extremely useful.

## Inclinable dresser (type 824)



The face or side of the wheel may be dressed at any required angle with the inclinable dresser.

Two stops are provided to enable two angles to be set.

The travel of the dressing spindle is 50 mm (1.97").

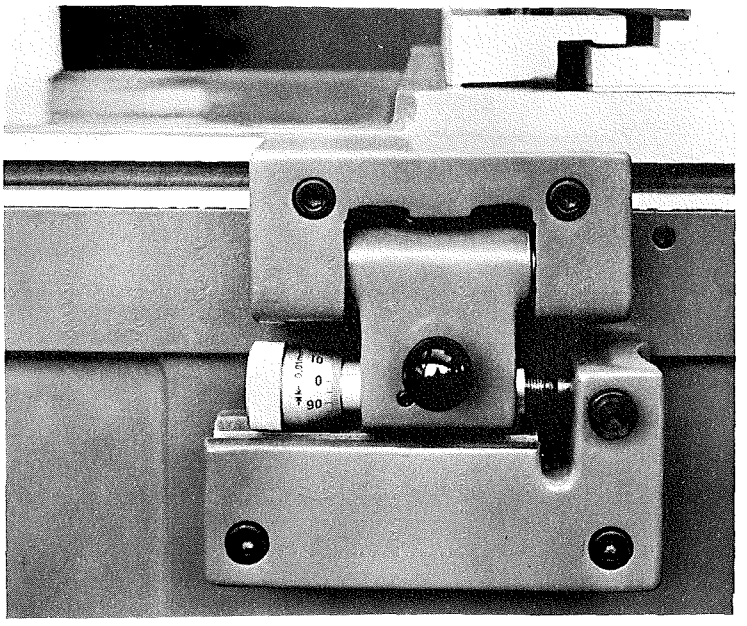
# Längsschlittenanschlag
# Butée pour coulisse longitudinale
# Stop on longitudinal slide

verwendbar als:
utilisable comme:
used as:

Fester Anschlag

Butée Fixe

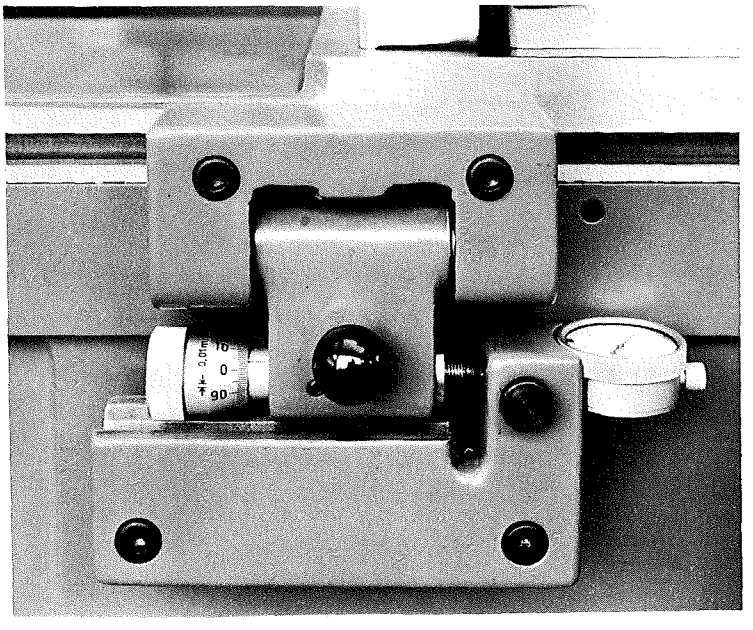
Fixed stop



Messuhranschlag

Butée à comparateur

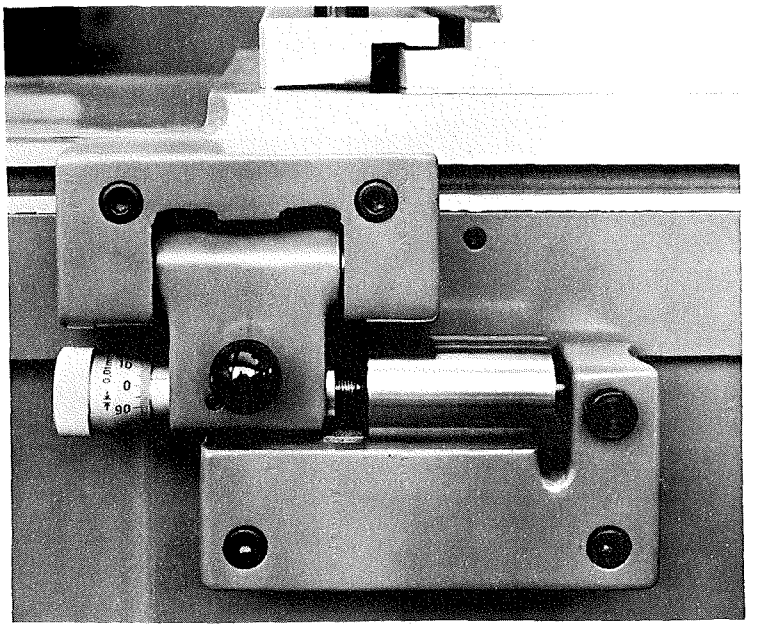
Dial indicator stop



Endmassauflage

Support pour cales-étalons

Support for slip gauges



1. Clamp screw
2. Wing nut for clamping the filter elements
3. Upper sealing ring in collector tube ( OR 28.25 x 2.62 )
4. Pressure plate
5. Hood
6. Filter pad (36 off)
7. Filter plate (36 off)
8. Collector tube
9. Base sealing ring ( OR 272.4 x 7 )
10. Drip tray
11. Blanking plate
12. Drain connection (if used with INTECLON)
13. Pressure relief valve
14. Clamp screw seal ( OR 9.92 x 2.62 )

## Application

In order to achieve a fine surface finish when superfine and lap-grinding, it is absolutely essential to filter the coolant. Using mechanical or magnetic filters, it not possible to seperate out particles of approximately 1 micron in size and smaller. In such cases a filter such as the FF 125 which operates on the absorption principle is extremely effective.

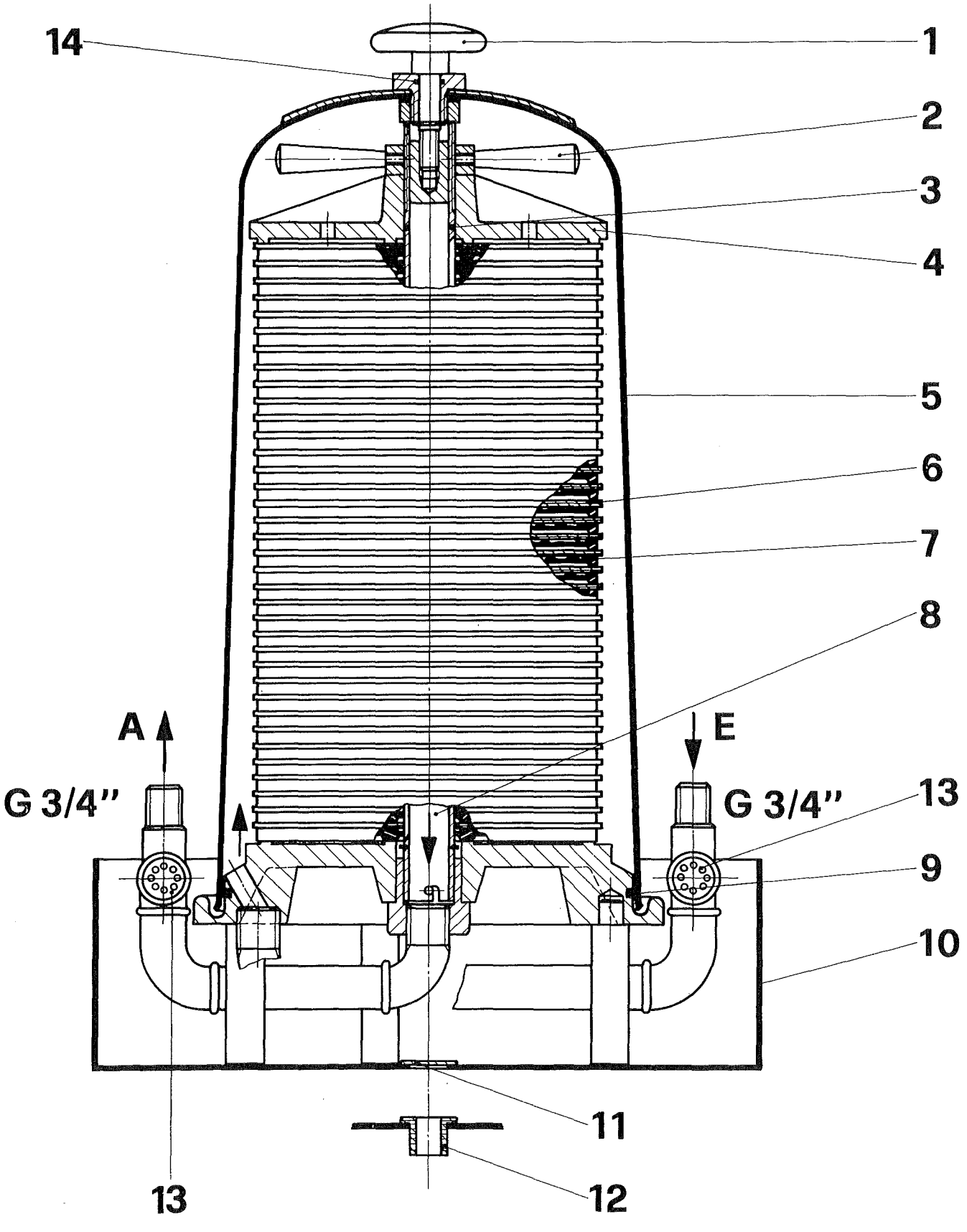
## Description and operation

The filter comprises 36 filter pads 6 each seperated alternately by a filter plate 7. The comtaminated coolant flows from the bottom (E) into the hood and passes through the filter pads. Filterred coolant flows into the central collector tube 8 and via outlet A is returned to the grinding wheel.

The arrangement of the connections on the base plate makes it easier to remove the hood when changing filter pads.

| | |
|---|---|
| Capacity | 50-60 l/min (11-13 gal/min) at 8 m (26¼") head |
| Filter | 125 $dm^2$ (13.5 $ft^2$) |
| Coolant capacity | ca. 18 litres (4 gal) |
| Connections | 3/4" gas. |

FF 125 Fine Coolant Filter




RM 250
RHU 500/750
RHU 400/650

07.14.00
10.7
08.07.00

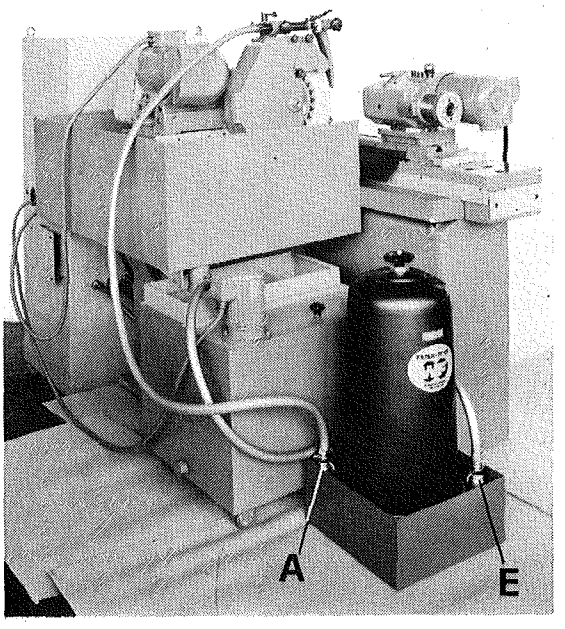
Installation

a. Used in conjunction with the standard coolant unit

The filter is placed in the drip tray 10 at the side of the coolant tank. The purpose of the drip tray in this case is to prevent spillage of coolant onto the floor when changing filter pads.

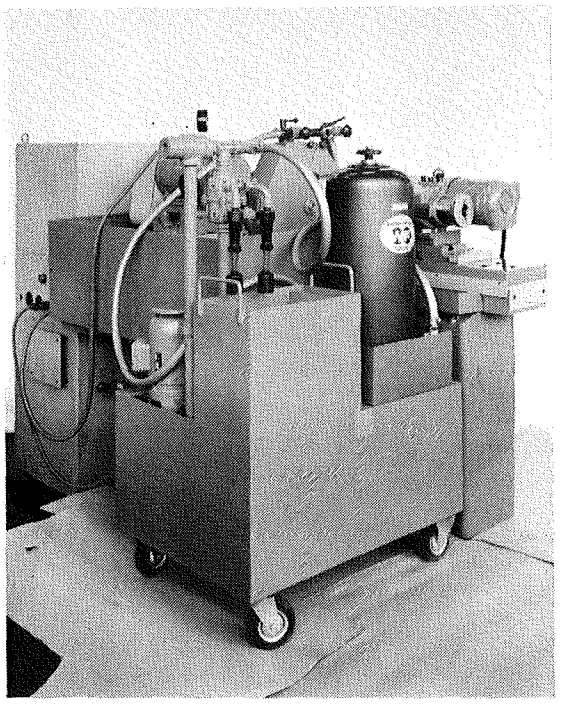
The connections can be seen in the illustration.

E = Entry for contaminated coolant from the pump
A = Outlet for filterred coolant to the grinding wheel




b. Used as a supplementary filter with the INTECLON coolant filtering unit

The filter is placed together with the drip tray on top of the coolant tank. Blanking plate 11 in the bottom of the drip tray is removed and replaced by drain connection 12. This drain connection engages in the hole in the tank cover. When changing filter pads, the drip tray simply drains into the coolant tank.



## Replacing the filter pads

Turn clamp screw (1) anti-clockwise until the hood (5) is free and can be lifted off.
Remove wing nut (2). Twist collector tube (8) by hand slightly anti-clockwise, then lift clear complete with the filter set.
(If no spare filter set is available, the 36 filter pads (6) and filter plates (7) must be removed one by one).
Guide the collector tube complete with the 36 filter plates (7) and filter pads (6) with wing nut (2) into the central hole in the base plate. Twist clockwise until the collector tube drops into the lowest position over the cross pin then twist lightly further to the right until the collector tube clicks into place. Remove wing nut (2), assemble pressure plate (4) and press by hand before replacing the wing nut and tightening in firmly.

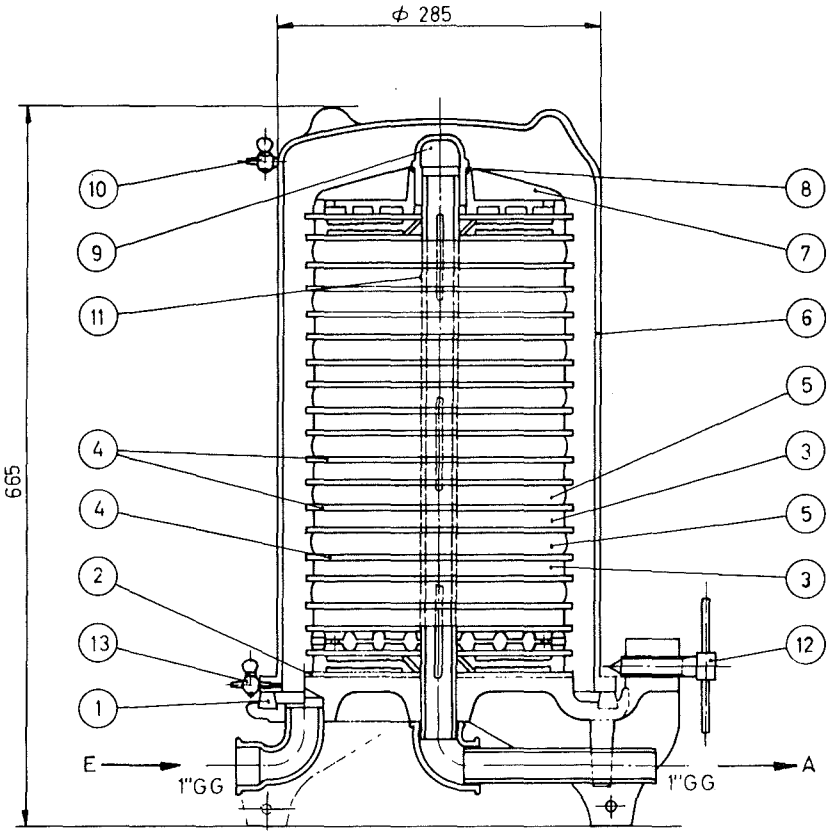
When changing the filter pads, ensure that the filter plates are assembled with the coarse grooves uppermost and the filter pads (6) with the printed side downwards.

The contact surfaces on the base and the filter plates must be clean.

## Maintenance

The FF 125 requires no maintenance. It is only necessary to change the filter pads when the output of the filter has deteriorated to a point where a sufficient flow of coolant is no longer available.

Coolant Filter FILTROX-WS (Type 827)




1 Rubber gasket for sealing the filter hood
2 Rubber slab for sealing the filter aggregate
3 Filter plate
4 Filter layer
5 Sludge plate
6 Filter hood
7 Closing cover
8 Fibre gasket
9 Closing nut
10 Venting cock
11 Collecting pipe
12 Rapid closure
13 Drain cock for emptying the filter

E Inlet
A Outlet
a Pressure connection of coolant pump
b Coolant equipment for FILTROX
c Coolant equipment for use without FILTROX

## Instructions for Using Coolant Filter FILTROX WS

### Installation

Fit the filter in the delivery piping (between pump and nozzle). Connect the piping to the pump at "a", after the closing plug has been removed.

### Putting into service

Start the coolant pump with the nozzle "b" slightly opened. Fully open the venting cock 10 of the filter, until a strong jet of coolant issues from it. Then close the venting cock; the filter is now ready for service.

It is very important that this manipulation should be carefully performed, since an air cushion present in the upper part of the filter would not only cause irregular delivery of the coolant, but also prevent the filter layers from being fully utilised.

The capacity of the filter is about 18 litres.

When the coolant pump and the settling tank are located below in the grinder, the following must be observed. If the machine has to be stopped, always close the nozzle before switching the pump off. This prevents any back-flow occurring in the filter.

### Renewing the filter layers

Empty the filter completely through the outlet cock 13 situated at the bottom. Screw back the rapid closures 12. Remove filter hood. Open bronze closing nut 9 with the spanner supplied. Lift closing cover 7. Then lift sludge plates 5 and filter plates 3 vertically out one by one from the collecting pipe 11 with filter layers adhering to them, until the last filter plate is reached. Carefully remove the used filter layers from the plates so that no residue is left. With a clean cloth, wipe the filter plates 3 (fine grooved, with 3 radial grooves). The sludge plates 5 (coarse grooved, with 6 large entrance holes), and the filter bottom with rubber gasket 1 and rubber slab 2, must also be cleaned, all particles adhering to them being removed.

The filter can now be provided with fresh layers in the following manner: Place a filter plate (finely grooved) on the rubber slab, then the first filter layer with its smooth side against the filter plate, then the first sludge plate (coarse grooved, with 6 holes), the second filter layer with rough side against the sludge plate, then again a filter plate, then a filter layer with the smooth side against the filter plate, then a sludge plate, and so on until all filter layers, filter plates and sludge plates have been inserted. Then replace the closing cover. (If the filter has been correctly assembled, the rough side of the last filter layer will lie against the closing cover).

Insert the cleaned fibre gasket 8 into the neck of the closing cover. Screw closing nut 9 on and tighten it well with the spanner; replace filter hood 6 and tighten rapid closures 12 well. Close venting cock 13.

The filter can now be put into service again as already described above.

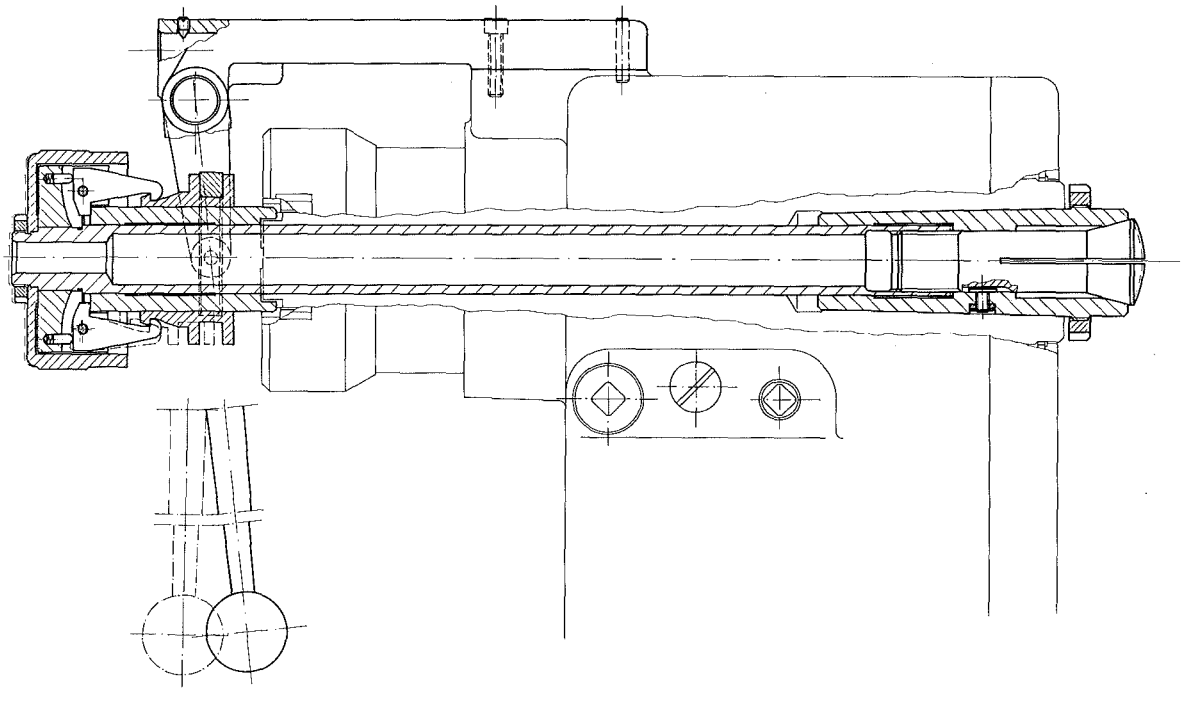
Maintenance

The FILTROX-WS needs no attendance. It is only necessary to change the filter layers when the performance of the filter has fallen so low that the quantity of coolant delivered to the nozzle is no longer sufficient.

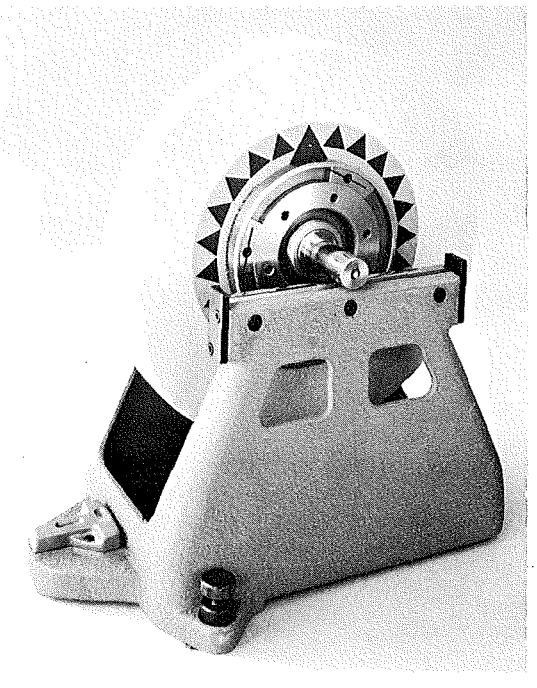
The fine filtering by the FILTROX-WS is only required for fine and lap grinding. In order to lengthen the life of the filter layers, it is therefore advisable, during normal grinding operations, to insert the nozzle "c" and thus by-pass the FILTROX-WS.

Lever operated collet draw bar (type 832 / 881)

If required the work head can be fitted with a rapid lever operation of the collet draw bar instead of the hand screw type. The collet clamping load can be adjusted via the knurled sleeve.

