



UNITECH – TROYAN Ltd.

Troyan

MANUAL

*for operation and maintenance of
Vertical Slotting (Stoss) Machines*

S200TGI and S315TGI
(ORIGINAL)

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DECLARATION OF CONFORMITY

Hereby we declare that the below mentioned machine with its the construction and design characteristics is in conformity with the essential requirements regarding safety at work and prevention of accidents stipulated in the EC Directive.

| | |
|---|--|
| Machine description: | VERTICAL SLOTTING (STOSS) MACHINE |
| Make: | S.....TGI |
| Serial No. | |
| Year of manufacture: | |
| Manufacturer: | UNITECH-TROYAN LTD. 229, General Kartzov str., 5600 Troyan, Bulgaria Tel./fax: +359 670 52117 e-mail: office@unitech-troyan.com URL: www.unitech-troyan.com |
| The machine is designed and manufactured in conformity with the following EC regulations: | Machinery Directive 2006/42/EC Low Voltage Directive 2006/95/EC Electromagnetic Compatibility Directive 2004/108/EC |
| The following (parts/clauses of) harmonised standards have been implemented: | EN ISO 12100-1:2004 EN ISO 12100-2:2003 EN ISO 60204-1:2006 |
| The following (parts/clauses of) national standards and technical specifications have been implemented: | DPR 547/55 DPR 459/96 |

The average noise level A in the workplace does not exceed 70 dB (A).

Troyan, Bulgaria

Date:

CEO:

Dipl. Eng. A. Kosharov/

Attachment to the Declaration of Conformity

List of the essential safety requirements taken into consideration

| | |
|-------------------------------|--|
| Machinery Directive reference | List of the essential safety requirements (RES) |
| 1.1. | General remarks |
| 1.1.2. | Principles of safety integration |
| 1.1.5. | Design of machinery to facilitate its handling |
| 1.2. | Controls |
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| 1.7.2. | Warning of residual risks |
| 1.7.3. | Marking |
| 1.7.4. | Operation instruction |

WARRANTY CERTIFICATE

Type of machine: Vertical slotting machine S..... TGI

Factory number:

Manufacturer: Unitech-Troyan Ltd.

This warranty is valid within 18 months from the sale of the machine but not more than 24 months from the date of manufacture. During the warranty period, all defective parts are replaced by the manufacturer, free of charge.

The warranty does not cover failures caused by:

- misuse, failure to observe the instructions for operation, including, but not limited only to, use not as intended or operation with inappropriate attachments and accessories;
- overloading, inappropriate or unstable power voltage, mechanical damage (falling or impact) or improper maintenance;

Disassembled or partially disassembled machines repaired by using non-original parts are also excluded from the warranty, as well as machines which have been attempted to repair by unauthorised persons.

Date:

Chief Executive Officer:

Dipl. Eng. Andrey Kosharov/

Use this Manual as an integral part of the machine. Keep it at hand for use throughout the whole life of the machine. Refer to it for any information concerning the proper transportation, storage, preservation, installation, commissioning, operation and maintenance of the slotting machines manufactured by us. This Manual will provide you with information and advice needed to solve various issues you may face.

Compliance with the requirements and recommendations in this manual will ensure sustainable, accurate, smooth and **safe** operation of the machine.

For any failure that cannot be corrected by you, please contact the repair service of Unitech – Troyan Ltd, Troyan, or the repair service of your local dealer.

1. Safe operation of the machine

This manual contains fundamental instructions that are to be complied with during installation, operation and maintenance of the machine. Therefore, the personnel involved in manufacture must read this manual before starting operation of the machine.

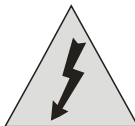
Not only the general safety instructions stipulated in this part, but also the special safety instruction included in the other parts of the manual must be complied with.

1.1. Identification of safety instruction in the manual and on the machine

The instructions in this manual that, if disregarded, can cause hazards to the operator, the machine and its functions are identified with an appropriate hazard symbol according to DIN 4844-2 D-W000.



The places of electric components fitted are identified with the electric hazard sign to DIN 4844-2 D-W008



1.2. Qualification of personnel and their training

The machine must be only operated, serviced and repaired by persons who are familiar with the present manual and have undergone training on the operation-related hazards. The area of responsibility, competence and supervision of personnel must be clearly determined by the user. If the operators do not have the required knowledge, they must be trained or instructed. The user must furthermore ensure that the personnel fully understands the contents of the manual.

Repair works not described in this manual may be only performed by specially authorized service shops.

1.3. Dangers due to non-observance of the safety instructions.

Non-observance of the safety instructions can lead both to implications for the personnel and for the environment and the machine itself.

Non-observance of the safety instructions can lead to the loss of any right to claim indemnification for the incurred losses.

In particular, non-observance can result in the following risks:

- danger to human life due to unsafe workplace
 - failure of important functions of the machine (stop, emergency stop, workpiece securing)
 - failure of prescribed methods for maintenance and conditioning

- danger to human health by mechanical influences

1.4. Carrying out work in a safety conscious manner.

The safety instructions set out in this manual, the existent nation-wide regulations for prevention of accidents as well as any internal operation and safety regulations must be complied with.

The occupational health and safety guidelines developed by the competent institutions and the accident prevention regulations are mandatory.

1.5. Safety instruction for the user.

1. Do not operate machines unless authorised and fully instructed on their operation and manner of action.
2. The machines may be only used for the functions they are intended for and in compliance with the received instructions.
3. Before starting your machine check whether it is properly functioning and all safeguards are in place.
4. Safeguards and protective devices should not be bypassed, removed or made non-functional.
5. Shut off the machine when not in use.
6. In case of failure never switch on any machine functions by forcedly activating the available limit switches.
7. Do not remove any cut cuttings manually, use the special tools (aids) provided for this purpose. For all operations required on the machine use only suitable hand tools.
8. Keep the tools, cleaning rags and machine attachments only in places intended for the purpose, not in the machine body, the gear box, etc.
9. Good order and cleanliness are the two essential prerequisites for secure operation. Therefore, keep the floor free and clean from any grease, oil and cut cuttings. Place workpieces and tools so as that they do not create risk for you and the other people present.
10. When using cooling fluid or oil protect appropriately your hands with protection equipment. Coolant may not be used for washing hands.
11. Report immediately any damage to your managers. Unauthorised repairs are unacceptable.
12. Use protective goggles if during work cut cuttings or dust are likely to be present around your face.
13. Wear only appropriate closed shoes meeting the requirements of the workplace. Open sandals or worn and inappropriate shoes are not acceptable. We recommend you to wear protective shoes.
14. Wear clothing that fits closely to the body. Loose clothing or wide sleeves are dangerous.
15. If there are specific instructions regarding the operation of specific types of machines, follow them closely.

1.6. Safety instructions for maintenance, inspection and installation work.

The user must ensure that maintenance, inspection and assembly work is performed by authorised and duly qualified specialists - adequately instructed in a comprehensive maintenance training course. The various maintenance works on the machine must be performed only while the machine is shutdown. When performing maintenance operations on a lifted implement always take appropriate safety measures by using props.

When changing working parts use appropriate tools and wear protective gloves. Thoroughly clean oil and grease.

After completion of the work all safety equipment must be refitted and brought into operating condition.

In case of recommissioning, the points listed in the commissioning section must be complied with.

1.7. Unauthorised modifications and manufacture of spare parts.

Modification or changes to the machine may only be made after consultation with the manufacturer.

An essential safety component are the original spare parts. The use of other parts can annul any responsibility for the consequences resulting from that.

1.8. Inadmissible modes of operation

The operational safety for the delivered machine is only guaranteed for its intended use as advised in s. 2.5. and 2.6. The parameter limits specified in Attachment 1 should not be exceeded.

2. Product details

2.1 Manufacturer details

Manufacturer:

Unitech – Troyan Ltd.
5600 Troyan
229, Gen, Kartzov str.
tel: +359 670 52117
fax: +359 670 52117
e-mail: office@unitech-troyan.com
URL: www.unitech-troyan.com

2.2. Passport details of Vertical Slotting Machine

| | |
|-----------------------|--|
| Type | |
| Factory No. | |
| Year of manufacture: | |
| Metric / inch version | |
| Power supply |V /Hz |
| Climatic version | normal for high humidity tropical climate |
| Weight | |

2.3. Location of the identification plate on the machine

The necessary data regarding the type of the machine, its factory number, year of manufacture, etc. is indicated on the control panel of the machine or on a separate plate fitted over the automatic lubrication pump.

2.4. Typical user of the machine

Typical users are small companies or machine-building enterprises which do not have specialised machines for machining keyways, splines or other specific shape channels in openings or outer surfaces.

The operation of the machine is relatively simple and does not require special training. The operator is required to possess basic knowledge in metal cutting and consult with the attached table of the respective cutting regimes for different materials (Attachment 1).

2.5. Intended use

The Stoss machines are vertical slotting machines. They are designed for cutting various shaped channels, machining of non-precise gears by copying the shape of the cutting tool, etc.



The machined surfaces should be open end holes and at least a minimum allowance should be ensured for the cutting tool to go out.

2.6. Applicability

2.6.1. Requirements to the room

The machine is virtually non-demanding to the installation room. It should be an indoor room, however, meeting the following requirements:

- the floor should be clean and not slippery to avoid incidents at work
- maintenance and repair area should be ensured, according to the dimensions in fig. 1

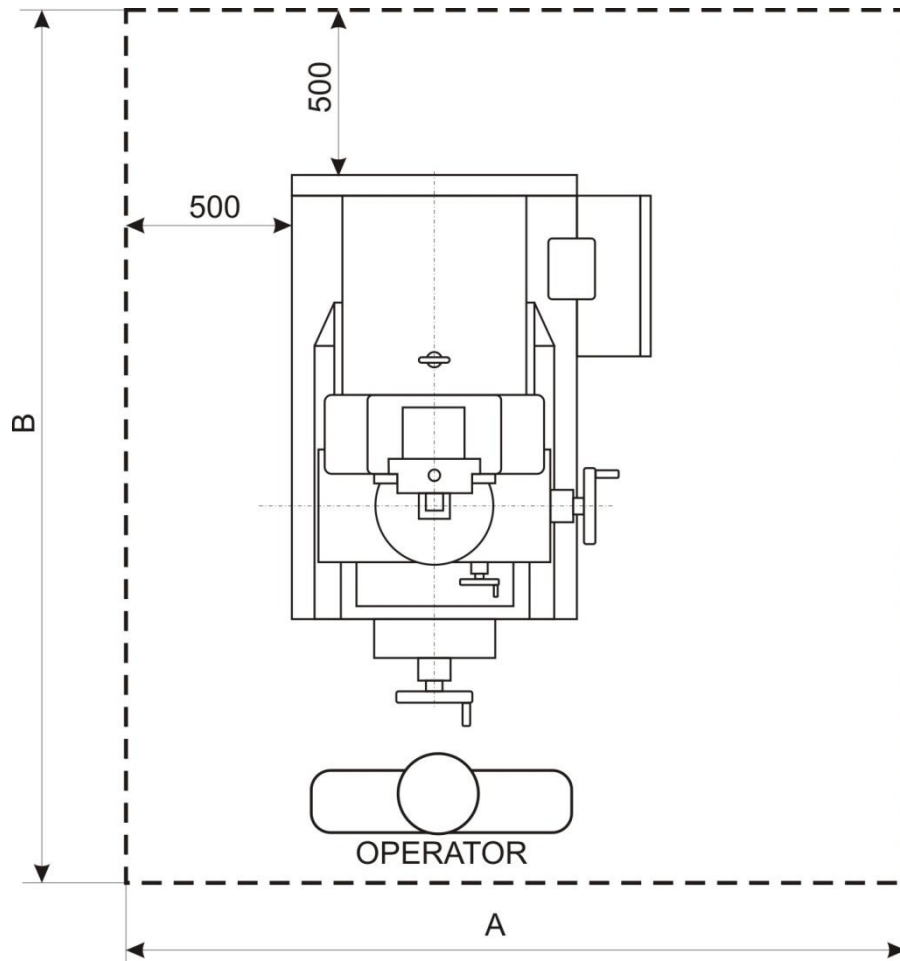


fig. 1

| TYPE | A | B |
|---------|------|------|
| S200TGI | 1950 | 2850 |
| S315TGI | 2100 | 3000 |

2.6.2. Environment

2.6.2.1. Humidity

Particularly sensitive to these environment characteristics are electric components. Therefore:



1. Machines not specified in this manual as intended for operation in high-humidity tropical climate must not be operated in such conditions.
2. After prolonged transportation, prior to commissioning, check the electric components and, if damped, dry them out in a suitable manner.

