

General View of the Machine

(This diagram is only for reference, and details please see Technical Specification)

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General View of the Machine

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## **I .Introduction**

**The main purpose of this Operation Manual is to help the operator and maintenance worker to realize and grasp the performance, construction features of the machine as well as the proper way of operation to the machine quickly so as to operate rationally and adjust the machine correctly. When the machine is in trouble or has broken down, they may shoot the trouble in time and fix a break down quickly so as to retain the stability of the working accuracy of the machine for a long time and to play the productive ability of the machine to the fullest extent.**

**This machine is a universal machine with a wide range of application and suitable for drilling, boring, counter-boring, and spot facing. In addition, it can be used also for internal thread cutting by means of the feed rate of the normal thread pitch. The radial traverse of the radial facing slide on the facing head may complete a machining process of radial feed movement, thereby, the machine can be used for boring a bigger hole or surface, cylindrical turning and recessing, etc. The machine model TX6113 is equipped with standard attachments, such as vertical milling head, and it can also be used as a milling machine in a wider range.**

**The horizontal boring machine model TX6113 is equipped with a dismountable facing head, and the machine models TPX6113, TPX6113/2 and TPX6113/4 are equipped with a fixed-type facing head.**

### **Safety Illustration**

- 1.1 It is the pre-condition to understand the function of the machine over-all, and to observe all kinds of operation instruction of the machine consciously in order to make the machine work without any trouble. Thus, what we particularly emphasize is that this Operation Manual is the main part of the machine and that the user must read it conscientiously before start the machine; and that to understand the construction of the machine, the safety operation standard, all the “Warning plate” and operation according to the claim strictly to avoid injury and death of person or accident of the machine.**
- 1.2 The installation, operation, maintenance, repair of the machine must be carried out according to the performance specified in the Operation Manual by special trained and authorized personnel.**
- 1.3 During the operation of the machine, the operator should wear labor-protective clothes instead of loosen clothes, forbidding to wear any accessories in order to avoid happening of accident.**
- 1.4 Checking the safety-protect device of all units of the machine and the working conditions around the machine before start it. If the limited switch of each moving part is active, if it is smoothly in the range of travel, if there are some obstacle, if it is assured that the machine is in nice and safe conditions at any time.**
- 1.5 Do not touch the rotating cutting tools during working. Shut down the**

machine while carrying out measurement, adjustment and cleanness of the machine, otherwise, it may result happening of accident. Clean the electric elements such as motor frequently to avoid hindering of ventilation (forbidding to clean the machine with press air).

**1.6 Operator should pay attention to the followings while the machine is running:**

**do not put any part of his body close to or on the rotary or moving parts, must not open the protective gate or any kind of protective cover while the machine is running, the working and cutting tools must be fixed tightly, never work with overload work-piece, etc.**

**1.7 The respective safety check must be finished before connecting the power.**

**Understanding the functions of all switches, shutting down or locking the power before open the gate of electric cabinet; the gate of protective cover or carry out maintenance. Maintenance work must be carried out by special trained and authorized personnel if it has to be performance with power active.**

**1.8 It is not allowed to pile combustible matter around the machine. Forbid to apply combustible cooling liquid while cutting and running. Shut down the main power after finishing the work to avoid danger of burning with nobody taking care.**

**1.9 Leave far away from the moving units while the machine is working.**

**1.10 Prevent the harm of noise. In order to control the noise, you can make use of installing isolative machine cover or soundproof rest room.**

## II .Features of the machine

- 2.1 The spindle of the machine is supported by three points. The spindle unit is of highly rigid construction and has been nitrided to raise its hardness and increase its friction endurance and therefore prolong its service life.
- 2.2 The machine is provided with a pendant operator panel and digital display as well, which can realize flexibility and convenience of operation and centralized arrangement of controls as well. The hydraulic pre-selection speed change rotary valves located in the front of the headstock are adopted in main speed or feed change mechanisms. The indicator will emit signal in the process of speed change, which can save non-production time and increase the work efficiency of the machine. In addition, when gear clashing is happened to the sliding gears, the main driven motor may periodically jog so as to get rid of the phenomenon of gear clashing.
- 2.3 The traverse up or down movements of the headstock, the longitudinal or cross movement of the table and its rotary movement are distributed by means of an electromagnetic clutch, and they adopt hydraulic clamping and releasing, which not only make operation flexible and convenient but also lighten the operator's manual labor and therefore increase the automation level of the machine. The

machine is equipped with mechanically self-locking devices after clamping to achieve secure and reliable clamping.

2.4 The hardness of the main guide-ways of the main parts of the machine such as bed, front column and upper guide-ways of longitudinal saddle are increased by the method of “electric contact surface self-cooling case-hardening”, so that the service lives of those guide-ways are greatly prolonged. The cross and longitudinal saddles are provided with the mechanical unloading device, so that the happening of transient crawl can be reduced when the table moves in the lower speed. For the machine with larger load, the guide-ways of main parts adopt method of mid-frequency quenching and has sliding contact with polytetrafluoroethylene plate with low friction coefficient, high hardness and long service life.

2.5 The safety devices are provided in the limit position of main moving units of the machine. Those mechanisms that should not be started simultaneously are provided with electro-interlocking devices. The safety clutches which are mounted in feed change box and rapid traverse box will disengage when the machine is overloaded so as not to the extent of causing damage to the machine.

2.6 Measuring system of the machine:

The Spherical grid digital display and economic digital display device with a 0.005mm of the reading accuracy made in English NEWALL are all adopted for measuring of the two axes: vertical travel of the headstock and table cross travel and the third coordinate of table longitudinal movement which special supplied on the request of the customer. Positioning of the rotary table at 0°, 90°, 180°, 270° positions can be carried out by adopting the optical aiming device, thus the positioning accuracy of the machine is greatly increased.

We can also supply Measuring device (arbitrary angle) of the rotary table according to the requirement of the customer.



Motors

Parameter Application	50HZ 380V		60HZ 440V 60HZ 220V	
	Power(kW)	Speed(rpm)	Power(kW)	Speed(rpm)
Main drive motor	15	970	15	1164
Rapid traverse motor	5.5	960	5.5	1152
Rear column motor	1.1	930	1.1	1116
Hydraulic oil pump motor for headstock	1.5	1500	1.1	1200
Hydraulic oil pump motor for table	0.75	1400	0.75	1200

7) While installing the machine pay attention that: the two insert flat keys inside the vertical feed rod hole of headstock and one flat key insert of the horizontal feed rod hole of lower saddle may have been shaken and dropped down during packing and transportation, thus we pay the custom's attention that before installing the machine, take care that if these three keys have fallen off and the installation of them should be according to the indicate drawings in page 26 and page 38 in LIST OF SPART PARTS.

8) While installing the machine, first adjust the machine bed by precision water level, after which can install the front column, worktable, boring stay and headstock. The final adjustment should be carried out only when all of the components have been installed. The water level and bridge-type devices should be used to adjust the machine in the two directions of the bed guide-ways. The leveling of the machine should be adjusted within 0.04/1000mm. Make sure that all the items accuracy to be check should be within the permission error according to the Test Certificate during the adjustment of the machine cause the installation will directly effect the machine's accuracy. Pay attention to the change of water level reading while tightening the foundation bolts, cause improper tighten may cause distortion of the machine.

#### 4.3 Prepare for trail running.

Clean all parts of the machine before starting the machine, and lubricate each lubrication points, headstock, tailstock and sliding guide-ways surface, etc.

Manual check should be carried out on each moving unit of the machine after the adjustment of clamping mechanism has been finished. Trial running can only be performed from lower speed to higher speed when everything is in normal, and then check each item's accuracy of the machine when the machine runs normally.

## V. Transmission of all units of the machine

### 5.1 Main motion

The main motion is driven by a 15 kW single-speed A.C. motor mounted on the rear upside of the headstock. The power of the main drive motor is transmitted by an elastic coupling through the shafts I, II, III, IV and V to the spindle shaft VI. Four speed-change oil cylinders controlled by means of the hydraulic pre-selected rotary valves push around the four groups of sliding gears on the said shafts to transmit the power to the boring spindle, so that the 24 steps of the spindle speed are obtained (refer to the transmission system diagram Fig. 5.1 for models T6113 and TX6113; Fig. 5.2 for models TP6113, TPX6113, TPX6113/2 and TPX6113/4).

The main motion that is divided into high and low speed steps has totally 24 speeds for spindle, of them, high range of the speed is 6, and low range of the speed is 18. Totaling 16 step speeds of the facing head of the horizontal boring machine model TX6113 are adopted from the low range of spindle speeds, i.e. 4-125rpm.

The facing head of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4 are of fixed-type. When the sliding gear 17 is shifted to the neutral position (i.e. zero position of the spindle, and the sliding gear 75 on the shaft XVIII is meshed with the fixed gear 76 on the shaft V), the power of the main drive motor is transmitted to the facing head, enabling it to obtain 18 steps of speed.

### 5.2 Feed motion

The feed rate for all moving units is in mm per revolution of the spindle (i.e. feed rate of spindle, headstock, cross and longitudinal saddles per revolution of spindle of the horizontal boring machine model TX6113, and feed rate of spindle, headstock, cross and longitudinal saddles per revolution of spindle or facing head of the

horizontal boring machine models TP6113 and TPX6113). The power of the feed is still driven from the main drive motor, then transmitted from shaft V through the shafts VII, VIII, IX, X and XI to shaft XII (i.e. feed safety mechanism), further, through the forward and backward mechanisms to the vertical feed shaft XIV, from where transmit to the lead-screws or the gear-racks of all moving units, enabling the spindle, headstock, cross and longitudinal saddles of the machine model TX6113 and the spindle, radial facing slide on the facing head, headstock, cross and longitudinal saddles of the machine models TPX6113, TPX6113/2 and TPX6113/4 to obtain 18 steps of feed rate respectively.

As transmission of the shafts V and VI is carried out by two pairs of gear, the spindle may be able to obtain two speed ranges of 4-200 rpm and 250-800 rpm respectively, so that the feed rate may also be able to obtain two feed ranges of 0.05-8 mm/spindle. rev. and 0.01-2 mm/spindle. rev. The feed of the radial facing slide on the facing head of the machine model TX6113 is completed directly by feeding of the rack driving bar inserted in the spindle.

### 5.3 Rapid traverse of all moving units

Rapid traverse of the spindle, headstock, table and rapid rotation of the rotary table of the machine model TX6113, and rapid traverse of the spindle or radial facing slide on the facing head, headstock, table as well as rapid rotation of the rotary table of the machine models TPX6113, TPX6113/2 and TPX6113/4 are driven directly by a 5.5 kW motor mounted at the right side of the bed. Power of the motor is transmitted through the shafts XXXII, XXXI and XXX to the vertical feed shaft, vertical lead-screw and horizontal feed shaft, etc., enabling all moving units to obtain 2500 mm/min. of rapid traverse speed and 1.2 r/min. of rapid rotation speed of the rotary

table respectively.

#### 5.4 Thread cutting

At the end of the headstock is provided a gear quadrant device for mounting change gears special used for thread cutting (supplied according to the need of the customer). A prescriptive range of Metric and Whitworth threads, just as shown in Fig. 5.3 table of gear quadrant for mounting change gears, can be cut by setting the spindle feed at 4 mm/spindle. rev. and utilizing the spare change gears.