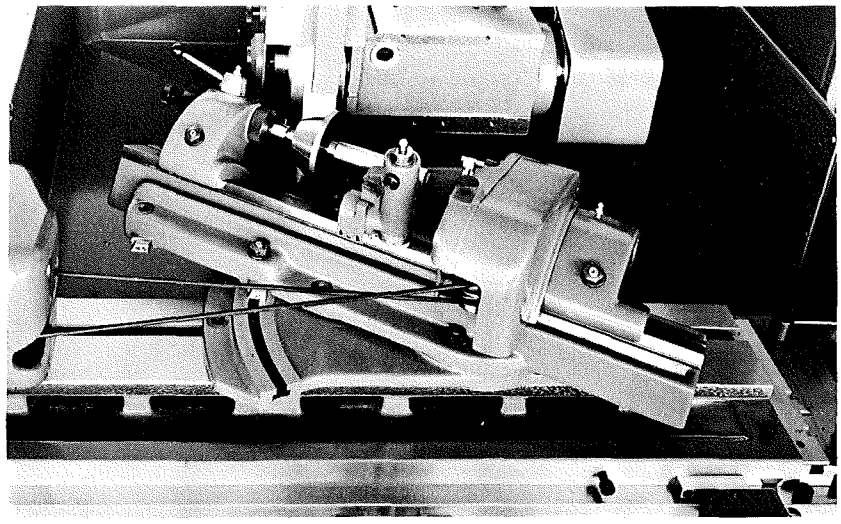


Static wheel balancing device (type 725)



These parallels are used for the fine balancing of the wheel assembly. Ensure the unit is used on a firm base.

## Steep taper grinding attachment (type 836/756)

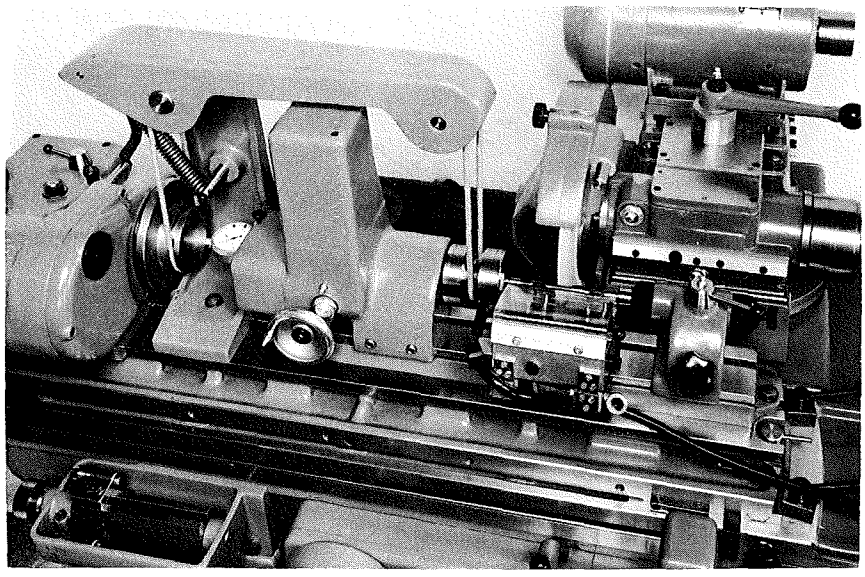


| | |
|---|---|
| Range of taper | 0 ÷ 45° |
| Distance between centres | 300 mm /12" |
| Heigth of centres | 60 mm /2.36" |

The swivelling table can be fixed, according to the workpiece, in two positions.
For angles below 10° the centre distance is reduced to 200 mm/8".

If the grinding wheel diameter is larger than 300 mm/12" or the setting angle above 30°, it is not possible to use the rapid approach of the wheel (selector switch 304).

## Length grinding equipment (type 1845)



The length grinding equipment is primarily used for the automatic grinding of shoulders e.g. on control valves.

The equipment can be supplied either for length match grinding or for the grinding of shoulders to a specific dimension. (see separate instruction book).

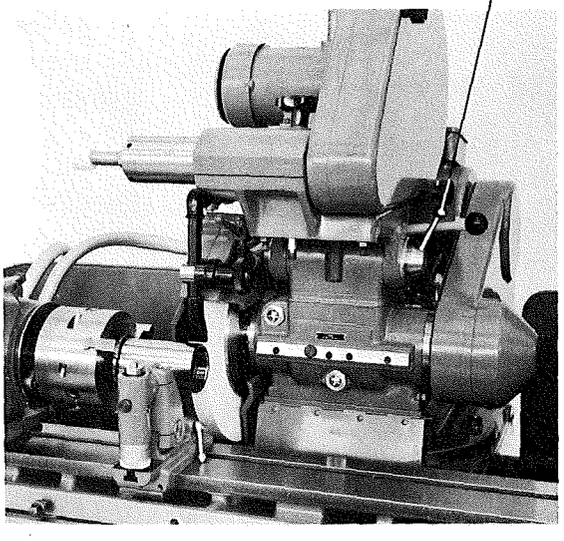
## Hinged internal grinding device (type 1815)

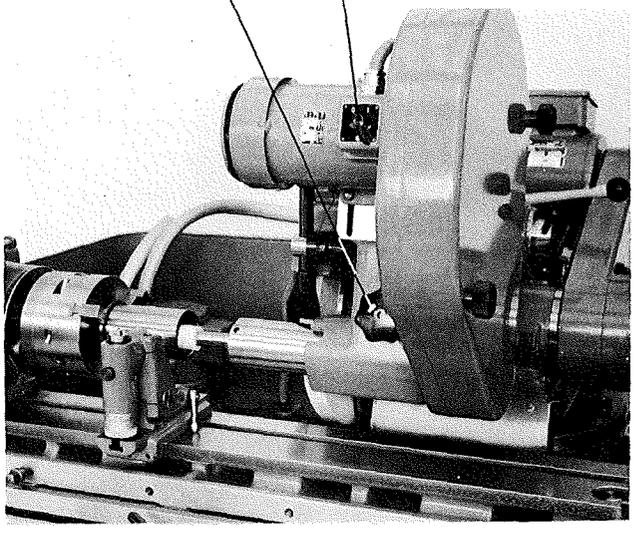
This device is designed for use with right hand rotation internal grinding spindles up to 80 mm body diameter. Smaller spindles may be used with a reducing bush.

The device may be equipped with the following drive units:

| | |
|---|---|
| 1815-1 | Standard frequency motor, spindle speeds from 4,600 to 28,000 rpm. |
| 1815-101 | Medium frequency motor, spindle sppeds from 5,200 to 40,800 mp. |
| | (see separate instruction book for air spindles up to 130,000 rpm.) |

Spindle speeds and pulley diameters are given in table 860-8.



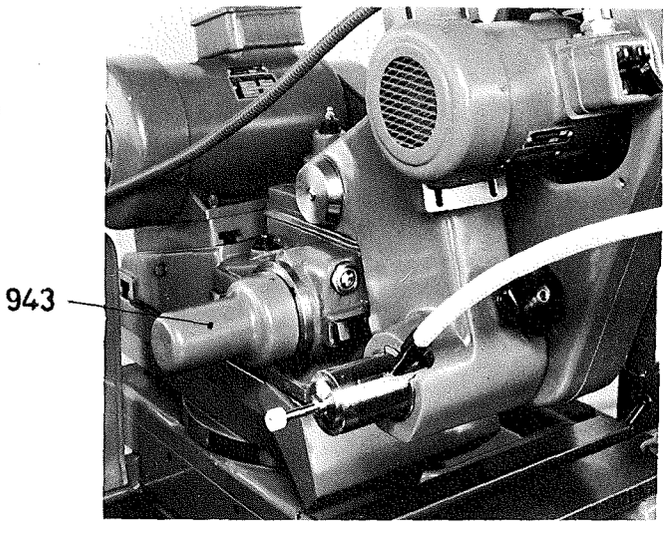



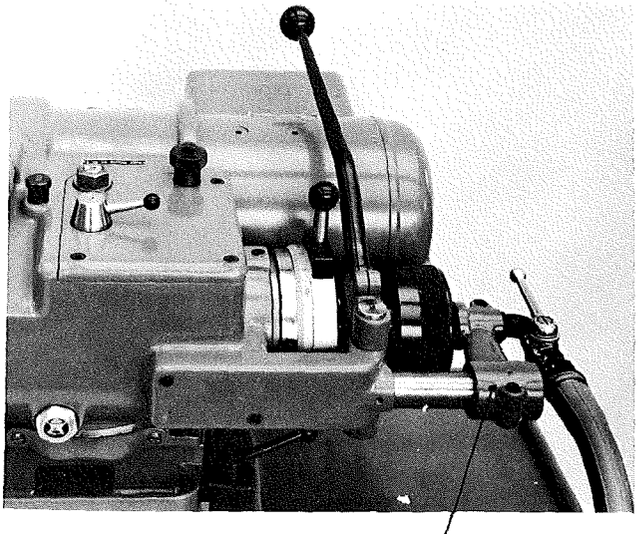

940 Motor switch. This switch will only switch the motor on and off when switch 302 is turned to the left.

941 Clamp screw for locking the hinged unit in its working position.

942 Clamp lever to hold unit in retracted position.

When the unit is in its working position this lever is tightened in order to remove the play in the pivot axis.




943 External grinding wheel spindle guard.

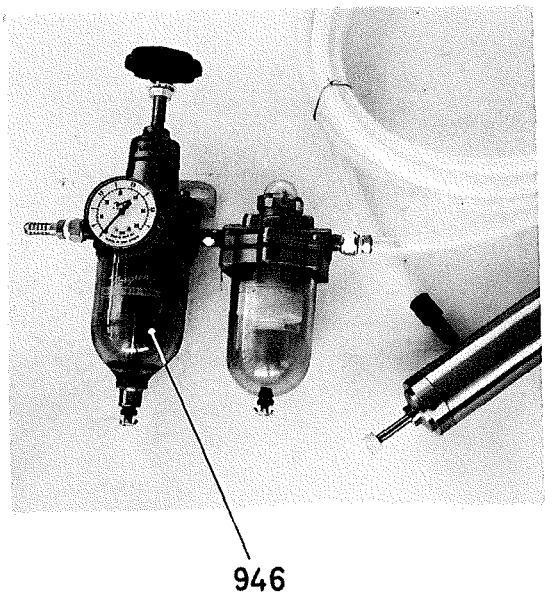
944 Coolant fitting (supplied as equipment with the internal grinding attachment).

## Cementing of internal grinding wheels

Technical copper oxyde (cuprum oxydatum technicum pulvis) is mixed in small quantities, for instance on a glass plate, with phosphorus acid 77%.

The stout pap thus obtained is applied evenly on the metal pins or screws and dried during about 6 to 8 hours (this can be accelerated over a flame).

## Oil mist unit for internal grinding attachment

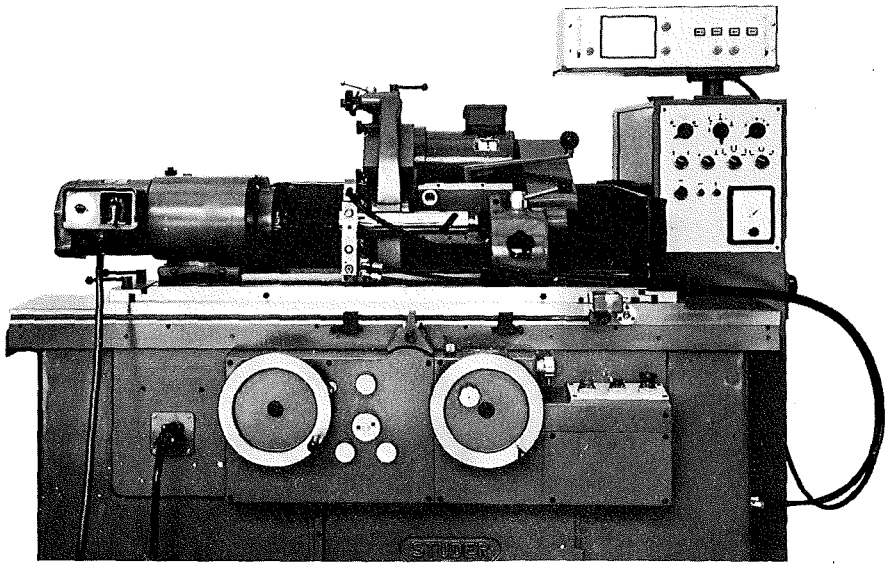



946 Norgren oil mist unit (additional equipment).

The oil mist unit automatically provides the correct air / oil mixture to cool the high speed bearing. It is also suitable for intermediate speed spindles but is essential for high speed spindles (as specially mentioned in table 860-8). The pressurisation in the spindle prevents the ingress of any dirt from the spindle during operation which prolongs the life of the bearings. (see separate instruction book).

In-process size control equipment MOVOLIMIT and DELTALIMIT

(type 1828)

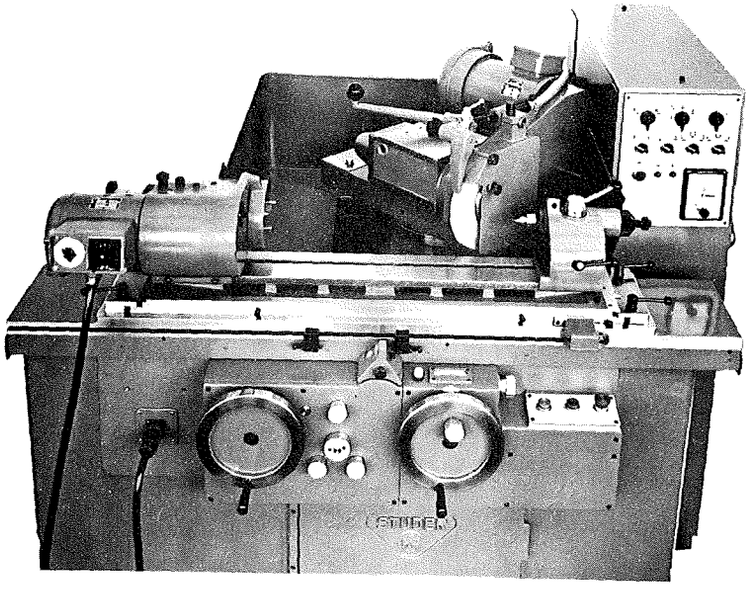


MOVOLIMIT enables shafts to be ground to a specific preset dimension.

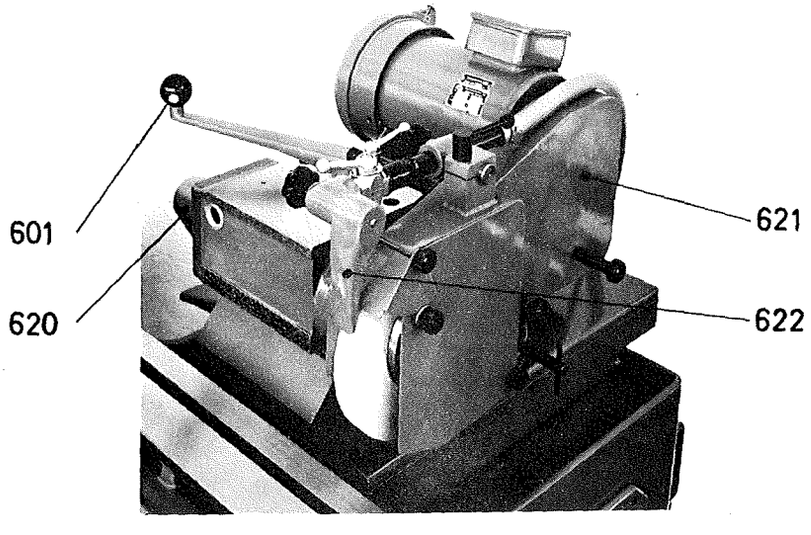
DELTALIMIT enables automatic diameter match grinding to be performed i.e. for the shaft to have a specified clearance with regard to the bore which it will fit.

The machine is supplied so that MOVOLIMIT or DELTALIMIT may be readily connected at any time. Measurement is effected either by a measuring head mounted on the table (with automatic retraction) or by a measuring head suspended from the wheel head (with manual retraction) (see separate instruction book).

Grinding wheel right (type 882)



- Remove lefthand grinding wheel and guard
- Cover spindle cone with cover 620
- Remove lefthand belt guard and replace by guard 621
- Screw coolant nozzle 622 into nozzle holder
- Fit grinding wheel dia 250 x 20 x 76 mm (10" x .79" x 2.99") on the grinding wheel adaptor, balance it and fit to the cone for the pulley. Secure with screw.
- To remove grinding wheel adaptor use extractor cap.




Setting up for grinding angles greater than 30°

- Set wheel slide at 90° to intermediate slide using clamp screws 610/611.
- Set intermediate slide at required angle to be ground, using clamp screw 611.
- The grinding stroke is effected via lever 601.

## Flat belt drive No. 892

- The flat belt drive serves for superfine and lap-grinding with a circumferential speed of 13÷17 m/sec. (42÷55 ft/sec).
- If specially quiet running is indispensable, the flat belt drive can also be recommended for finishing and fine grinding.
- The vee-belt pulley on the grinding wheel spindle must be exchanged for the flat belt pulley Ø 120 (4.7").
- The motor pulley must be selected according the grinding wheel diameter (see following chart)

Flat belt drive for superfine and lap-grinding

Grinding wheel circumferential speed = 13÷17 m/sec (42÷55 ft/sec)

| Grinding wheel diameter | Motor pulley | | Flat belt | |
|---|---|---|---|---|
| | 50 cycl. | 60 cycl. | 50 cycl. | 60 cycl. |
| 400 ÷ 300 ; 16" ÷ 12" | 33 | 27 | 920 x 35 | 920 x 35 |
| 300 ÷ 230 ; 12" ÷ 9" | 44 | 36 | 920 x 35 | 920 x 35 |
| 300 ÷ 230 ; 12" ÷ 9" | 44 | 36 | 920 x 35 | 920 x 35 |

Flat belt drive for finishing and fine grinding.

Grinding wheel circumferential speed 28÷31 m/sec. (92÷101 ft/sec)

| Grinding wheel diameter | Motor pulley | | Flat belt | |
|---|---|---|---|---|
| | 50 cycl. | 60 cycl. | 50 cycl. | 60 cycl. |
| 400 ÷ 365 ; 16" ÷ 14 ¼" | 60 | 50 | 970 x 35 | 950 x 35 |
| 365 ÷ 330 ; 14 ¼" ÷ 13" | 65 | 54 | 970 x 35 | 950 x 35 |
| 330 ÷ 300 ; 13" ÷ 12" | 72 | 60 | 970 x 35 | 950 x 35 |
| 300 ÷ 270 ; 12" ÷ 10 ½" | 80 | 65 | 1000 x 35 | 970 x 35 |
| 270 ÷ 245 ; 10 ½" ÷ 9 ½" | 88 | 72 | 1000 x 35 | 970 x 35 |
| 300 ÷ 270 ; 12" ÷ 10 ½" | 80 | 65 | 1000 x 35 | 970 x 35 |
| 270 ÷ 245 ; 10 ½" ÷ 9 ½" | 88 | 72 | 1000 x 35 | 970 x 35 |
| 245 ÷ 220 ; 9 ½" ÷ 8 ½" | 97 | 80 | 1000 x 35 | 970 x 35 |

## Mode d'emploi pour le dispositif de réglage micrométrique du mandrin "BURNERD"

Le réglage est très simple. La pièce à usiner sera d'abord serrée comme d'habitude au moyen de la clef à bout carré. Pour obtenir le centrage exact de la pièce ainsi que de la partie supérieure du mandrin, procéder de la manière suivante: Desserrer les 3 vis du dispositif micrométrique situées à côté des 3 pignons à l'aide de l'extrémité correspondante de la clef. Déterminer le faux-rond de la pièce à usiner avec un comparateur et serrer la vis la plus proche du point de lecture minimum jusqu'à réduction de la concentricité voulue. Enfin s'assurer que les vis sont serrées sans être bloquées. Pour conserver la concentricité lors de l'usinage de pièces identiques, il faut toujours serrer à l'aide du même pignon (ils sont marquées 1 2 et 3). En général, un nouveau réglage n'est nécessaire que pour le serrage particulièrement précis de pièces d'un diamètre différent.

## Operating Instructions for Micro-Centering Device of Chucks "BURNERD"

Operation of the adjustment is simplicity itself. The parts to be machined are gripped in the usual way, using the square head of the key. In order to center the gripped workpiece correctly, all three micro adjusting screws near the pinions must be slightly slackened, using the appropriate end of the dual purpose key. Using a dial gauge registered on the diameter of the component gripped in the jaws, the roundness is checked and the lowest reading marked. The micro adjustment screw nearest to this low reading position is tightened until the dial indicator shows that approximately half of the previous deflection has been corrected. The chuck is then slowly rotated and same procedure repeated until the required accuracy has been obtained. Check that all three centering screws have been tightened, but never overtighten them. Make sure when gripping a similar series of workpiece that the same pinion marked 1 2 or 3 is used. A readjustment of the centering device may become necessary if workpieces with different diameters must be gripped with best possible accuracy.

Adjustable tailstock (type 885/1841)

Temperature fluctuations during cylindrical grinding may lead to errors on cylindricity.
To correct these errors the adjustable tailstock is used.

In its centre position the tailstock spindle can be moved towards the crosslide and away from it by 0.020 mm (.000.7") which means a total range of adjustment within ± 40/um (.0015") on diameter.

Setting up for cylindrical grinding

- Set the swivelling table parallel to the longitudinal slide movement with the aid of the table aligning device (Type 823) as follows:

  1. Set the tailstock spindle approx. over the pivoting axis of the swivelling table and register dial indicator.
  2. Move the slide and keep the tailstock standing against the dial indicator. Set the swivelling table parallel with the aid of the adjustment screw.
  3. Check parallelism by moving slide and tailstock, readjust if necessary.

- Set fine adjustment of tailstock to its centre position.

If an error on cylindricity is measured on the first workpiece ground, the fine adjustment must be corrected by the amount found on the enclosed chart.

This method of setting ensures that the workhead and tailstock spindles are on the same axis for an accurat cylindrically ground workpiece.

Setting up for taper grinding

- Set tailstock fine adjustment to its centre position.
- Set the taper with the table aligning device as described in the general instructions for this machine.
- The angle error on the first ground taper necessitating an adjustment of several hundredths of a mm is corrected by adjusting the swivelling table according to chart 808-8, 1808-8 or 760-8, page 2.
- As the fine adjustment of the tailstock spindle can be moved backwards and forwards by only 0,020 mm (.0007") from the centre position, the fine adjustment should be used for angle corrections necessitating adjustment of some thousandths of a mm of the swivelling table.

Lubrication and maintenance

The element of the tailstock fine adjustment should be filled with oil halfyearly. Best suitable is VELOCITE Nr. 10 or oil having the same viscosity and lubrication characteristics.