2.6.2.2. Temperature

The ambient temperature should be in the range from +10⁰ to + 40⁰ C. High temperatures make it difficult to cool the electric motor and the inverter and low temperatures worsen the performance of the lubrication system. The following combinations of humidity and temperature values should not be exceeded:

- 50 % relative humidity at +40⁰ C
- 90 % relative humidity at +20 C.

2.6.2.3. Explosive environment

This machine is not suitable for operation in atmosphere containing explosive substances.



Do not use the machine in explosive atmosphere. It is not designed to operate in such conditions. Otherwise, there is a serious risk of explosion.

2.7. Overall dimensions, weights, capacities

2.7.1. Overall dimensions and weights

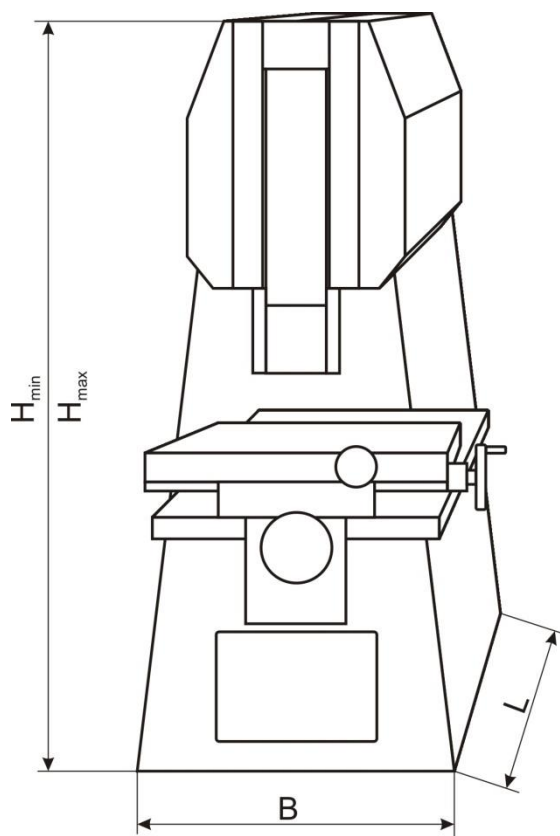


fig. 2

| PARAMETER | S200TGI | S315TGI |
|------------------------------|---------|---------|
| Length L, mm | 1350 | 1500 |
| Width B, mm | 860 | 1000 |
| Height H _{min} , mm | 1820 | 2250 |
| Height H _{max} , mm | 2120 | 2650 |
| Weight G, kg | 875 | 1310 |

2.7.2. Capacities

- | | |
|-------------------------------|-----------------------------------|
| 1. Coolant tank | 15 litres of coolant |
| 2. Automatic lubrication pump | 1 litres of oil for the slideways |
| 3. Reduction motor | 1 litre of transmission oil |

2.7.3. Basic dimension of the working area

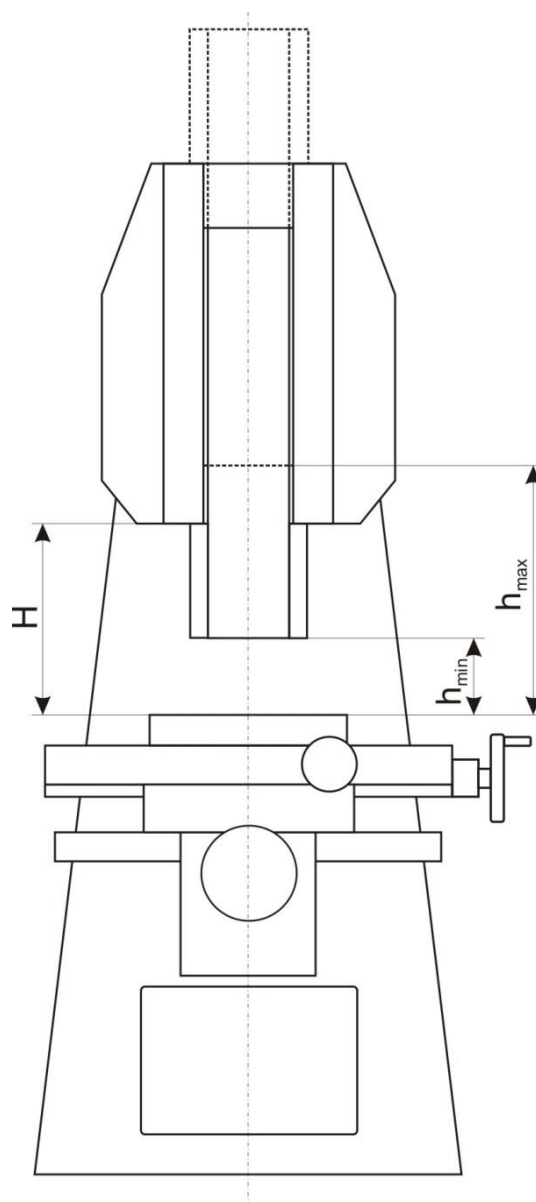


fig. 3

| PARAMETER | S200TGI | S315TGI |
|----------------|---------|---------|
| H, mm | 355 | 510 |
| h_{min} , mm | 80 | 145 |
| h_{max} , mm | 490 | 695 |

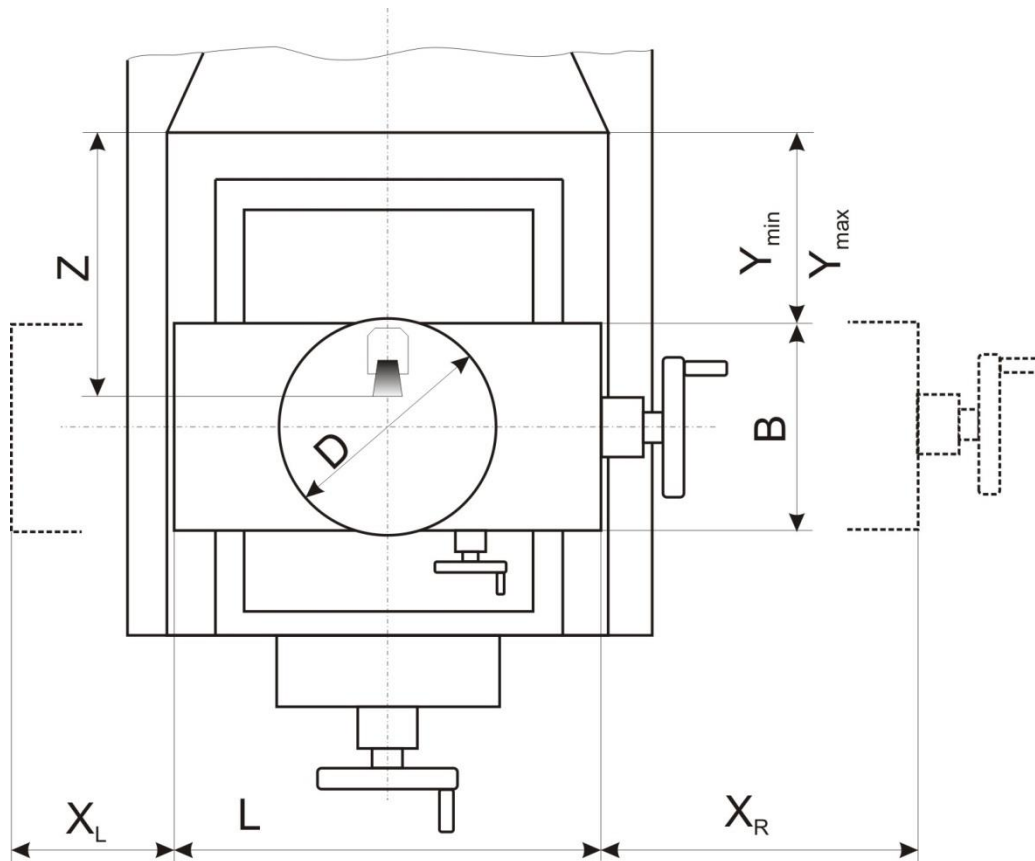


fig. 4

| PARAMETER | S200TGI | S315TGI |
|----------------|---------|---------|
| D, mm | 315 | 450 |
| L, mm | 600 | 700 |
| B, mm | 300 | 430 |
| X_L , mm | 70 | 85 |
| X_R , mm | 200 | 180 |
| Y_{min} , mm | 100 | 100 |
| Y_{max} , mm | 330 | 300 |
| Z, mm | 350 | 460 |

2.8. Electric system

The machine is equipped with a main drive, cooling pump, automatic lubrication pump, low-voltage illumination lamp, electric panel, electric controls and connection cables.

The electric systems is available in two main drive options:

standard option – with a speed controlled three-phase induction motor with short-cut rotor windings and a 4 kW brake.

b) customised option – with a motor variator group and electric control, 1.1 kW for S200TGI and 2.2 kW for S315TGI

The electric system is designed according the customer's specifications for the mains voltage and frequency. The control and lighting circuitry is powered via a low voltage transformer with output voltages of 24V AC and 12V AC, respectively.

A schematic diagram of the electric system is shown in fig. 5.1. and 5.2.

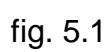


fig. 5.1

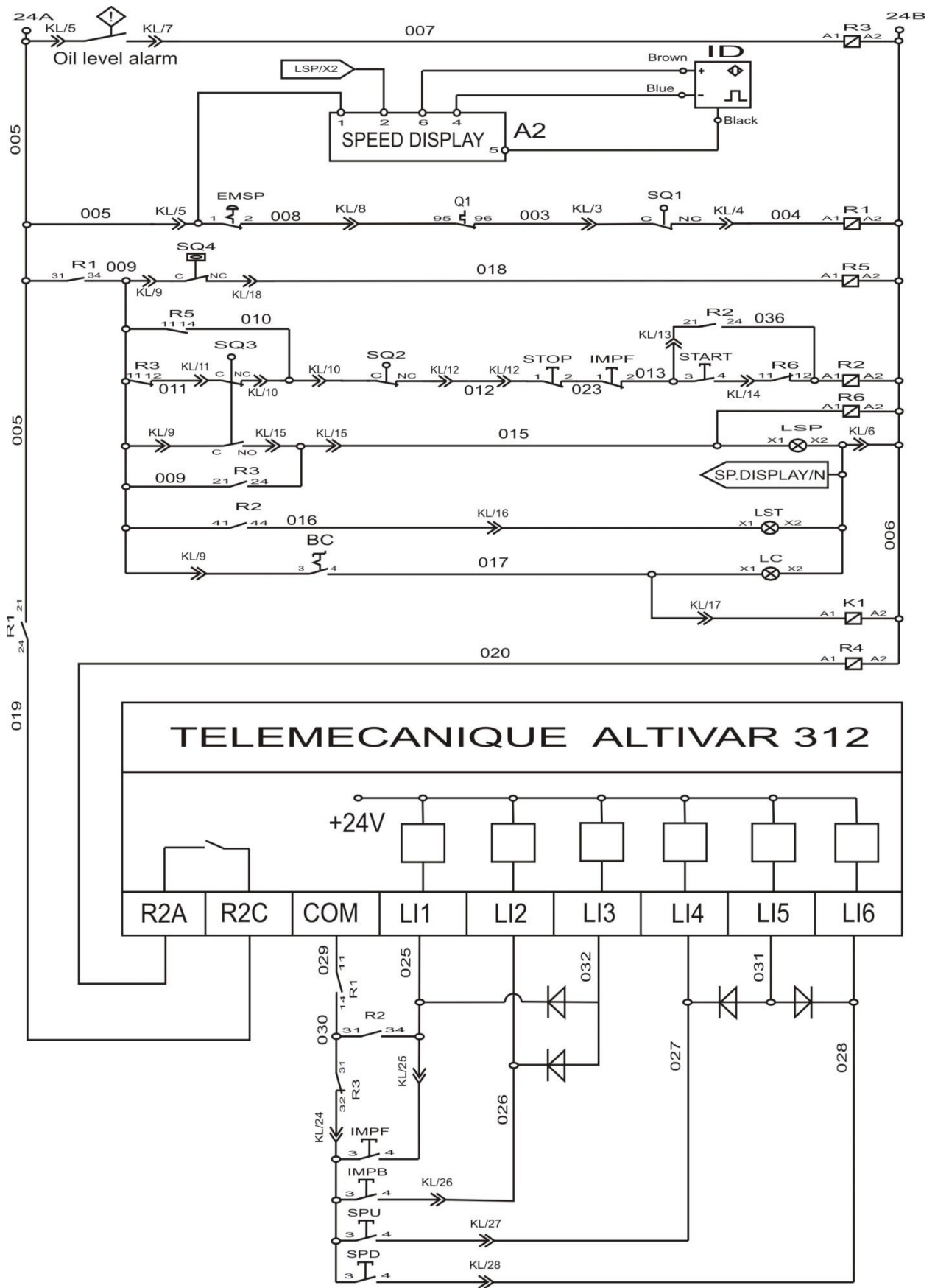


fig. 5.2.