#### 5.5 Rapid traverse of rear column and boring bar bearing

The rear column and boring bar bearing are driven by an individual 1.1 kW motor mounted on the saddle of the rear column. Power is transmitted from the motor through a distributing mechanism to the rear column and the boring bar bearing, so as to traverse them.

#### 5.6 Hand traverse of all the moving units

##### 5.6.1 Hand traverse:

5.6.1.1 For obtaining the hand traverse of the boring spindle of the horizontal machine model TX6113, first push on the turnstile to the middle position. The hand traverse of the spindle can be obtained via the shafts XV, XVI and XVII by turning the turnstile after the worm-wheel clutch on the shaft XV has been disengaged by acting of the hydraulic operation system controlled by the electric devices.

For obtaining the hand traverse of the boring spindle or radial facing slide on the facing head of the horizontal machine models TPX6113, TPX6113/2, and TPX6113/4, first push on the turnstile to the middle position. The hand traverse of the spindle can be obtained via the shafts XV, XVI and XVII by turning the turnstile, or hand traverse of the radial boring bearing on the facing head is obtained via the shafts XIX, XXVI,

XXVII and XXVIII by turning the turnstile after the worm-wheel clutch on the shaft XV has been disengaged by acting of the hydraulic operation system controlled by means of electric devices.

5.6.1.2 The hand traverse of the headstock, cross and longitudinal saddles, and hand rotation of the rotary table as well as hand longitudinal traverse of rear column and hand traverse of the boring bar bearing are accomplished by turning a special used lever (supplied with machine) via the shafts XXXIV, XXXVIII and L1 respectively.

#### 5.6.2 Fine hand adjustment of all moving units

For obtaining the fine hand adjustment of all moving units, first distribute the distributing switch to the required position, the corresponding clutch will be engaged by electric and hydraulic system, then shift the turnstile to the most interior position, so that the fine hand adjustment of the corresponding unit can be obtained by turning the turnstile.

The fine hand adjustment of the rotary table can be obtained by pressing the push-button for releasing the table and pushing on the turnstile to the fine hand adjustment position, finally turning it.

#### 5.7 The machine can be used under different voltages:

According to different orders for different voltages, we provide necessary parts as follows based on the transmission system diagram.

##### 5.7.1 Gears

Table of gears

Motor Number	60HZ, 220V	50HZ, 380V
1	3-27	3-30
2	3-28	3-26
3	3-19	3-22
4	3-23	3-26
5	3-65	3-62
6	3-68	3-66
7	3-61	3-57
97	3-32	3-29
98	3-27	3-29

1) Motor

Table of motors

Parameters Applications	50HZ, 380V	60HZ, 440V 60HZ, 220V	50HZ, 420V
Main drive motor	Y180L-6-B5	Y180L-B-B5	Y180L-6-B5
Rapid traverse motor	Y132M2-6-B5	Y132M2-6-B5	Y132M2-6-B5
Motor for rear column	Y90L-6-B5	Y90L-6-B5	Y90L-6-B5
Oil pump motor for hydraulic system of headstock	A02-8024	Y90L-6-B5	A02-8024
Oil pump for hydraulic system of worktable	A02-8024	A02-90S6J	A02-8024

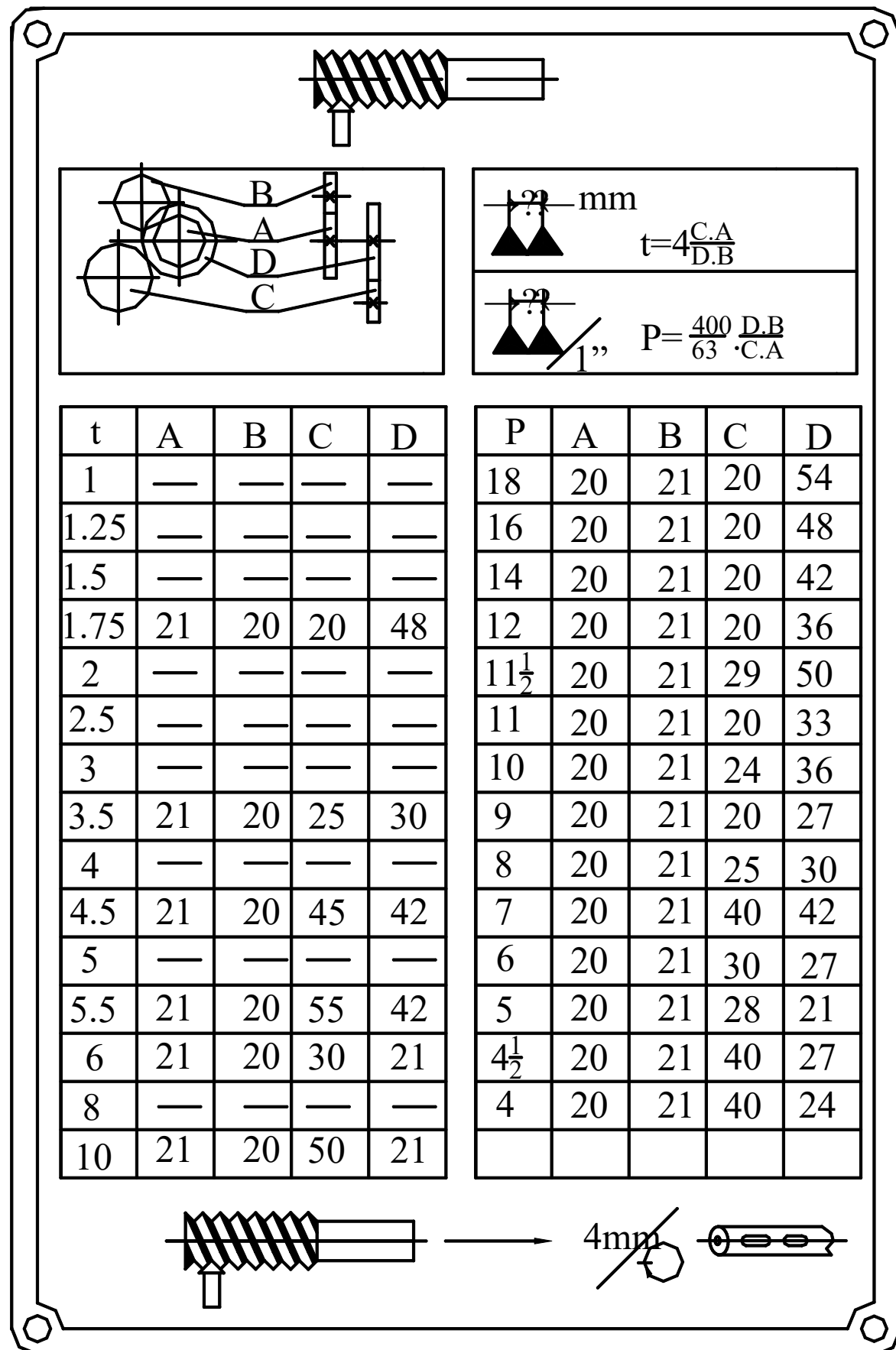


Fig. 5.3 Table of change gears for thread cutting



5.8 Our company can also supply the machine in Whitworth system, the comparison gears are shown as follows:

No. \ Motor	60HZ 440V	50HZ 380V
54	3.5-28	3-26
55	3.5-22	3-24
56	2.5-41	2.5-40
57	2.5-19	2.5-20
59	2.5-21	2.5-20
61	2.5-35	2.5-36
62	2.5-19	2.5-20
63	2.5-51	2.5-50

## VI. Controls of the machine

All the control systems of the machine are concentrated on the pendant operator panel (Fig. 6.1 and Fig. 6.2) on which the switch ⑳, ㉑, ㉒, ㉓ are used for distributing the movements of all main moving units of the machine (such as the spindle, headstock, cross and longitudinal saddles of the horizontal boring machine model TX6113, the spindle or radial facing slide, headstock, cross and longitudinal saddles of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4). After distributing of movement of the moving unit mentioned above, all moving units except for the spindle or radial facing slide on the facing head of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4 can be released automatically, and the corresponding indicator lamp lights up at the same time, showing that the required moving unit has been released.

The hydraulic pre-selection mechanisms are adopted for main speed change and feed change of the machine, which can be carried out at the same time that the machine is being in operation or prior to operation of the next procedure.

Illustrations of the main speed or feed change of the machine are as follows:

6.1 After connect the machine to power supply, the indicator lamp ① for power supply lights up (Fig. 6.1 and 6.2), showing that the machine has been already for working. ㉔ is the switch of the machine illumination lamps.

6.2 Rotation of the boring spindle of the horizontal boring machine model TX6113:

The forward or reverse continuous rotations of the spindle can be realized respectively by depressing the push-button ⑫ or ⑬ on the pendant operator panel (Fig. 6.1); the forward or reverse inching rotation of the spindle can be obtained by depressing the push-button ⑨ or ⑩ respectively; and to stop rotation by

depressing the push-button ⑮.

#### 6.3 Rotation of spindle or facing head of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4:

To obtain the rotation of spindle or facing head, the knob of the hydraulic distributing rotary valve ⑳ (Fig.6.3) must be set to the spindle or facing head position, then depress the push-button ⑦ for changing speed (Fig. 6.2), and when the indicator lamp lighted up and then extinguished, showing that the distributing of the position has come to an end. Thereafter, the forward or reverse continuous rotation of the spindle or facing head can be accomplished by depressing the push-button ⑫ or ⑬ respectively; the forward or reverse inching rotation of the spindle or facing head can be obtained by depressing the push-button ⑨ or ⑩. Furthermore, the radial facing slide on the facing head is equipped with two clamping points, which clamping the radial facing slide in order to avoid periodic slip when there is no requirement of radial feed of the facing slide; and which will give the facing slide a suitable per-tight (i.e. the two clamping points are bore with some force) in order to feed evenly when there is a requirement of radial feed of the facing slide.

#### 6.4 Operation of the main speed or feed change of the horizontal boring machine model TX6113:

To change the main speeds or feeds, the knob of spindle speed hydraulic rotary valve ⑳ or feed change hydraulic rotary valve ㉑ in Fig. 6.3 must first be turned to the required pre-selected speed or feed change position, then the speed or feed change of the spindle can be carried out automatically by depressing the executive push-button ⑦ in Fig. 6.1. At the same time, when the indicator lamp lighted up and then extinguished, showing that the hydraulic pre-selected speed or feed change

has been realized already.

#### 6.5 Operation of speed or feed change of spindle or facing head of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4:

To change the speeds or feeds of the spindle or facing head, first the knob of the spindle speed change rotary valve ⑳ or feed change rotary valve ㉞ in Fig.6.3 must be turned to the required position, and then the spindle or facing head distributing rotary valve ㉟ in Fig. 6.3 is turned to the required position, the speed or feed change of the spindle or facing head is carried out automatically by depressing the executive push-button ㉡. At the same time, when the indicator lamp lighted up and then extinguished, showing that the required speed or feed change has been obtained already.

#### 6.6 Power feed and rapid traverse of all moving units:

If there is a need for the power feed or rapid traverse of all moving units, first depress the respective knob switch (Fig. 6.1 and 6.2) on the pendant operator panel, then the big turnstile ㉣ (Fig.6.1) must be set to the outermost or middle position, the forward or reverse power feed can be achieved by depressing the push-button ㉤ or ㉥ according to the required feed direction, and stop feeding by depress the push-button ㉦. It should be noted that, when the operator select high speed and heavy feed to machine work-piece, there may has unusual noise and the gears can not engaged neither in forward nor in reverse direction after depressing the executive push-button ㉤ or ㉥, this is because that the level moving speed of forward or reverse clutch of the machine is less than the rotation speed of the inner gears (for mechanism, see Fig.8.3). In this case, the operator can stop the machine immediately and may perform the following sequences: first depress the push-button ㉤ or ㉥

according to the required feed direction, and then depress the push-button ⑫ or ⑬, the power feed in high speed and heavy feed can be achieved.