Refilling is effected as follows:

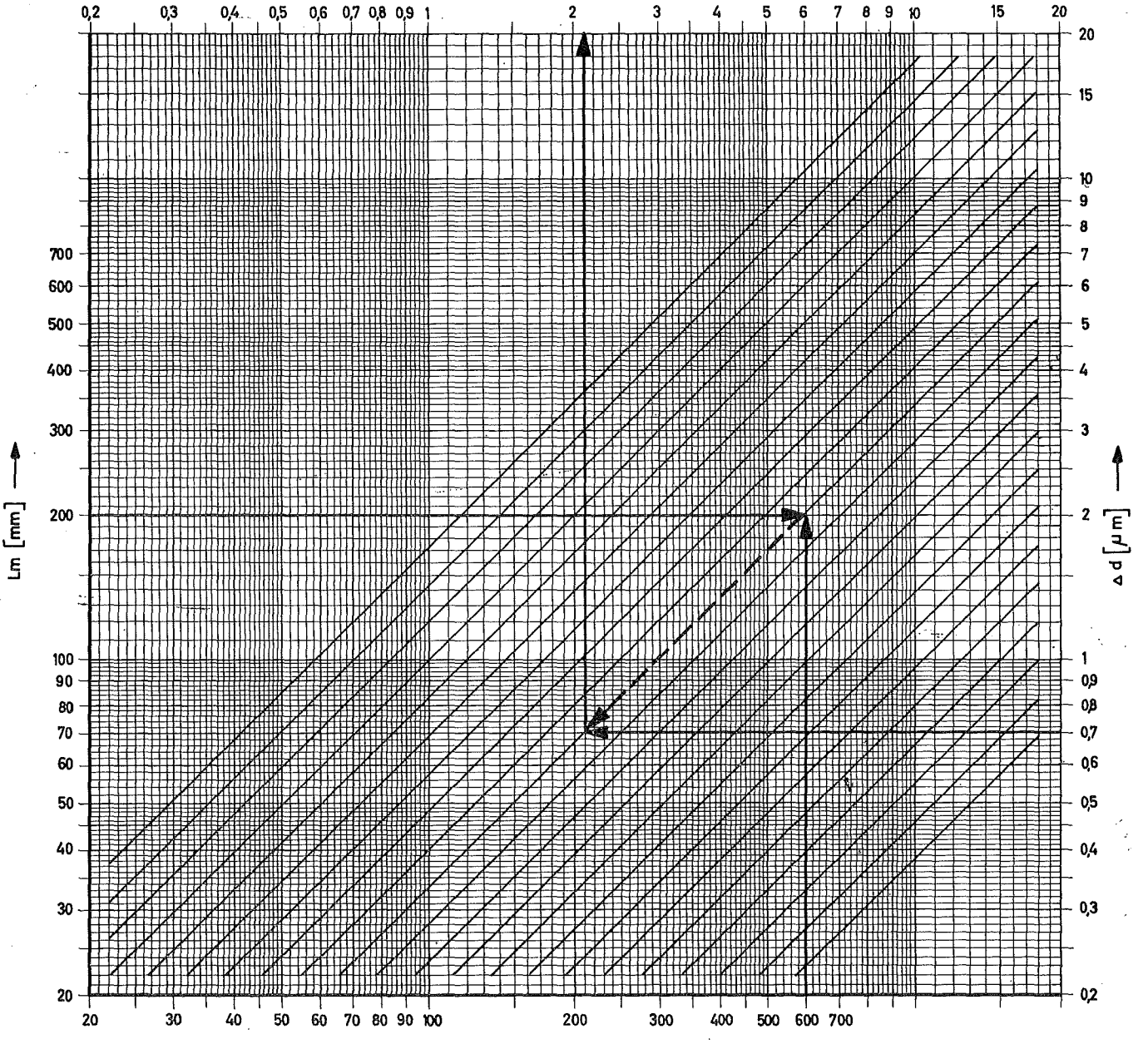
- Remove the black cover at the left. The adjustment spindle must be screwed in to the last division on the scale.
- Turn the tailstock upside down in order that the fine adjustment stands vertically. Fill up with oil.
- Screw out the spindle in this position to the last division of the scale and refill again with oil.
- Screw on the cover and ensure good sealing.
- Turn fine adjustment again to its centre position.

# RHU 500 / 750

## Verstellbarer Reitstock
## Contre-poupée réglable
## Adjustable tailstock

Verstellwert
déplacement
adjustment value

$s = \Delta d \cdot \frac{Lw}{Lm}$ [µm/ø]



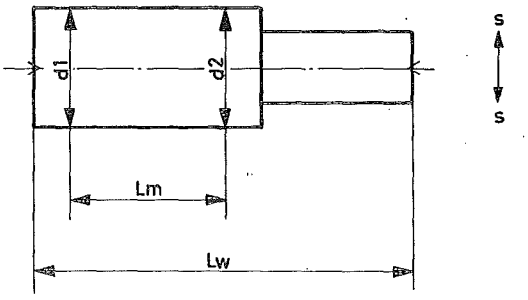

Beispiel:
Exemple:
Example:

Werkstücklänge zwischen den Spitzen
Longueur de la pièce entre pointes Lw=600
Workpiece length between centres

Messlänge
Longueur mesurée Lm=200
Measuring length

ø Differenz gemessen
Différence des ø mesurés Δd=0,7µm
Dia. difference measured

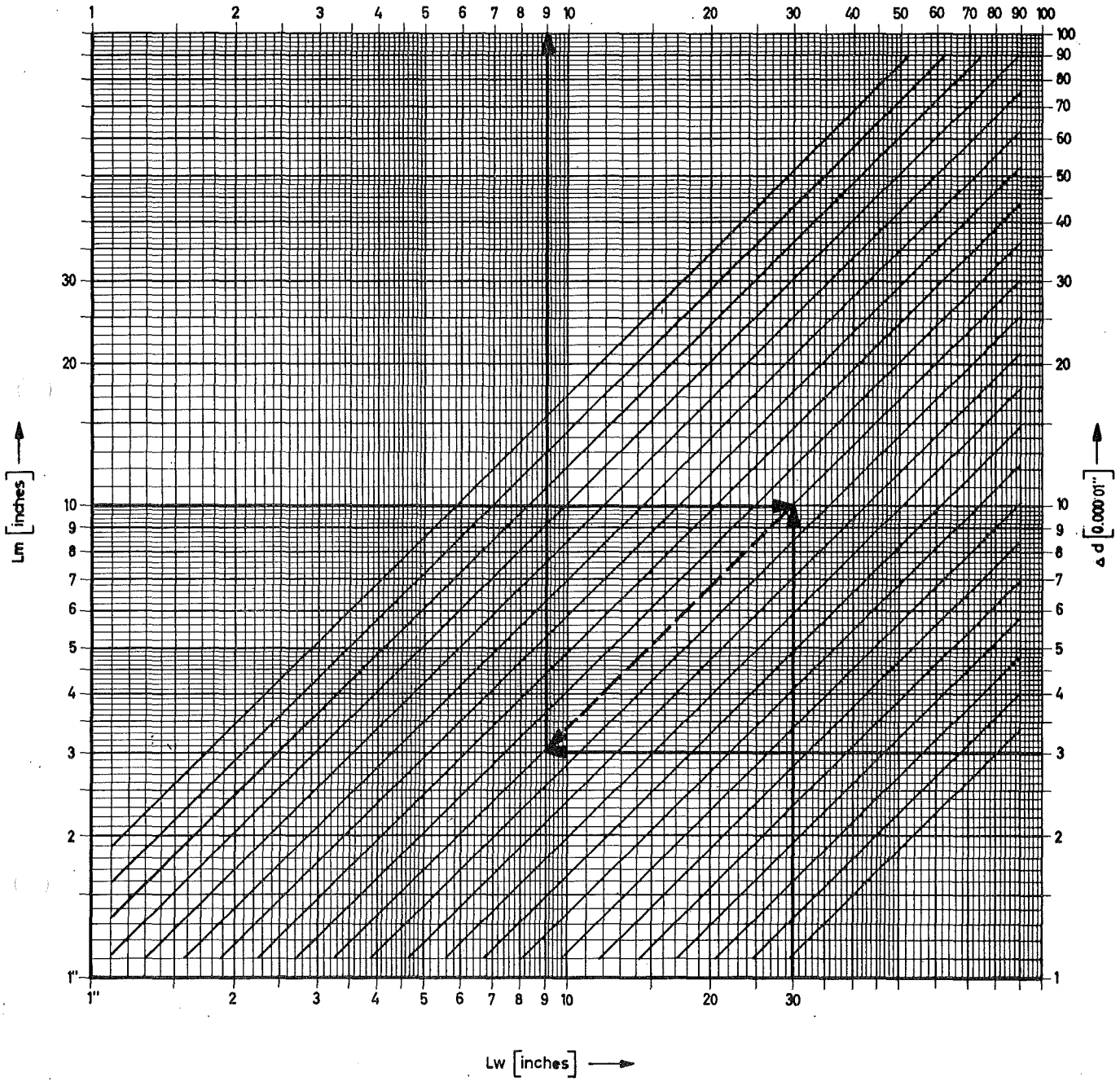
Verstellwert nach Tabelle
Déplacement d'aprés tabelle s=2,1
Adjustment value according to table



# RHU 500 /750

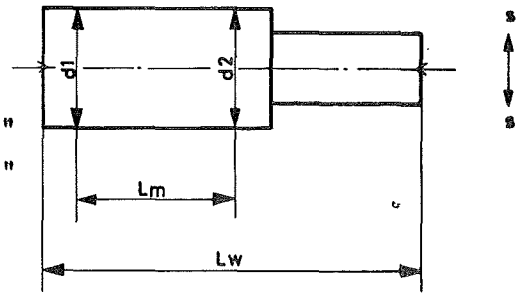
## Adjustable tailstock

Adjustment value $s = \Delta d \cdot \frac{Lw}{Lm}$ [0,000 01"]



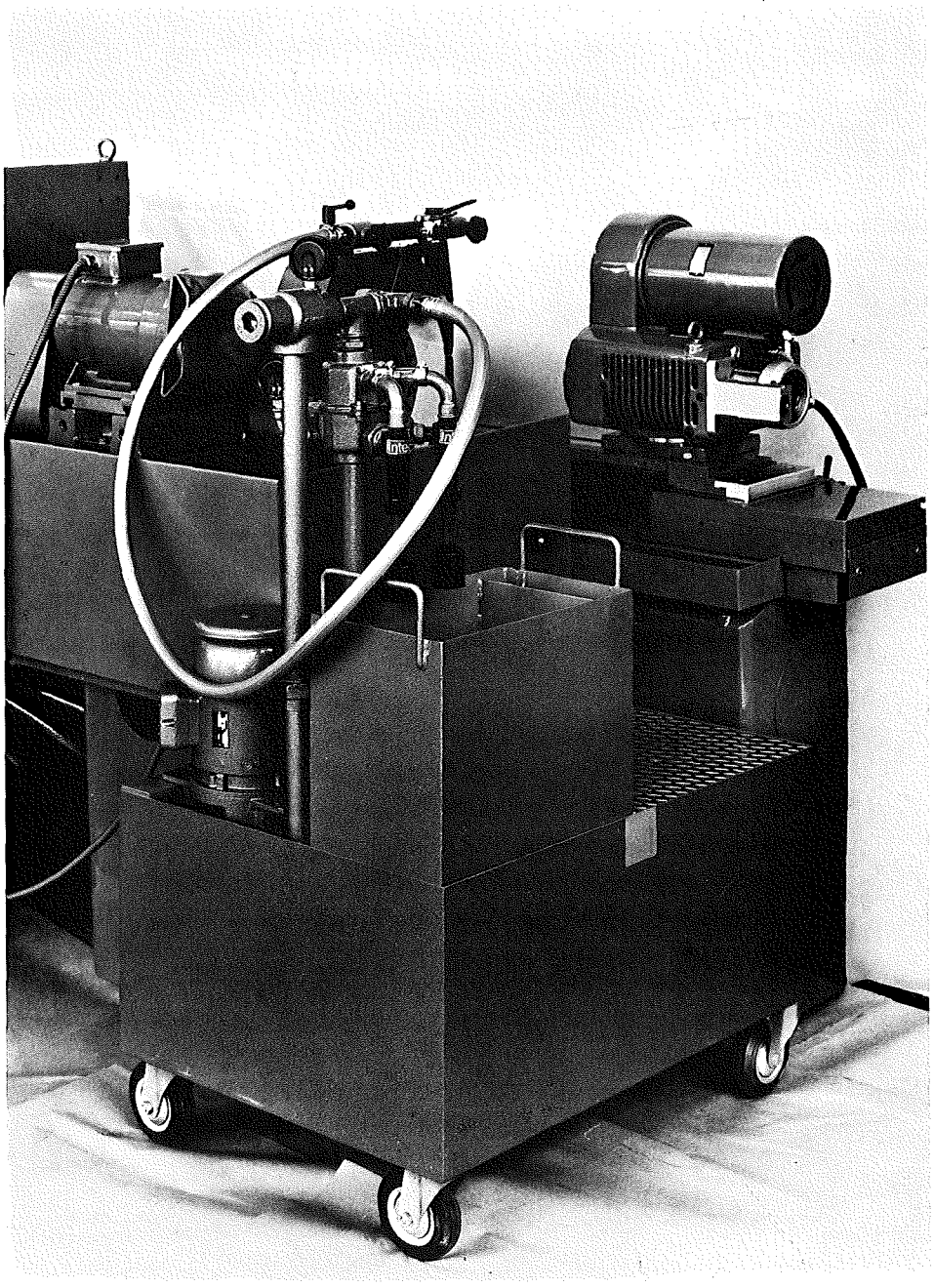

**Example:**

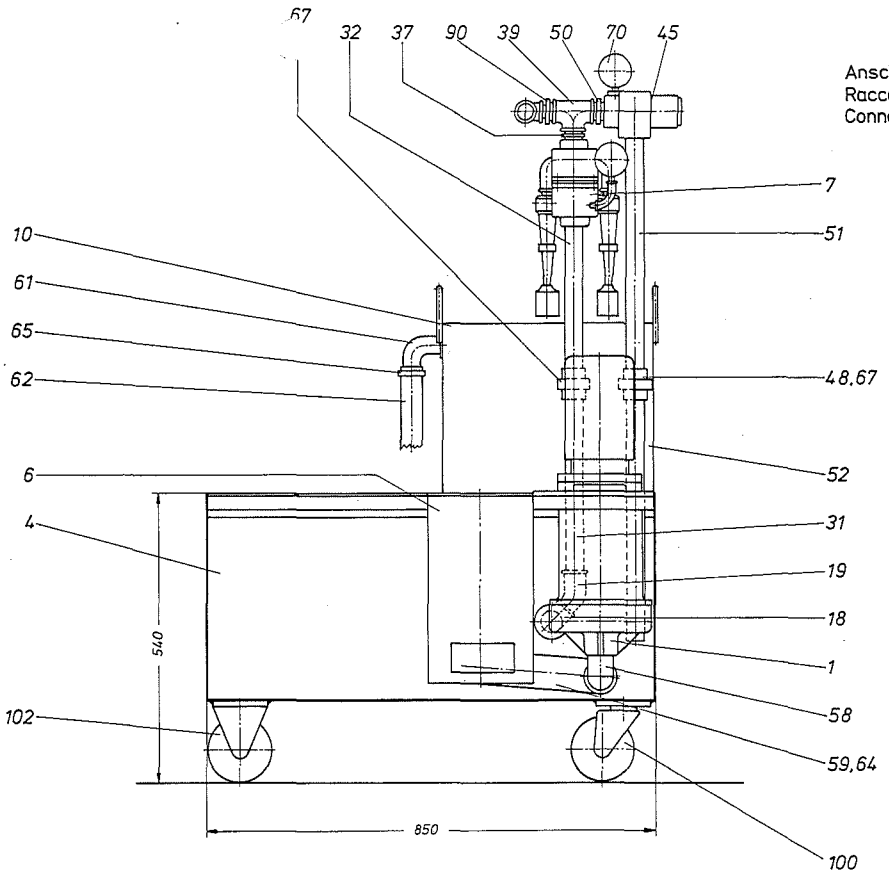
| | |
|---|---|
| Workpiece length between centres | Lw=30" |
| Measuring length | Lm=10" |
| Dia. difference measured | Δd=0,00003" |
| Adjustment value according to table | s=0,00009" |

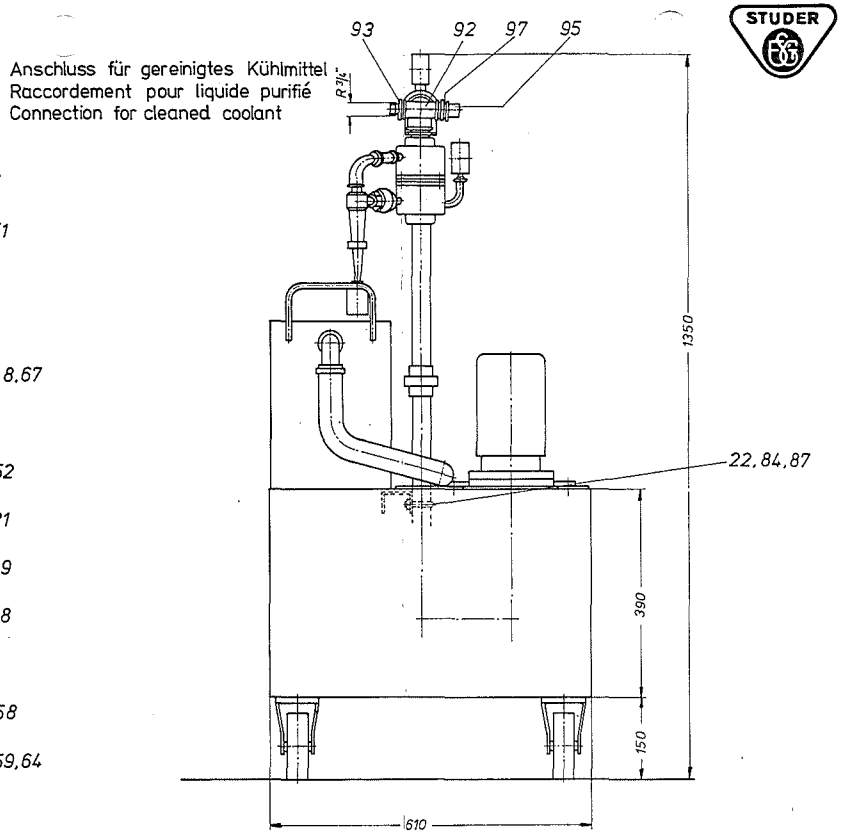


Kühlmittelreiniger INTECLON Typ 28/2
Epurateur de liquide d'arrosage INTECLON Type 28/2
Coolant equipment INTECLON Typ 28/2

(Sonderausrüstung Nr. 812-201)
(Accessoire supplémentaire Nr. 812-201)
(Additional accessorie Nr. 812-201)



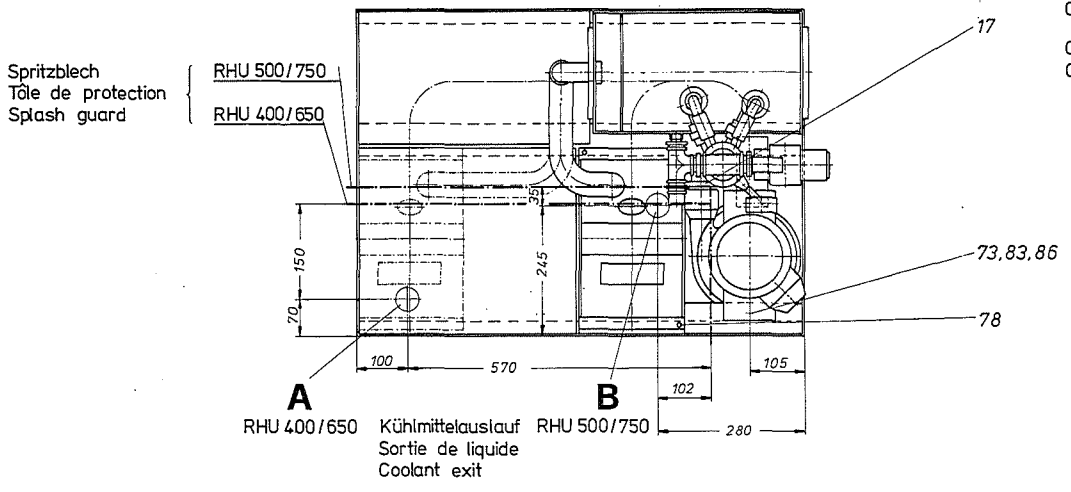



Durchlaufleistung
ca. 40 l/min.
Behälterinhalt 200 Liter

Débit 40 l/min.
Capacité 200 l

Capacity 40 litres/min.
Container of 200 litres




Baugruppen der Anlage

| | |
|---|---|
| 1 | Schmutzwasserpumpe |
| 4 | Kühlbehälter mit Abdeckblechen |
| 6 | Einlauftrichter mit Siebkorb |
| 7 | Hydro-Zyklonbatterie mit kpl. Verrohrung |
| 10 | Schlammkasten |
| | lose beigelegte Kleinteile: |
| 7/14 | Unterlaufdüsen mit } siehe Seite 08.19.09 resp. 10.28 d |
| 7/15 | Spritzschutz } |
| 62 | Schlauch für Schlammkasten |
| 70 | Manometer 0-2,5 kp/cm² |
| 71 | Manometer 0-6 kp/cm² |
| 67 | 2 Dichtungen für Steig- und Rücklaufleitung |

Eléments composant l'installation

| | |
|---|---|
| 1 | Pompe d'eau sale |
| 4 | Réservoir de liquide d'arrosage avec tôles de couverture |
| 6 | Entonnoir d'amenée avec crépine |
| 7 | Batterie d'hydrocyclones avec tuyauterie complète |
| 10 | Bac à sédiments |
| | Pièces diverses: |
| 7/14 | Buses de sortie des sédiments avec } voir page 08.19.09 |
| 7/15 | Nez de buse } resp. 10.28 d |
| 62 | Tuyau pour le bac à sédiments |
| 70 | Manomètre 0-2,5 kp/cm² |
| 71 | Manomètre 0-6 kp/cm² |
| 67 | 2 Joints pour les canalisations de refoulement et le retour de la pompe |

Components of the unit

| | |
|---|---|
| 1 | Dirty coolant pump |
| 4 | Coolant tank with cover plates |
| 6 | Inlet hopper with screen |
| 7 | Hydro-cyclon battery complete with plumbing |
| 10 | Sediment container |
| | Accessories attached: |
| 7/14 | Lower nozzle with } see page 08.19.09 resp. 10.28 d |
| 7/15 | Spray guard } |
| 62 | Hose for sediment container |
| 70 | Gauge 0-2.5 Kp/cm² |
| 71 | Gauge 0-6 Kp/cm² |
| 67 | 2 Gaskets for pressure line in and out |

Operating instructions for coolant equipment INTECLON Type 28/2.

## 1. Description and method of operation

According to its system the INTECLON is a centrifugal separator wherein with help of the centrifugal force the easiest and most efficacious separation of solid particles from the liquid is obtained.

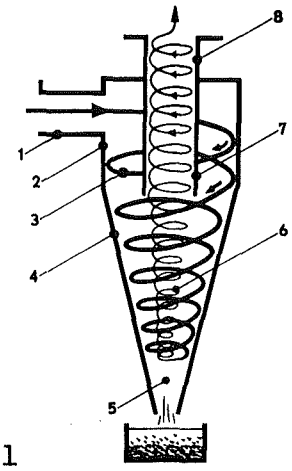



Fig.1

1 Whirl nozzle
2 Cylindrical whirl chamber
3 Down draft primary whirl
4 Conical chamber
5 Lower course valve
6 Updraft secondary whirl
7 Whirl searcher
8 Upper course valve

As shown on fig. 1, the lubricant to be purified enters as a laminar flow tangentially through the whirl-nozzle into the cylindrical chamber of the hydrocyclone which brings it into rapid rotation. Here the primary whirl originates and is directed steadily downward through the conical chamber where it approaches the lower course valve. The throttling effect of this valve transforms the primary whirl into a secondary whirl in the same sense of rotation which at the middle of the apparatus is directed upward and captured by the whirl seacher, in order to pass off through the upper course valve.

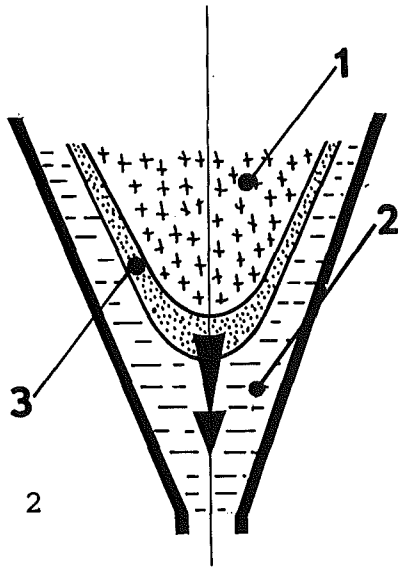



Fig. 2

Flow field of a conical whirl chamber:

1 Whirl course
2 Sump
3 Mixed whirl

The separation of the solid particles is obtained by the centrifugal force which acts on the particles during their rotation. Whilst the major part of the particles is already projected by the primary whirl into the smooth wall of the conical chamber where they slide down with a small quantity of liquid for elimination by the lower valve, a refined separation takes place from the secondary whirl into the primary whirl. That's why it is possible to obtain a purity of up to 98 p.c. Since only the specifically heavy particles are separated. The impoverishment of the coolant is therefore avoided. When examining the axial section of a conical chamber, as shown in fig. 2, it appears clearly that the effect of separation of the solid particles from the flow field is best when the mixed flow approaches nearest to the lower course valve.