2.8.1. Power supply requirements

For normal operation of the machine the mains parameters should be within the following limits from the rated values:

- voltage – from +10% to -15%
- frequency - $\pm 2\%$

2.8.2. Power consumption

The machine is powered by electricity. The power consumption is as follows:

- main drive motor – 4 kW
- coolant pump – 0.06 kW
- automatic lubrication pump – 0.04 kW
- illumination lamp – 0.02 kW

Total power demand – 4.12 kW

2.8.3. Connection to the mains

The machine is delivered to the customer with its electric, cooling and lubrication systems fully ready for operation. It needs only to be connected to the mains by a power cord.

The connection must be implemented by a qualified electrician. When doing this, comply with the following instructions:



1. Check if the electrical specifications of the machine match those of the mains.
 2. If the electric motors are too dampened (due to being kept in a damp room, prolonged transportation or other reasons), check the insulation resistance (of the main drive motor, in the first place) and replace if necessary. It should not be less than 0.1 M Ω .
 3. The resistance between the yellow-green zeroing terminal on the panel and any exposed metal part of the machine must not be more than 0.1 Ω .
 4. The cross section of the power cord should be adequate to the total power demand of the machine. The cord should enter the machine through the opening in the lower part of the electric panel.
 5. The zero lead of the power cord is to be connected to the 'N' terminal of the panel and in case of five-wire mains the 'PE' cable from the mains is to be connected to the 'PE' terminal on the panel.
-

2.9. Personal protective equipment

Operation of the machine does not require any special personal protective equipment.

2.10. Transportation, storage, installation, fastening and dismantling

2.10.1. Transportation and storage

The machine may be transported in any type of closed vehicles. It is dispatched from the manufacturer's premises on a skid and secured to it by bolts. Upon customer's request the machine can be packaged in a wooden case.

Lifting and loading on vehicles can be performed by either of the following methods:

1. By a crane, with the ropes passing through as shown in fig. 6

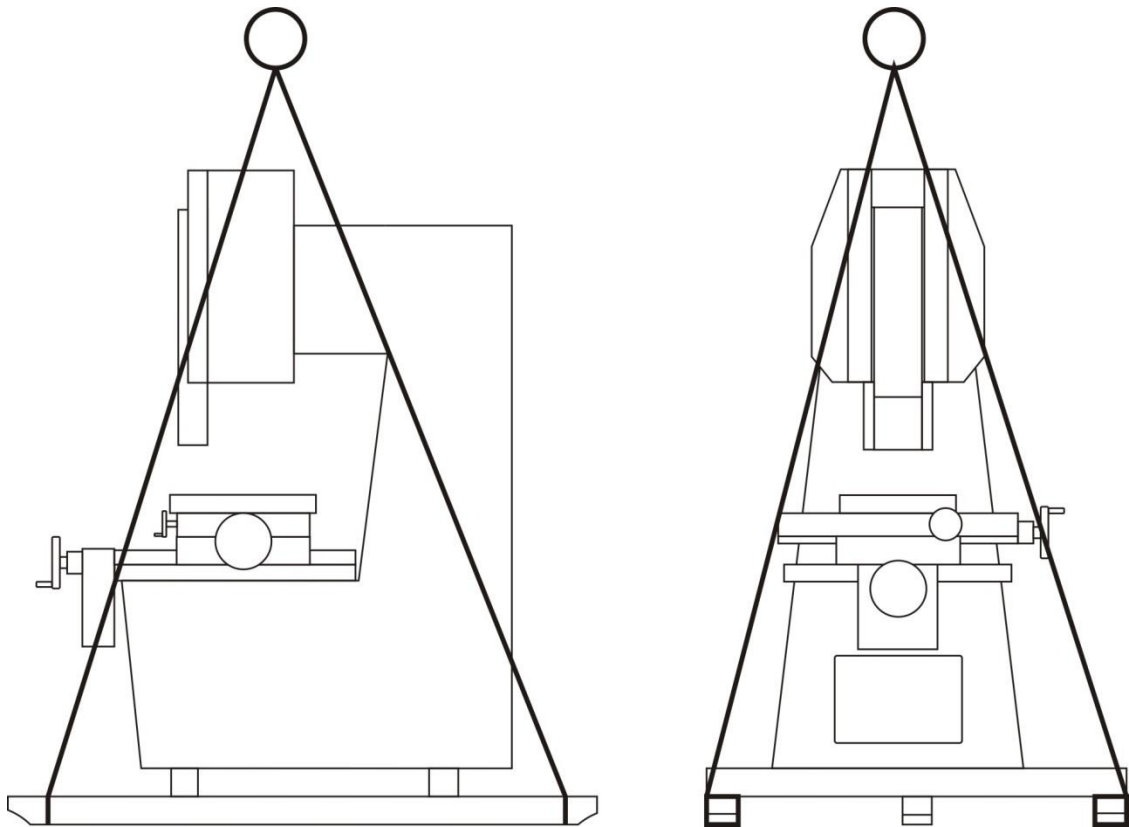


fig. 6



The loading capacity of the crane and the ropes must be adequate for the machine weight.

2. By a forklift truck.

In this case the truck forks are to be inserted on both sides of the middle beam of the skid or case. The forks should be long enough to pass under all transversal beams of the skid or case.



1. Do not stay under the lifted machine. There is a risk of serious injury.

2. Do not lift the machine using forklift whose lifting capacity is lower than the machine weight.

3. The ground on which the forklift travels should be as flat as possible and without any longitudinal or lateral slope. Due to the height of the machine being much larger than its other dimensions there is a risk of tilting and tripping.

During transportation, the machines are to be arranged according to the driver's instructions with the skids secured by wooden blocks on both sides, on the front and the rear. In addition, because of the high gravity centre of the machine, it must be strapped by belts as shown in fig. 7.

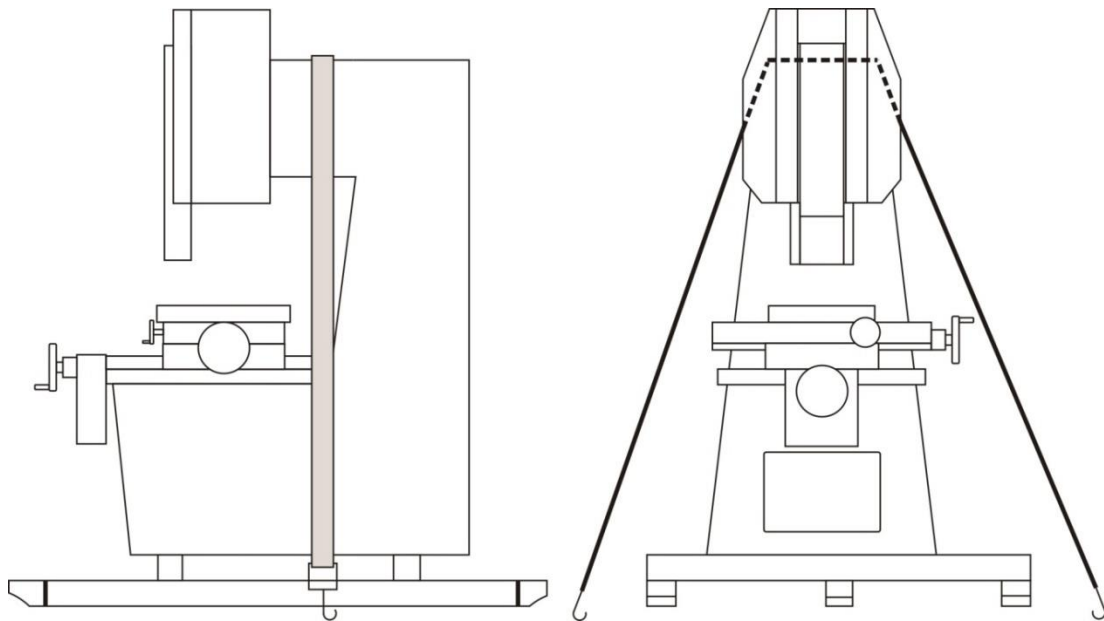


fig. 7

While in storage, the machines should be arranged tightly one to the other, indoors in any case. The temperature of the room should be from 0°C to $+50^{\circ}\text{C}$. In case of long-term storage, depending on the humidity, it might be necessary to unpack, clean and repack the machine for conservation.

2.10.2. Unpacking

If the machine is shipped only on a wooden skid, it is wrapped in packaging foil. To unpack such machine proceed as follows:

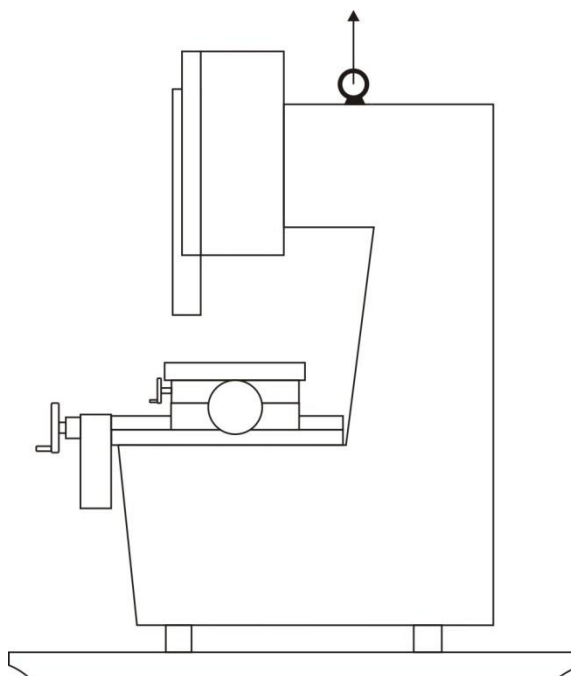


fig. 8

1. Tear the foil open and remove it from the machine.
2. Remove the front and rear covers. Unscrew the nuts securing the machine to the skid.
3. By using a crane lift the machine hooked in the ring on its top - fig. 8 and unload from the skid.

If the machine is in a wooden case, remove the case cover first, then the side panels and further act in the same manner as above.



Before lifting, check if the ring is firmly secured to the machine body.

2.10.3. Cleaning

Clean the rust-preventive grease by non-corrosive solvents. After removing the conservation grease, lubricate the clean unpainted surfaces by applying a thin oil film. Non-moving unpainted parts may be left covered with conservation grease.



When removing the conservation grease use solvents that are safe for the face and the hands. As in most cases the solvents are highly inflammable, observe all regulations applicable to the use of inflammable liquids.

2.10.4. Mounting, fixing, fastening

2.10.4.1. Mounting

Handle the unpacked machine by a crane. Hook the crane rope into the ring on the top of the machine body as shown in fig. 8.



The loading capacity of the crane and the rope must be adequate for the machine weight.

2.10.4.2. Fixing, fastening

The Stoss machine does not need special levelling provided the working ground is sufficiently even and with cement floor. For more stable operation it needs to be fastened to the floor by 4 bolts according to the diagram in fig. 9. You may use anchor bolts or make 100 x 100 mm holes and cement ordinary M12x150 bolts in them.

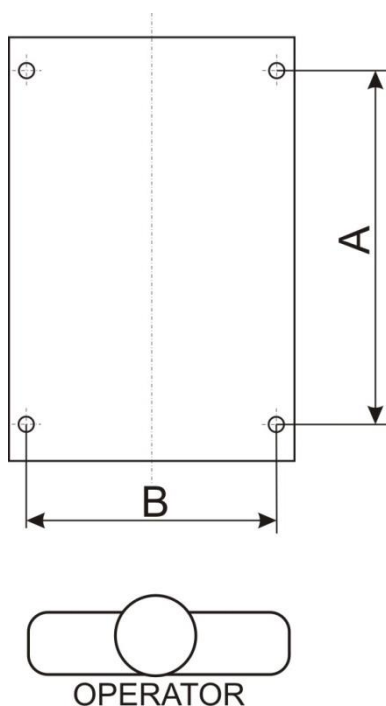


fig. 9

| SIZE | S200TGI | S315TGI |
|------|---------|---------|
| A | 615 | 730 |
| B | 500 | 620 |

2.10.5. Dismantling, packing, loading

2.10.5.1. Dismantling

1. Disconnect the power cord from the mains.
2. Open the electric panel and disconnect the power cord from the terminals and then remove it from the panel.
3. Remove the front and the rear covers and unscrew the nuts fastening the machine to the floor.
4. Lift the machine by a crane as described in s. 2.10.4.1. and mount it on the wooden skid from which it was originally removed.