If by depressing the push-button ② or ③, the forward or reverse rapid traverse of the corresponding moving unit can be obtained, but when depress the push-button ④⑩, the big turnstile ②⑤ must be drawn out to the outermost position. To obtain the rapid rotation of the rotary table, depressing the distributing push-button ⑧, the clockwise or counter-clockwise rapid rotation of the rotary table can be achieved by depressing the push-button ② or ③.

#### 6.7 Hand traverse of all moving units:

##### 6.7.1 Hand fine adjustment:

To obtain the hand fine adjustment of all moving units, first push the big turnstile ②⑤ to the innermost fine adjusting position, then depress the distributing push-button respectively, the hand fine adjustment of the corresponding moving unit can therefore be achieved by turning the turnstile ②⑤. But if it is necessary to hand fine-adjust the spindle of the horizontal boring machine model TX6113, after depressing the spindle distributing push-button ④⑩, the handle ②⑧ (Fig. 6.3) must be shifted to the releasing position. But if it is necessary to hand fine-adjust the spindle or radial facing slide on the facing head of the machine models TPX6113, TPX6113/2 and TPX6113/4, after depressing the distributing push-button ④⑩, the handle ②⑧ (or bolts for clamping the sliding block) must be set to the releasing position.

Provided that depressing the worktable rotary distributing push-button ④①, the hand fine rotation of the rotary table can be obtained by turning the turnstile ②⑤.

##### 6.7.2 Hand traverse

###### 6.7.2.1 Hand traverse of the spindle of horizontal boring machine model TX6113:

First depress down the spindle distributing switch ④①, then push the big turnstile ②⑤ to the middle position, and shift the handle ②⑧ to the releasing position, the hand feed of the spindle can be realized by turning the turnstile ②⑤. The traverse distance can be read out from the graduated dial.

6.7.2.2 Hand traverse of spindle or radial facing slide on the facing head of the machine models TPX6113, TPX6113/2 and TPX6113/4:

For obtaining the hand traverse of these units, first the knob of rotary valve ③① (Fig.6.3) is set to the spindle or facing head position, then the distributing push-button for spindle or facing head ④① is depressed, the big turnstile ②⑤ pushed to the middle position, and the handle ②⑧ (Fig.6.3) or bolt for clamping the radial facing slide set to the releasing position, the hand traverse of the spindle or radial facing slide on the facing head is achieved by turning the big turnstile ②⑤. The traverse distance can be read out from the graduated dial.

6.7.2.3 Hand traverse of headstock, cross and longitudinal saddles and hand rotation of the rotary table:

The hand traverse of the headstock and cross and longitudinal saddles can be accomplished respectively as follows: first depress the required distributing switch ④①, and then turn the special lever (supplied with the machine) after it has been inserted into ②⑨ or ②② (Fig. 6.3) of horizontal machine model TX6113,

If depressing the distributing switch ⑧, and insert the special lever into ②②, the hand rotation of the rotary table can be obtained by turning the special lever.

6.7.2.4 Hand traverse of longitudinal saddle of the rear column and up and down of the boring bar bearing

First shift the distributing lever ①⑧ to the required position, and insert the special

lever into ⑰, and the hand traverse of longitudinal saddle of the rear column and up and down of the boring bar bearing can be obtained by turning the special lever.

#### 6.8 Operation of the facing head of the horizontal boring machine model TX6113

At ordinary time, the facing head should be laid nearby the work field, and when it come into use, after being hoisted, it should be fixed in the end of the milling spindle (hollow spindle) (Fig. 6.4) ⑳ by means of four screws. Then draw out the handle ㉑ and turn the big turnstile to extend out the boring spindle outside the facing head, at the same time, insert the rack draw bar ㉒ into the spindle taper hole, thereafter insert the connector for tool shank ㉓ into the tool releasing hole in the boring spindle, and the boring spindle is returned to the original position after the rack draw-bar has been locked by tightening the screws. Finally, push on the handle ㉔ to inner side so that, the hand feed, hand fine adjustment and power feed of the radial facing slide on the facing head can be obtained by pushing in the big turnstile ㉕ in Fig.6.3 to the different position respectively.

After the handle ㉑ is drawn out, the position of the radial facing slide on facing head can be adjusted by turning the shaft ㉖ with a hexagonal socket head wrench. The screw ㉗ is used for tightening the radial facing slide on the facing head.

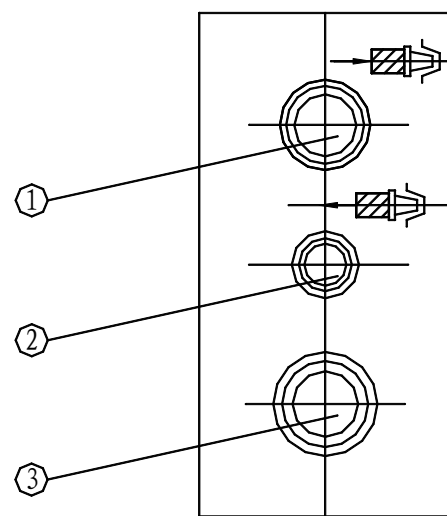
In order to ensure the machine safety in operation, the speeds of facing head must be controlled within the range of less than 125 rpm; otherwise, there will occur damage to the machine and personal injury caused by an accident. For this reason, there should be to operator's enough attentions.

The push-button ㉘ in Fig.6.1 and 6.2 is the one for stopping the power feed, push-button ㉙ is the one for stopping the spindle rotation, and the push-button ㉚ is the one for emergency stopping of the complete machine set. In order to ensure

the machine safety in operation, the push-button is used only in emergency condition, and is not used in the general condition (because once it has been depressed, the complete machine set will be in cutting off the power supply condition. If it is necessary that the machine restart up again, the main switch of the machine must be switched on once again, thus it will certainly bring too much trouble to the operator).

#### 6.9 Automatic loading and unloading tools of the boring spindle

The machine is equipped with a stationary push-button station in the left lower part at the front side of the headstock and there are three push-buttons on it, for details please see follows:



Stationary push-button station

① \_\_ Tooling clamping button

② \_\_ Tool release button

③ \_\_ Emergency stop button

First the boring spindle should stop running during tool unloading, then depress the button ②, at this time the lamp on the button ② will lights up then the lamp on button ① will extinguish, showing that the machine is in the condition of tool unloading state and can take out tool now.

First clean the taper before loading a tool, then insert shank, and depress the button ①, at this time the lamp on button ① will lights up then the lamp on button ② will extinguish, showing that the machine is in the condition of tool clamping state.