## 2. Installation

The coolant tank with the inlet funnel must be set up near the machine so that the discharge pipe for the impure coolant is placed above the inlet funnel of the INTECLON unit.

A = for RHU 400/650
B = for RHU 500/750

The feed pipe with valve batterie must be fitted to the connection in the pressure pipe of the pump. The pressure gauge with range 0 - 6 atm. indicates the pump pressure, the pressure gauge with range 0 - 2,5 atm. indicates the outlet pressure of cleaned coolant. These pressure gauges must be fitted in the corresponding sockets.

After fitting the splash guard to the lower course valves, the sediment container can be set up underneath the nozzles.
The 1" plastic hose serves as outlet from the sediment container to the inlet funnel. This tube must be fitted to the outlet of the sediment container. The coolant for the machine must be led from the indicated position to the machine trough a hose or tube.

## 3. Electrical connections

The driving motor of the pump unit is designed for three-phase current. Before connecting read the motor plate. The indicated tension and frequency must correspond with those of the mains. The motor protector must be set to the indicated amperage. Direction of rotation seen from above must be to the right, i.e. clockwise (see directional marker).

4. Putting into operation (see pages 08.19.01 respect. 10.23 b)

4.1 Check if screen is installed in the inlet hopper (6) and suction hose (59) is properly connected to dirty coolant pump and inlet hopper.

4.2 Fill the coolant tank with coolant to approximately 2" below the top and the sediment container to the overflow. Only synthetic coolants or water soluble oils with a viscosity not higher than 1.2° Engler at 20° centigrade are suitable.

4.3 Turn off clean coolant outlet on the machine.

4.4 Turn on dirty coolant pump. The unit now operates in a closed loop circuit. In other words, the coolant circulates within the unit. With the correct motor rotation, the pump pressure should be 1.2 to 1.8 Kp/cm$^2$. The pressures are fixed and cannot be varied. The entire coolant flows through the relief valve back into the coolant tank. The clean coolant pressure gauge should register 0.6 to 0.8 Kp/cm$^2$.

4.5 Open clean coolant outlet on the machine. This will reduce the clean coolant pressure to 0.4 to 0.5 kp/cm$^2$. This pressure is absolutely necessary for proper purification. The pressure can be adjusted by varying the spring tension of the relief valve.

4.6 The unit operates continuously and should not be turned off. For instance, if the machine is stopped for thirty (30) minutes, continue to operate the INTECLON coolant purifying system.

5. Turning off unit

Please observe the following sequence:

5.1 Turn off the clean coolant outlet on the machine. This is done to flush the machine bed.

5.2 After another three minutes turn off the dirty coolant pump. This required to purify the dirty coolant still entering the unit.

6. Maintenance

6.1 Inlet hopper:
Empty screen occasionally. Never operate the unit without the screen in place.

6.2 Sediment container:
Should be emptied regularly to prevent overflow.

6.3 Coolant tank:
Coolant level should not be below 7" from the top of the tank because the dirty coolant pump will pump air (cavitate) and impair the functioning of the cyclone.

6.4 Coolant change:
When coolant has to be changed, all tanks and containers should be emptied and cleaned.

6.5 Fam housing (113) (see pages 08.19.07 respect. 10.28 b)
Remove fan housing to clean fan and motor housing. This should be done at least once a year.

If these guidelines are followed no additional maintenance is required.

One cyclone can remove a maximum of 0.6 g/l of dirt.

Particles larger than 1 mm cannot be removed by the unit continuously.
The efficiency is 97 cent for particles larger than 10 my.

7. To change and adjust pump impeller (see pages 08.19.07 respect. 10.28 b)

7.1 Disassembly:
Remove pump from tank. Remove impeller housing (2) by unscrewing eight screws (7). Loosen lock washer (11) and nut (10). Pull off impeller (5). Do not remove flat spring washers (8) from shaft. Do not change spring arrangement.

7.2 Assembly and Adjusting:
Apply some lubricant (f.i.Molykote) to the impeller seat. Install impeller (5), lock washer, and nut. Tighten nut until the gap between impeller (5) and housing (3) is 0.1 - 0.2 mm.
It is important to hold this gap within these limits for proper functioning of the pump. Secure nut and replace impeller housing.

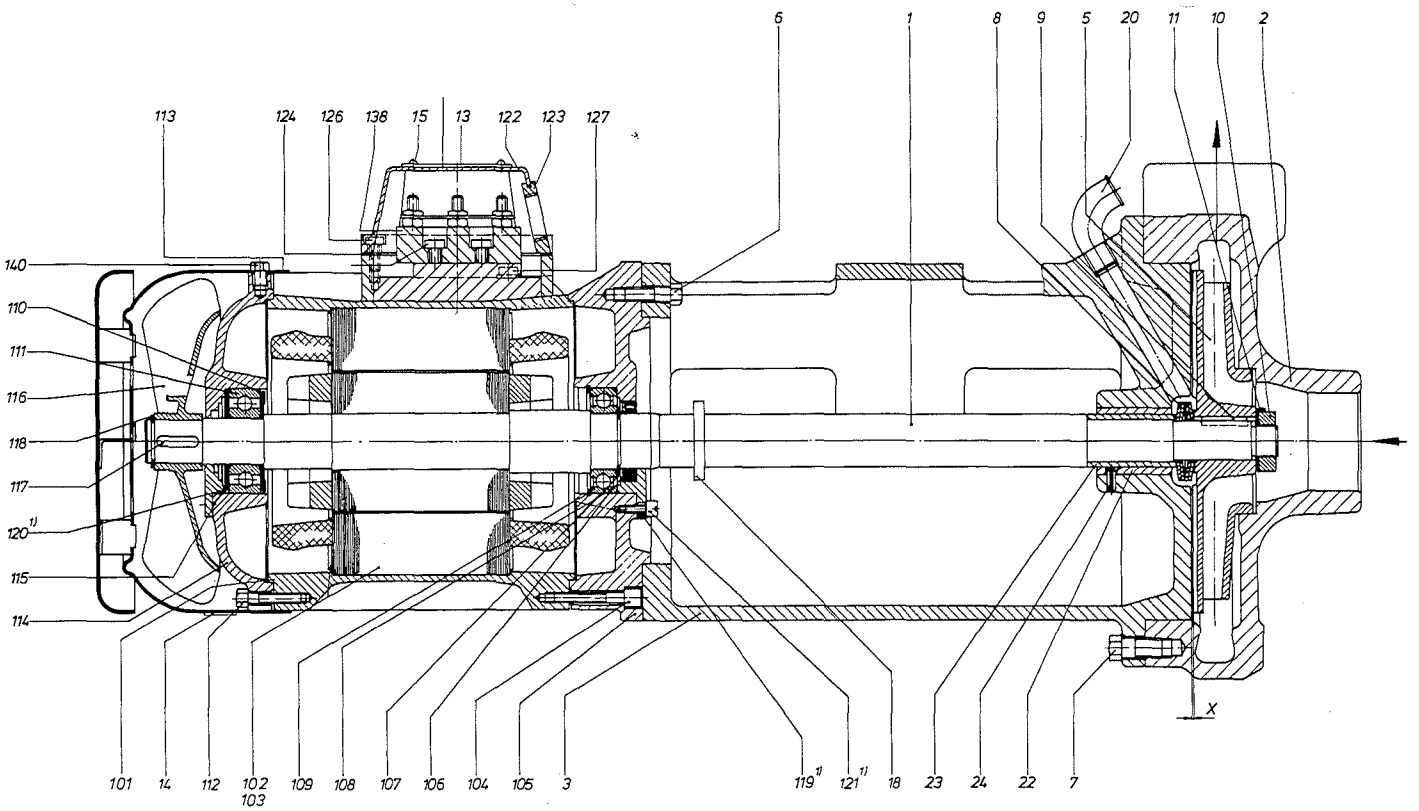
8. Changing the bishing and shaft sleeve
(See drawing of centrifugal pump MT 25, see pages 08.19.07 respect. 10.28 b)

8.1 Dismantling:
Disassemble pump, impeller dismantling according 7.1 loosen adaptor housing (3).

8.2 Assembly:
In opposite sequence, essential to perform impeller adjustment according 7.2.

## 9. Operating problems

| Problem | Cause | Repair (Always stop unit) |
|---|---|---|
| 9.1 Pump-motor vibrating | Pump impeller is clogged. Points 5.2 and 5.3 were not observed | Remove pump from tank. Remove impeller housing by unscrewing eight screws. Clean impeller and impeller housing. Observe points 5.2 and 5.3. |
| | Screen dirty or missing | Clean screen |
| | Lower nozzle clogged | Unscrew lower nozzle and plow through in opposite direction |
| | not sufficient coolant in the unit | fill up coolant |
| | Shaft bushing and impeller worn | fit new parts (see points 7 and 8) |
| 9.2 Lower nozzle clogged | Large dirt particles or fabric waste in the unit | Remove lower nozzle and blow air through from small end. |
| | Points 5.2, 5.3 and 6.2 were not observed | Observe points 5.2, 5.3 and 6.2. |
| | Screen dirty or missing | Clean screen |
| 9.3 Heavy underflow from the lower nozzle | Small hole diameter of lower nozzle is enlarged too much due to wear. | Install a new lower nozzle. |
| | Normal Dia.: 157" | |
| | Foreign body in cyclone | Remove and clean cone shaped casing. |
| 9.4 Counterpressure at exit of hydro cyclone over 0,5 kp/cm$^2$ or under 0,4 kp/cm$^2$ | Pressure valve incorrectly set (see pages 08.19.08 respect. 10.28 c) | loosen locking screw (11) of pressure valve, setting piece to left (pressure drops) or to right (pressure builds up) until 0.4-0.5 kp/cm$^2$ are reached (with coolant tap at grinding wheel opened fully) |
| | foreign body in cyclone | see 7.2 |
| | pressure of dirty coolant too low | see 9.1 |




1) Nur für 2, 3 und 4 PS Motor
only for 2, 3 and 4 HP motor
Seulement pour moteur avec 2, 3 et 4 PS

Montagehinweis:

Laufrad mit Wellenmutter anziehen bis Spielraum $0,1 + {}^{0,1}$ mm (Spalt „X") zwischen Laufrad und Verbindungsstück gewährleistet ist.

Note for assembly:

Tighten the impeller with shaft nut until the clearance between the impeller and the connection piece is $0,1 + {}^{0,1}$ mm (Gap „X")

Notice de montage:

Serrer la roue à aube avec l'écrou de l'arbre de Transmission jusqu' au moment ou un jeu de $0,1 + {}^{0,1}$ mm soit assuré entre la roue à aube et la pièce de liaison (écartement „X")

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Motorwelle mit Rotor<br>motor shaft with rotor<br>Arbre de transmission du moteur avec rotor | **10** | Wellenmutter<br>shaft nut<br>Ecrou de L'arbre de transmission | **23** | Wellenschonhülse<br>shaft sleeve<br>Chemise-entretoise | **107** | Sicherungsring<br>lock washer<br>circlips | **115** | Kugellagerausgleichsscheibe<br>ball bearing preload spring<br>Disque d'equilibre des washer roulements á billes | **123** | Klemmkastenschieber<br>inlet support<br>Support bouchon d'entrée |
| **2** | Spiralgehäuse<br>pumphousing<br>Diffuseur en colimacon | **11** | Sicherungsblech<br>lock washer<br>Rondelle frein | **24** | Spannhülse<br>locking sleeve<br>Douille de serrage | **108** | Rillenkugellager<br>radial ball bearing<br>Roulement á billes | **116** | Ventilatorflügel<br>fan<br>Ailettes de ventilation | **124** | Klemmkastendichtung<br>terminal box gasket<br>Joint pour boite de connection |
| **3** | Verbindungsstück<br>adaptor housing<br>Manchette de raccordement | **13** | Leistungsschild<br>name plate<br>Designation (Caractéristiques) | **101** | Umgußstator<br>stator<br>Bobinage | **109** | Sicherungsring<br>lockwasher<br>Circlips | **117** | Paßfeder<br>key<br>Clavette | **126** | Zylinderschraube<br>socket head cap screw<br>Vis cylindrique |
| **5** | Laufrad<br>impeller<br>Roue à aubes | **14** | Hinweisschild-Pfeil<br>direction of rotation arrow<br>Flèche de sens de rotation | **102** | Statorpreßspan<br>stator plate<br>plague stator | **110** | Kugellagerspritzscheibe<br>ball bearing spay dise<br>Disque de retenue du roulement á billes | **118** | Sicherungsring<br>lockring<br>circlips | **127** | Zylinderschraube<br>socket head cap screw<br>Vis cylindrique |
| **6** | Sechskantschraube<br>hex head screw<br>Vis à six pans | **15** | Halbrundkerbnagel<br>drive screw<br>Rivet á tête demie-vonde | **103** | Stator- u. Rotorblech<br>stator- and rotor lamination<br>Tôle pour rotor et stator | **111** | Rillenkugellager<br>radial ball bearing<br>Roulement á billes | **119** | Lagerabschlußdeckel<br>bearing cover<br>Support de protection | **128** | Scheibe<br>washer<br>Rondelle |
| **7** | Sechskantschraube<br>hex head srew<br>Vis à six pans | **18** | Dichtung<br>gasket<br>Joint | **104** | Zylinderschraube<br>socket head cap screw<br>Vis cylindrique | **112** | Sechskantschraube<br>hex head screw<br>Vis á six pans | **120** | Lagerabschlußdeckel<br>bearing cover<br>Support de protection | **138** | Klemmbrett<br>terminal board<br>Cables de jonction |
| **8** | Tellerfeder<br>disc spring<br>Disques ressort | **20** | Winkel<br>street, elbow 90°<br>Coude | **105** | Flanschlagerschild<br>bearing bracket with flange<br>Assise de roulement á billes | **113** | Lüfterhaube<br>fan protection<br>Protection du ventilateur | **121** | Zylinderschraube<br>socket head cap screw<br>Vis cylindrique | **140** | Linsenzylinderschraube<br>hex head cylinder screw<br>Vis cylindrique á tete demie-ronde |
| **9** | Paßfeder<br>key<br>Clavette | **22** | Büchse<br>bushing<br>Douille | **106** | Radialdichtring<br>radial lip seal<br>Bague radiale de étancheite | **114** | Lagerschild<br>bearing plate<br>Assise | **122** | Klemmkasten für Klemmbrett<br>terminal box for terminal board<br>Boite de connection pour cables de jonction | | |

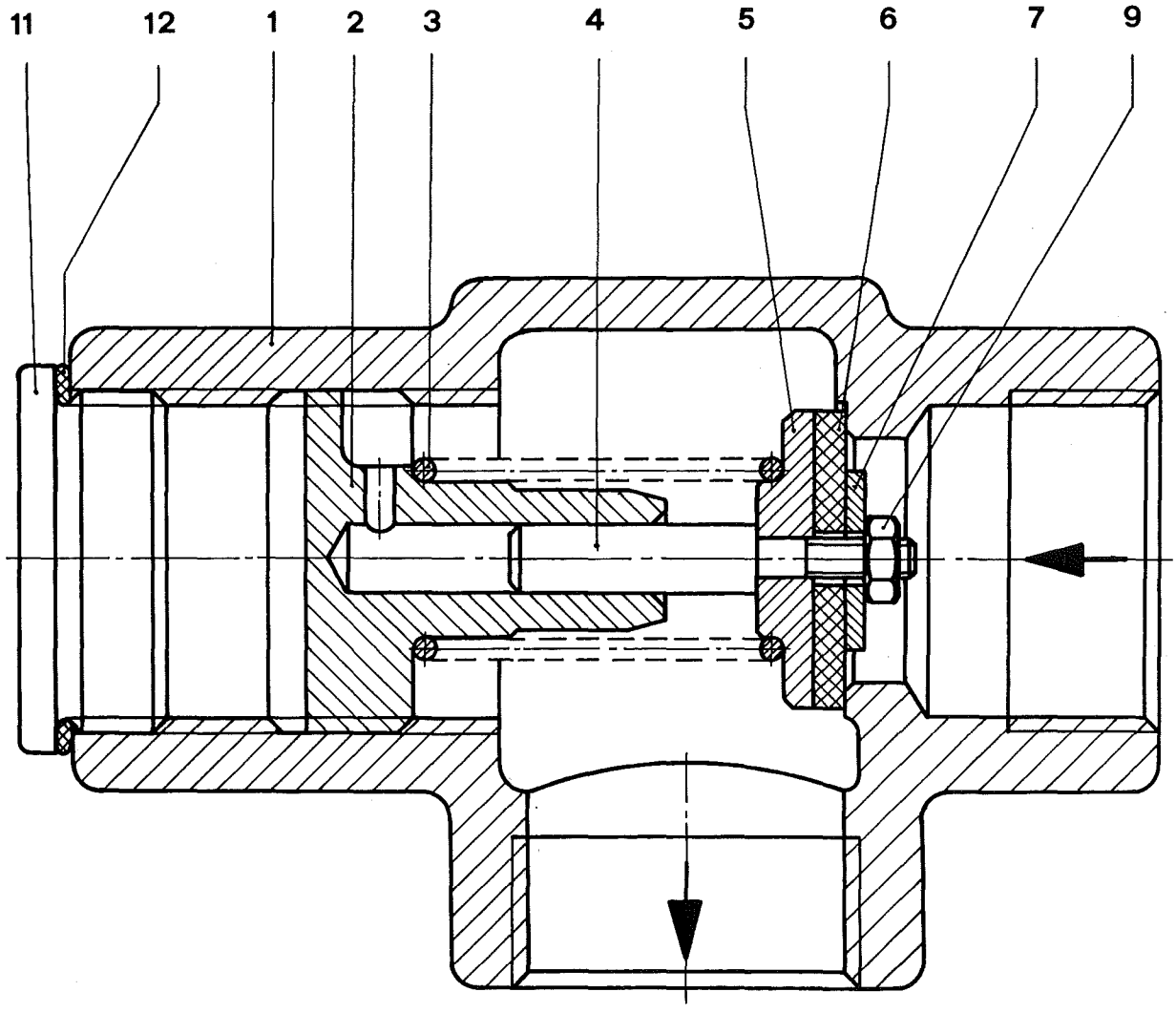
# INTECLON

## Kühlmittelpumpe
## Pompe à réfrigérant
## Coolant pump

RHU 400/650 08.19.07

RHU 500/750 10.28b

10. Druckbegrenzungsventil
Clapet de surpression
Pressure relief valve




1 Ventilgehäuse
Corps de clapet
Valve body

2 Einstellstück
Vis de réglage
Regulating insert

3 Druckfeder
Ressort de pression
Compression spring

4 Führungsbolzen
Broche-guide
Guide pin

5 Ventilteller
Tête de soupape
Valve disc

6 Dichtung
Joint
Gasket

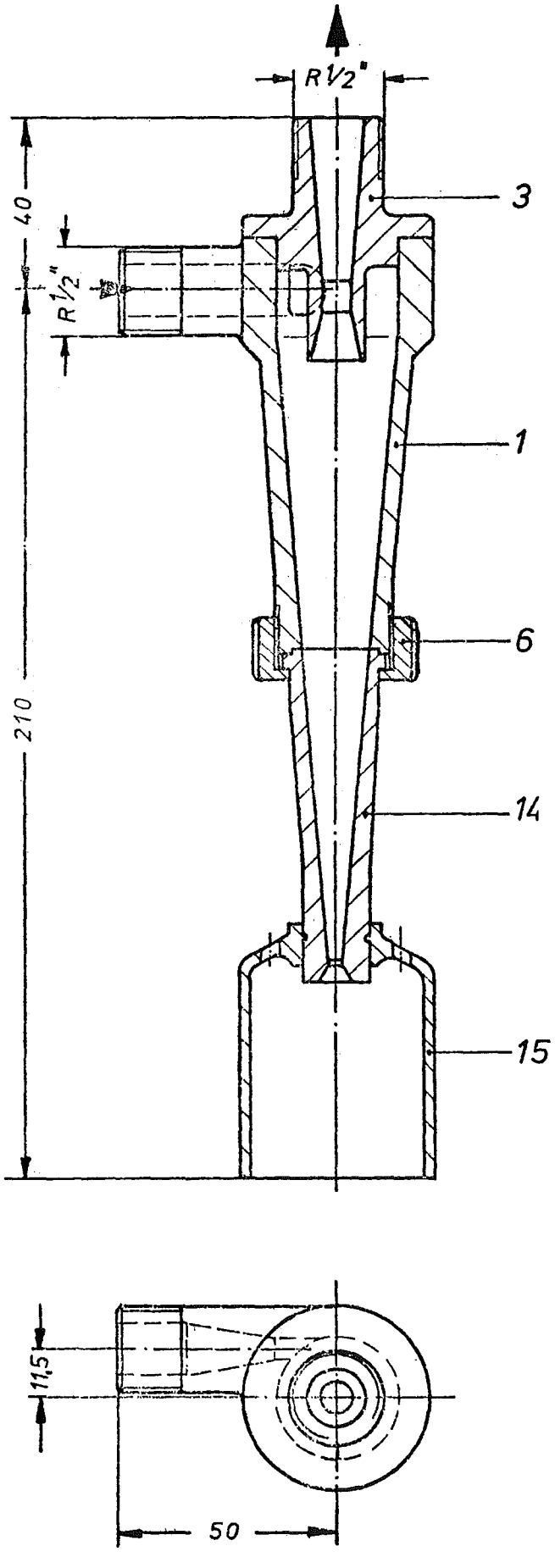
7 Scheibe
Rondelle
Washer

9 Sechskantmutter
Ecrou à six pans
Hex. head nut

11 Verschlussschraube
Bouchon
Screw plug

12 Dichtring
Joint du bouchon
Joint for screw plug

11. Zyklon 28
Cyclone 28




1 Konusgehäuse
Corps conique
Cone-shaped casing

3 Oberlaufdüse
Museau supérieur
Upper-nozzle

6 Ueberwurfmutter
Ecrou-chapeau
Cap-nut

14 Unterlaufdüse
Museau inférieur
Lover-nozzle

15 Spritzschutz
Manchon protecteur
d'éclaboussures
Spray-protection

## Oil Mist Lubrication for Internal Grinding Spindles

### I. Installation, operation and maintenance of the pressure reduction valve with built in filter (drawing 826-4, pos. I)

**Installation**

A metal tag fixed to every apparatus specifies the pressure range for which it was built. The models with transparent bowls are suitable for operating pressure up to 10 atmosphere gauge and for temperatures up to 50° C (122° F): the models with metal bowls can be used with operating pressures up to 14 atmosphere gauge and temperatures up to 150° C (302° F).

Connect the pressure reduction valve with filter to the pipe so that the pressure enters the apparatus by "IN" and leaves it at "OUT" (these marks are stamped on the body). Install the pressure reduction valve as close as possible to the spindle requiring the filtered regulated air pressure, and before the oil atomizer. Do not use undersized piping, fittings or other controls that might restrict the flow through the reduction valve.

After the pressure reduction valve with filter has been installed, and before turning on the air supply, turn the adjusting screw 1 or the handwheel counter clockwise until it is able to turn freely and without friction, whereby the tension of the regulation springs 2a and 2b is released. Then turn on the air supply. In order to obtain the desired secondary pressure, turn the adjustment screw 1 clockwise until the pressure gauge fixed to the apparatus shows the desired air pressure.

The built-in filter needs no special adjustment, as it operates automatically. To get the best performance of the water separator and filter, drain the bowl regularly, otherwise the collected impurities and residue of condenser water might enter the air pipes again. The transparent bowls have great advantage of showing when draining is necessary. Under no circumstances dare the condensed water reach the baffle 3 inside the bowl!