2.10.5.2. Unpacking

Apply thin oil film or conservation grease on all unpainted surfaces depending on the destination and the time during which the machine will be conserved. If the period of transportation and non-operation will not exceed 15 days and the machine is not shipped by sea, no special conservation greases are required.

Wrap the machine in packaging foil (stretch).

2.10.5.3. Loading

See s. 2.10.1.

3. Operation manual

Technical specifications

| Pos. | PARAMETER | S200TGI | S315TGI |
|------|--|--------------------------|--------------------------|
| 1. | Tool stroke length | 0 – 200 mm | 0 – 315 mm |
| 2. | Maximal width of the machined channel for materials with $\sigma_B=600 \cdot 10^6 \text{ N/m}^2$ | 16 mm | 18 mm |
| 3. | Strokes per minute | 17 – 60 | 17 – 60 |
| 4. | Ram height adjustment | 210 mm | 235 mm |
| 5. | Swivel angle of the head | $\pm 45^\circ$ | $\pm 45^\circ$ |
| 6. | Head to table distance | 355 mm | 510 mm |
| 7. | Tool to column distance | 350 mm | 460 mm |
| 8. | Rotating table diameter | 315 mm | 450 mm |
| 9. | Number of rotating table indexed positions | 24 (15°) | 24 (15°) |
| 10. | Longitudinal travel of worktable | 270 mm | 265 mm |
| 11. | Table transverse travel | 230 mm | 200 mm |
| 12. | Main motor power rating | 4 kW | 4 kW |
| 13. | Net weight | 875 kg | 1310 kg |
| 14. | Overall dimensions | 860 x 1350 x 1820 mm | 1000 x 1500 x 2250 mm |
| 15. | Overall dimensions on a wooden skid | 1100 x 1500 x 2050 mm | 1150 x 1800 x 2450 mm |

Automatic tool stop

Adjustable number of strokes per minute

Luminous display of the number of strokes per minute

Automatic cycle of longitudinal feed by steps from 0 to 0.3 mm per stroke.

3.2. Geometric accuracy verification report

Type:

Factory number:

Year of manufacture:

| Pos. | Parameter and method of verification | Tolerance, mm | Deviation measured, mm |
|------|---|--|------------------------|
| 1. | Flatness of the working surface of the rotating table Put two equal height gages on the rotating table. Place a standard ruler on them. Measure the distance between the table surface and the ruler in different directions. | 0.02 mm at a length of 300 mm, only concavity is admitted. | |
| 2. | Pulsation of the working surface of the rotating table in axial direction Fix a dial indicator in the toolholder so as to touch the table surface by its probe tip. Turn the table at 360° | 0.03 mm at 300 mm diameter | |
| 3. | Perpendicularity of the ram travel to the work surface of the rotating table. Fix a dial indicator in the toolholder so as to touch by its feeler tip the vertical arm of an engineer's square placed on the table. Check the tolerance in two perpendicular directions – longitudinal and transversal to the table | 0.03 mm at 300 mm length | |
| 4. | Precise parallel alignment of the machined surfaces of a workpiece. Machine two opposite channels on the surface of the workpiece (by rotating the table at 180°). The length of the channels (and of the workpiece) should be ½ of the maximal tool travel. Place flat parallel end gages in the channels. Check the parallelity by a micrometer. | 0.03 mm at 300 mm length | |

Date:

Verified by:

3.3. Machine description:

Fig. 10 shows a general view of the machine, where the positions 100 – 810 identify the main machine assemblies (groups).

MAIN ASSEMBLIES:

- 100 - Body
- 210 - Base
- 215 – Drive gear box
- 220 – Intermediate slide
- 235 – Rotating table
- 300 – Toolhead
- 310 – Ram
- 320 – Toolholder
- 400 – Guards (safety device)
- 500 – Cooling system
- 600 – Drive
- 700 – Lubrication system
- 800 – Electric system
- 810 – Control panel

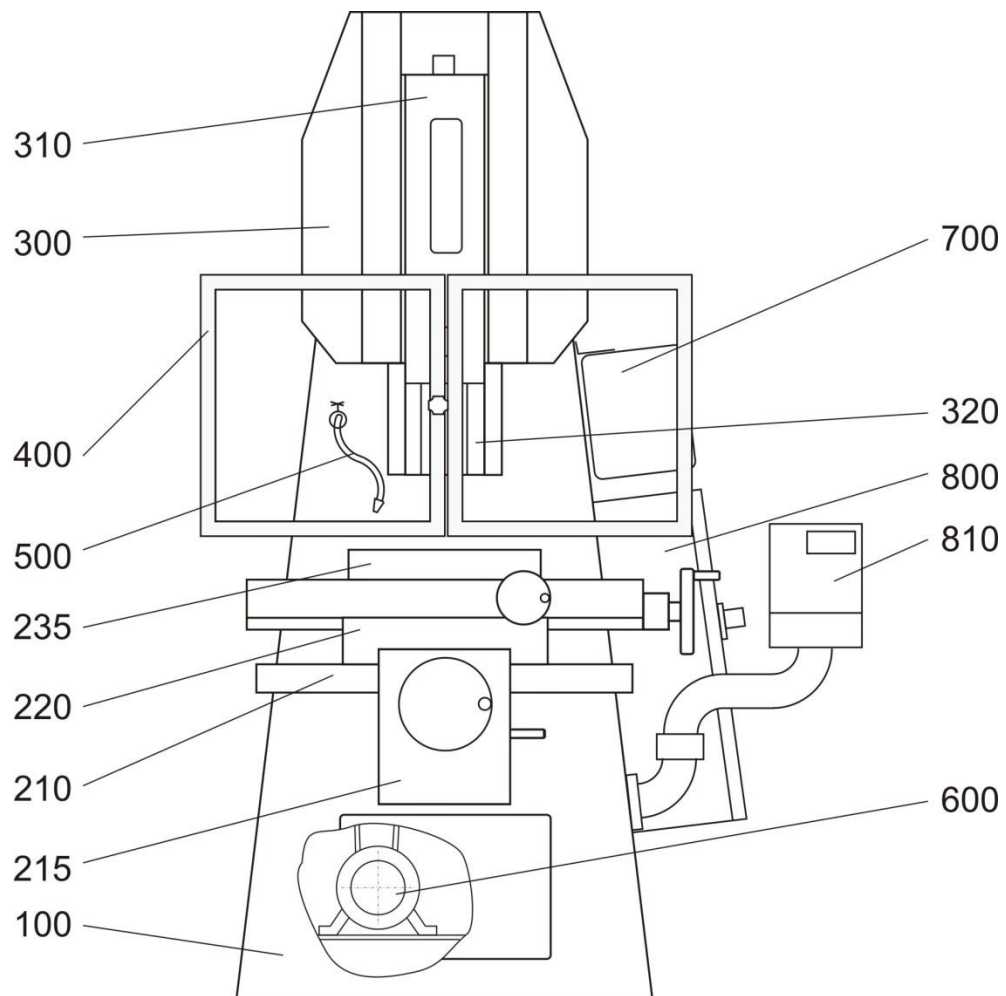


fig. 10

CONTROLS

Fig. 11 shows the machine controls.

1. Turnwheel for manual transversal feed of the table
2. Turnwheel for rotating the table
3. Handle for fixing the rotating table
4. Handle for switching to automatic transversal feed of the table
5. Handle for increase/decrease of the transversal feed rate
6. Turnwheel for manual longitudinal feed of the table
7. Limit switch for automatic transversal feed
8. Ram height adjustment bolt
9. Cutting rate (strokes per minute) indication display
10. Emergency stop button
11. Stop button (red) of the main driving motor
12. Start button (green) of the main driving motor
13. Cooling start button
14. Adjustment button – left rotation of the main motor
15. Adjustment button – right rotation of the main motor
16. Main motor speed decrease button
17. Main motor speed increase button
18. Main circuit breaker

3.3.1. Main assemblies

3.3.1.1 - Body

In fig. 10, “100” denotes the machine body. It supports all other assemblies and ensures stability of the machine during work. It is manufactured as a welded structure of steel sheet material.

3.3.1.2 - Base

In fig. 10, “210” denotes the base of the . It bears the intermediate slide and the rotating table.

3.3.1.3. Drive gear box

In fig. 10, “215” denotes the gear box. Its main function is to produce automatic transverse feed of the table.

It is driven by the shaft 1. To the front end of the shaft is fitted a cam 2 with a radial ball bearing 3 on it. When the shaft 1 rotates, the bearing pushes the rocker 5 upwards. It in turn abuts against the cam 4, which is connected to the handle for adjustment of the automatic transversal feed (pos. 5 in fig. 11). The higher the cam 4 raises the rocker 5, the smaller is the contact area between it and the cam on the bearing 3, i.e. the rocker and the rack bar 6 driven by it will have a smaller stroke.

By its movement up and down under the action of the rocker 5 and the spring, the rack bar 6 makes the gear 7 to oscillate, which in turn drives the gear 8. The gear 8 is mounted on the unidirectional bearing 10, whose inner ring is mounted on the table driving screw.

The oscillating gear 8, via the bearing 10, drives the screw when rotating in one direction and disengages in the other. Thus is produced the working feed of the table.