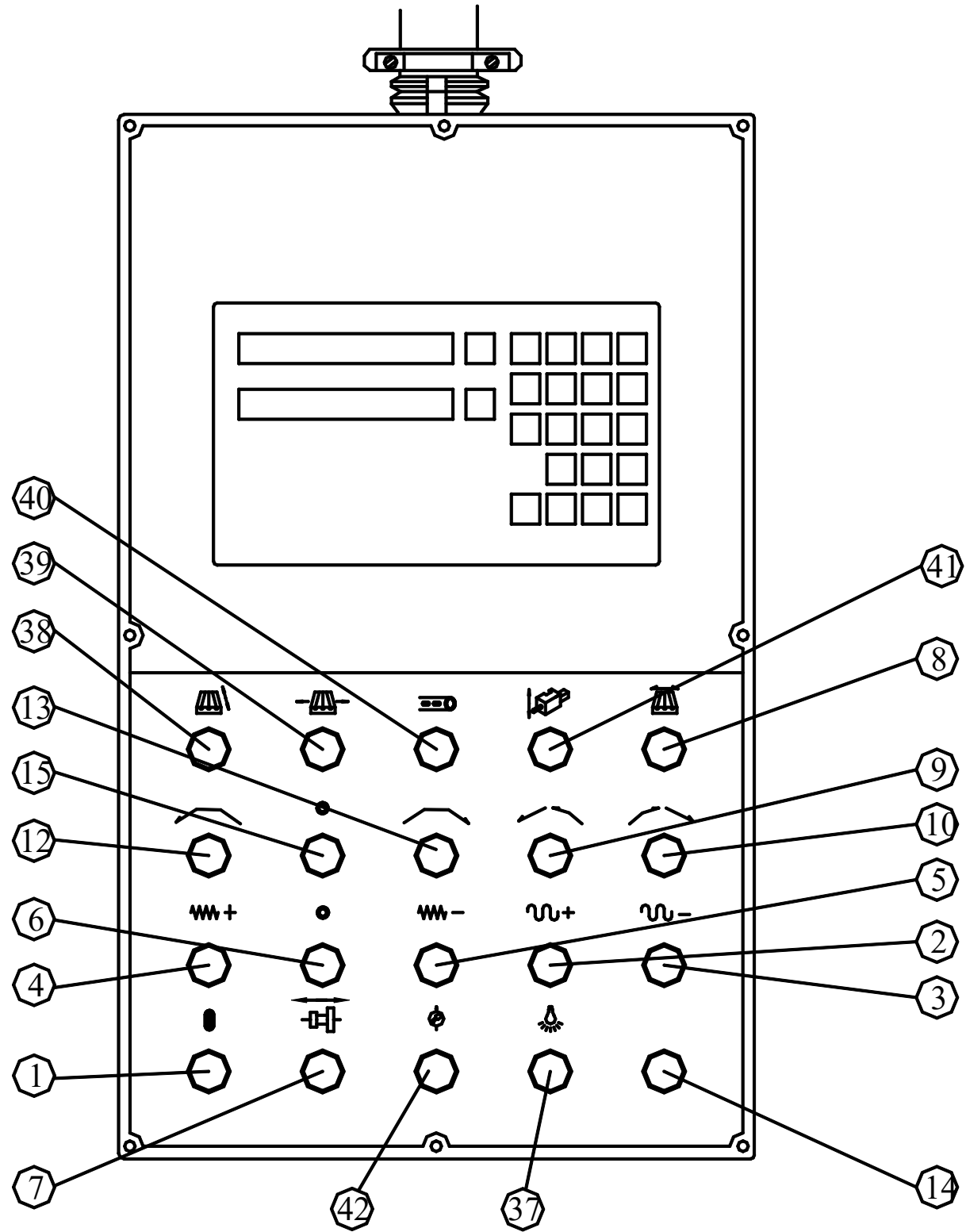


Fig.6.1 Pendant operator panel of the machine model TX6113

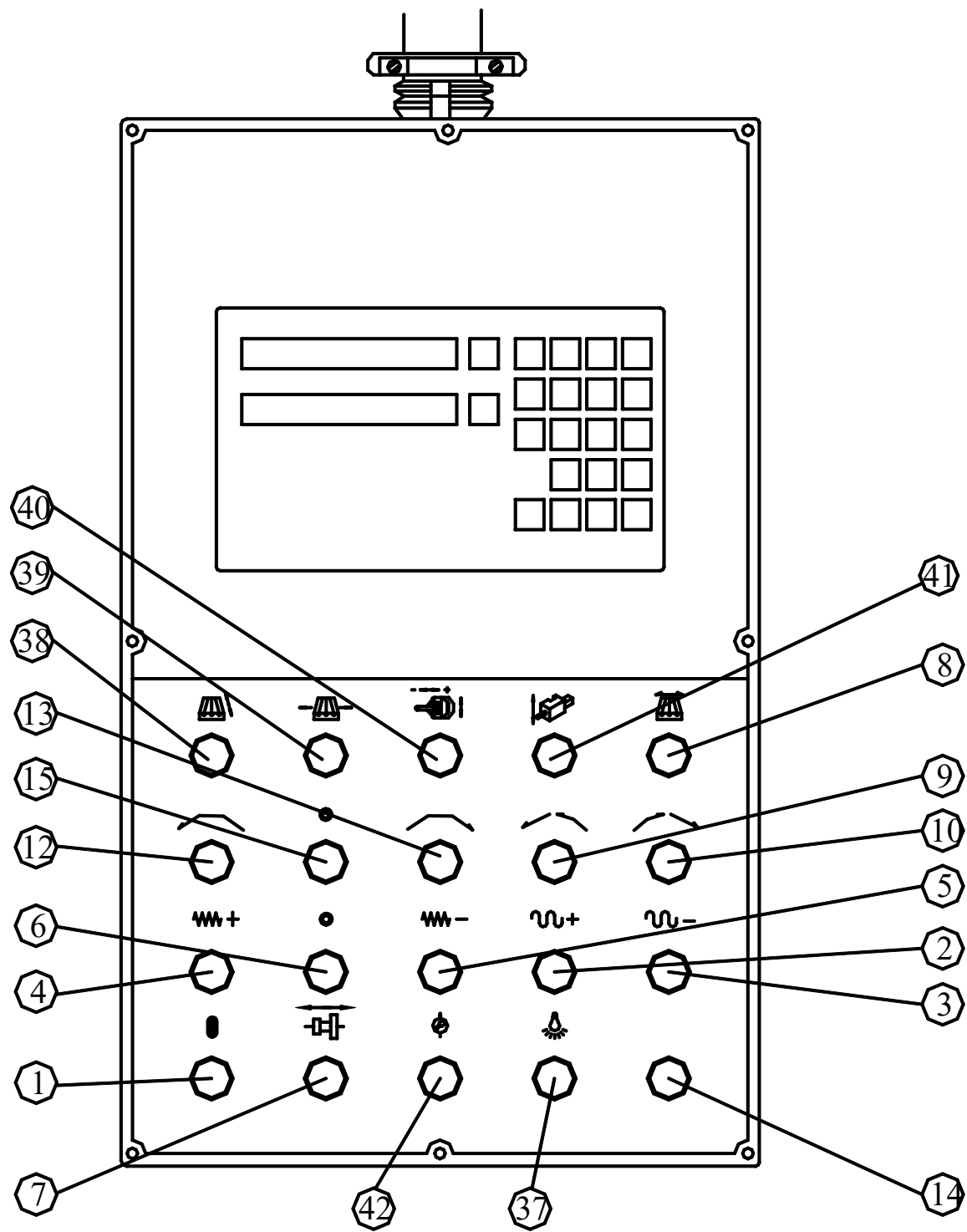


Fig. 6.2 Pendant operator panel of the machine  
models TPX6113 etc. with fixed-type facing head

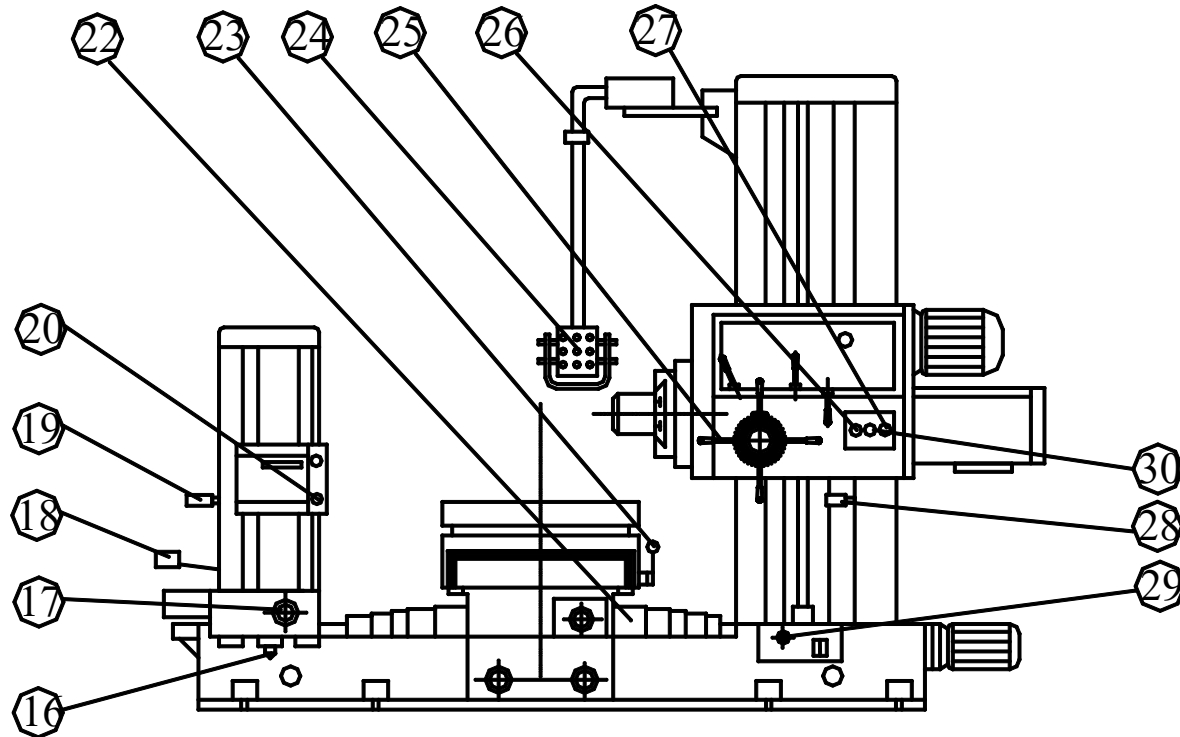


Fig. 6-3

No.	Name of controls
16	Screws for clamping the rear column
17	Hand lever hole for hand traversing the rear column longitudinally and boring bar bearing
18	Distributing hand lever for selecting the traverse of rear column and boring bar bearing
19	Handle for fine hand adjustment for boring bar bearing
20	Screws for clamping the boring bar bearing
22	Hand lever hole for hand traversing the cross and longitudinal saddles and rotary motion of the table
23	Hand lever for controlling the position pin of rotary table
24	Pendant operator panel for controlling the machine
25	Distributing turnstile for hand traversing of the spindle, fine adjustment and power feed
26	Feed speed change rotary valve
27	Speed change rotary valve for main motion
28	Hand lever for clamping the spindle
29	Hand lever hole for vertically traversing of the headstock
30	Rotary valve for selecting the movement of spindle or facing head (only used in horizontal boring machine with fixed facing head)

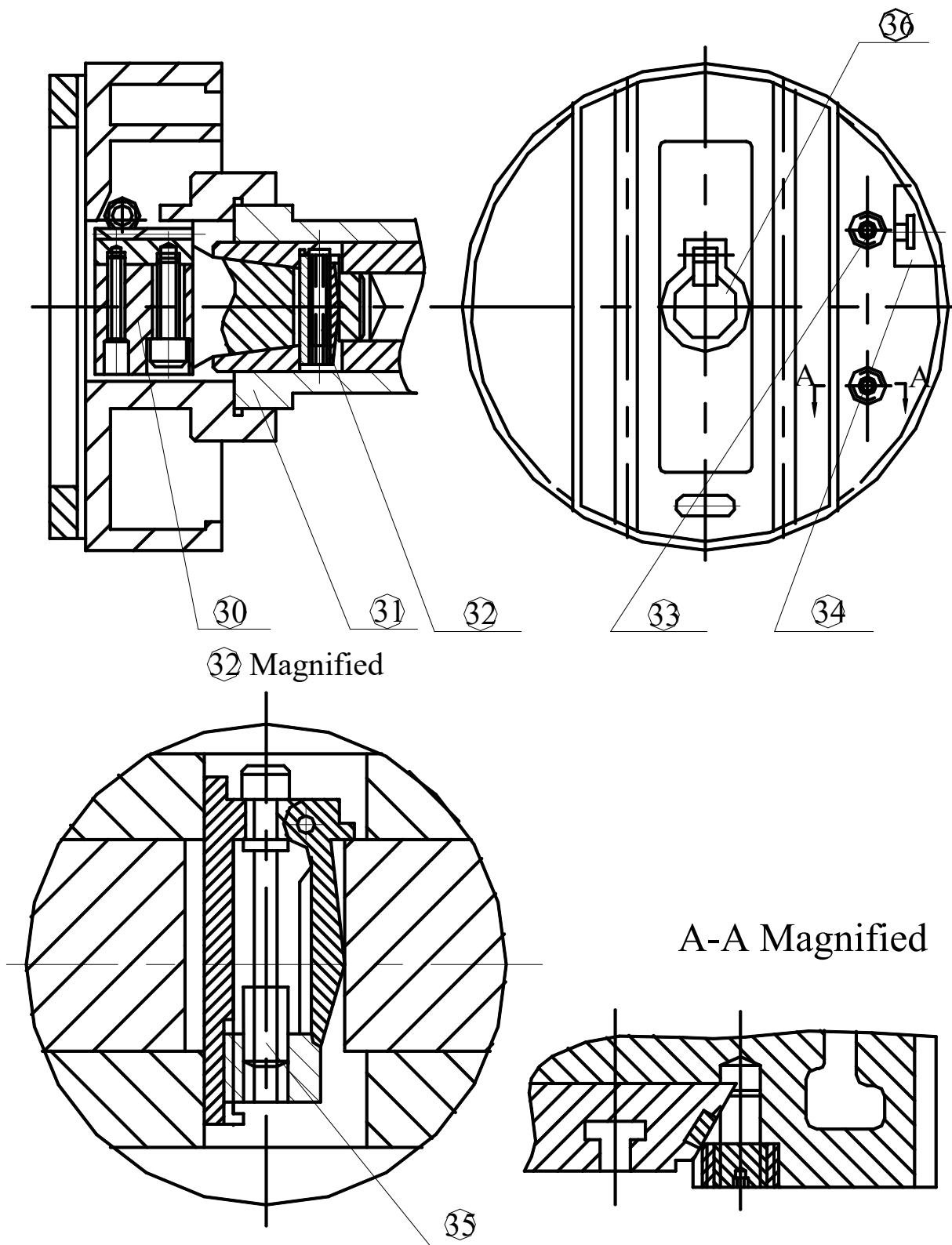


Fig.6.4 Construction diagram of facing head of machine models TX6113

## VII. Lubrication of the machine

7.1 Inner part of the headstock and guide-ways of all moving units are lubricated automatically by means of a secondary cycloidal oil pump driven by shaft I of main motion. The oil is distributed to the oil distributor and the oil-distributing pipeline located on the upper part of headstock through filter, and will flow into various lubrication points inside the headstock.

For observing the condition of the oil supply and the oil level, an oil dripping window is provided at the upper left part at front surface of the headstock, and an oil leveler is provided in the lower side at back surface of the tail bracket.

The oil for lubricating the headstock comes from the tail bracket, and it is filled through filling oil hole of tail bracket, at the bottom of the tail bracket is equipped with an oil plug ready for draining oil.