**Maintenance**

The best filter performance and the lowest pressure drop are obtained by cleaning regularly the filter element 4. This cleansing can be effected by unscrewing the discharge cock with hexagonal nut 5 and by removing the bowl 6. Take out the filter mesh and wash it in a cleaning solvent. The filter element must be blown out with compressed air.

The transparent bowl is cleaned with carbon tetrachloride, kerosene or petroleum. Do not use acetone, ethyl acetate, ethylene dichloride, toluence etc. as these solvents will damage and deteriorate the bowl. By taking suitable care, the pressure reduction valve with filter will give you good service during many years.

./.

Trouble

In case of any trouble please notice the following directives:

1.) If the regulating performance is irregular or inaccurate:

   a) remove the discharge cock 5, the bowl 6 and the filter element 4. Unscrew the valve guide with axle 7 and examine if any dirt managed to enter between the guide and the square extension of the valve 8. Clean all these parts thoroughly.

   b) remove the bonnet 9, the diaphragm 10, the lower spring gasket 11, the valve pin 12, the valve seat 13 and the baffle 14. Clean these parts thoroughly.

2.) If the air pressure flow is weak or stops completely:

   a) take away the filter element 4 and examine if the air holes on the inside are not blocked by dirt scale or other foreign matter. Clean the element and check afterwards if the filter is completely clean.

   b) Inspect the valve to make sure that the valve disc is being held firmly in place. If not you have to replace the whole valve.

3,) If the connection of the body and the bonnet 9 leaks:

   a) fasten all the bonnet screws 16

   b) if the leaking air pressure does not stop, remove the bonnet 9. Examine the diaphragm 10 and the gasket. If necessary these parts must be replaced. It is most important that the diaphragm and the gasket are held firmly around their circumference by the clamping action of the bonnet and body.

## II. Installation, operation and maintenance of the NORGREN "Micro Fog" Oil mist lubrication apparatus (drawing 826-4, pos. II)

Performance

The NORGREN oil atomizer for the lubrication of spindles is generally connected with a closed by-pass (adjusting screw on the air pressure outlet side closed). Under these conditions the oil mist apparatus will consume 0,03 to 0,04 m3 compressed air per minute according to the number of spindles connected with the system. With an operating pressure of about 0,7 atmosphere gauge and a fully opened by-pass the consumption of air will vary between 0,06 and 0,1 m3, also according to the number of spindles connected with the lubrication system. A higher operating pressure up to 10 atmosphere gauge can be used without any bother, but the consumption of air is increased considerably without giving any better performance.

Maximum safe operating pressure = atmosphere gauge
Maximum safe operating temperature = 50° C (122° F)

## Installation

Install the oil mist lubrication apparatus with the direction of air flow, the same as indicated by the arrow on the body of the apparatus. To obtain the maximum efficiency it is necessary, that the interior of the apparatus should be protected against condensed water, pipe scale or other foreign matter etc. The installation of a NORGREN air pressure filter and water drain as well as a NORGREN air pressure reduction valve immediately ahead of the oil mist lubrication apparatus is necessary.

To replenish the oil supply, shut off the compressed air and remove the filler plug 30. Afterwards insert and tighten the filler plug.

## Lubricant

At normal operating temperature the oil mist lubricating apparatus will atomize any high grade lubrication oil with a viscosity of 1.5 to 2,5 E at a temperature of 50° C (122 F). For extremely high temperatures use an oil with an appropriate viscosity index.

## Operation

About 10 % of the oil flow visible in the sight feed dome, that is one out of 10 drops casting through the sight feed dome, will be available for lubrication. The rate of oil feed must be regulated accordingly. If the oil atomizer is operated with the open air by-pass the rate of oil delivery is approximately half of that with closed air by-pass. This must be considered if the apparatus is regulated according to the oil flow visible in the sight feed dome. The apparatus is equipped with two adjusting screws on each side of the sight feed dome. The apparatus is equipped with two adjusting screws on each side of the sight feed dome.

A 3/32" allen key is used to adjust the two adjustment screws. The oil feed adjusting screw 31 on the inlet side of the oil mist lubrication apparatus controls the amount of lubrication oil flowing through the sight feed dome. The by-pass adjusting screw for the air by-pass 32 on the outlet side of the oil mist lubrication apparatus controls the amount of air passing through the by-pass of the apparatus, thus permitting greatest flexibility of operating in the adjustment of the apparatus.

## Adjustment

Adjust the applied pressure with the pressure reduction valve to about 0,9 atmosphere gauge. Make sure that the adjustment screw of the by-pass 32 is closed. Turn the oil feed screw 31 until you get in the side feed dome about 6 drops of oil per minute for each spindle (counter clockwise rotation increases the rate of oil feed). The rate of oil seen flowing through the sight feed dome (drops per minute), should be approximately 10 times greater than the amount of oil needed for lubrication. In some applications, it may be desirable to increase the rate of air flow to maintain higher air pressure within the device to be lubricated. This is done by opening the air circulation adjustment screw 32 which allows a greater amount of compressed air to flow through the oil atomizer (turn the adjustment screw clockwise to close and counter clockwise to open).

After by-pass, or after changing the applied air pressure, it will be necessary to re-adjust the oil feed adjustment screw to restore the desired oil mist. This is done by turning the oil feed screw as described above.

If any difficulties occur, please note the following service hints: Maintenance

1.) No oil flowing through the oil drip tube:

a) make sure there is ample supply in the bowl 33 or in the oil tank.

b) turn the adjustment screw 31 of the oil feed counter clockwise.

c) make sure that the compressed air is flowing. The oil mist lubricating apparatus works only when compressed air flows through.

d) make sure that the spindle being lubricated uses the minimum recommended for oil mist lubricating apparatus.

e) remove the bowl 33, the oil cup 34 and venturi tube 35. Test and clean the filter with kerosene or another solvent, and blow it out with compressed air. Re-assemble the apparatus.

f) Remove the clamp ring of the sight feed dome 36, take away the sight glass 37, and the bowl and oil cup 34. Push the valve 38 out of the apparatus body.

Check if no foreign matter has entered the valve or the oil passage. Please check also the "O"-ring with 5/8" external diameter of the valve and replace it if necessary. Clean all these parts thoroughly with kerosene and blow them out with compressed air before re-assembling them in the apparatus. When re-assembling the valve 38 make sure that the arrows show in the same direction of the flow of air.

2.) Compressed air leaking from the sight feed dome. 37:

a) tighten the clamp ring 36 of the sight feed dome.

b) if compressed air still leaks, remove clamp ring and the sight feed dome. Check the O-ring Ø 1 1/6" and lower surface of sight feed dome. Replace these parts in case they should be damaged.

3.) Leak at the adjustment screws:

Remove clamp ring 36 and sight feed dome 37. Back out the adjustment screws 31 and 32 (oil feed adjusting screw has left hand thread, by-pass adjusting screw has right hand thread). Check the 1/4" external diameter "O"-ring and replace it if damaged.

4.) Leaks between bowl and body of the apparatus:

a) make sure that the scres in the body flange are firmly and evenly tightened.

./.

b) If the air still leaks, check the gasket 45. Control if this is in good condition and properly assembled. Replace this gasket if necessary. When re-assembling the transparent bowl make sure the bowl gasket 45 and the packing 41 of the clamp ting 46 are in the right place. If the clamp ring gasket 41 is not in the right place an uneven distribution of pressure may crack the bowl. Tighten therefore all screws evenly to avoid uneven-pressure on the bowl flange.

If necessary, clean the bowl washing it with carbon tetrachloride, kerose or with a petroleum solvent. Under no circumstances use acetone, ethyl, azetat, ethylene dichloride or toluene etc., as these solvents will destroy the bowl.

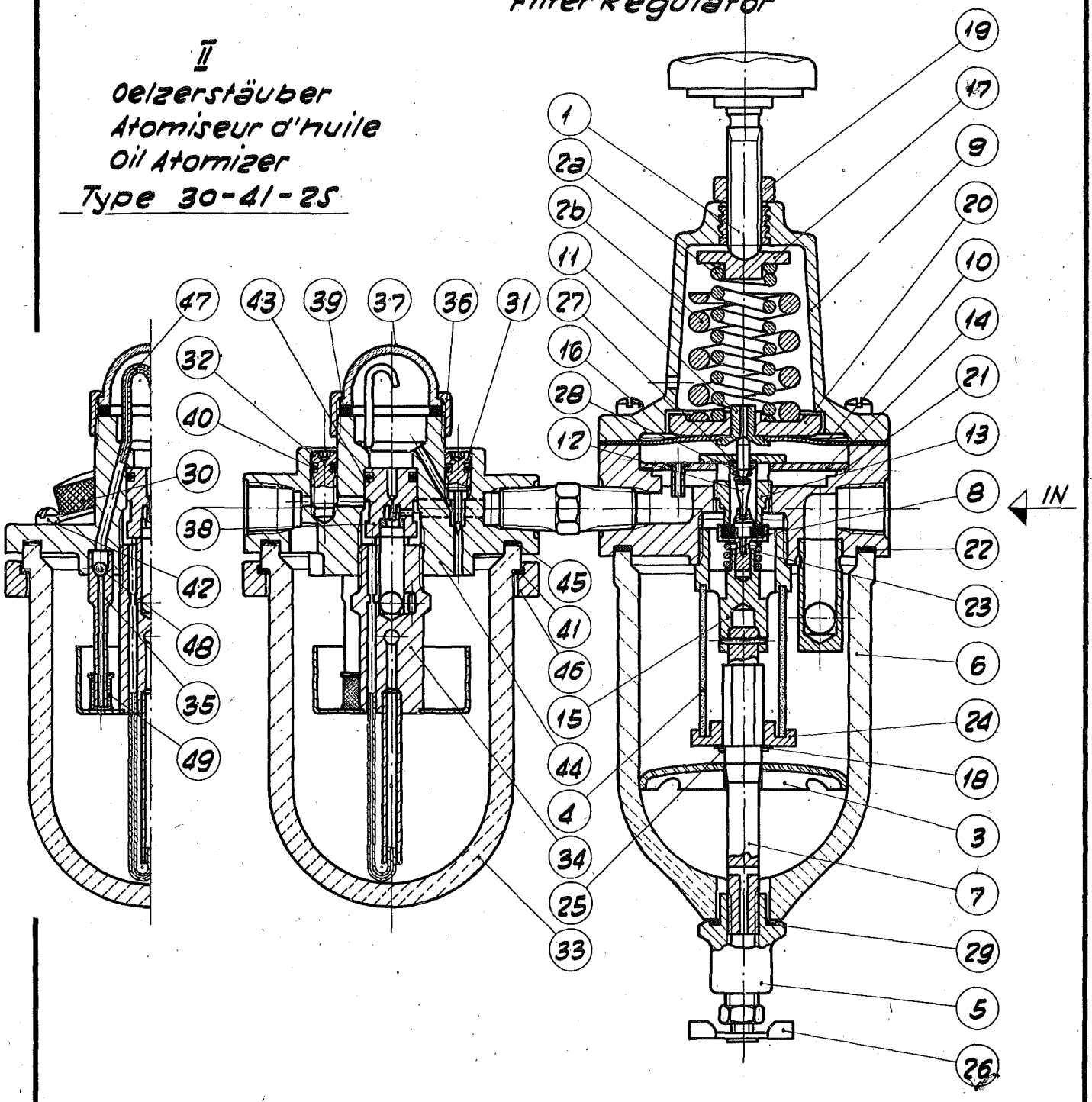
Aktiengesellschaft **FRITZ STUDER** Maschinenfabrik
GLOCKENTHAL-THUN

Oelnebelschmiergerät - NORGREN
Oil Atomizer - NORGREN Modell Nr. 3765 FRX-2S-1/4"
Dispositif de graissage par brouillard d'huile - NORGREN

Z. No. **826-4**
20.1.58. W

I
Filterregulator
Valve de réduction de pression avec filtre incorporé Type 5AX2-GG-25
Filter Regulator

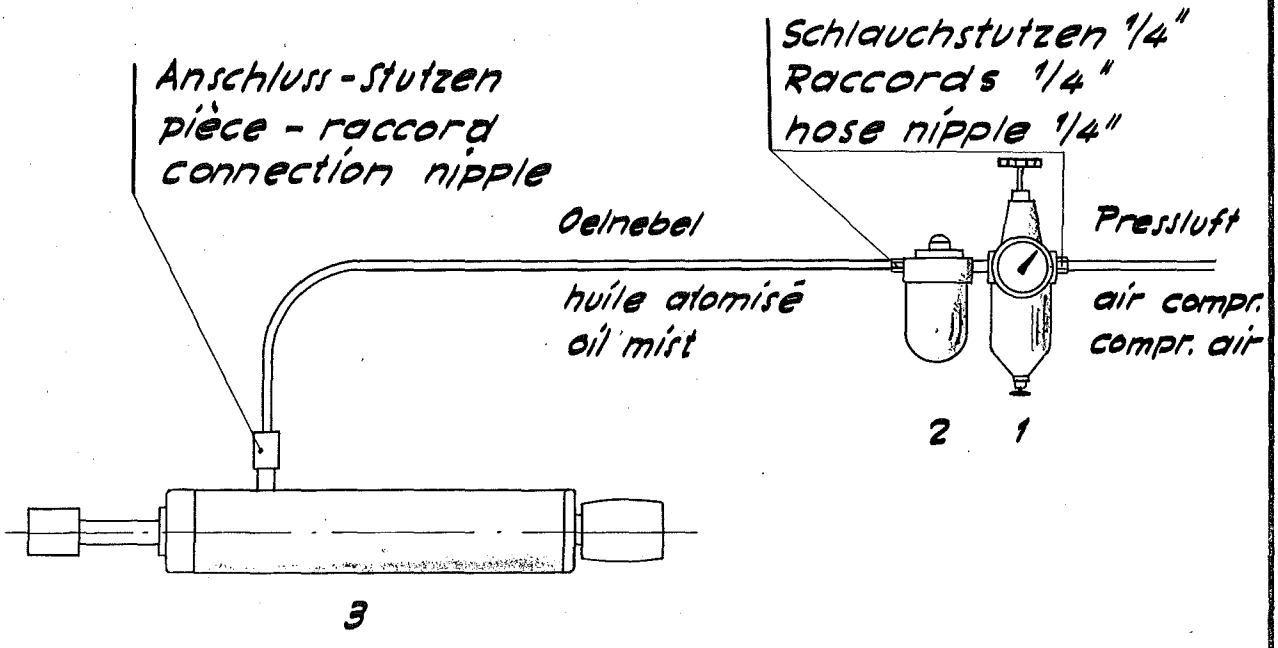
II
Oelzerstäuber
Atomiseur d'huile
Oil Atomizer
Type 30-41-2S



Aktiengesellschaft **FRITZ STUDER** Maschinenfabrik
GLOCKENTHAL-THUN

# Oelnebelschmiergerät für Innenschleifspindel
# Disp. de graissage de la broche par brouillard d'huile
# Oil atomizer for internal grinding spindles

Z. No. **P14-19**
13.7.60 Nk




1 Druckreduzierventil mit angebautem Filter
2 Oelzerstäuber
3 Schleifspindel

1 Valve de réduction de pression avec filtre incorporé
2 Atomiseur d'huile
3 Broche

1 Pressure reduction valve with attached filter
2 Oil atomizer
3 Grinding spindle

OPERATING INSTRUCTIONS for

MOVOLIMIT - SECTOLIMIT - DELTALIMIT electronic measuring, control and match grinding equipment for STUDER types RHU 500 and 750 grinding machines.

I N D E X


| | Page |
|---|---|
| MOVOLIMIT - SECTOLIMIT - DELTALIMIT | |
| Description, automatic cycle | MSD 2.1 |
| Connection diagram for MOVOLIMIT - SECTOLIMIT - DELTALIMIT for RHU 500/750 | MSD 3.1 |
| Assembling the equipment | MSD 3.2 |
| Legend for connection diagram MSD 3.1 | MSD 3.2 |
| Measuring and control amplifiers types MI 3 N, MI 3 DN, DI 3 N | MSD 4.1 |
| MOVOLIMIT type CR 100 Tr measuring head | MSD 5.1 |
| Bleeding the hydraulic system | MSD 5.2 |
| Setting the depth stop | MSD 5.2 |
| Setting the equipment | MSD 6.1, 2 |
| Setting the relays | MSD 6.3 |
| Correction of size | MSD 6.3 |
| MOVOLIMIT type CR 80 S suspended measuring head | MSD 7.1 |
| Assembling the measuring head | MSD 7.2 |
| Setting the equipment | MSD 7.3 |
| SECTOLIMIT type CR 200 Th measuring head | MSD 8.1 |
| Setting the equipment | MSD 8.2, 3 |
| Graph of maximum grinding feeds | MSD 8.4 |
| Minimum speed and width of tooth on SECTOLIMIT | MSD 8.5 |
| Setting the machine | MSD 9.1, 2 |
| Setting DELTALIMIT match grinding equipment | MSD 10.1 |
| Setting DELTASECTOLIMIT match grinding equipment | MSD 10.2 |

| | Page |
|---|---|
| INTERLIMIT type CI 213 TS internal measuring head | MSD 11.1 |
| Fitting and centralising the measuring arbor | MSD 11.2 |
| Setting the eccentries | MSD 11.2, 3 |
| INTERLIMIT types CI 6 T and VCI 6 T internal measuring heads | MSD 12.1 |
| Setting the measuring heads | MSD 12.2 |
| Changing measuring fingers and tables | MSD 12.2 |
| Setting the vibrator | MSD 12.2, 3 |
| INTERLIMIT type CIU 120 T internal measuring head | MSD 13.1 |
| Setting up the measuring head | MSD 13.2, 3 |
| INTERLIMIT type CI 60 S suspended internal measuring head | MSD 14.1 |
| Assembling the suspension unit and measuring head | MSD 14.2 |

| Schematic wiring diagrams for the amplifiers | | Drawing No |
|---|---|---|
| Amplifier MI 3 N; | connection diagram | MOV 3102 |
| | wiring diagram | MOV 2101 |
| Amplifier MI 3 DN; | connection diagram | MOV 3202 |
| | wiring diagram | MOV 2201 |
| Amplifier DI 3 N; | connection diagram | MOV 3117 |
| | wiring diagram | MOV 2116 |
| Amplifier DI 3 DN; | connection diagram | MOV 3207 |
| | wiring diagram | MOV 2206 |

## MOVOLIMIT - DELTALIMIT

**MOVOLIMIT** comprises a measuring head and a measuring and control amplifier and is used for the grinding of plain diameters.

**MOVOLIMIT** ensures the quick, precise and reliable production of workpieces to a pre-determined size.
For batch production on STUDER types RHU 400 and RHU 650 cylindrical grinding machines, the amplifiers control the automatic cycle relative to workpiece size. Wear of the grinding wheel is therefore automatically compensated.

DELTALIMIT is a match grinding unit comprising MOVOLIMIT with the addition of an INTERLIMIT internal measuring head.

With this equipment, a component can be automatically externally ground to a pre-determined fit relative to a mating bore.

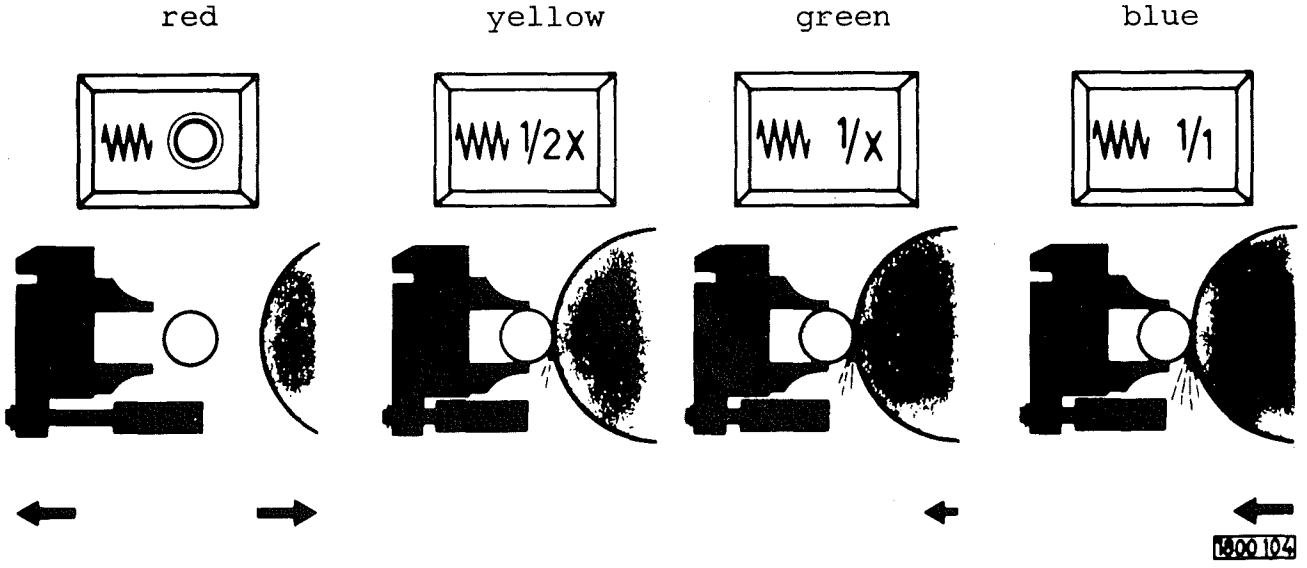
### Sensitivity

Extremely high sensitivity of the equipment is achieved by having no sliding members in the measuring head and by a 1 to 10'000 electronic amplification of the mechanical movement.

### Accuracy

The repetitive accuracy of the equipment is within a few millionths of an inch.

### Automatic cycle

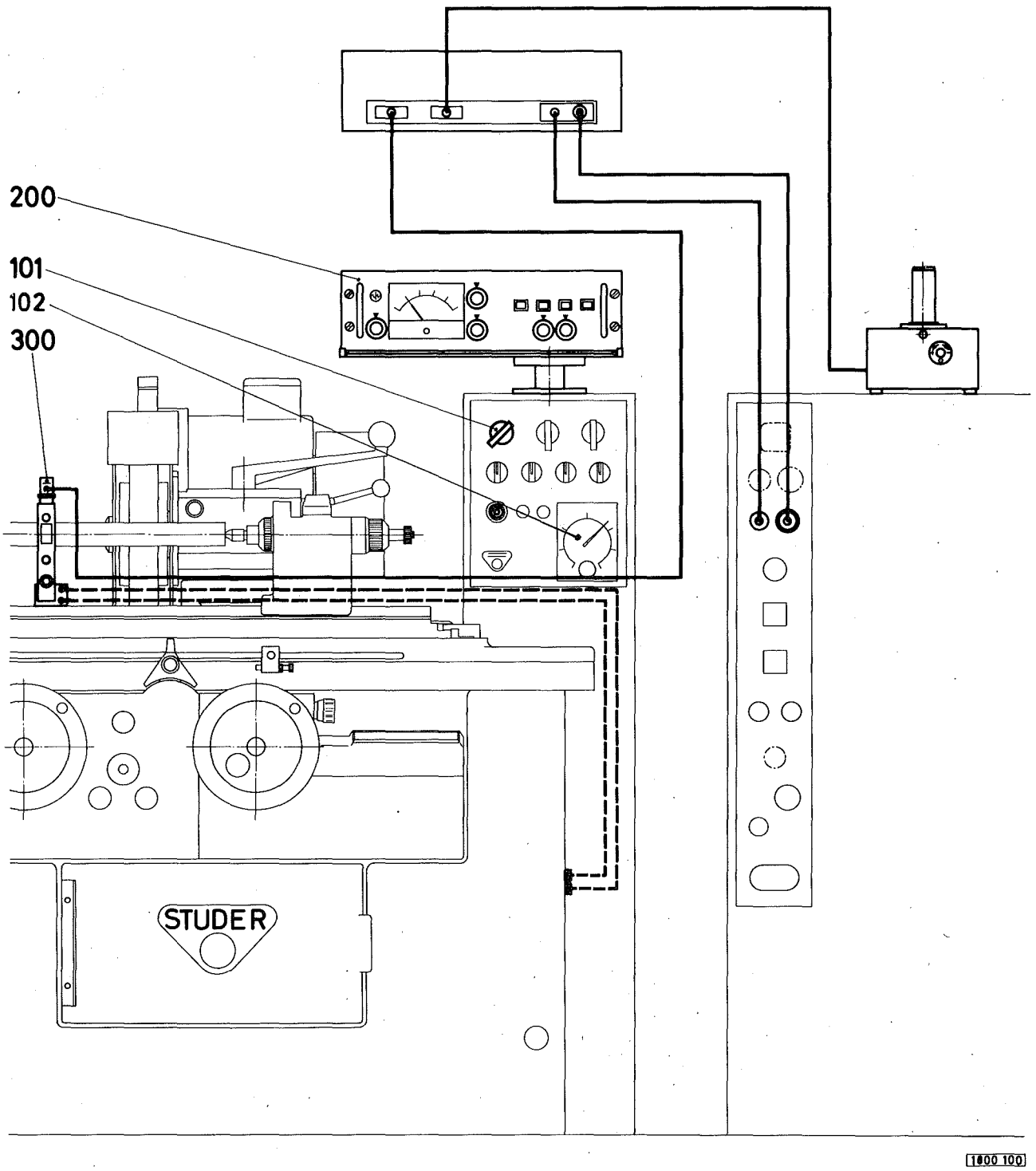



| Finished size | Spark out | Fine feed | Normal feed |
|---|---|---|---|
| Retraction of wheelhead and measuring head | Grinding feed stopped. By depressing the green button, the fine feed can be re-engaged. | Switchover from normal to fine feed | |

# Anschlusschema für Movolimit - Deltalimit

# Schéma de raccordement pour Movolimit - Deltalimit

# Connection diagram for Movolimit - Deltalimit




Elektrisch
Electrique
Electric

Hydraulisch
Hydraulique
Hydraulic

Assembling the equipment

- Mount the measuring head on the machine table

- Connect the hydraulic pipes to measuring head and side of stand. The connections on the measuring head are marked "A" and "R". The connections on the side of the stand are described in the instruction book. Page 4. 14 for RHU 500 or page 4. 16 for RHU 750.