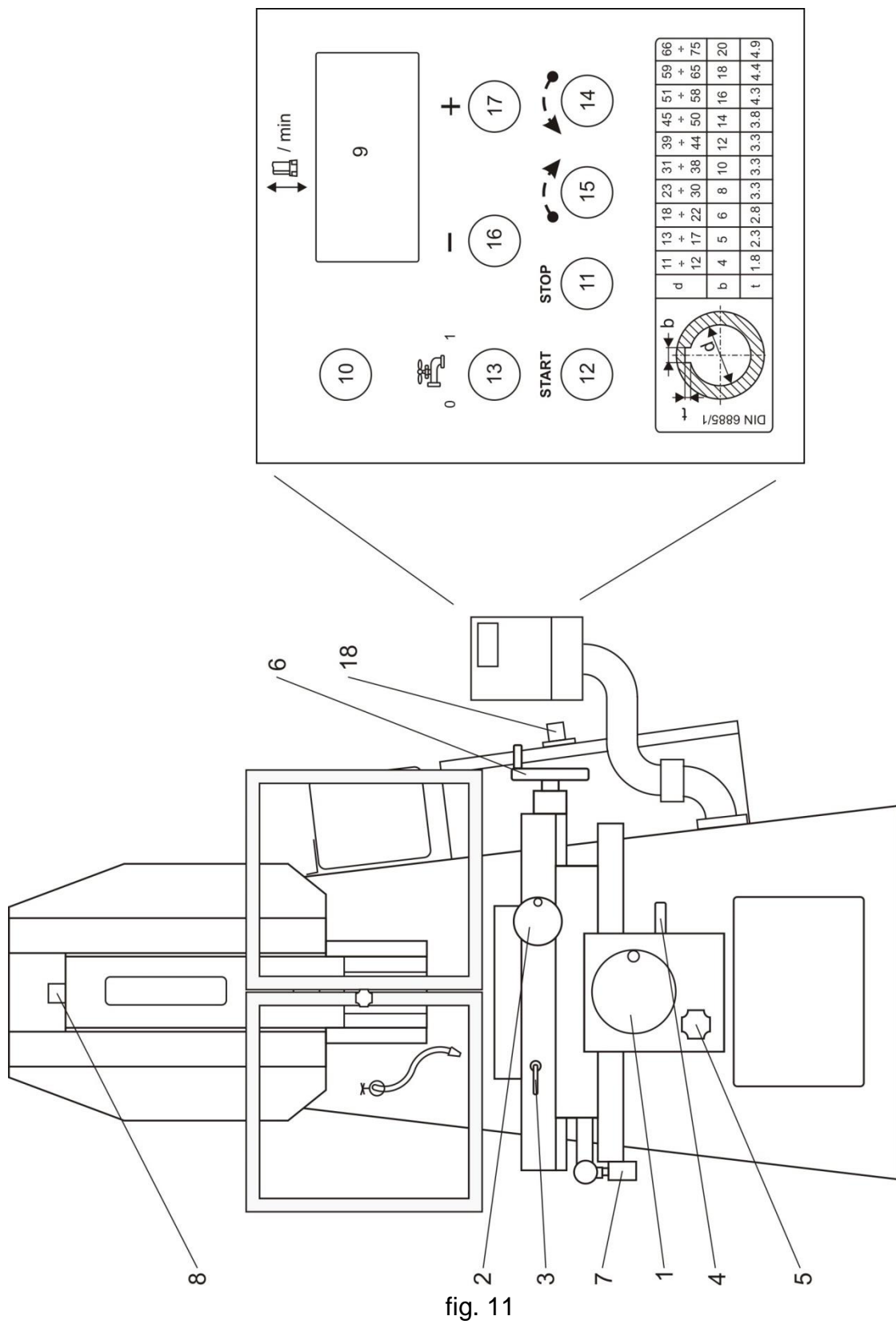


fig. 11

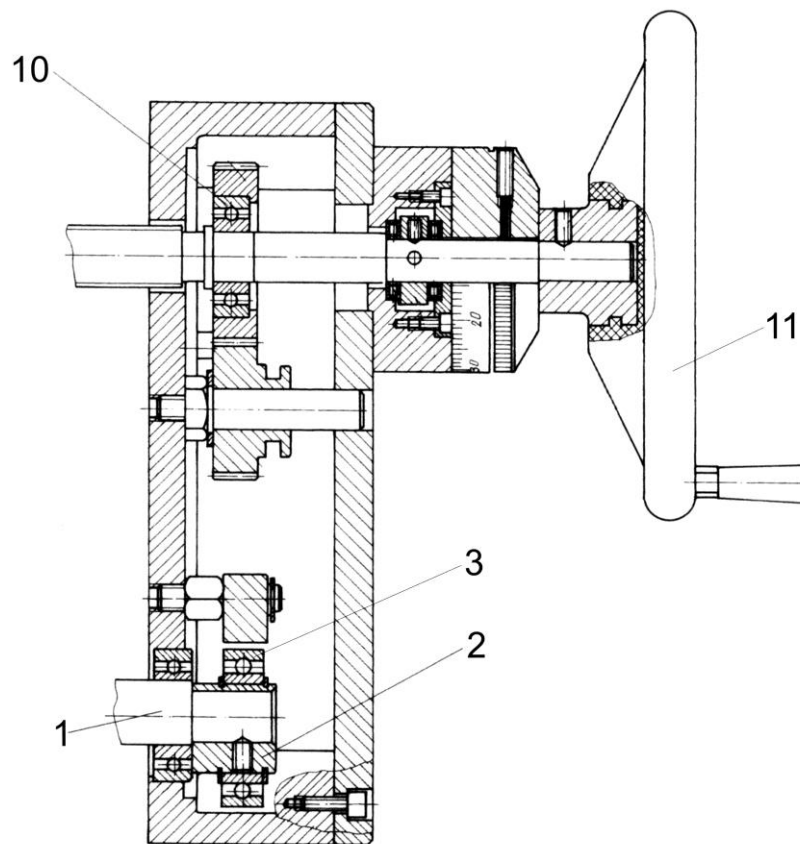
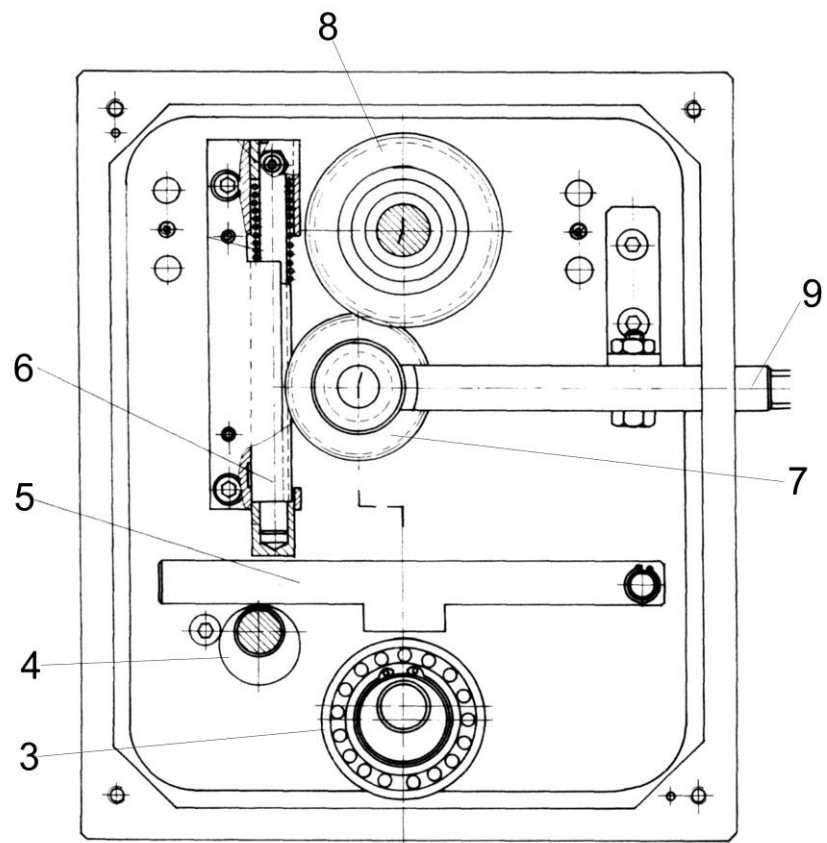


fig. 12

Important! When the cam 4 reaches the left end position (with the handle turned counter-clockwise to the end), no feed is performed. The handle 9 is used to switch the automatic feed on and off. When pressed inwards to the machine, the wheel 7 disengages 6 and 8 and feeding ceases.



Feeding must be switched on while the machine is in motion because, when standstill, teeth of the gear 7 may coincide with teeth of gear 6 or 8 making engagement impossible.



Drive the table manually by using the handle 11 only when the automatic feed is switched off.



Do not unscrew the fastening screw of the feed rate increase/decrease handle, because the cam 4 may instantly return to the lower position leading to uncontrolled increase of the feed rate to the maximum which can result in breakdown of the tool and risk of injury for the operator.

3.3.1.4 – Intermediate slide

In fig. 10, “220” denotes the intermediate slide. Its main function is, by moving along two perpendicular slideways, to connect the base and the table of the machine. On the transversal guide, the intermediate slideway and the assemblies on it move in direction from the operator to the machine (transversally) and along the other guide the table moves longitudinally. Longitudinal movement is performed only manually, by using the turnwheel 6 shown in fig. 11, while transversal movement may be performed manually or automatically - by the drive gear box. Automatic movement is only possible in the direction from the operator to the machine.

Note: The terms longitudinal and transversal here are indicative only, but they are chosen by analogy with the universal lathes, namely, the cutting feed is called transversal, and the perpendicular movement – longitudinal.

3.3.1.5 – Rotating table

In fig. 10, “235” denotes the rotating table. There is no principal difference between S200TGI and S315TGI. The differences are in the dimensions. The table diameter for S200TGI is 315 mm, and for S315TGI – 450 mm.

The workpiece is placed on the table – directly on the table surface, in a multifunctional holder, or otherwise. The rotating table itself, pos. 2 in fig. 13, is mounted on the longitudinal machine table, called rotating table support (pos. 1). It has a central opening where the special mounting flange, pos. 3, is inserted, with the wormgear 10 fitted on it. The flange is supported by two bearings in the base of the rotating table – the radial bearing 12 and the tapered roller bearing 11, through which the rotating table is tightly fastened to the face surface of the support by the nut 13. The wormgear and the table are driven by the worm drive 9 and the handle 14. On the lower surface of the rotating table there are 24 (at 15°) hardened conical couplings. When the table is rotated, they pass over the index finger 7, which enters the conical opening of the coupling and thus ensures precise positioning of the table (so called direct indexing). This allows fast and precise positioning (avoiding any plays of the dividing mechanism, with a tolerance of 0.02 mm of the position of the machined channel at a diameter of 400 mm) for machining of the most common slotted bushings, namely those with 2, 3, 4, 6, 8, 12 or 24 channels. The index finger is released by operating the cam 16 and the handle 15. When the handle is turned counter-clockwise, the cam retracts the index finger in its opening and allows the table to rotate.

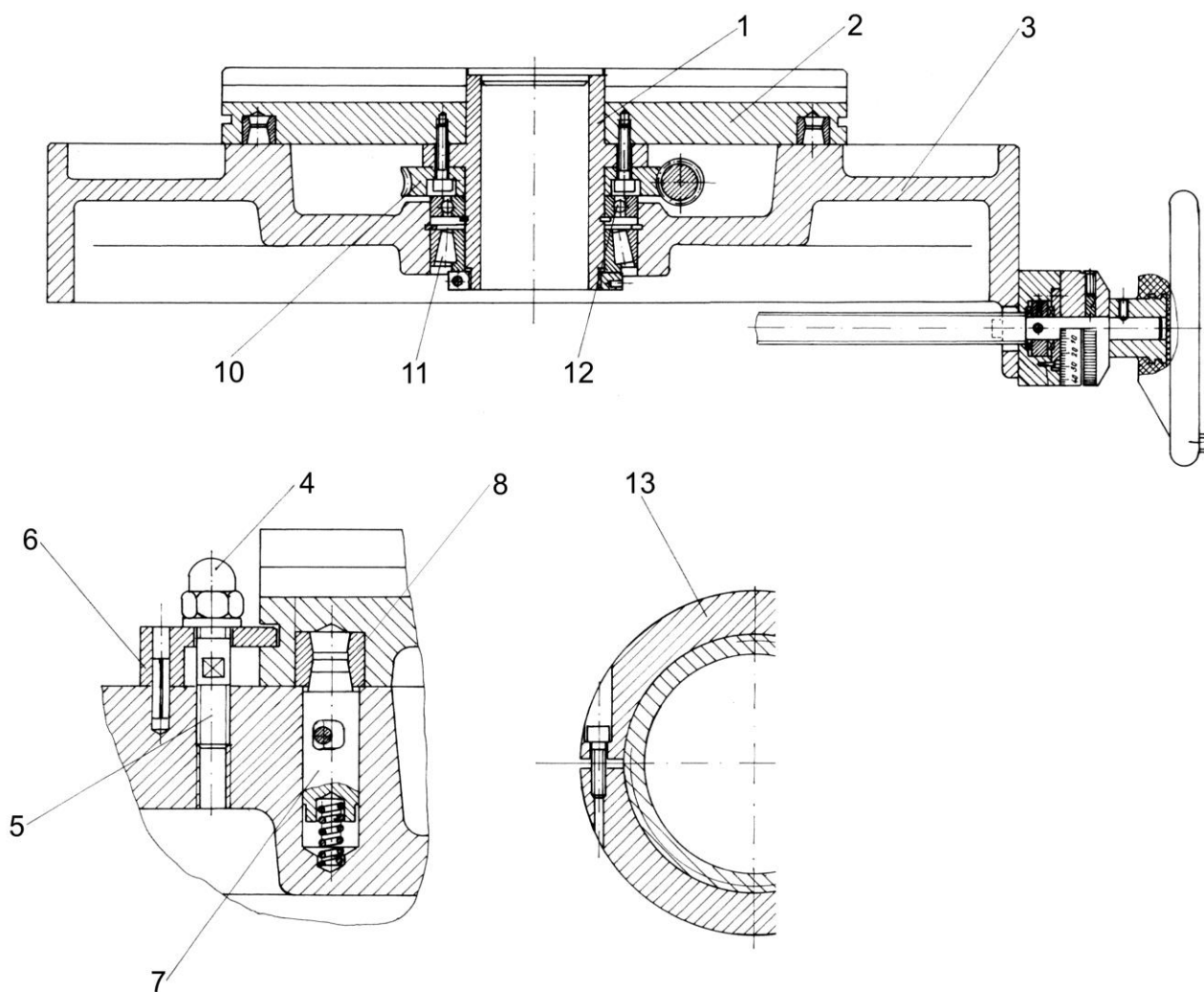


After adjusting the longitudinal position of the table, block the longitudinal movement by operating the handle 21. The rotation is blocked by the two nuts 4 in fig. 13. Do not overtighten. In general, it is sufficient to tighten to a torque of 10 – 15 Nm.



Always ensure that the workpiece is fixed in such a way that the machined channel is as close as possible to the transversal centre line of the rotating table. If the channel is offset from the centre line, the forces generated in the cutting process will try to rotate the table, which will require overtightening of the nuts 4 and still will affect the channel tolerance.