7.2 Lubrication oil in the tail bracket comes from the oil reservoir at the bottom of tail bracket, and a small oil reservoir is provided at the sliding block of spindle.

7.3 The rapid gearbox and the traversing mechanism of the rear column saddle are lubricated by their respective oil reservoir. The bottom part of these two cases is the oil reservoir; the oil splashes and lubricates the gears while the gears are running. Fill oil from the top of the two cases respectively. The rapid gearbox is provided with oil leveler for observing the condition of the oil level on the front side, and the oil-draining pipe at the lower front side. There is an oil level mark in the oil-filling hole of the rear column saddle transverse mechanism.

The lubrication of the rapid safety device is accomplished by means of lubrication oil wicks leaded from a small oil reservoir on the motor flange. A special oil window is provided on the top of the case for the purpose of filling the oil and of

observing the condition of the oil lever.

7.4 The lubrication of the rotary mechanism of the table and the cross and longitudinal saddles are realized through the concentrate lubricating device which is located at the end of the longitudinal saddle (Fig.7.1). Before using the machine, the push-button ④<sub>2</sub> should be push for several times to give a full lubrication for the guide-ways. When the machine begins to work ordinary, the device can transmit lubrication oil to each lubrication points regularly and in fixed quantity to give each part enough lubrication.

Users should fill oil periodically according to the oil meter located on the concentrate lubrication device to ensure the device work ordinarily.

7.5 The other lubrication points shown in Fig. 7.1 should be lubricated in accordance with the regular described in lubrication chart. The oil inside all the lubrication oil reservoirs should be renewed every 6 months.

7.6 The guide-ways of the rear column, the radial facing slide, boring stay supporting and elevating feed screws for the headstock should be lubricated in time whenever they are moved.

7.7 The lubrication for the guide-way of the headstock is accomplished by the quantity pump ③ located in the oil pool. When the distributing switch ④<sub>1</sub> is depressed, the guide-way will be strongly lubricated once automatically.

### VIII. Adjustment and maintenance of the machine

As the correct or improper adjustment of the machine plays an important role to the machine's accuracy and service performance, and it also has great effect upon the machine's service life as well as the machining quality of work-piece. Thus the machine must be adjusted and repaired correctly, and must strengthen the maintenance in order to remain the machine's accuracy for longer time and extend the service life and ensure the quality of the machined work-piece as well.

8.1 Adjustment of front and rear bearings of the spindle of machine model TX6113  
(see Fig. 8.1)

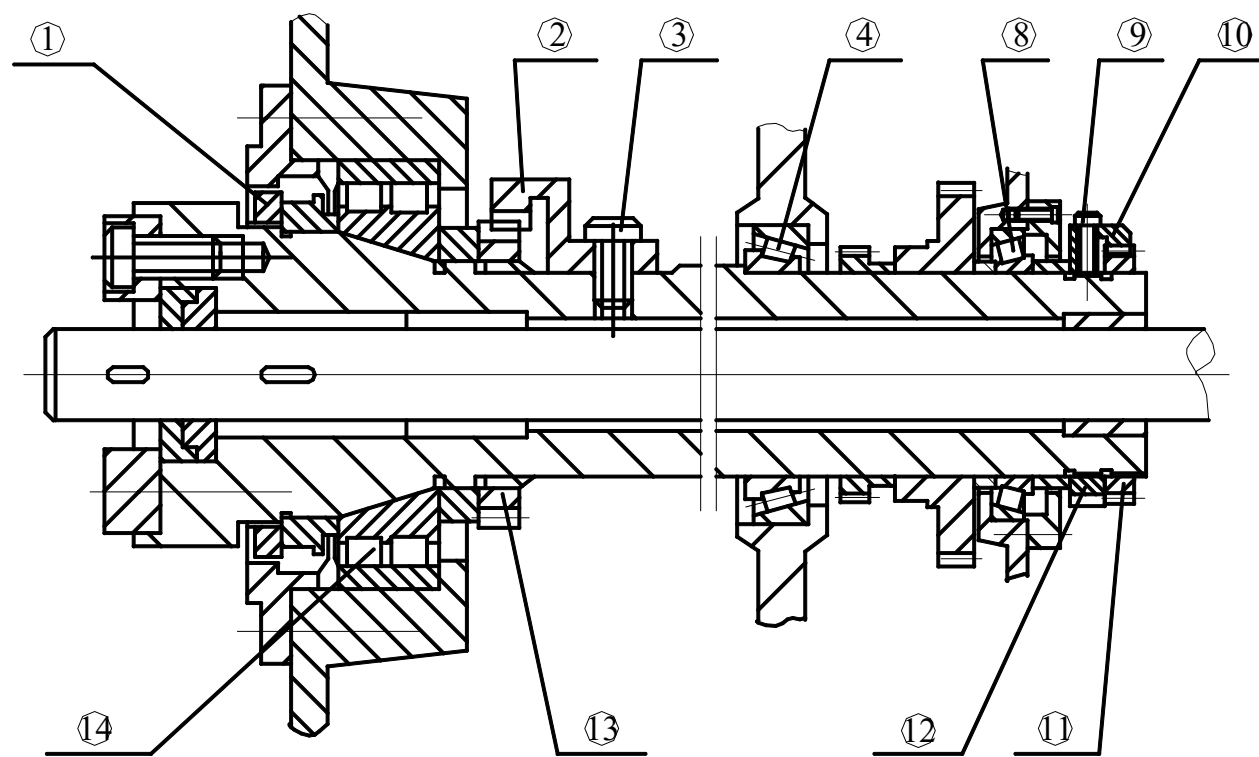


Fig. 8.1 Spindle structure diagram of machine model TX6113

#### 8.1.1 Adjustment of the front bearings of the spindle:

First loosen the screw ③ and the locking block ②, and then screw the nuts ① and ⑬ to adjust the bearing ⑭. After the adjustment has been finished, remounting the locking block ② and tightening the screw ③ so that the nut

⑬ is to be secured again.

#### 8.1.2 Adjustment of the rear bearings of the spindle:

First loosen the screw ⑨, locking block ⑩ and nut ⑪ during adjusting, then screw the nut ⑫ to adjust the bearings ④ and ⑧. After the adjustment has been finished, tightening the nut ⑪, remounting the locking block ⑩ and tightening the screw ⑨ to tighten the two nuts respectively.

#### 8.2 Adjustment of the front and rear bearings of the spindle of machine models TPX6113, TPX6113/2 and TPX6113/4 (see Fig. 8.2)

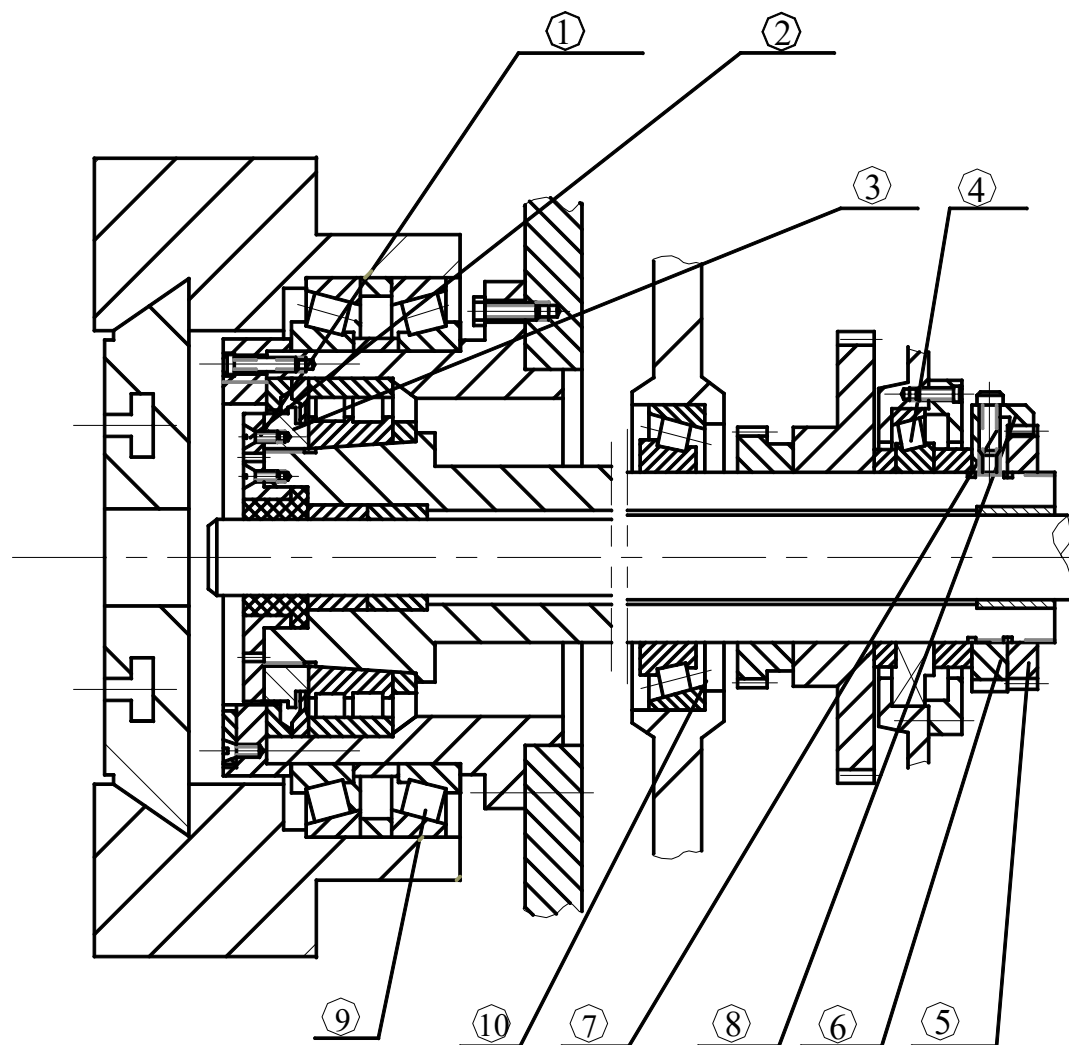


Fig. 8.2 Spindle structure diagram of machine models TPX6113, TPX6113/2 and TPX6113/4



### 8.2.1 Adjustment of the front bearings of the spindle:

First loosen the screw ① and remove the locking block ②, and then screw the nut ③ to adjust the bearing ⑨. After the adjustment has been finished, remounting the locking block ② and tightening the screw ① so that the nut ③ is to be secured again.

### 8.2.2 Adjustment of the rear bearings of the spindle:

Before adjusting, loosen the screw ⑦ and remove the locking block ⑧, then loosen the nut ⑤. Screw the nut ⑥ to adjust the bearings ④ and ⑩. After the adjustment has been finished, screwing the nut ⑤, remounting the locking block ⑧ and tightening the screw ⑦ so that the nut ⑥ is to be secured again.