  If an equipment has been supplied subsequently, the valve V 52 can be built in according to the machine instruction book page 4. 15 and wiring diagramme of the machine.

- Connect the HF cable to the amplifier.

NOTE !

Ensure that neither the HF cable nor the hydraulic pipes are trapped or stretched when the table is traversed.

- Connect the amplifier to the machine control cabinet.

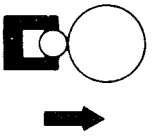
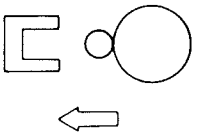
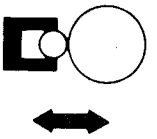
- Turn switch 201 to "on" and the indicator lamp should light. If it does not, check the fuse.

- Advance the measuring head with selector switch 101 and by raising the upper measuring jaw by hand, check that the indicator needle moves across the scale.

- The equipment is now ready for setting.

Legend for connection diagram MSD 3.1

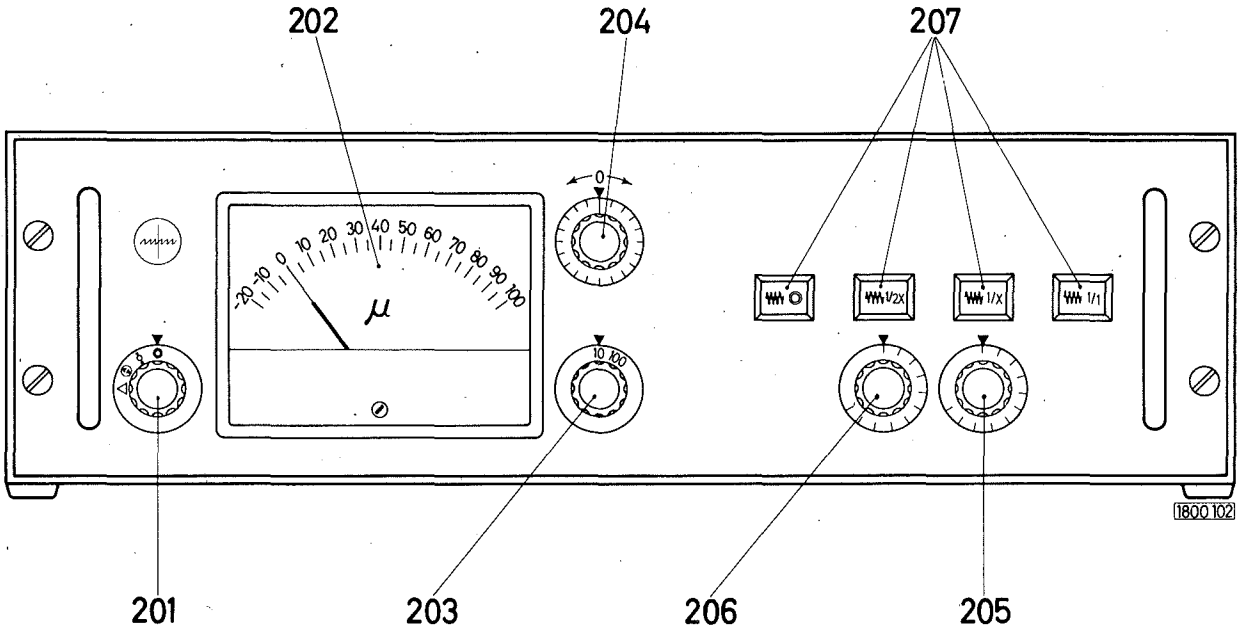
101 Selector switch

| Measuring head advance | Measuring head retraction | Automatic cycle |
|---|---|---|
|  |  |  |

102 Delay timer

Range, 3 - 180 seconds.

200 Measuring and control amplifiers types MI 3 N, MI 3 DN or DI 3 N




201 ON - OFF and selector switch

For MOVOLIMIT amplifier MI 3 N

◎ OFF, ① ON

For SECTOLIMIT amplifier MI 3 DN

◎ OFF, ○ plain diameters, ◡ interrupted diameters

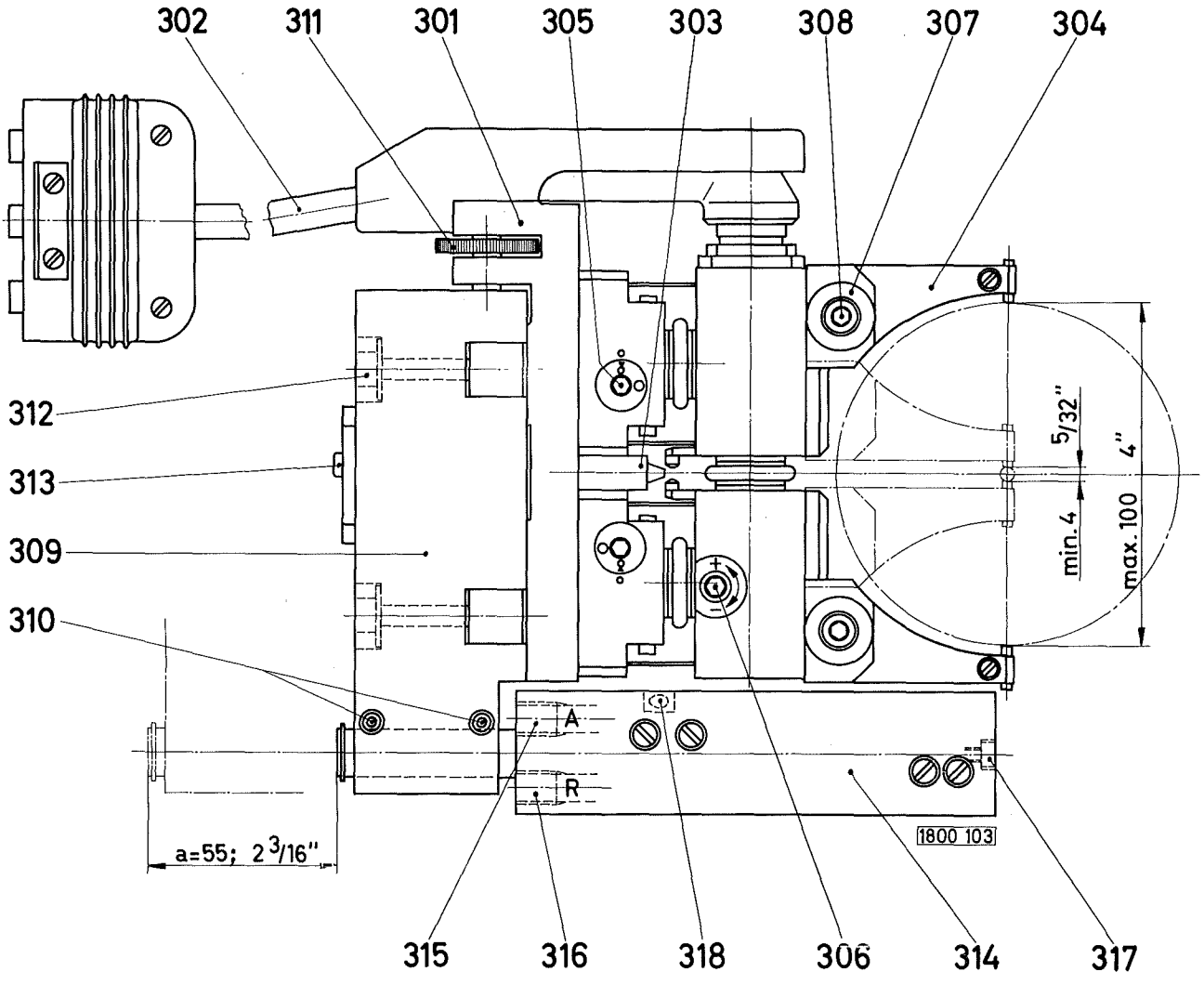
For DELTALIMIT amplifier DI 3 N

◎ OFF, ⧗ MOVOLIMIT, ⇕ INTERLIMIT, △ DELTALIMIT

202 Indicator instrument
203 Range selector switch and for DELTASECTOLIMIT SECTO-switch
204 Zero adjuster (± 0,004")
205 Potentiometer - relay setting, normal to fine feed
206 Potentiometer - relay setting, stop fine feed
207 Relay indicator lamps

| | | |
|---|---|---|
| 1/1 | Normal feed | (blue) |
| 1/x | Fine feed | (green) |
| 1/2x | Spark out | (yellow) |
| ◎ | Finished size - retraction | (red) |

300 External measuring head type CR 100 Tr




301 Measuring head
302 HF cable with plug, length 10 ft.
303 Taw retractor, automatic, .040" (1 mm) per jaw
304 Measuring jaws, measuring pressure 280 grams

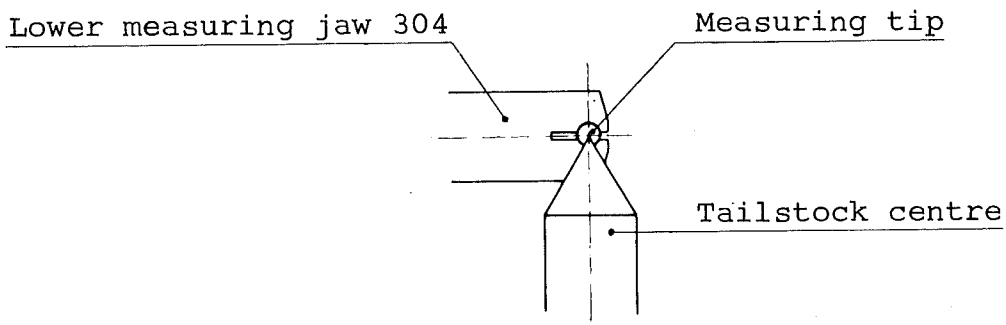
305 Setting eccentric: ▼ ○ Gauge, ◯ Setting
306 Mechanical fine adjustment (± 0,012")
307 Measuring jaw adjusting knob
308 Measuring jaw locking screw
309 Frame
310 Frame locking screws
311 Heigth adjustment
312 Measuring head clamp screws
313 Taw retractor bleed screw
314 Retraction unit, a = 2.165" (55 mm)
315 Hydraulic connection (A), constant pressure
316 Hydraulic connection (R), (pressure = retract, exhaust = advance)
317 Bleed screw
318 Bleed screw

Bleeding the hydraulic system

- Start the hydraulic pump (see machine handbook)
- Retract the measuring head with switch 101. By releasing the two bleed screws 313 and 317 vent the hydraulic pipes and then secure the bleed screws.
- Advance measuring head into measuring position: release bleed screw 318 and vent, then secure bleed screw.
- Advance and retract measuring head several times.
- If necessary repeat until the system is free of air.

Setting the depth stop

- Remove the upper measuring jaw
- Advance the measuring head
- Raise the lower measuring jaw until it is close to the tailstock centre.
- Position the tip of the tailstock centre above the measuring tip.




- Release locking screws 310. (On RHU 750 the angle bracket must be removed) Slide the measuring head backwards or forwards to position the centre of the measuring tip in line with the tip of the centre, then set the measuring head square to the table.
- Tighten locking screws 310 securely. The head is now firmly secured to the retraction unit and set so that even when grinding the minimum diameter, 5/32" (4 mm), the grinding wheel will not touch the measuring jaws.

## Setting the equipment

Assemble the measuring head and amplifier and connect cables and pipes as described on pages MSD 3.1, 3.2 and 5.2. Set switch 201 to "ON" ⏽ or MOVOLIMIT ⧗ and retract the measuring head.

- Set zero adjuster 204 to the centre of its range. (Turn to the stop then turn back 5 revolutions).

- Place the reference piece between the centres (The reference piece and - for match grinding the reference bore - should be ground to the required size (fit).

  If no reference piece is available, one should be produced as follows:

  MOVOLIMIT

  Grind a component without using Movolimit to approximately .00024" (0.006 mm) above finished size. Determine the precise oversize and take this into account when setting the measuring head. See corrections on page MSD 6.3.

  DELTALIMIT

  Grind a workpiece "size and size" to the reference bore. In this condition ie with zero clearance, the workpiece should enter the bore for about a quarter of its length. The setting of the desired clearance is described on page MSD 6.3.

- Spread the measuring jaws 304 so that they do not hit the workpiece when the measuring head advances.

- Advance the measuring head with switch 101.

- Turn both eccentrics 305 to the setting position ◯ .

- Set range selector switch 203 to range 4000 µ inches.

- Turn the fine adjuster 306 to + or - as required to bring the indicator needle on the amplifier to zero.

- Turn the lower eccentric 305 to "Gauge" ⧗ .

Access to the lower measuring jaw is easy

- Raise lower measuring jaw 304 with adjusting knob 307 until the measuring tip touches the workpiece and the indicator needle moves from "minus" to approx. "0".
  Lightly lock screw 308.
  (The special allen key supplied can be inserted in the adjusting knob 307 and used as a tommy bar for ease of setting).

Access to the lower measuring jaw is difficult

- Release the two clamp screws 312 and lightly nip them again.
- Regulate measuring head 301 with height adjustment 311 until adjustment towards the bottom of approx. 1/16" (2 mm) is available.
- Raise the lower measuring jaw 304 with the aid of knob 307 to within 1/32" (1 mm) of the reference piece and lightly lock.
- With height adjustment 311 raise the complete measuring head 301 until the indicator needle reaches "0".
- Tighten both clamp screws 312 securely.

- Turn upper eccentric 305 to "Gauge"  .
- Move upper measuring jaw towards the reference piece until the indicator stands approx on "0", then slightly lock.
- Rectract the measuring head.
- Firmly lock both measuring jaws (keep the allen key as near as possible in a horizontal position).
- Advance the measuring head.
- Bring the indicator needle to zero with fine adjuster 204.
- Allow the workpiece to rotate (for very precise work, the wheel should be advanced to within .004" (0.1 mm) of the workpiece and the coolant switched on).
- Advance and retract the measuring head 2 or 3 times.
- Check position of indicator needle:

  If the needle is within $\pm$ .000,8" (0.02 mm) of zero, it can be set exactly to zero with fine adjuster 306 (Turn fine adjuster in the "minus" direction if indicator needle must move minus and vice-versa).
  If the deviation is greater, the setting procedure should be repeated.

- Select required range with range selector switch 203 (e.g. 10 µm / 400 µ inches).

Setting the switch-over points from normal to fine feed and from fine feed to sparking out (potentiometer)

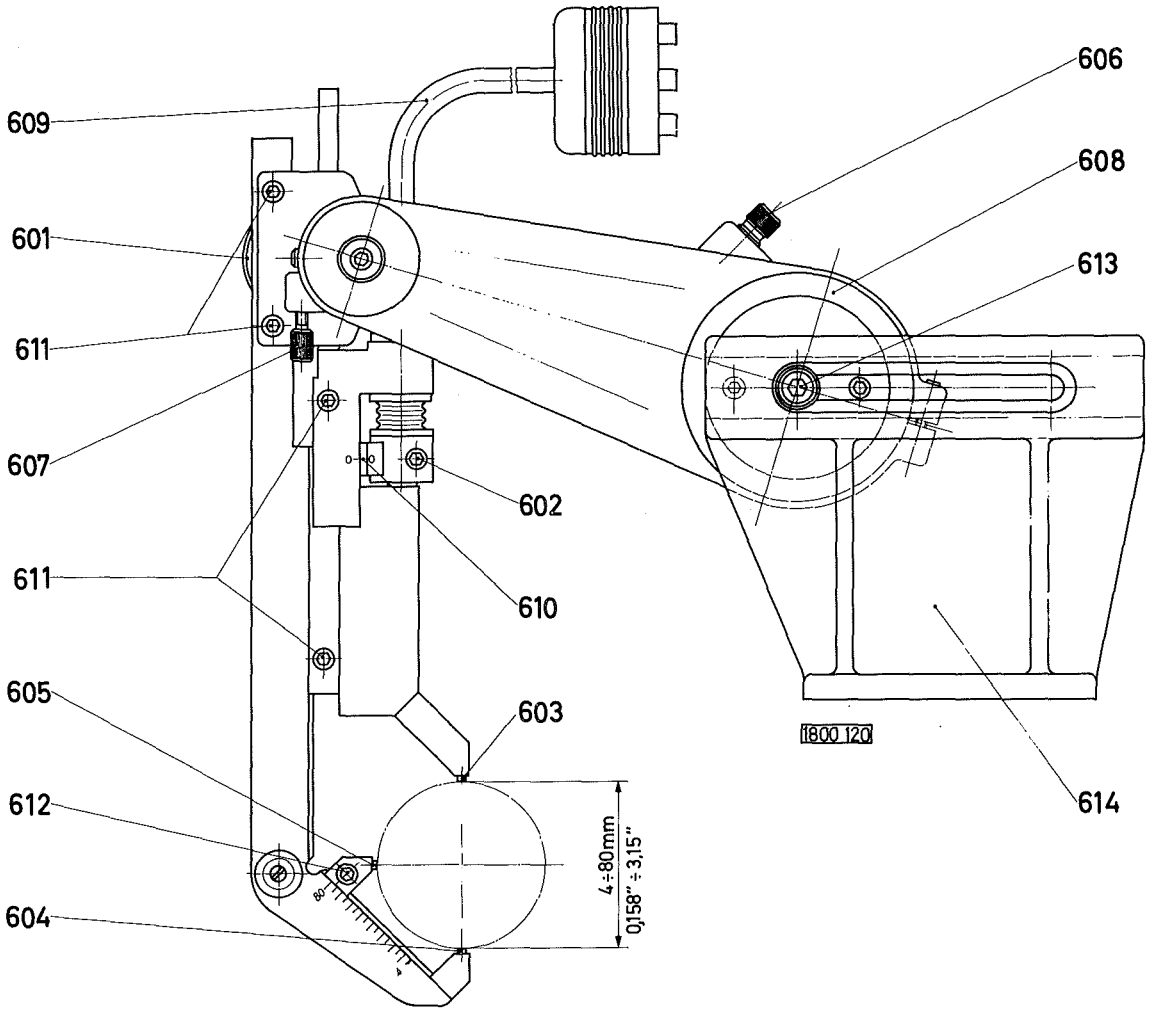
- Set the switch-over point from normal to fine feed with potentiometer 205. (Approx. to .000,4" (0.01 mm). Indicator lamp [1/x] green.
- Set the switch-over point from fine feed to sparking-out (fine feed is interrupted) with potentiometer 206. (Approx. to .000,08"- .000,12" (0.002 - 0.003 mm) Indicator lamp [1/2x] yellow.
- During grinding, the appropriate signal lamps must light at the values set.

Corrections to be made in case the workpiece diameter is not correct

- Set up workpiece on the machine. Advance measuring head onto the rotating workpiece, apply coolant.
- If the workpiece diameter is too small (too large clearance for match grinding) the zero adjuster 204 must be set to the appropriate value "minus".

  (If the difference is greater than 0.002 mm (.000,1") select the coarse scale to make the correction).
- If the workpiece diameter is too big (insufficient clearance for match grinding) the zero adjuster 204 must be set to the appropriate value "plus"

600 Type CR 80 S Suspended measuring head

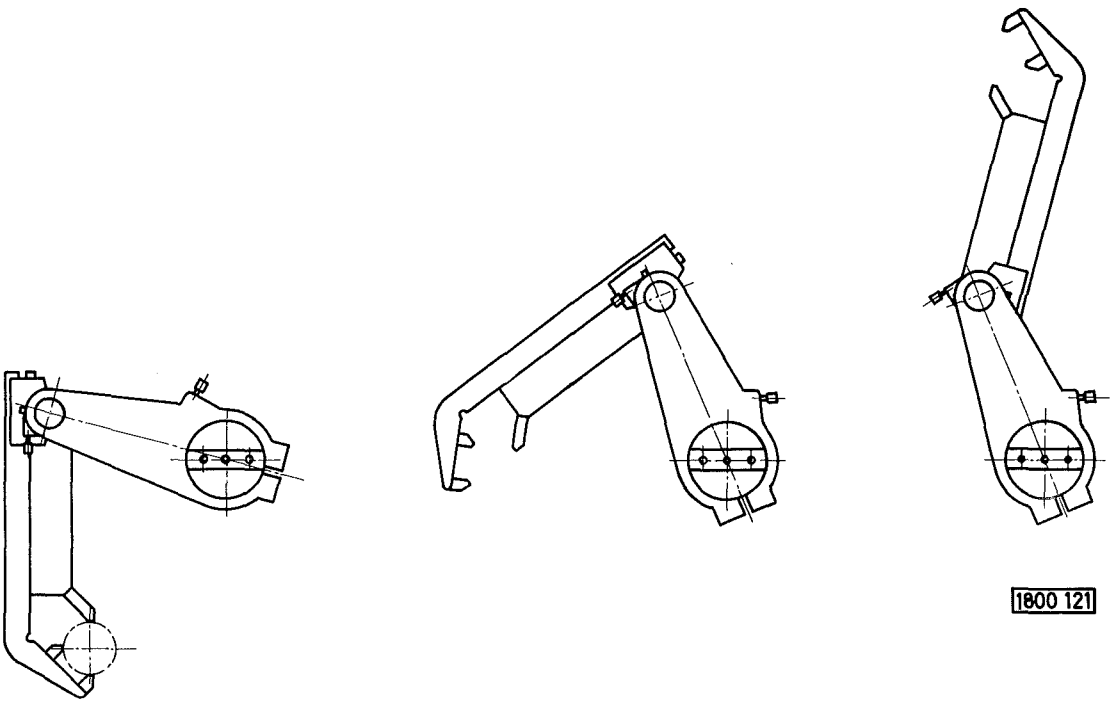



601 Diameter setting knob
602 Mechanical fine adjustment ($\pm$ 200 /um, $\pm$ .008")
603 Measuring jaw, measuring pressure approx 250 g, stroke approx. 1.2 mm (.048"), max permissible grinding allowance on dia 0.8 mm (.032")
604 Fixed jaw, measuring pressure approx 450 - 700 g.
605 Adjustable support jaw
606 Main stop screw
607 Safety stop screw
608 Spring housing
609 HF cable with plug, length 3 m (10 ft).
610 Reference lines
611 Slide clamp screws
612 Support jaw clamp screw
613 Suspension unit retaining screw
614 Support bracket on grinding machine

## Fitting the suspended measuring head to the grinding machine

- Mount the suspension unit 608 on the support bracket 614 and lightly tighten screw 613. The measuring head is disengaged.
- Slacken clamp screws 611 and with knob 601, set the upper and lower jaws to the approximate diameter required.
- Slacken clamp screw 612 and set the support jaw 605 to the required diameter then re-tighten screw 612.
- Place a reference piece between centres. (If no reference piece is available, one must be produced as described on page MSD 6.1)
- Advance the grinding wheel to within 1 mm of the reference piece.
- Engage the measuring head on the reference piece. (if necessary adjust main stop screw 606)
- Slide the suspension unit on the support bracket to bring the measuring head in a vertical position then secure screw 613.
- Set stop screws 606 and 607 so that they are within approx 0.5 - 1 mm of the stops. (These stops ensure that the measuring head cannot be pushed against the grinding wheel.)
- Connect the HF cable to the amplifier and ensure that it is neither stretched nor trapped when the machine table is traversing or the wheelhead advances and retracts.
- Connect the amplifier to the control cabinet.