OPTION: To more precise readout of the rotation at an arbitrary angle of the rotating table, an option is available with an electronic readout with 0.01^0 accuracy (meaning 0.02 mm tolerance of the channel position at 200 mm diameter).



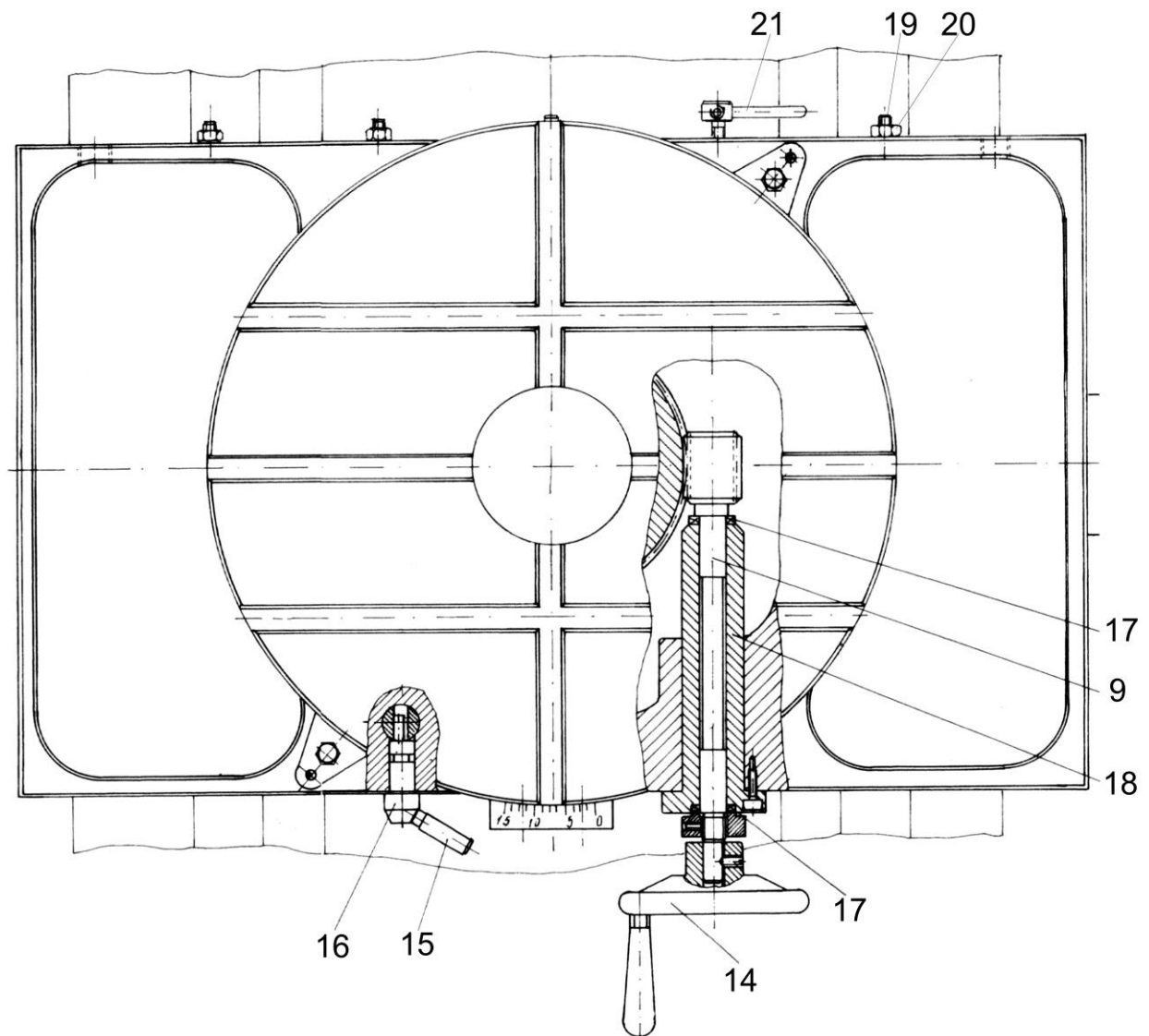


fig. 13

3.3.1.6 – Toolhead

Its main function is to support the ram with the toolholder where the machining tool is mounted and through its slideways ensure their secure and clearance-free guiding during their movement.

The head is fixed to the machine body by 4 special bolts M16, whose heads freely move in a T-channel in the machine. This allows to turn the head for machining of inclined channels.



Do not turn the head to more than 45° . There is a risk for the head of any of the two lower bolts to go out of the channel "A" (see fig. 14)

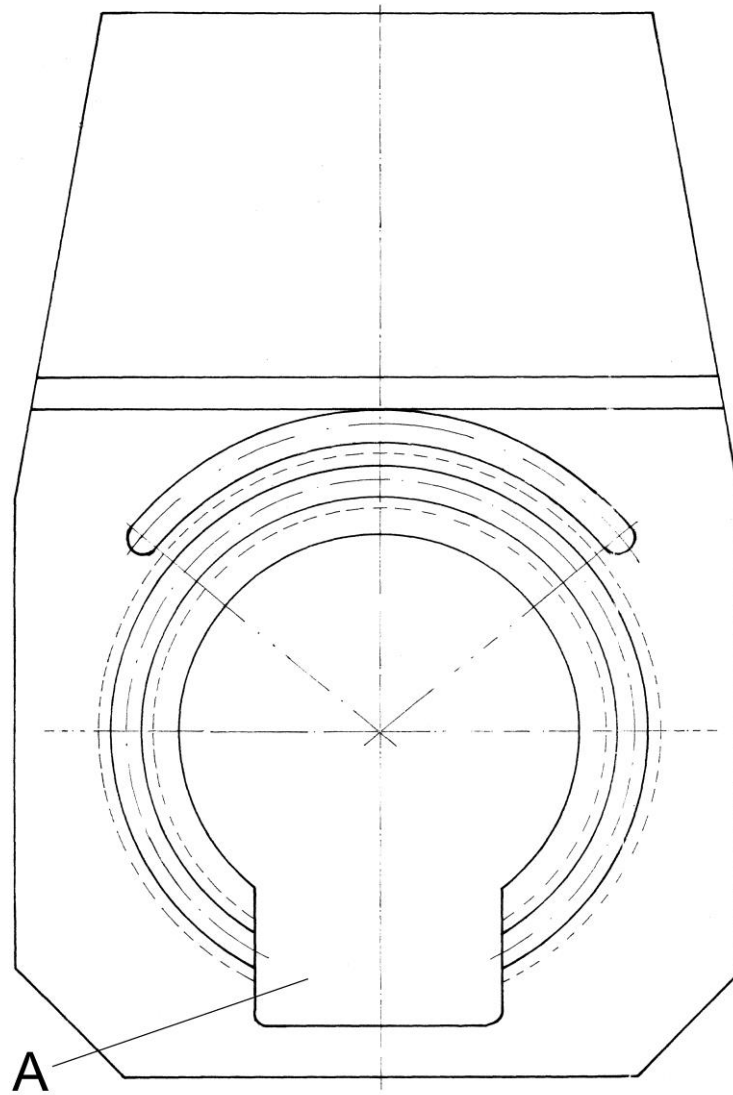


fig. 14

3.3.1.7 – Ram

In fig. 10, “310” denotes the ram of the machine. It moves forth and back and bears the tooholder. The ram is fine machined to match the guiding surfaces of the head. Its cutting stroke can be adjusted continuously from 0 to 205 mm for S200TGI and to 320 mm for S315TGI.



Due to machine design characteristics, the shorter is the ram stroke, the lower is the cutting torque required, which allows to machine wider channels. Therefore, do not set an excessively long ram stroke when machining short channels. The stroke is normally adjusted so that the tool travels about 10 mm after the end of the channel and retracts at 30-40 mm over the channel. This will ensure adequate distance for activating the mechanism for detaching the tool from the workpiece during the return stroke.

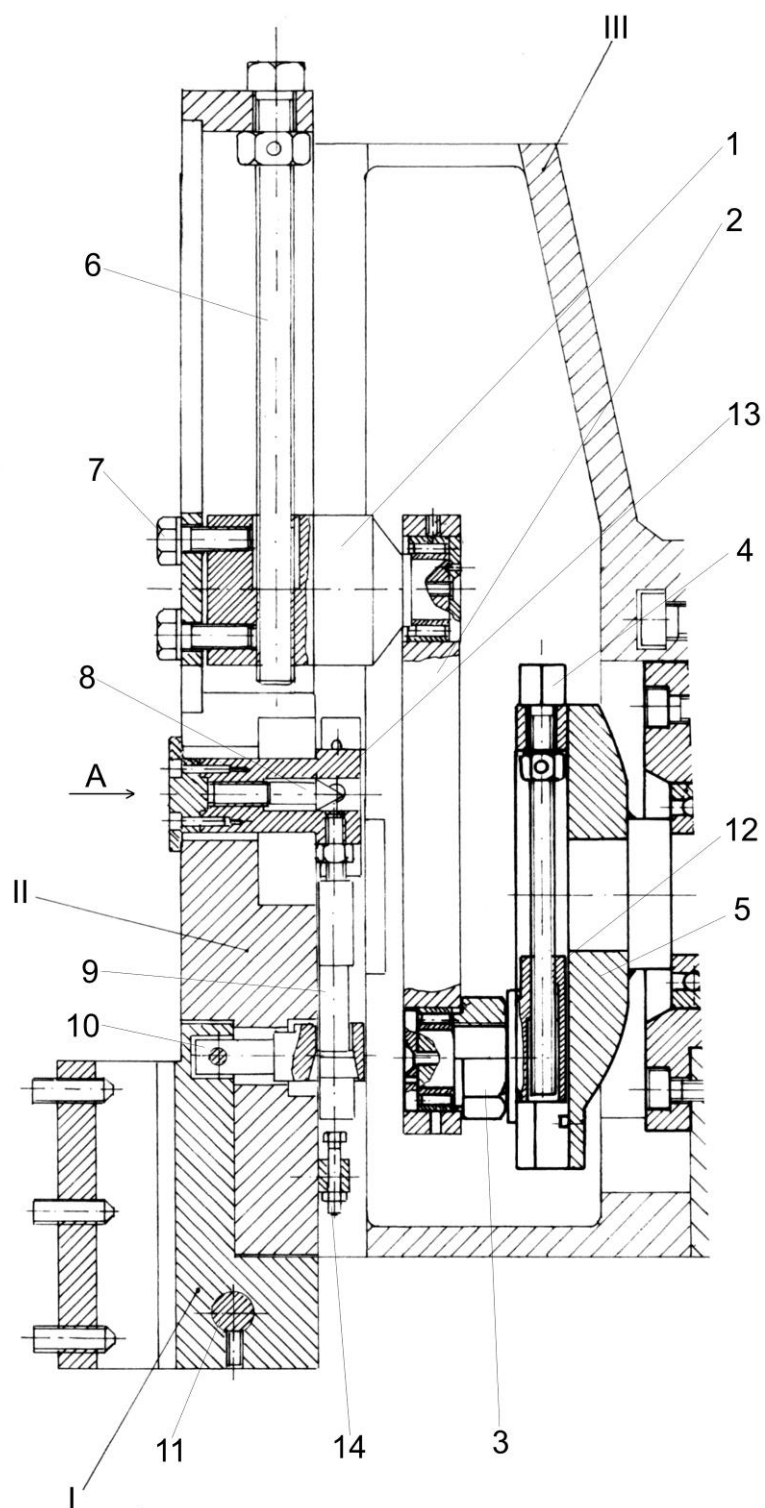


fig. 15

The ram stroke length can be increased or decreased in the following manner – fig. 15.

1. Remove the safety window in the right part of the head. By using the black buttons on the control panel rotate the connecting rod of the machine so that the nut 3 in fig. is positioned against the window.

2. Untighten the nut by using the S55 wrench from the machine tool kit.
3. Using the black buttons rotate the connecting rod 5 again so that the head of the screw 4 faces the window. Rotate the screw 4 clockwise to decrease the stroke length or counter-clockwise to increase it.
4. Rotate the connecting rod again so that to be easier to tighten the nut 3, tighten it and mount the safety glass again.

Now the new stroke length is set.



During the steps described in 1 – 4, while making adjustments in the head opening, always keep the machine emergency stop button pressed (or the power supply shut-off). Otherwise there is a risk of unintended operation of the machine and dangerous injuries.

Apart of the ram stroke length, the ram height can be also adjusted with respect to the machine head. This is done to ensure the required position of the tool with respect to the machined workpiece.