### 8.3 Adjustment of feeding safety clutch (see Fig. 8.3)

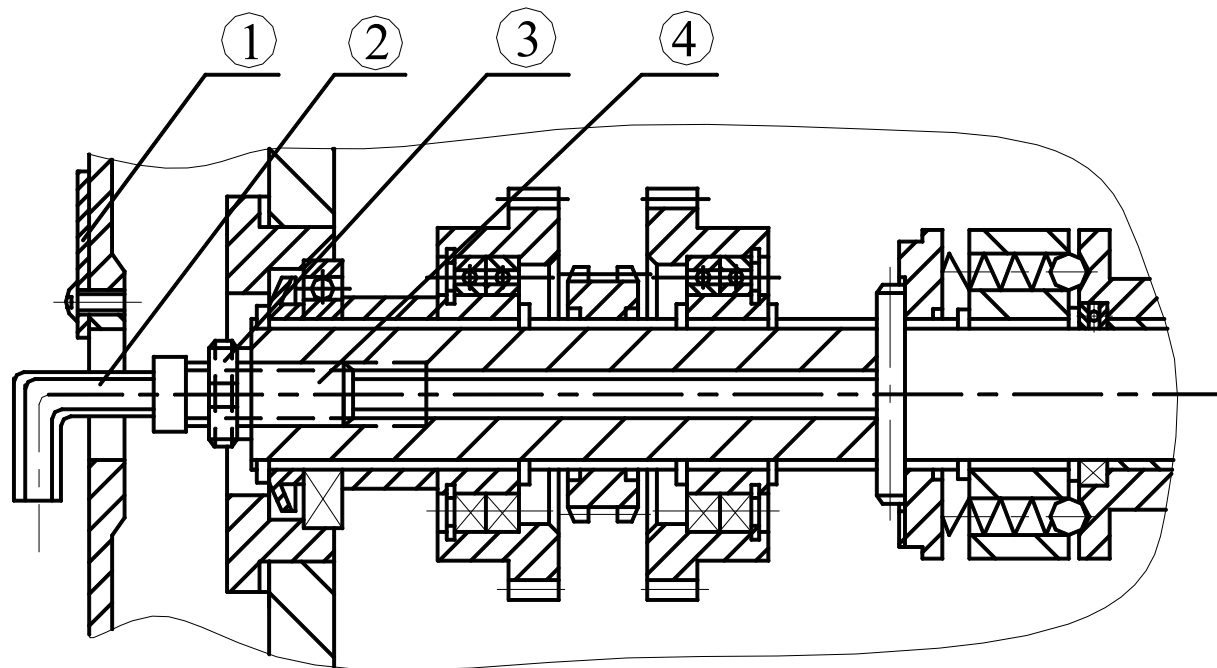


Fig. 8.3 Feeding direction change and feeding safety clutch

After removing the indicating plate ① with a marker “place for adjusting safety device” from the end face of the headstock, then adjusting screw ④ will be exposed. For adjusting the clearance, first loosen the locking nut ③, and turn the special spanner ② to make the adjusting screw ④ compressing or extending the spring so as to realize the adjustment of the safety clutch.

Checking methods of safety clutch adjustment are follows:

#### 8.3.1 Checking by pressure gauge:

Place a work-piece on the table, and insert the pressure gauge into the boring spindle taper hole. When the spindle or lower saddle is fed and the hand of the gauge is indicated to the figure not more than 31360 N, the machine should be still in normal operation state. But if the feed resistance is larger than 31360-39200N, the feeding safety clutch should be disengaged to realize the function of safety.

#### 8.3.2 Checking by cutting method:

The material of the work-piece to be cut is cast iron with hardness of HB 150-180. The high speed steel drill with the diameter of  $\Phi 60$  mm is used for drilling. When the spindle speed is 50rpm and the feed amount is 1mm/r fed by worktable, the machine should works in normal; but when the feed amount converts to 1.5mm/r by use of high-speed steel drill with diameter of  $\Phi 62$ mm, the feeding safety clutch should be disengaged.

After the adjustment has been finished, take down the spanner ② and tighten the locking nut ③, then remount the indicating plate ① to its original position.

#### 8.4 Adjustment of the safety clutch for the rapid transmission mechanism (see Fig. 8.4)

Before adjusting of rapid transmission safety clutch, this plate should be taken down.

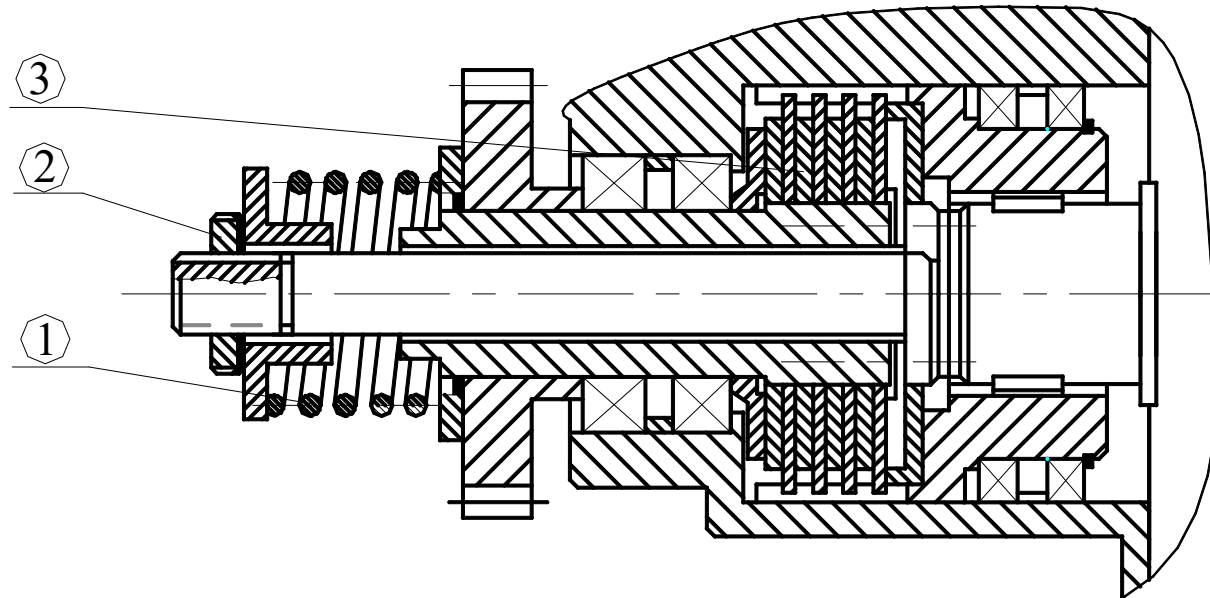
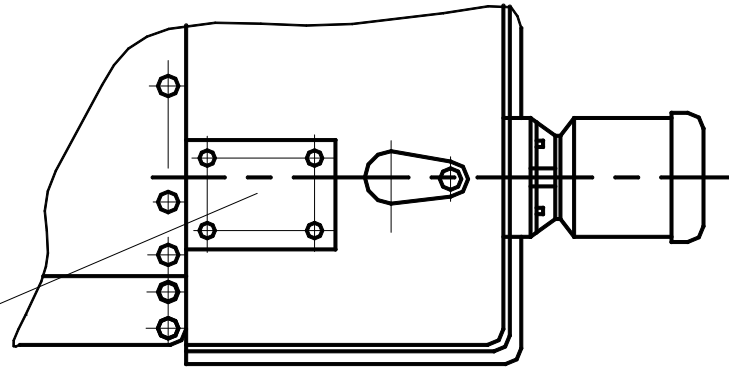


Fig. 8.4 Rapid transmission safety clutch

Before adjusting of the safety clutch, take down the cover from the bed, and then the pressure spring will be compressed or extended by regulating the nut ② so as to achieve the purpose of adjustment. When rapid traversing the table with a load of 6300 kg, the friction discs ③ of the safety clutch should be able to slip, showing that the safety device is flexible and reliable and the safety device has the function of safety. Remount the cover on the bed after adjustment.

8.5 Adjustment of clamping device of all moving units (see Fig. 8.5)

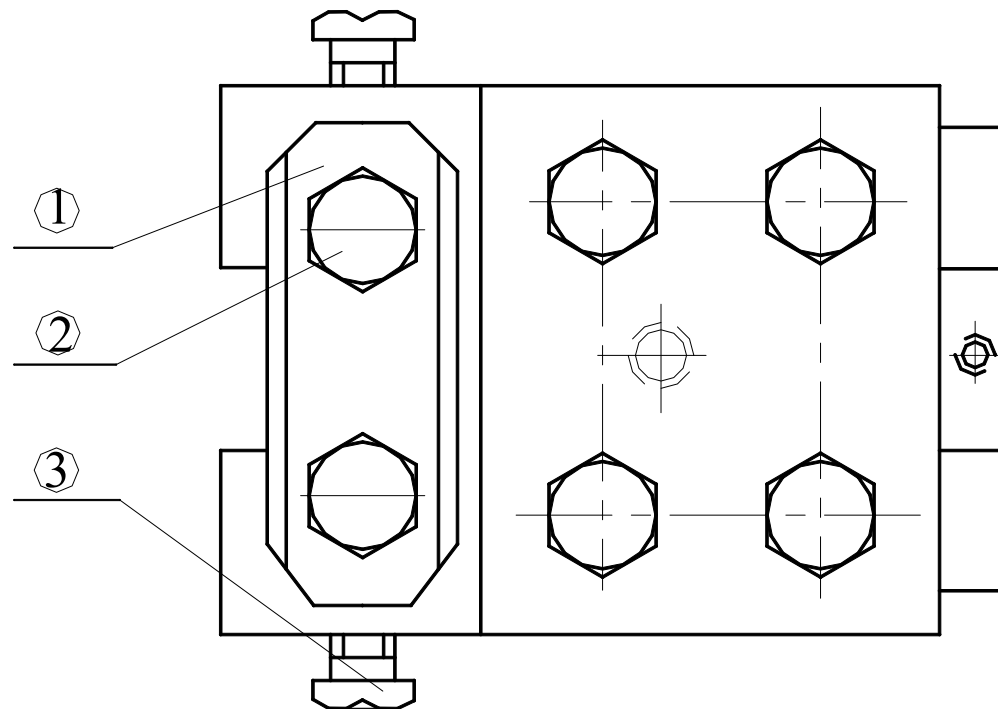


Fig. 8.5 Clamping device of the machine

#### 8.5.1 Adjustment of clamps of headstock, cross and longitudinal saddles

First loosen the adjusting screws ③ and ② mounted on the clamping device. By this time, the clamping device should be in clamping state and readjust the clamping screw ② to enable the pure tighten torque meet the request as following. Use the special handle lever of this machine as arm of force to bring torque to each clamping device of each unit, the pulling force should be (not including the torque before clamping):

- (1) for headstock:  $\geq 225.4\text{N}$ .
- (2) for cross saddle:  $\geq 196\text{N}$ .
- (3) or longitudinal saddle:  $\geq 196\text{N}$ .

The clamping device should be in releasing state after the clamping force meets the requirements. Check the spring plate that should be active, and then tighten the loose-proof screws.

#### 8.5.2 Adjustment of worktable clamping force:

The adjustment of clamping force of the table can be accomplished by adjusting the nut that is exposed on the clamping block. For determining the clamping force, the table must first be shifted to one end of the longitudinal saddle so that the distance between the table center and the spindle axis is 500 mm, where the max. feeding resistance test is carried out with the power feed of spindle. When the safety clutch disengages, the table rotation must be forbidden (it has been adjusted before delivery).

8.5.3 Clamping of the spindle, radial facing slide, rear column saddle and boring bar bearing are all accomplished by means of hand-operated clamps. When the facing head rotates and the radial facing slide does not need feeding, the hand-operated clamping screws should be in clamping state to prevent the radial facing slide from moving during the rotation of facing head.

8.6 Adjustment of eliminating the clearance in transmission system of radial facing slide of the machine model TX6113 (see Fig.8.6).