Engaged Dis-engaged Rest position



Setting the instrument

- Turn mains switch and selector switch to positions ⏻ and ⧗ respectively. If the indicator lamp does not light, check fuses.

- Move the upper measuring jaw by hand and check that the indicator needle moves across the scale.

- With handwheel 601, close the upper and lower jaws onto the reference piece until the reference lines 610 are aligned.

- Clamp the 4 slide clamping screws 611.

- Check that stop screws 606 and 607 are still clear of the stops.

- Set range selector switch to 100 /um (.005")

- Set fine adjuster 204 to the middle of its travel, ie turn to the stop and then turn back 5 revolutions.

- Allow the reference piece to turn (For precise measurement, the wheel should be within 0.1 mm of the reference piece and the coolant should be running)

- With fine adjuster 602 on the measuring head, bring the indicator needle to zero on the scale.

- Disengage and re-engage the measuring head 2-3 times.

- If the indicator needle remains within $\pm$ 20 /um ($\pm$ .0008") of zero, bring the needle back to zero with fine adjuster 602 on the measuring head or 204 on the amplifier.
  If the deflection is greater, repeat the setting procedure previously described.

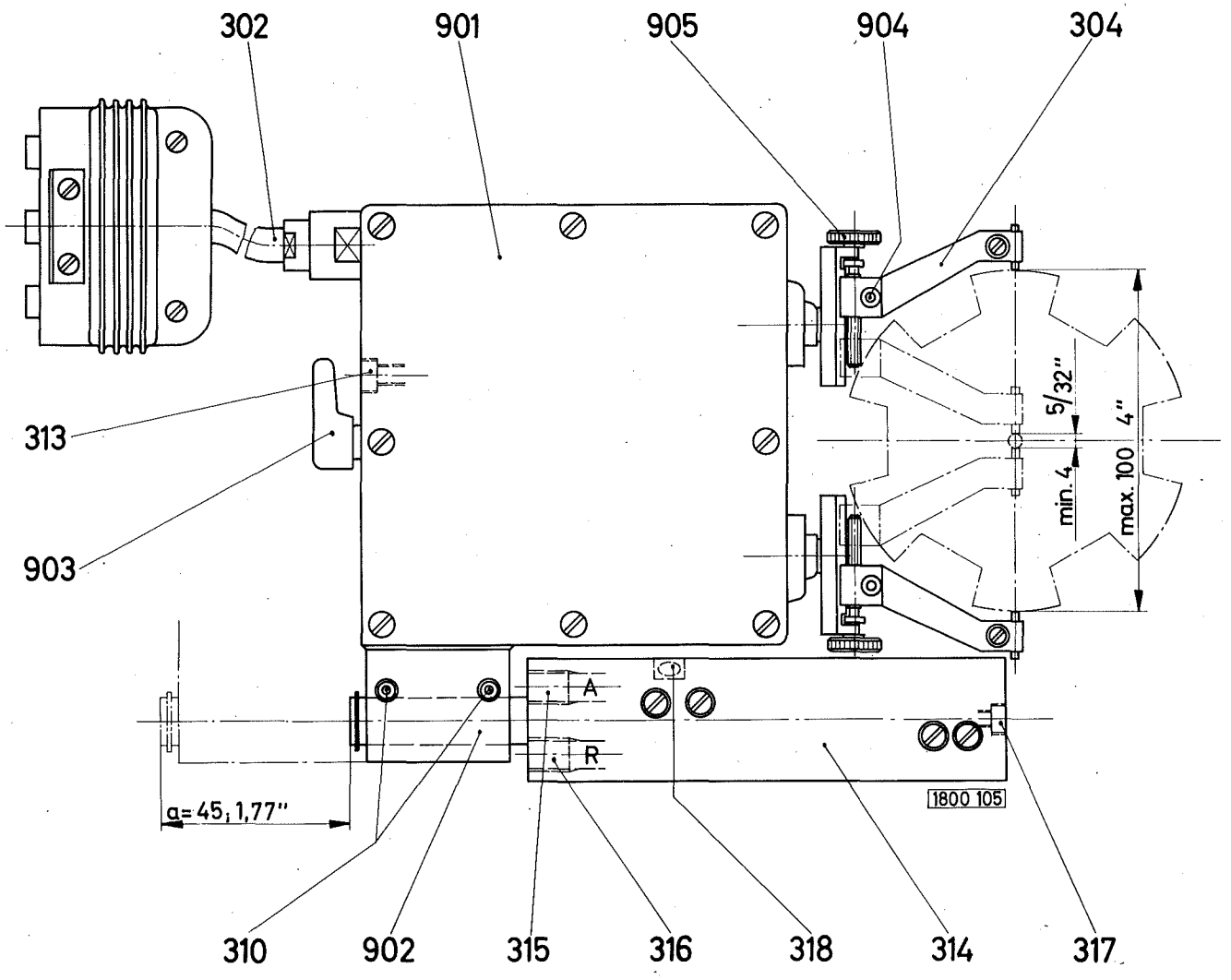
- Set required measuring range with selector switch 203 (e.g 10 /um - .0005")

- Set the feed switching relays as desribed on page MSD 6.3.

- If necessary correct size as described on page MSD 6.3.

- Set up the machine as described on page MSD 9.1, 2

900 SECTOLIMIT type CR 200 Th measuring head




901 Measuring head
902 Measuring head frame
903 Setting lever: ⧗ Gauge, ◯ Adjust.
904 Measuring jaw locking screws
905 Measuring jaw adjusting screws.

302 HF-cable with plug, length 10' (3 m)
304 Measuring jaws (automatic retraction .040" (1 mm) par jaw).
Measuring pressure approx. 150 g.
310 Frame locking screws
313 Measuring head bleed screw
314 Retraction unit, a = 1,77" (45 mm)
315 Hydraulic connector for constant pressure pipe (A)
316 Hydraulic connector for control pipe (R)
(Pressure = Retract, Exhaust = Advance)
317 Retraction unit bleed screw
318 Bleed screw

## Setting the SECTOLIMIT measuring equipment

Mount measuring head on the machine, connect to amplifier and set controls as described on pages MSD 3.2 and 5.2. With measuring head retracted and no workpiece between the centres:

- Assemble and set the measuring jaws 304 so that they will clear the component when the measuring head advances, then lightly lock screws 904.
- Turn lever 903 to "ADJUST" ◯ .
- Turn main selector switch 201 to ◯ .
- Set range selector switch 203 to 12000/µ inches (300/µm)
- With switch 101 advance the measuring head (the measuring jaws will close).
- With fine adjuster 204 set the indicator needle to -.0004 0.01 mm)
- Place the reference piece between the centres ensuring that the measuring jaws 304 are not in contact with it.
- If no reference piece is available, a workpiece must be ground - without SECTOLIMIT - to approximately .00025" (0.006 mm) oversize. The exact oversize must be determined and taken into account when setting the measuring head. See corrections page MSD 6.3.
- Turn the reference piece so that the lower measuring jaw will contact the diameter when setting.
- Raise the lower measuring jaw with adjusting screw 905 until it contacts the reference piece and the indicator needle moves to zero.
- Lock the lower jaw with screw 904 (the indicator needle should not deviate more than ± .0004" (± 0.01 mm) from zero after the jaw is locked.
- Lower the upper jaw with adjusting screw 905 until it contacts the reference piece and the indicator needle registers + .0008" (+ 0.02 mm).
- Lock the upper jaw with screw 904. (When the jaw is locked, the indicator needle must lie between + .0004" and + .0012" (+ 0.01 and + 0.03 mm)
- Turn main selector switch 201 to ◯ .

- Set the relays controlling the automatic selection of the fine feed as described on pages 6.3 and 8.4.

- Retract the measuring head.

- Firmly lock the two measuring jaws.

- Turn lever 903 to "GAUGE"  .

- Allow the reference piece to rotate and then advance the measuring head.

  The speed of rotation of workpieces with large interruptions should be increased until the indicator needle remains steady.
  The minimum speed can be theoretically established - see Diagram MSD 8.5.

- With fine adjuster 204, bring the indicator needle to -.0004" (0.01 mm). (This allows a safety setting margin and the first off will probably be oversize; this can however be corrected with fine adjuster 204.)

  If SECTOLIMIT is used for match grinding (DELTASECTOLIMIT) the indicator needle must be set to "0". Security can be considered when setting clearance (MSD 10.2).

- Advance and retract the measuring head 2 or 3 times.

- If the indicator needle shows a variation of less than $\pm$.000.8" (0.02 mm), bring it back to -.0004" (0.01 mm) with fine adjuster 204. If the variation is greater, the complete setting procedure must be repeated.

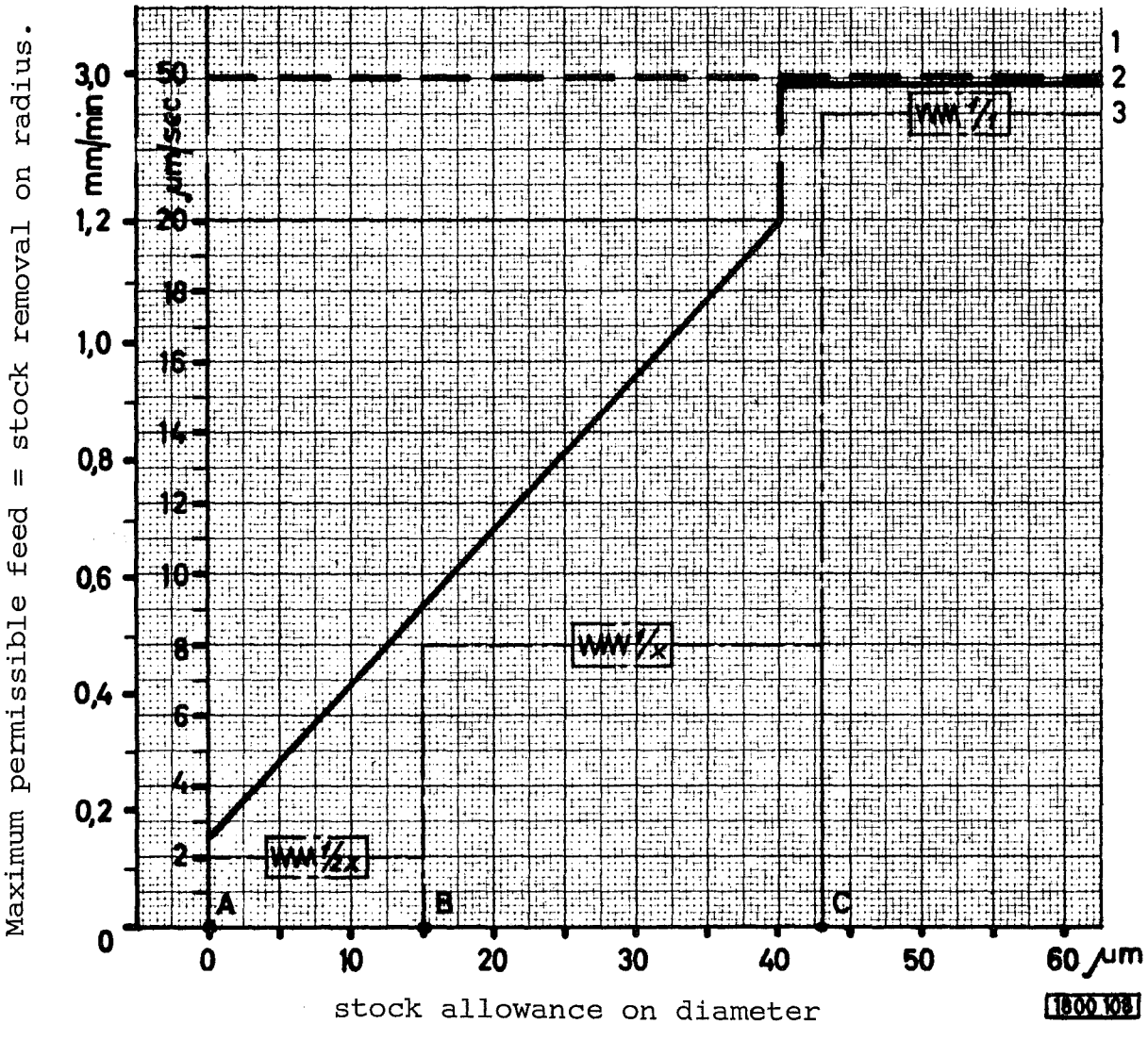
- Select the required measuring range with switch 203.

- See page MSD 6.3 for corrections of size.

ATTENTION! Once the workpiece speed, the relay potentiometers 205 and 206 and the grinding feeds have been set when grinding an interrupted diameter, they must not be alterred.

NOTE With switch 201 set at ◯ , normal workpieces without interruptions can be ground.

## Graph of maximum grinding feeds for SECTOLIMIT




The actual working values selected must always lie within the maximum curve (see example ——·——·——·—)

1 - - - - - - - Maximum curve at switch 201 setting ○

2 ——————— Maximum curve at switch 201 setting ↻

3 ——·——·—— Grinding example at switch 201 setting ↻

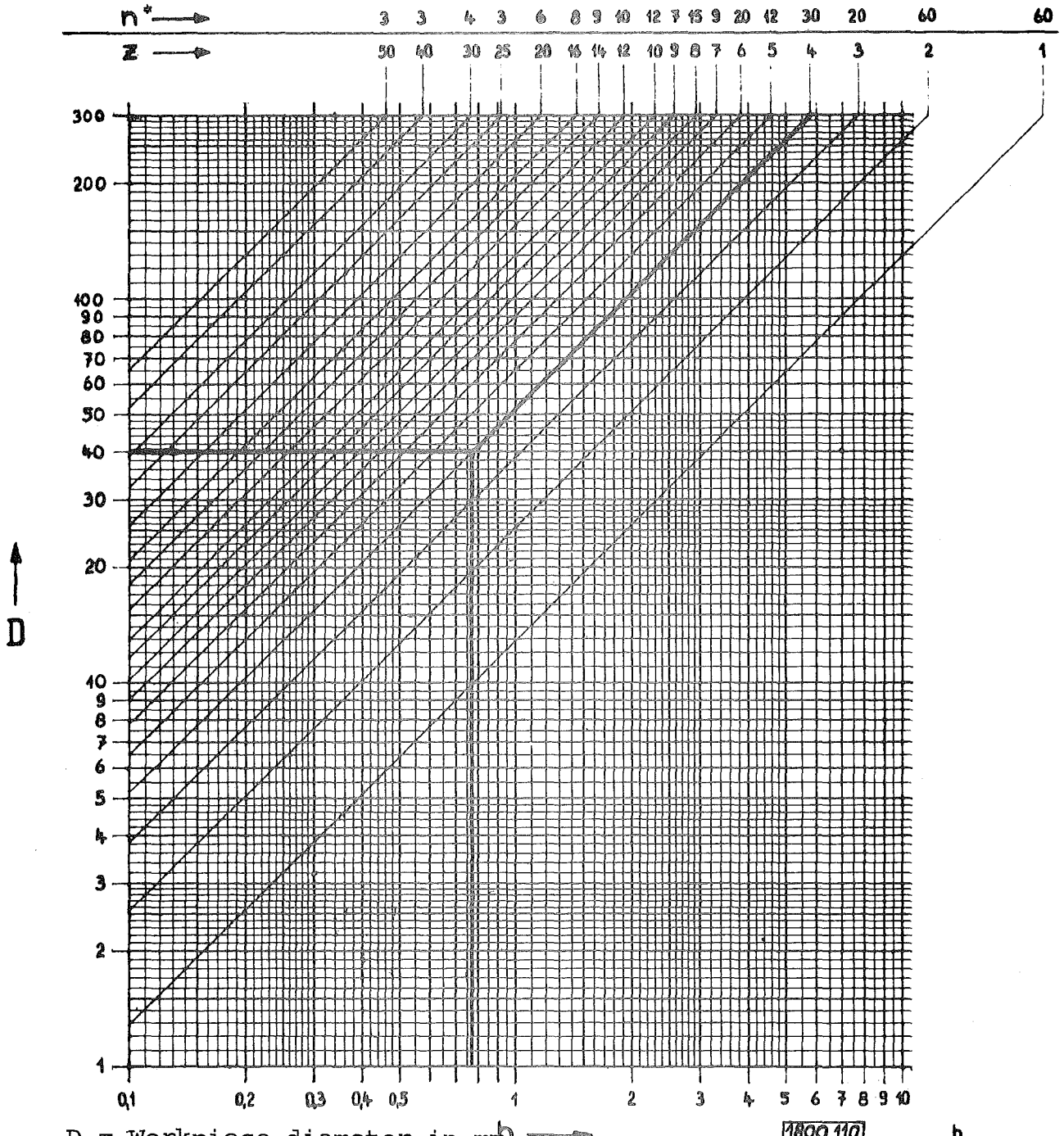
C Switch over point from normal to fine feed; can be selected with potentiometer 205.

B Switch over point from fine feed to sparking out; can be selected with potentiometer 206.

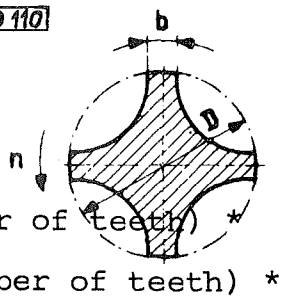
A End of grinding operation, set permanently at zero.

(Explanation of lamp symbols see legend on page MSD 4.1)

Minimum speed and width of tooth of a workpiece in relation to the number of teeth and diameter on SECTOLIMIT




D = Workpiece diameter in mm
b = min. theoretical width of tooth
z = evenly distributed number of teeth on circumference
n = min. theoretical speed in r.p.m.




Conditions: $b \geq \frac{D}{13z}$; $n \geq \frac{120}{z}$ (for even number of teeth) *

$n \geq \frac{60}{z}$ (for uneven number of teeth) *

Example: D = 40 mm; z = 4: $n \geq 30$ r.p.m. * and $b \geq 0{,}77$ mm

* If during the grinding operation with this speed the selected fine feed switches back to faster feed, the speed must be increased.

Setting the machine

( BA = machine handbook).

Assemble and set the measuring equipment ready for operation.

- Turn programme selector switch BA 302 to  .
- Start the workhead, wheelhead and hydraulic pump motors with switches BA 303 and BA 401.
- Depress cycle start button BA 314 until the green lamp BA 309 lights, indicating that the feed mechanism is fully advanced.
- Bring the grinding wheel as close as possible to the workpiece.
- Unlock coupling BA 202 on the feed handwheel.
- Advance the wheelhead with feed handwheel BA 201 and grind the workpiece until it cleans up.
- Half depress stop button BA 313. (The wheelhead will retract but the feed mechanism remains fully advanced).
- Determine the exact oversize of the workpiece.
- Lock feed handwheel coupling BA 202.
- Set the oversize plus a safety margin of .004" (0.1 mm) on scale ring BA 205.
- Unlock coupling BA 202
- Turn feed handwheel BA 201 to bring setting scale BA 205 to zero.
- Lock coupling BA 202
- Set programme selector switch BA 302 to programme required
- Set selector switch 101 to automatic 
- Set the stock allowance with knob BA 204 allowing an extra .004" (0.1 mm) for safety.
- Set measuring head delay timer BA 311.
  (With un-ground components, the measuring head should not advance until the component has cleaned up. For rough ground components with relatively small grinding allowance, the timer can be set to the minimum dwell).

- Set the feed speeds with throttling valves BA 110 and BA 111 (The feeds should be set according to experience with similar workpieces.
  With SECTOLIMIT, maximum feed rates according to page MSD 8.4)

- Depress cycle start button 314. The programme set will run automatically. Ideally the grinding pressure should be nil at the end of the cycle when the component has reached size.

- If finished size is not reached, the start button BA 314 can be depressed to re-engage the fine feed. For the next component however, either the feed rates should be increased slightly or the changeover points from normal to fine feed and from fine feed to spark-out moved a little closer to zero.

- If finished size is reached too quickly i.e.if there is no appreciable delay between the illumination of the spark-out and finished size indicator lamps, then the feed changeover points should be moved a little further away from zero.

- If there is a deviation from the finished size required, a correction should be made with fine adjuster 204.

## Setting DELTALIMIT match grinding equipment

Connect equipment as per drawing MSD 3.1

Amplifier see page MSD 4.1

Measuring head see page MSD 5.1

Depth setting and bleeding of measuring head as per page MSD 5.2

Set the equipment ready for operation as described on pages MSD 6.1, 2, 3 and 7.4.5

## Calibration of measuring head, amplifier and internal measuring head

- Turn fine adjuster 701 to the stop in the "+" direction
- Select required measuring range with switch 203
- Place the reference bore on the measuring arbor
- Set fine adjuster 204 to the middle of its travel
- Turn selector switch 201 to position ⊜ (INTERNAL)
- Bring indicator needle to zero with fine adjuster 701
- Turn selector switch 201 to position ⧗ (External)
- Bring indicator needle to zero with fine adjuster 306.
- Turn switch 201 to position △ (DELTALIMIT)
  (The indicator needle should now be at zero).
- Set the required clearance (or interference) on the indicator needle with fine adjuster 204. See corrections on page WSC 6.3 (The zero setting 204 is not changed if reference pieces with the required clearance are used for setting).
- Fine adjuster 204 should not be moved if reference pieces with the desired fit have been used for setting.
- Set the machine as described on pages MSD 9.1 and 9.2.