It can be achieved as follows – fig. 15.

1. By using the black buttons on the control panel move the ram at the lower end position.
2. Loose the two bolts 7. Turn the bolt 6 so that the cutting tip of the mounted tool travels 6-10 mm past the lower end of the machined channel.
3. Retighten the bolts 7.

Now the ram height is set.



During the steps described in 1 – 3, while operating in the head opening, always keep the machine emergency stop button pressed (or the power supply shut-off). Otherwise there is a risk of unintended operation of the machine and dangerous injuries.

3.3.1.8. Tool holder

In fig. 10, “320” denotes the toolholder of the machine. In fig. 15 it is denoted by “I”. The toolholder is equipped with a lever, whereby, during the upward (non-cutting) travel of the ram, the tool is pulled apart from the channel surface to prevent friction.

The method of action is as follows:

In two side openings of the bushing 13, friction pad jaws are mounted which, during the ram travel, contact the inner surface inside the head

When the ram is moving downwards, under the action of friction force the jaws pull the bushing 13 upwards, it pulls the special outwards inclined axis 9, which in turn retracts the lever 10. The lever retracts and fixes the toolholder to the ram. In this position, the tool is fixed and performs cutting.

When the ram starts moving upwards, the whole system operates in the reverse mode: 9 starts moving downwards and releases 10, and, under the tension of the spring, the toolholder turns slightly around the axis 11. In this position the tool is detached from the workpiece.

If this mechanism does not operate properly when the machine is put into operation, by using the alien key S8 through the face opening “A”, carefully and stepwise tighten the taper key 8 which fastens the friction pad to the head until the mechanism starts operating.



Turn the alien key at not more than 60°, then start the ram to check if the tool detaches. Fast tightening to a greater angle can block the ram and cause a damage.

By adjusting the support bolt 14 in the rear part of the ram, set the detachment clearance between the tool and the workpiece during the reverse stroke of the ram.

3.3.1.9. Guards

In fig. 10, “400” denotes the protective guard of the machine working area.

It is intended to protect the operator from cuttings, coolant fluid, etc., and prevent potentially dangerous access in the working area of the machine during operation. It is designed so as to allow excellent monitoring of the machining process without any risk of injury. A shut-down switch installed between the two half-guards stops the machine when they open.



During adjustments of the machine, it may be necessary to operate machine controls with opened guards. For this purpose, the machine can be operated for a short-time by the black forward and reverse stroke buttons which are not self-locking. OPERATE WITH CAUTION!

3.3.1.10. Cooling system

In fig. 10, “500” denotes the cooling system. The coolant tank is accommodated in the machine body (the front left part), on a special stand. It can be serviced after opening the machine front cover. The cooling fluid is drawn by the pump on the tank cover to the frontal intermediate wall of the body and goes out behind the working area. The return fluid is collected via side channels in the central part of the base where, through an inlet, it enters back the tank. The coolant tank can be removed for cleaning and replacing the cooling fluid at regular intervals of time depending on the load on the machine and in particular on the cooling system. In most cases the required coolant flow is very low and is adjusted by the tap before the nozzle.

The type of cooling fluid to be used depends on the material to be cut and the instructions of the supplier of that material.

3.3.1.11. Drive

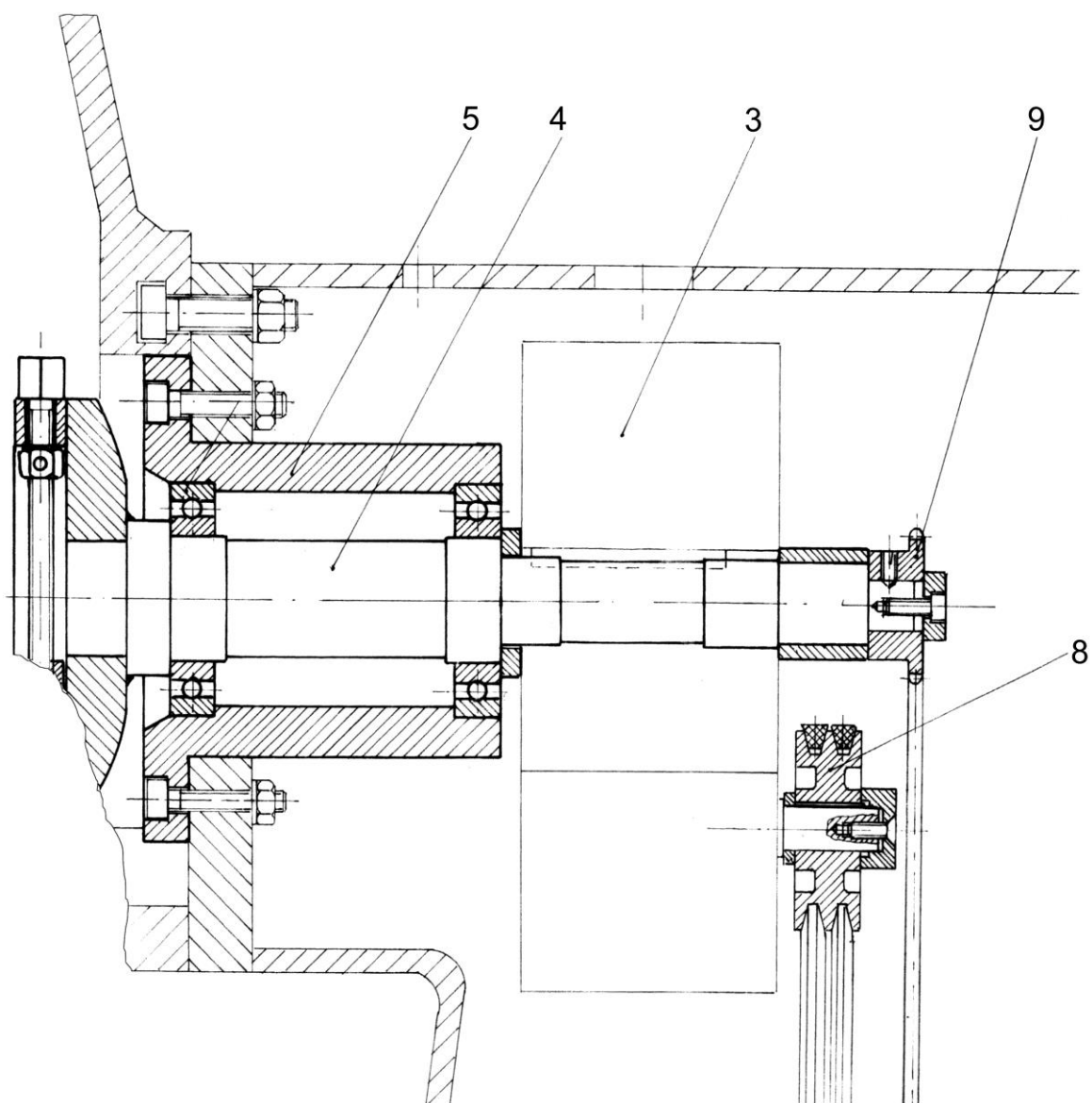
In fig. 10, it is denoted by “600”. The main drive motor 1 (fig. 16) is mounted on a special suspension support to the body, which stretches the belts conveying the drive from the pulley 7 to the pulley 8 and then to the reduction gear 3. Its reduction ratio is 1:16 and it has a hollow output shaft mounted on the shaft 4. The shaft 4 is welded to the connecting rod and machined together with it. It is supported by two radial ball bearings in the flange 5. Thus the rotation motion is transmitted from the motor to the shaft mounted on the connection rod 4 and is transformed into linear forth and back motion of the ram.

A chain pulley 9 is mounted on the shaft 4, which drives the gear box.

The main motor is available in two options:

1. Speed controlled three-phase induction motor with a built-in 4 kW brake, 1500 rpm
2. Customised option – motor-variator group consisting of a 1.1 or 2.2 kW electric motor, respectively, with a brake and electrically controlled mechanical variator.

We definitely recommend the first option as it has indisputable advantages in terms of reliability, long life, torque over the whole operating range, price, etc.



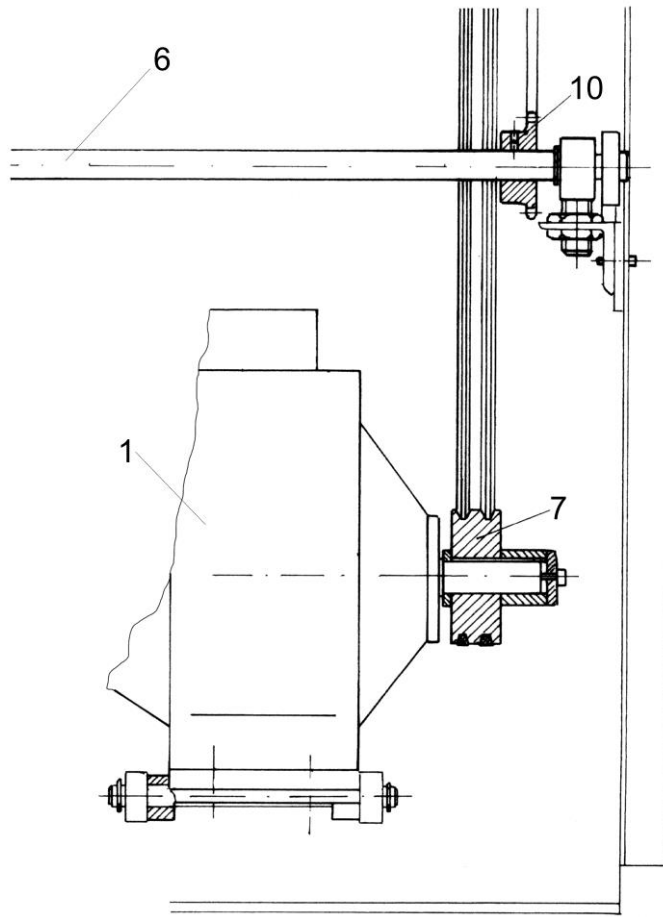


fig. 16

3.3.1.12. Lubrication system

It is indicated by “700” in fig 10. The lubrication unit is accommodated in the left part of the machine body, over the electric panel. It is a vibration type automatic unit and can be adjusted to various operation/non-operation periods.

The unit starts operating when the machine is switched on. Via a plastic tube it feeds lubrication oil to a distribution valve in the rear part of the toolhead. It has 6 output tubes feeding oil to the sliding area of the ram. An operation and control instruction for the unit is attached to the machine documentation.



Although the user can adjust the lubricant flow within a broad range, we do not recommend to change the pre-set intervals of pump operation and non-operation.

For safety reasons, the lubrication unit is so connected to the machine that when the oil level is low the red button on the control panel goes on and the machine stops.

The use of higher viscosity oils will overload the lubrication unit while lower viscosity oils will lead to unjustified increase of oil consumption.

Lubricate the slideways of the compound rest with the same oil manually by pressing the oil cups fitted in the intermediary slide, as required by the operating conditions, the environment contamination and the abundant use of coolant – but not less than once a week.

3.3.1.13. Electric system

1. Connection to the mains

Make sure that the mains parameters – frequency and voltage – match those specified on the machine details plate. The mains shall be a four- or five-wire power system. Connect the three phase conductors to the L1, L2 and L3 terminals, respectively. For a four-wire system connect the neutral terminal on the panel to the PE terminal.

2. Functions of the electric system.

2.1. Provision of driving and operating voltage.

With the machine connected to the power supply, check if all protective circuits are functional. Shut the electric panel door and close the main circuit breaker. The green button and the display on the control panel must be lit up.

2.2. Starting up the main motor

Start up the motor by pressing the green START button on the control panel. Looking through the protective window, verify that the connecting rod is moving in the proper direction. The direction must be as shown by the arrow fixed next to the window. The machine circuitry is designed so as to be independent of which power cord lead to which of the L1, L2 or L3 terminals is connected. If, despite of this, the machine rotates in the opposite direction, reverse the direction by exchanging the connections of the two phases in the main motor terminal box.

Stopping the main motor

Stop the motor by pressing the red STOP button on the control panel.

2.4. Momentary starting of the main motor.

It is applied when making adjustments on the machine by using the two black buttons on the control panel for the two opposite directions respectively. The buttons are not self-locking and when released the machine stops.

2.5. Increase/decrease of the main motor speed and hence the ram stroke rate.

This is achieved through the two blue buttons. The actual stroke rate per minute is indicated on the display when the ram is moving.

2.6. Start/stop of the coolant pump motor.

Start the pump motor by turning clockwise the green key BC. Stop the pump motor by turning the same key counter-clockwise.