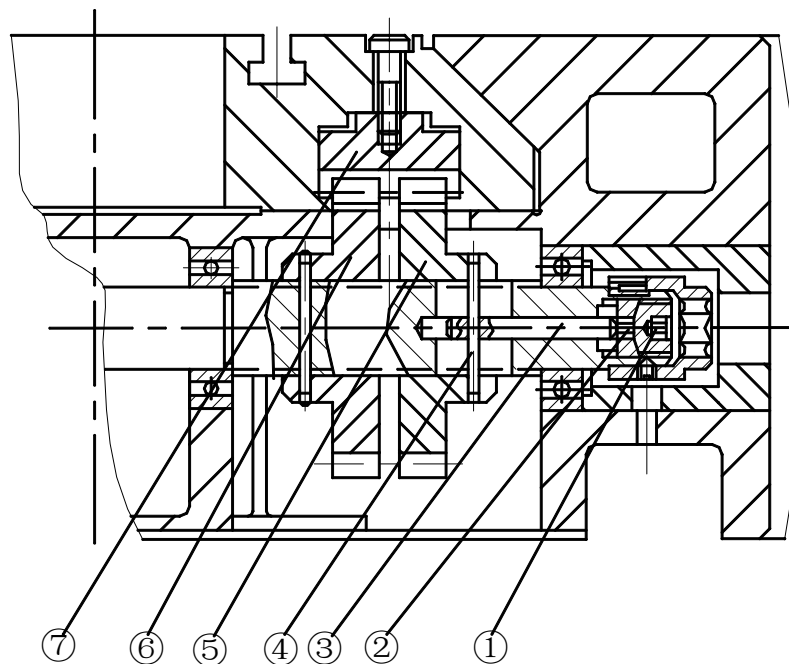


Fig. 8.6 Double screw rod structure of the machine models TX6113

The gear-rack mechanism driving the linear movement of radial facing slide may bring clearance owing to wear cause of long time using. The means for eliminating it is that: screw off the locking nut ①, screw the nut ② to push the drawing bar ③ moves forward, and the gear ⑤ driven by pin moves both along linear axis and turns around it, then the gear ⑥ will run together with the gear ⑤, thus the clearance between the gear ⑤, gear ⑥ and the two side faces of rack ⑦ is eliminated simultaneously. Retighten the nut ① after adjustment.

8.7 Adjustment for eliminating the clearance of radial facing slide on the facing head for machine models TP6113, TPX6113, TPX6113/2(taper Metric 80) and TPX6113/4. See Fig. 8.7

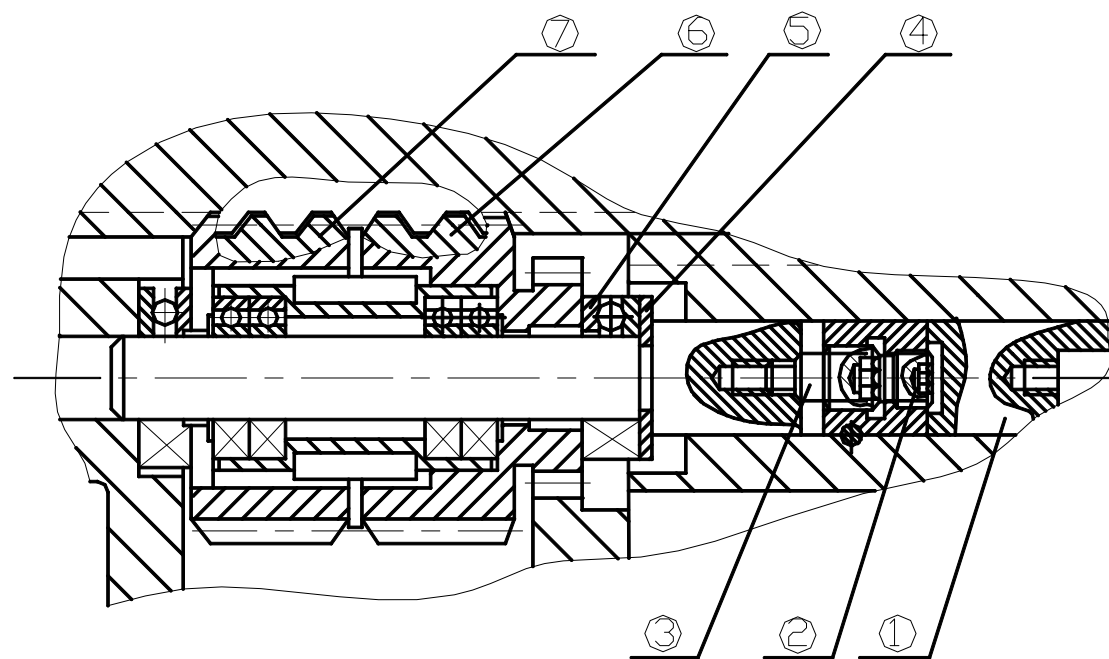


Fig.8.7 Double screw bar construction for horizontal boring machine models TP6113, TPX6113, TPX6113/2(taper Metric 80) and TPX6113/4.

Before adjustment, first remove the plug ①, and then loosen the adjusting screw bar ②. Turn the adjusting bar ③ to push pressure washer ④ and bearing ⑤,

and impact the gear-screw rod ⑥, thus the clearance between it and the screw rack and those between the screw bar ⑦ and screw rack will eliminate.

Install the plug ① and tighten the screw bar ② after adjustment. When the custom uses the machine for a certain period of time, adjust according to the steps said above if the clearance comes up.

8.8 Adjustment for eliminating the clearance of radial facing slide on the facing head for machine model TPX6113/2(taper 7:24). See figure 8.8

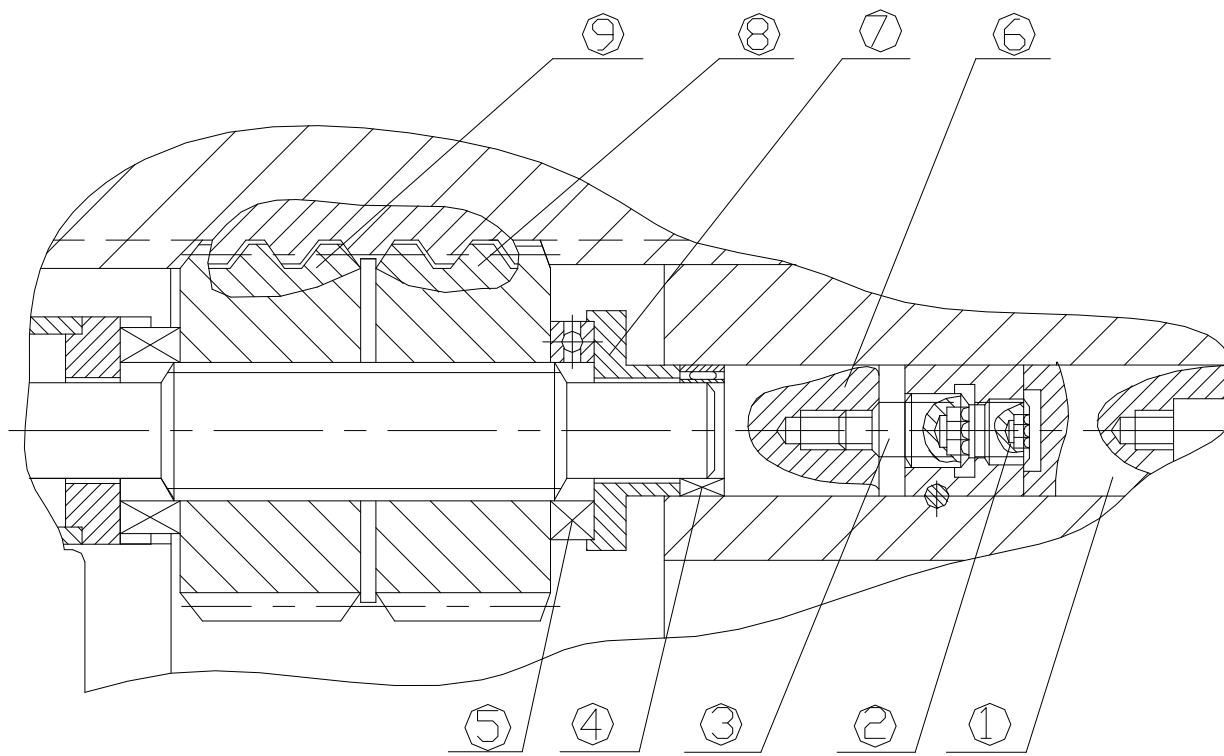


Fig. 8-8 Double screw bar construction for machine model TPX6113/2 (taper 7:24)

Before adjustment, first remove the plug ①, and then loosen the adjusting screw bar ②. Turn the adjusting bar ③ to push pressure washer ⑥, ⑦ and bearings ④, ⑤, and impact the gear-screw rod ⑧, thus the clearance between it and the screw rack and those between the screw bar ⑨ and screw rack will eliminate.

Install the plug ① and tighten the screw bar ② after adjustment. When the

customer uses the machine for a certain period of time, adjust according to the steps said above if the clearance comes up.

8.9 Adjustment of taper roller bearings of facing head for machine models TP6113, TPX6113, TPX6113/2 and TPX6113/4 (see Fig.8.9):

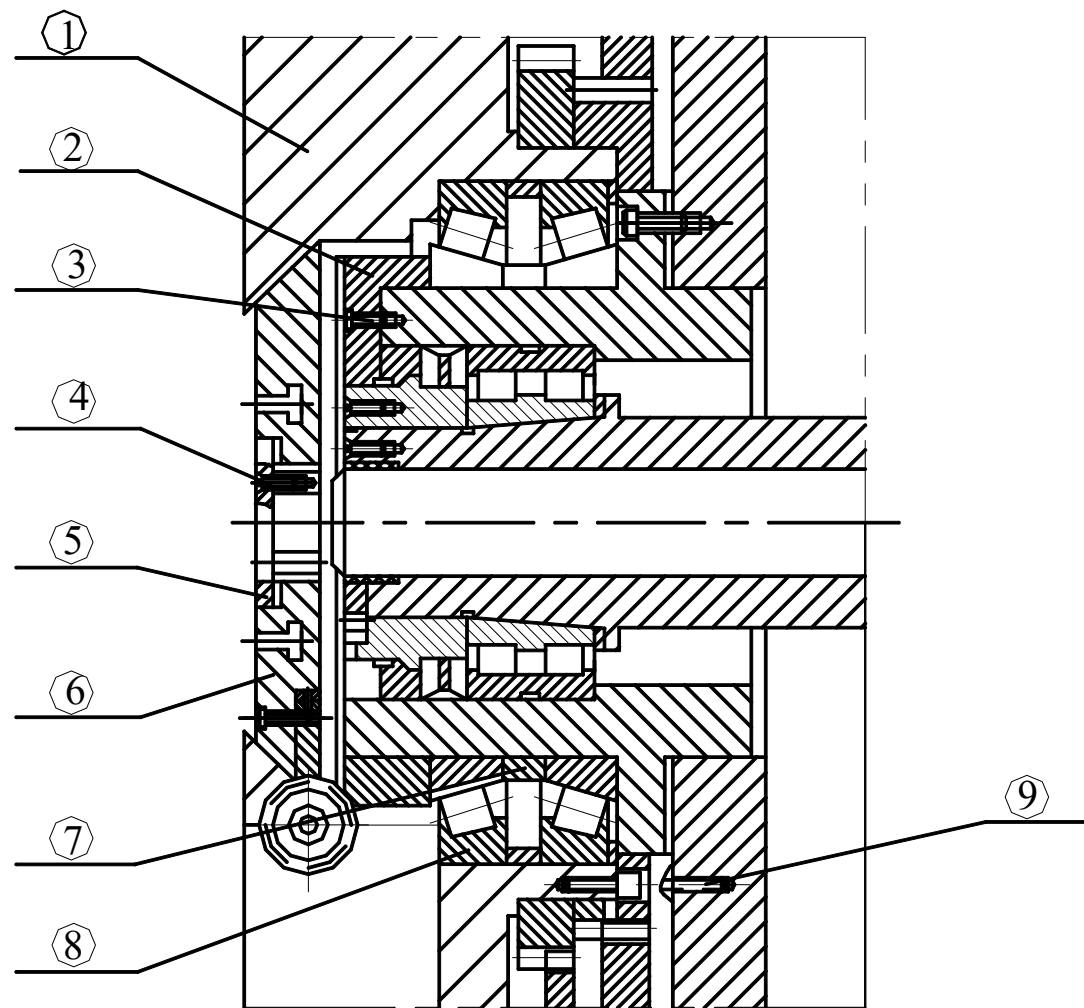


Fig. 8.7 facing head structure of machine models  
TP6113, TPX6113, TPX6113/2 and TPX6113/4