Setting DELTASECTOLIMIT match grinding equipment

Connect equipment as per drawing MSD 3.1

Amplifier see page MSD 4.1

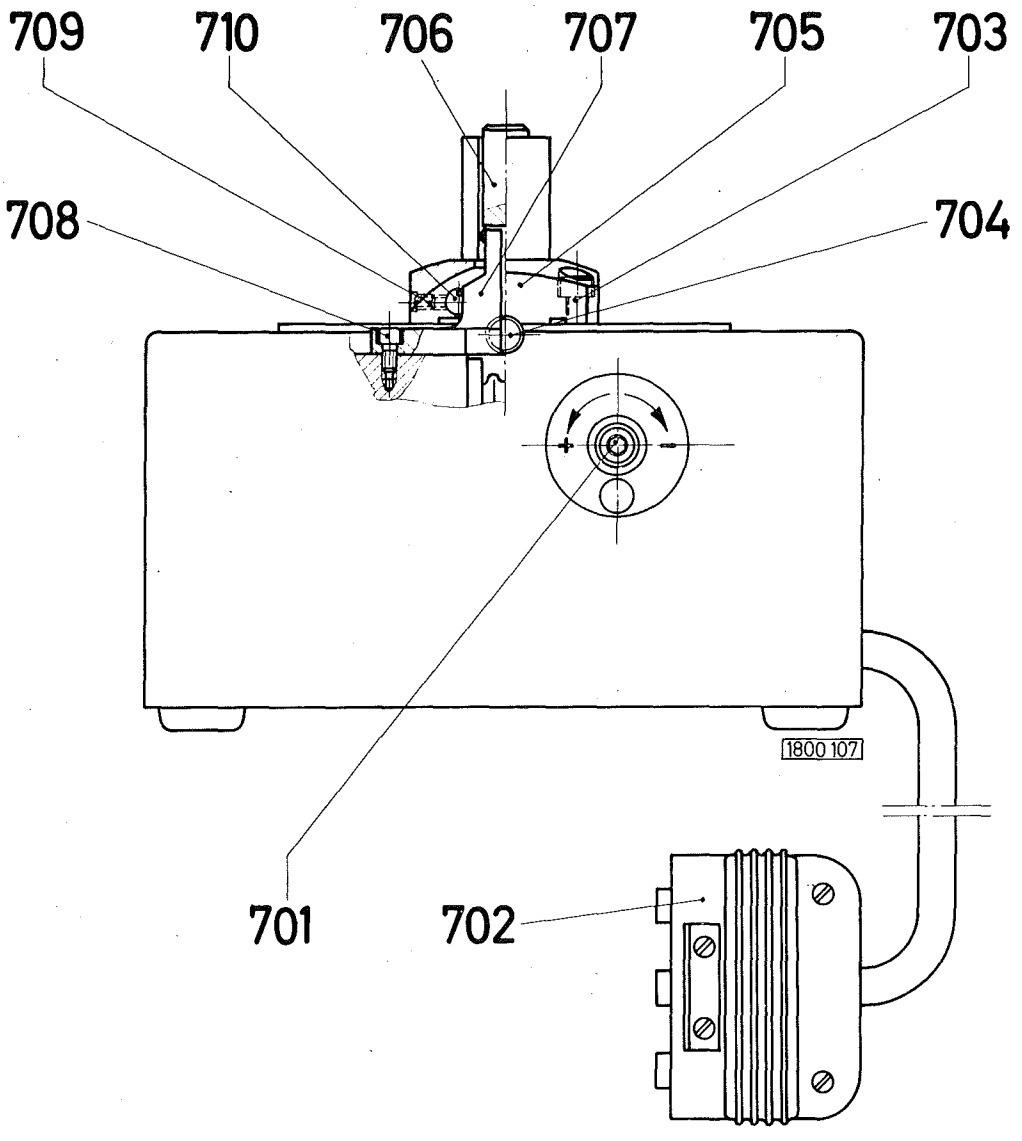
Depth setting and bleeding of measuring head as per page MSD 5.2

Measuring head see page MSD 8.1

Calibration of measuring head, amplifier and internal measuring head

- Turn fine adjuster 701 to the stop in the "+" direction
- Select required measuring range with switch 203
- Place the reference bore on the measuring arbor
- Set fine adjuster 204 to the middle of its travel
- Turn selector switch 201 to position ⊕ (INTERNAL)
- Bring indicator needle to zero with fine adjuster 701
- Turn selector switch 201 to position ⧗ (EXTERNAL)
- Set the SECTOLIMIT equipment ready for operation as described on pages MSD 8.2 and MSD 8.3
- Turn switch 201 to position △ (DELTASECTOLIMIT)
  (The indicator needle should now be at zero).
- Set the required clearance (or interference) on the indicator needle with fine adjuster 204. See corrections on page MSD 6.3
  (The zero setting 204 is not changed if reference pieces with the required clearance are used for setting).
- Fine adjuster 204 should not be moved if reference pieces with the desired fit have been used for setting.
- Set the machine as described on pages MSD 9.1 and 9.2.

700 INTERLIMIT type CI 213 TS internal measuring head




701 Fine adjuster
702 HF-cable with plug, length 10' (3 m)
703 Measuring arbor securing screws
704 Knurled adjusting screws
705 Flange
706 Centering arbor
707 Measuring fingers
} interchangeable from Ø 3,5 ÷ 108 mm (.138" ÷ 4.25")
708 Measuring finger securing screws
709 Locking screw
710 Eccentric stop

## Fitting and centering the measuring arbor

- Turn selector switch 201 on amplifier to position (INTERLIMIT)
- *Turn fine adjuster 701 on internal measuring head in the "+" direction until the stop is reached.
- *Lightly nip the locking screws 709.
- *Turn the eccentric stops 710 outwards.
- Assemble the two measuring fingers and secure.
- Assemble the measuring arbor 706 and lightly secure.
- Place reference bore carefully on the arbor.
- Turn selector switch 203 on amplifier to the fine scale.
- Turn fine adjuster 701 on internal measuring head until the indicator needle appears on the scale.
- Move the measuring arbor sideways with adjusting screw 704 in the direction in which the indicator moves "+". Continue turning screw 704 until the indicator passes through the maximum plus reading and starts to move "-". Secure the arbor in this position. This adjustment ensures that a true diameter and not a chord will be measured.

  * Only if the eccentric stops have to be set! (Unless otherwise stated, the eccentrics are set before delivery).

## Setting the eccentric stops

- Turn the eccentrics (one at a time) towards the measuring fingers. As soon as they touch, the indicator needle will move towards "-".

  Turn each eccentric so that indicator needle moves .00004" - .0002" (0.001 - 0.005 mm) towards "-" (both stops equal)

- Remove the reference piece. The indicator needle should remain still since the measuring jaws are held by the eccentrics. Turn selector switch 203 on amplifier to the coarse scale and with fine adjuster 701, set the indicator needle at the extreme left of the scale.

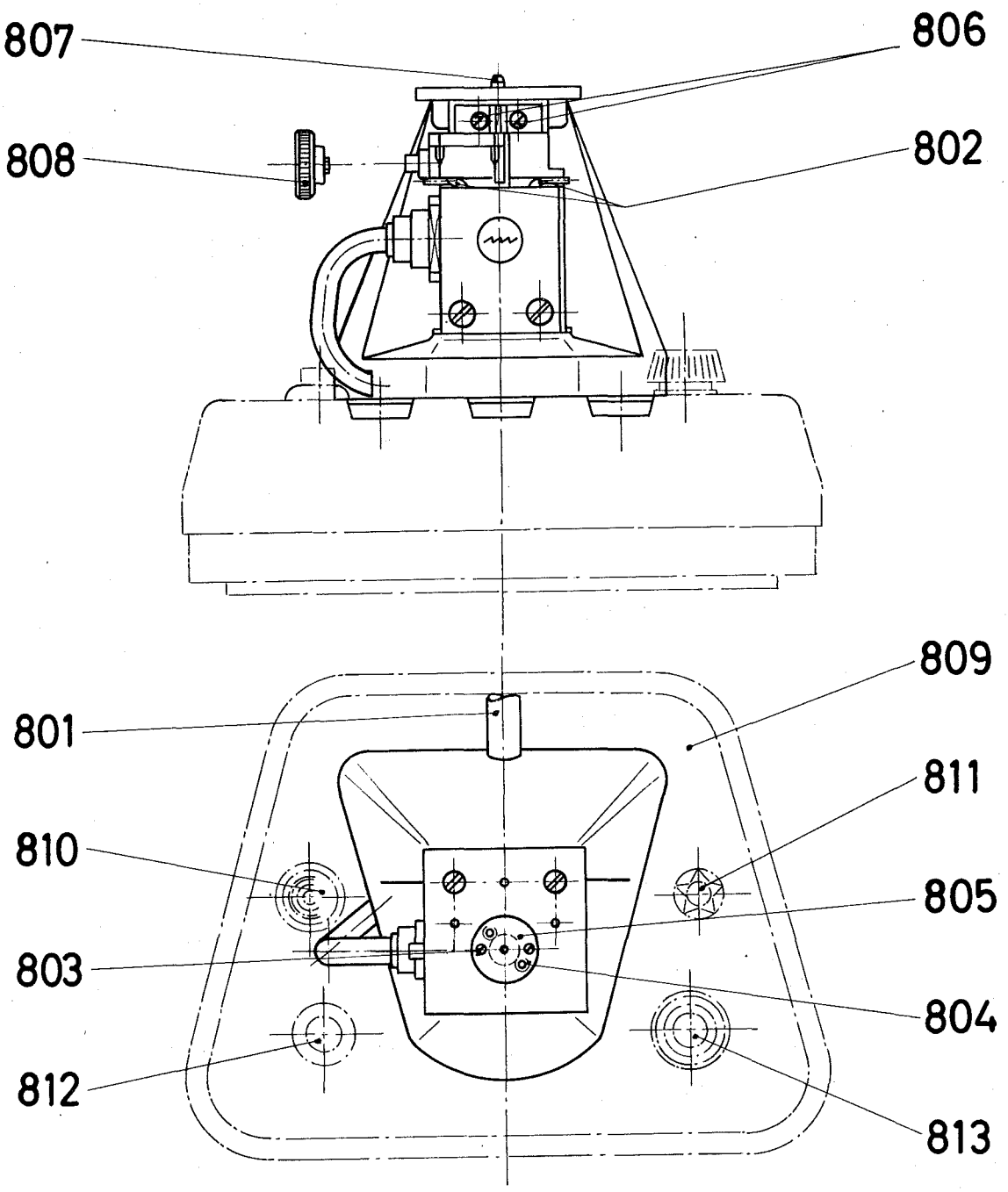
- Turn one of the eccentrics 710 to bring the indicator needle to the extreme right of the scale ie + .004" (0.1 mm).

- Lock this eccentric with screw 709 then, with fine adjuster 701, bring the indicator needle again to the extreme left of the scale.

- Turn the second eccentric to bring the indicator needle to + .004" (0.1 mm), then lock with screw 709.

  This setting applies only for measuring arbors up to .4" (10 mm) diameter. For measuring arbors larger than .4" (10 mm) dia., the indicator needle must be moved twice across the scale with each eccentric ie a total movement per eccentric of .008" (0.2 mm).

800 INTERLIMIT types CI 6 T and VCI 6 T internal measuring heads




801 HF-cable
802 Safety dowels
803 Table insert securing screws
804 Table insert extractor holes
805 Table insert
806 Locking screws
807 Interchangeable measuring fingers for diameters .040"-.024" (1-6 mm)
808 Setting knob
809 Vibrator
810 Vibrator indicator lamp
811 Fuse for vibrator, 0.2 amp
812 Vibrator start button
813 Vibration frequency setting knob.

## Setting the measuring heads CI 6 T and VCI 6 T (with vibrator)

- Turn selector switch 201 on amplifier to ⇕ (INTERLIMIT)
- Place the reference bore over the measuring fingers 807
- Select fine measuring scale with switch 203
- Turn the setting knob 808 to bring the indicator needle onto the scale

## Changing measuring fingers and tables

- Insert safety dowels 802
- Remove securing screws 803
- Insert screws 803 in extractor holes 804 and remove table insert 805
- Loosen locking screws 806 and remove measuring fingers 807
- Insert the required pair of measuring fingers 807 and push them down as far as they will go in the holders, then lock screws 806
- Mount the table insert required and secure
- Remove safety dowels

## Setting the vibrator (VCI 6 T only)

- Connect the vibrator to the supply
- NOTE! Check that supply voltage agrees with that stamped on the name plate
- Check the function of the vibrator: Depress button 812 when the indicator lamp 810 should light and the vibrator start vibrating. If the vibrator fails to start, check fuse 811 and/or supply fuse
- Place the reference bore on the measuring fingers and weigh down with the appropriate weight - if supplied.
- Select measuring range required with switch 203

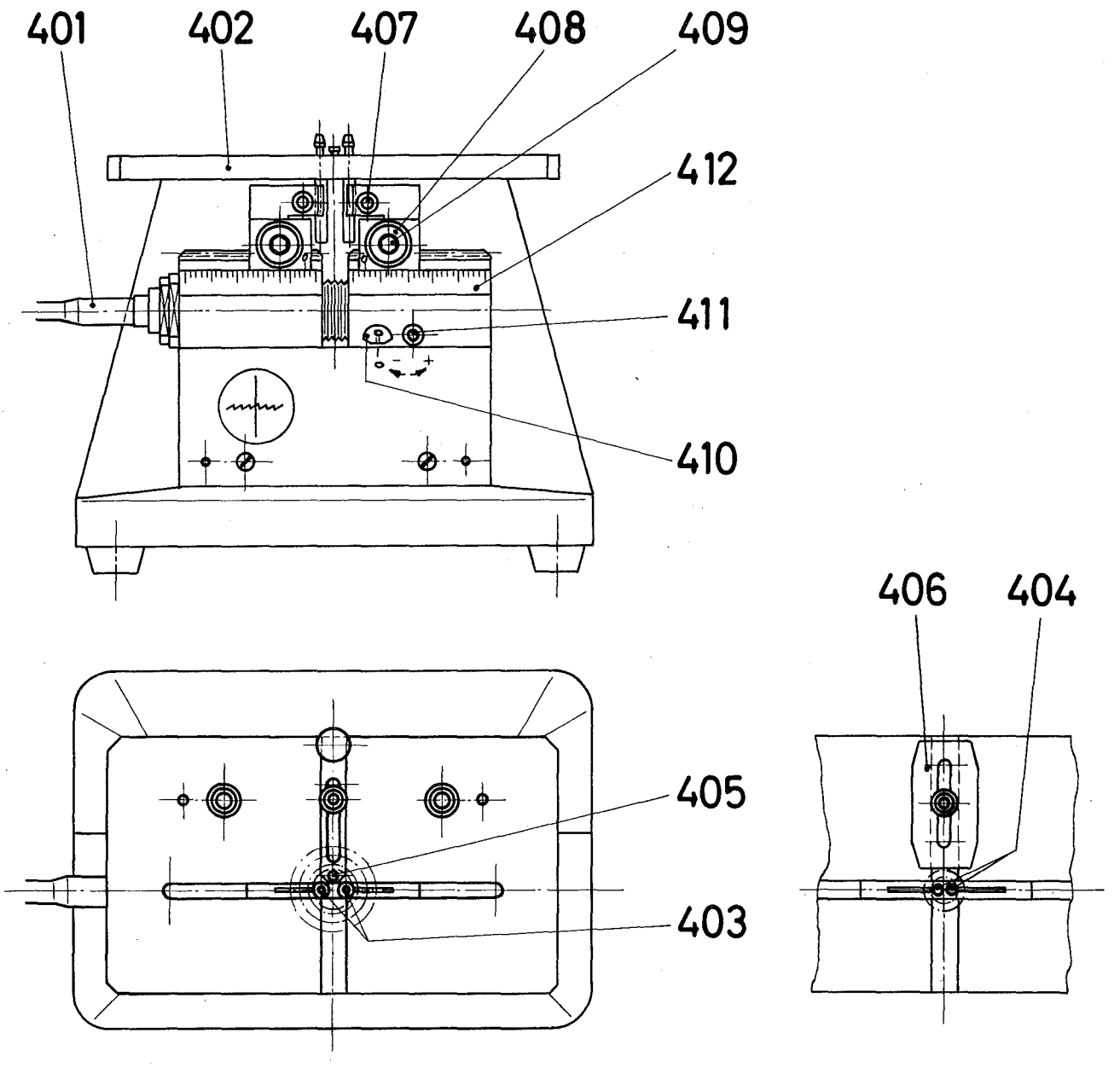
- With fine adjuster 808, bring the indicator needle into the left hand half of the scale

- Switch on vibrator with start button 813 and with knob 813 select the most suitable frequency. The vibration reduces the friction between the component and the table insert and the light measuring pressure is then sufficient to centralize the component so that it's effective diameter is measured. The ideal vibration is found by gradually increasing the strenght from the minimum setting until the indicator needle moves towards "+". As soon as the needle remains steady, the component is centralised.

- Set the indicator needle to zero with setting knob 808.

NOTE! The vibrator should be switched on every time a reference piece or component is placed on the measuring fingers.

400 INTERLIMIT type CIU 120 T internal measuring head




401 HF-cable
402 Measuring table
403 Measuring tips, Measuring height 0 ÷ 15 mm (0 ÷ .59") adjustable interchangeable for diameters from .35"- 4.72" (9-120 mm)
404 Measuring tips, Measuring height 0 ÷ 6 mm (0 ÷ .236") adjustable eccentric, for diameters from .118" - .35" (3-9 mm)
405 Stop for diameters over .47" (12 mm)
406 Stop for diameters below .47" (12 mm)
407 Locking screws
408 Measuring jaw setting knobs
409 Measuring jaw locking screws
410 Reference lines
411 Mechanical fine adjuster
412 Measuring jaw setting scales

Setting up the CIU 120 T universal internal measuring head

- Turn selector switch on amplifier to ⇕ (INTERLIMIT)
- Fit the required measuring tips (403 or 404)
- Fit the appropriate stop, 405 or 406. If the component is centralised from the outside diameter ie with stop 406, an accurate measurement can only be guaranteed if the eccentricity between O/D and I/D is relatively small. For example, an eccentricity of .0002" (0.005 mm) when measuring a bore of .118" (3 mm) diameter, will give a measuring error of approximately .00004" (0.001 mm).
- Set the measuring tips 403 or 404 to the required measuring height and secure with screws 407. If measuring tips 404 are used, ensure that the throw is correctly positioned.
- Set stop 405 or 406 so that it is clear of the component when placed on the measuring tips.
- Set mechanical fine adjuster to the middle of it's travel ie turn clockwise to the stop then turn back approx. 15 revolutions.
- Unlock screws 409 and with knobs 408 bring the measuring jaws to the centre so that the component can be placed over them.
- Roughly centralize the reference bore.
- With knobs 408, spread the measuring jaws until the measuring tips contact the bore. Check with the scales 412 that the jaws are equally spaced about the centre; this is particularly important when gauging small bores.
- Lock the left hand measuring jaw with screw 409.
- Bring right hand measuring tip into contact with the bore and continue to turn knob 408 until the indicator needle is within ± .0004 (0.01 mm) of zero, then lock measuring jaw with screw 409.

- Determine the maximum reading in the bore by moving the reference piece slowly at right angles to the measuring direction. The maximum "+" reading on the indicator scale indicates when the true diameter is reached. Should the indicator needle move right off the scale when carrying out this initial setting, re-adjust the right hand measuring jaw to bring it back onto the scale.

- Check that the reference lines 410 are aligned.

- Bring the indicator needle to zero with fine adjuster 411.

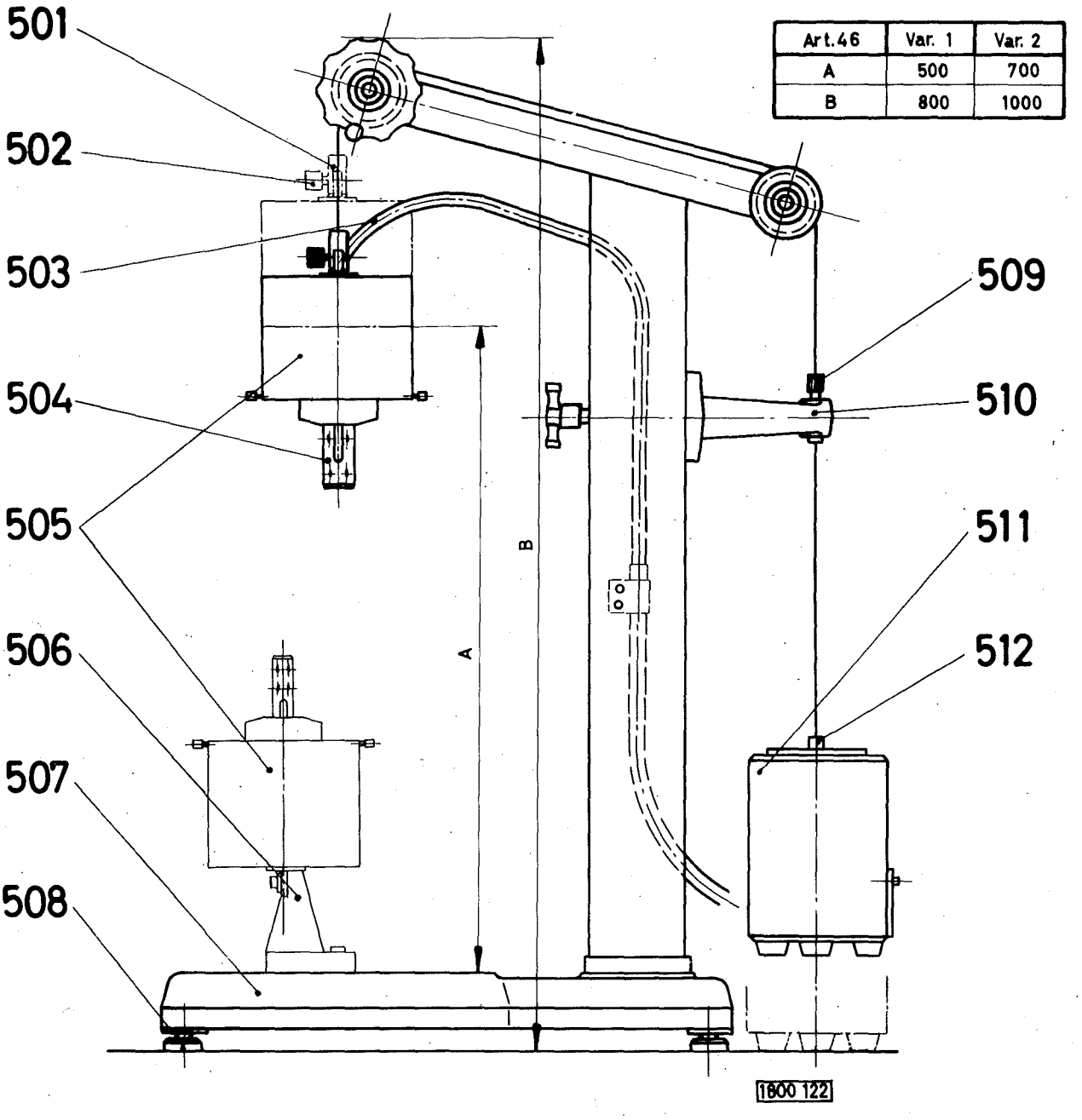
- The following procedure is only necessary if either of the stops 405 or 406 is used. If the stops are not used, the maximum scale reading must be determined each time the component is moved or a fresh one placed on the instrument.

- Replace the reference bore with a component and, once again, establish the maximum scale reading. The difference in maximum readings indicates the difference between the reference bore and that of the component.

- Adjust the previously mounted stop 405 or 406 until it just touches the bore or O/D respectively of the component then secure. The indicator needle must not deflect.

- Remove the workpiece and replace it again pressing lightly against the stop and the left hand, fixed measuring tip and check that the indicator needle repeats the previous reading.

500 INTERLIMIT type CI 60 S suspended internal measuring head




| Art.46 | Var. 1 | Var. 2 |
|---|---|---|
| A | 500 | 700 |
| B | 800 | 1000 |

501 Suspension cable clamp
502 Locking pin
503 HF-cable
504 Measuring arbor interchangeable from Ø 3,5 ÷ 108 mm (.138" ÷ 4.25")
505 Internal measuring head
506 Support bracket
507 Table
508 Levelling pads
509 Fine adjuster for stop
510 Depth stop
511 Counterweight
512 Cable clamping screws

## Assembling the suspension unit and measuring head

- Place the table in the position where it is to be used and mount it on the 3 levelling pads.
- Secure the column to the table 507 with the screws provided.
- Assemble the depth stop through the bottom end of the slot in the column.
- Place the empty counterweight 511 underneath the stop 510.
- Secure the suspension cables to the counterweight 511 with screws 512. Hang the cable clamp 501 on the other end of the cables and pass them over the rollers.
- Secure the measuring head 505 to the cable clamp 501 with locking pin 502. Gently lower the measuring head until the counterweight 511 lifts and is held by the stop 510.
- Fill the counterweight with the lead shot provided until it balances the measuring head exactly.
- Adjust the length of the cables with screws 512 until both the counterweight and the measuring head hang exactly upright.
- Secure the HF cable to the column with the clamp provided ensuring that sufficient free cable is available for the measuring head to move freely up and down.
- If it is not required to use the measuring head in a suspended position, it should be inverted and mounted on support bracket 506 secured to the table.
- The fitting of the measuring arbor and setting of the eccentric stops is described on pages MSD 11.2 and 11.3.