2.7. Machine emergency stop.

This is done by pressing the red EMERGENCY STOP button, which is self-locking and will remain pressed down. After the cause for the emergency stop is eliminated, release the button by turning it clockwise.

2.8. Switching on the illumination of the working area.

The machine is equipped with a low voltage (12V) illumination lamp. The on/off switch is fitted to it.

3. Protection.

The electric system is protected against short-circuit and long-time overload by melting fuses and an automatic circuit breaker on the coolant pump.



Do not change the settings of the automatic fuses and do not replace the blown fuses with non-standard fuses or fuses rated for higher current values than the specified. Risk of serious damage on the machine.

4. Protection against self-starting.

When in result of a mains voltage drop or drop out machine electric motors automatically shut down, they will remain switched off even if the voltage recovers until switched on from the machine control panel.

5. Service and maintenance

For safe operation of the machine regular checks are required of the earthing (zeroing) according to the applicable regulations. Clean regularly the electric motor from dust and other grease.



Inspection and repair of the electric system are only allowed after disconnecting the machine from the mains by the main circuit breaker. The electric system may be manipulated only by qualified electricians.

3.4. Operation of the machine

3.4.1. First time start up

After completing the operations under s. 2.8.3. and 2.10.4., you may proceed to start the machine. Required preliminary operations:

- Check the mains connection – voltage, zeroing, earthing
- Check the tension of the trapezoidal belts. For the purpose remove the rear cover, adjust the belts tension as necessary and replace the cover.
- Check if there is sufficient oil in the tank of the automatic lubrication pump.
- Check if the guards are properly closed.
- Close the main circuit breaker. The oil pump should start within about 5 seconds. If the pump does not start, stop the starting procedure and investigate the cause.
- Immediately after closing the main circuit breaker the green START button on the control panel and the display should lit on. If, instead of the green, the red STOP button is lit on, this means that the cam that activates the automatic tool stop has pressed the limit switch. Move the slide or adjust the cam position.

Press the START button. The ram starts moving. Make sure that the rotation is in the proper direction, as described in s. 3.3.1.13.

Adjust the speed by pressing the blue "+" and "-" buttons. The current speed is indicated on the display.

Press the STOP button. The machine stops.

Press any of the black buttons. The ram will keep moving in the respective direction while the button is pressed.



The black buttons allow to move the ram even with open guards. Operate them with caution.

If necessary, fill the coolant tank and check the operation of the cooling system.

3.4.2. Types of operations

The machine is intended basically for slotting operations on metal pieces, with the main movement being of the tool gripped in the toolholder, and the feed movement being of the workpiece fixed in a chuck or otherwise to the table.

By suitable set up and alignment of the tool and the workpiece various forms can be machined in outer or inner surfaces – see fig. 17.

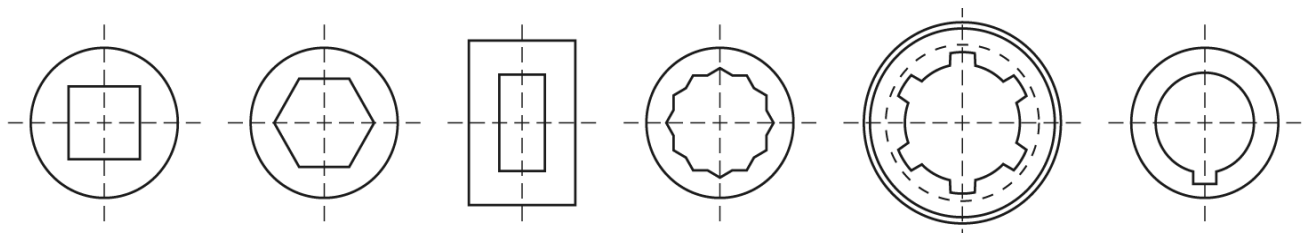


fig. 17

3.4.3. Controls

The main adjustment operations on the machine are the following:

3.4.3.1. Setting the ram stroke

The ram stroke can be adjusted in terms of length and position with respect to the toolhead as described in s. 3.3.1.7.

3.4.3.2. Positioning the workpiece with respect to the tool.

This is performed by using the two turnwheels (controlling the transversal and longitudinal travel) so as the machined channel to be positioned as specified in the design drawing.

3.4.3.3. Cutting speed setting

This is achieved by changing the stroke rate of the ram by using the blue buttons on the control panel. Look up the required values in table 1.

3.4.3.4. The automatic feed setting.

This is achieved by using the handle 8 in fig. 11. Look up the required values in table 1.

3.4.3.5. Setting the length of the automatic transversal feed of the table

As shown in fig. 18, the stand 5 is mounted in the right part of the machine on the intermediate slide and is moving transversally with it. The cam 2, which is fixed to the screw 4 and slides along the axis 3, can be adjusted along the whole length of the stand.

On the body, the limit switch 1 is mounted. It is fixed. By using the screw 4, adjust the cam so as to contact the limit switch when the desired depth of the channel is achieved. Then the ram will end the current stroke and stop in the upper end position.

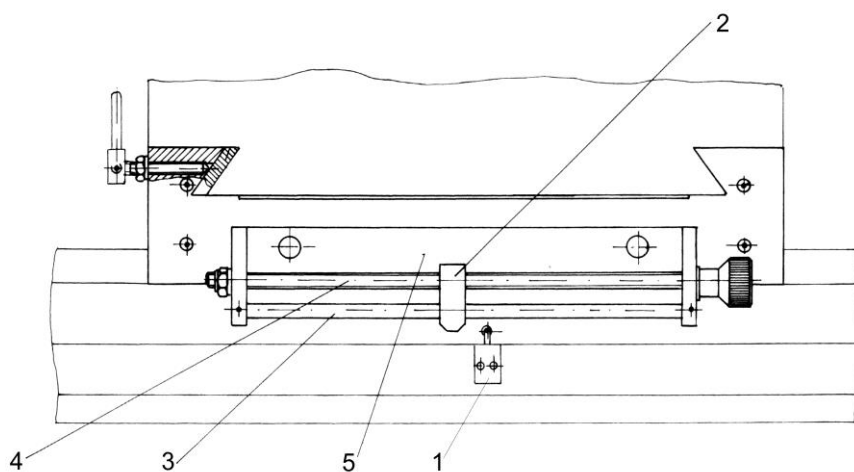


fig. 18

3.4.3.6. Hints for successful operation of the machine.

1. Secure firmly the machine to the floor.
2. Ensure that the workpiece is well fixed to the table (at least in 3 points)
3. After aligning the tool, lock the longitudinal position of the table.
4. Use only well-dressed tools
5. Use the tools with as stable holders as possible. Holder's elastic deformations are one of the main causes for irregular feeds.
6. When machining wide channels (over 10 mm width), adjust the tool stroke to the minimum acceptable length, namely by 40 mm over the channel length.
7. Ensure that there is enough space under the workpiece for the cuttings.
8. Ensure adequate lubrication of the cutting tip of the tool. In general, several drops of oil per stroke is sufficient.
9. Do not overtighten the screws controlling the clearance in the slideways in order to reduce the clearance. Overtightening will make it difficult for the table to move and will cause uneven feeding.

4. MAINTENANCE

The machine is not difficult to maintain and will operate smoothly for a long period of time if the operators perform regularly certain operations. They are as follows:

- In the end of each working day, clean the table and the other machine parts from cuttings and cooling fluid, wipe them dry and lubricate by applying a thin oil film. Thus you will protect them from corrosion.
- Keep the tank of the automatic lubrication pump full and once a week lubricate the slideways of the compound rest by using the oil cups built-in in the slideways.
- Check the tension of the trapezoidal drive belts quarterly and adjust as appropriate.
- Once a year check the oil level in the reduction gear. If the level is low, eliminate the cause and top up with oil. Use transmission oils of viscosity class 90 according to API GL-5.
- Depending on the conditions and intensity of work, regularly clean the tank of the cooling system and replace the coolant as necessary.

ATTACHMENT 1

Recommended operation modes and channel widths
for S200TGI and S315TGI
The feed speed depends on the stability of the cutting tool

| | Channel length up to, mm | Channel width, mm | | | |
|-------|-----------------------------|--------------------|-----------|-----------|-------------|
| | | 5 | 8 | 10 | 12 and more |
| | | feed S (mm/stroke) | | | |
| Steel | up to 100 | 0.07÷0.1 | 0.09÷0.11 | 0.10÷0.12 | 0.10÷0.13 |
| | up to 200 | 0.05÷0.07 | 0.06÷0.09 | 0.07÷0.08 | 0.08÷0.1 |
| | over 200 | up to 0.05 | 0.04÷0.06 | 0.05÷0.07 | 0.07÷0.09 |
| Iron | up to 100 | 0.13÷0.15 | 0.15÷0.17 | 0.16÷0.18 | 0.18÷0.2 |
| | up to 200 | 0.10÷0.12 | 0.12÷0.14 | 0.14÷0.17 | 0.16÷0.2 |
| | over 200 | 0.08÷0.1 | 0.1÷0.12 | 0.12÷0.14 | 0.14÷0.16 |

Cutting speed and maximum channel width for steel pieces machined by S200TGI

| H_B | σ_B (N/mm ²) | Feed S (mm/stroke) | | | | | Maximum channel width (mm) |
|--------------|---------------------------------|-----------------------|------|------|------|------|--|
| 131÷140 | 450÷490 | 0.1 | 0.15 | 0.23 | 0.28 | 0.3 | 14 (stroke ≤ 200 mm) 16 (stroke ≤ 100 mm) |
| 141÷152 | 500÷530 | 0.08 | 0.12 | 0.18 | 0.23 | 0.25 | |
| 153÷163 | 540÷570 | 0.07 | 0.1 | 0.15 | 0.18 | 0.22 | |
| 164÷174 | 580÷610 | — | 0.08 | 0.12 | 0.15 | 0.18 | |
| 175÷189 | 620÷660 | — | 0.07 | 0.1 | 0.12 | 0.15 | |
| 190÷205 | 690÷720 | — | — | 0.08 | 0.1 | 0.12 | 12 (stroke ≤ 200 mm) 14 (stroke ≤ 100 mm) |
| 200÷224 | 730÷780 | — | — | 0.07 | 0.08 | 0.1 | |
| 225÷240 | 790÷840 | — | — | — | 0.07 | 0.08 | |
| 241÷260 | 850÷910 | — | — | — | — | 0.07 | |
| Piece type | | Cutting speed V m/min | | | | | |
| Rolled stock | | 14 | 12.5 | 11 | 8.5 | 6.5 | |
| Casting | | 13 | 11.5 | 10 | 7.5 | 5.9 | |

Cutting speed and maximum channel width for steel pieces machined by S315TGI

| H_B | σ_B (N/mm ²) | Feed S (mm/stroke) | | | | | Maximum channel width (mm) |
|--------------|---------------------------------|-----------------------|------|------|------|------|--|
| 131÷140 | 450÷490 | 0.1 | 0.15 | 0.23 | 0.28 | 0.3 | 16 (stroke ≤ 315 mm) 18 (stroke ≤ 200 mm) |
| 141÷152 | 500÷530 | 0.08 | 0.12 | 0.18 | 0.23 | 0.25 | |
| 153÷163 | 540÷570 | 0.07 | 0.1 | 0.15 | 0.18 | 0.22 | |
| 164÷174 | 580÷610 | — | 0.08 | 0.12 | 0.15 | 0.18 | |
| 175÷189 | 620÷660 | — | 0.07 | 0.1 | 0.12 | 0.15 | |
| 190÷205 | 690÷720 | — | — | 0.08 | 0.1 | 0.12 | 14 (stroke ≤ 315 mm) 16 (stroke ≤ 200 mm) |
| 200÷224 | 730÷780 | — | — | 0.07 | 0.08 | 0.1 | |
| 225÷240 | 790÷840 | — | — | — | 0.07 | 0.08 | |
| 241÷260 | 850÷910 | — | — | — | — | 0.07 | |
| Piece type | | Cutting speed V m/min | | | | | |
| Rolled stock | | 14 | 12.5 | 11 | 8.5 | 6.5 | |
| Casting | | 13 | 11.5 | 10 | 7.5 | 5.9 | |

$$V_{\text{cutting}} = \frac{2 \cdot n \cdot l}{1000} \text{ [m/ min]} \quad \text{or} \quad n = \frac{1000 \cdot V_{\text{cutting}}}{2 \cdot l} \text{ [stroke / min]}$$

where:

n – number of strokes per minute (indicated in the display)

l – stroke length, mm