If it is necessary to adjust the clearance of the taper roller bearing to be worn after operation for a certain period of time, first loosen the screws ④ on the slide protection plate, and remove the plate ⑤ and the radial facing slide ⑥. Then after loosening the tighten screw ③, take down the bearing pressure cover ②. At the



same time, the facing head ① and the taper roller bearing ⑧ can be removed by turning the spare screws ⑨ for fixing the facing head. Finally measure the clearance of the worn-out taper roller bearing ⑧, and the regulation ring ⑦ should be ground so as to make the parallelism tolerance between the flat surfaces be within a range of 0.005 mm.

Only when the adjustment of the tolerance has been finished, all mentioned above parts to be dismantled can be remounted respectively to their original position in sequence as shown in Fig.8.9.

## IX. Hydraulic system of the machine

The hydraulic system of the machine is divided into two parts, i.e. the hydraulic system of the headstock and the hydraulic system of the table.

### 9.1 Hydraulic system of the headstock:

The oil pump motor, oil pump and one-time oil filter in the hydraulic system of the headstock are mounted at the back part of the tail bracket. The lower part of the tail bracket is the oil reservoir. The electromagnetic valve plate, two-time oil filter, discharge valve and pressure gauge are all located on the top part of the headstock.

9.1.1 Spindle speed and feed change, engagement or disengagement of the facing head of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4 are controlled by a 2 –position 4-way electromagnetic valve (YV1). The changing of the spindle speed is accomplished by a 25-position 10-way rotary valve to control three 3-position oil cylinders and one 2-position oil cylinder.

The rotary motion of the facing head and feeds of the radial facing slide of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4 are realized by one 2-position 8-way rotary valve to control two 2-position oil cylinders.

For changing of the spindle speeds, first the knob of the rotary valve must be turned to the required position. Depress the speed-change executing push-button, then the oil pump motor starts up. At the moment, the electromagnetic valve (YV1) is electrified and supply oil to the hydraulic system, at the same time, all the oil cylinders begin to act. After the action of all cylinders have been finished, the pressure relay is controlled by the closed-type circle oil circuit of all the oil cylinder piston bars, so that the electric switch is changed from the releasing

position to the compression position, at the same time, the oil pump motor come to a stop, and the electromagnetic valve (YV1) is deselected. Now changing of speeds has been completed and the main motor will automatically be started to rotary.

9.1.2 Distribution of the spindle feeds of the horizontal boring machine model TX6113, and of spindle or facing head motion of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4 are accomplished by a 3-position 4-way electromagnetic valve to control a 2-position oil cylinders.

When the distributing switch is distributed to the spindle position and the spindle or facing head position of the horizontal boring machine models TPX6113, TPX6113/2 and TPX6113/4, the oil pump motor starts up to energize the circuit of the electromagnetic valve (YV10), delivering the oil to the oil cylinder. When the act of the cylinder piston is ceased, depress the electric switch, and the oil pump motor comes to a stop after delay a while. The electromagnetic valve (YV10) is deselected.

9.1.3 Clamping and unclamping of the headstock as well as lubrication of the guide-ways are controlled by a 3-position 4-way electromagnetic valve. When the distributing switch is distributed to the headstock position, the oil pump motor starts up to energize the circuit of the electromagnetic valve (YV12), delivering oil to the oil cylinder. By this time, the headstock is changed from clamping state to unclamping state, and the headstock guide-ways are force-lubricated quantity automatically once. After the said actions are accomplished, the electric switch is pressed, causing the stop of the oil pump motor and deselected of circuit of coil of the electromagnetic valve (YV12) after a delaying a while.

9.1.4 The changing of the feed direction is controlled by a M-type 3-position 4-way electromagnetic valve, the forward or reverse feed push-button is pressed, the oil pump motor is started to actuate and the circuit of coil of the electromagnetic valve (YV2) or (YV3) is energized, so that the forward or reverse feed can be obtained. After the said actions are accomplished, the oil pump motor will stop rotating.

For stopping of the feed movement, depress the push-button for stopping the feed to disengage the circuit of coil of the electromagnetic valve (YV2) or (YV3). At the moment, the electromagnetic valve returns to the middle position to start the oil pump motor, delivering oil to both ends of the oil cylinder simultaneously, as a result, the clutch is disengaged. For the moment, the oil pump motor will stop rotating.

## 9.2 Hydraulic system of the table

The clamping and unclamping of the rotary table and cross & longitudinal saddles are controlled separately by three 3-position 4-way electromagnetic valves (Fig.9.3). The working principle is the same as that of selecting headstock movement. This hydraulic system is centralized on the end part of the longitudinal saddle.

In case there should occur some abnormal noise after long time service of the oil pump, the oil filter in the oil reservoirs must be cleaned immediately.

## X. Measuring system of the machine

The English Newall electronics spherosyn and the economic type digital display device with reading accuracy of 0.005mm are used for measuring the vertical movement of the headstock and cross traverse of the table.

The optical aiming device with a magnification ratio of seven times is used for positioning the rotary table at position of  $4 \times 90^\circ$ .

### 10.1 Digital display device

#### 10.1.1 Installation process

This installation process is fitted for measuring the elevating movement of the headstock and cross traverse of the table: first the fixed scales are mounted respectively on the base surface of the column and the cross saddle, then the sliding scales are mounted respectively on the base surface of the headstock and the longitudinal saddle through mounting fixture. The digital display device is mounted on the fixture for digital display device at back of bed.

#### 10.1.2 Using method

For details please refer to the Operation Manual for sphere inductosyn and digital display device (supplied by manufactory).

### 10.2 Positioning of rotary table

For convenience of positioning of the rotary table, an optical aiming device with magnification of seven times is adopted for precision setting of the rotary table at the positions of  $90^\circ$ ,  $180^\circ$ ,  $270^\circ$  and  $360^\circ$ . The four aiming block with scale are mounted respectively on the four position of the rotary table. Switch on the machine and inching the rotary table, enabling the scales on the aiming block located exactly between the double lines of the screen, only after this the table can

be clamped for machining.

10.3 According to the requirement of the custom, this machine can supplied specially with measuring system of longitudinal movement of the table, whose installation process is the same with those explained above.

10.4 According to the requirement of the customer, this machine can be supplied specially with coordinate measuring system of rotary table, which can realize positioning of arbitrary angle. This system is mounted inside the table. For details about using method please refers to Operation Manual of sphere inductosyn (supplied by manufactory).

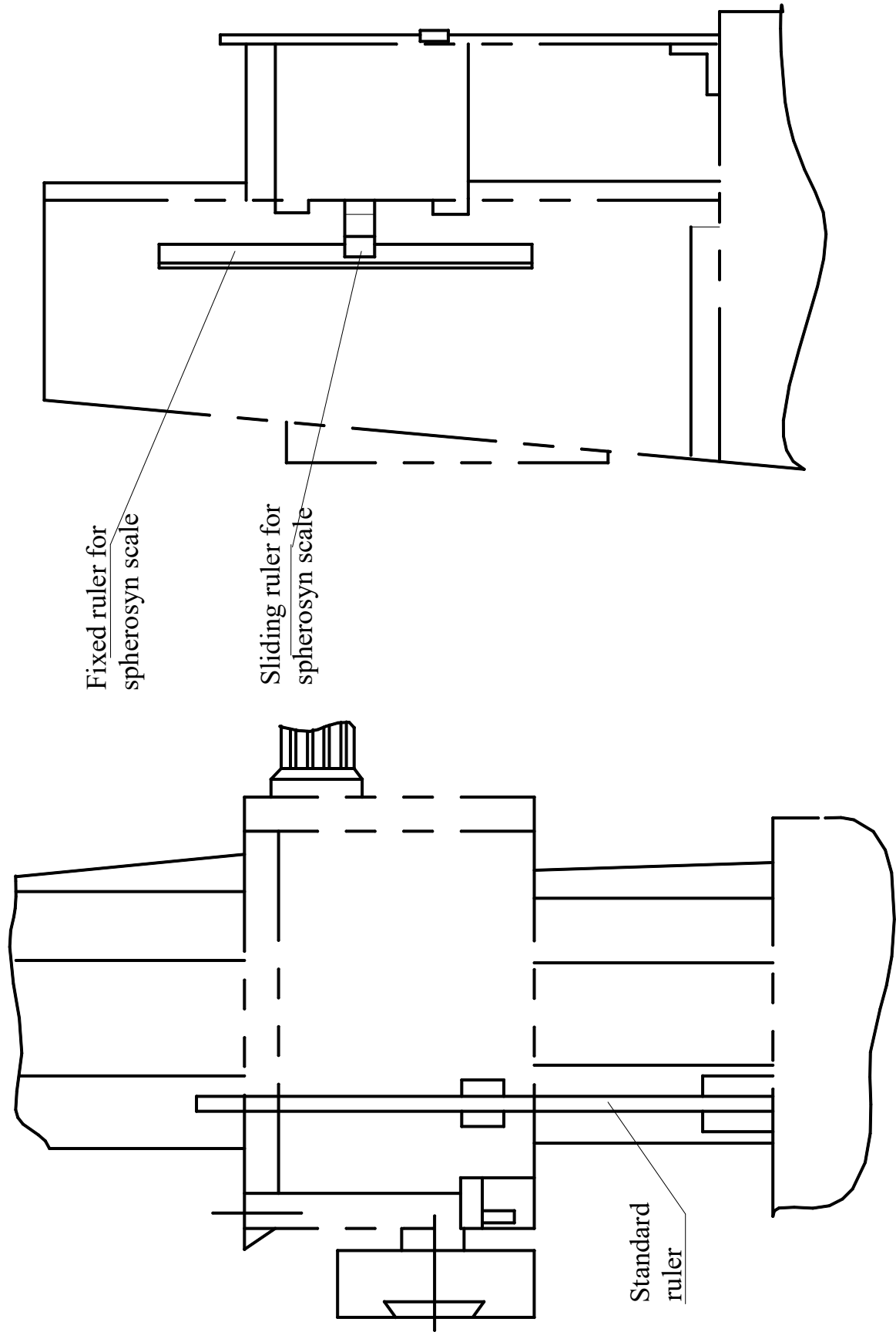


Fig.10.1 Position diagram of spherosyn scale for headstock

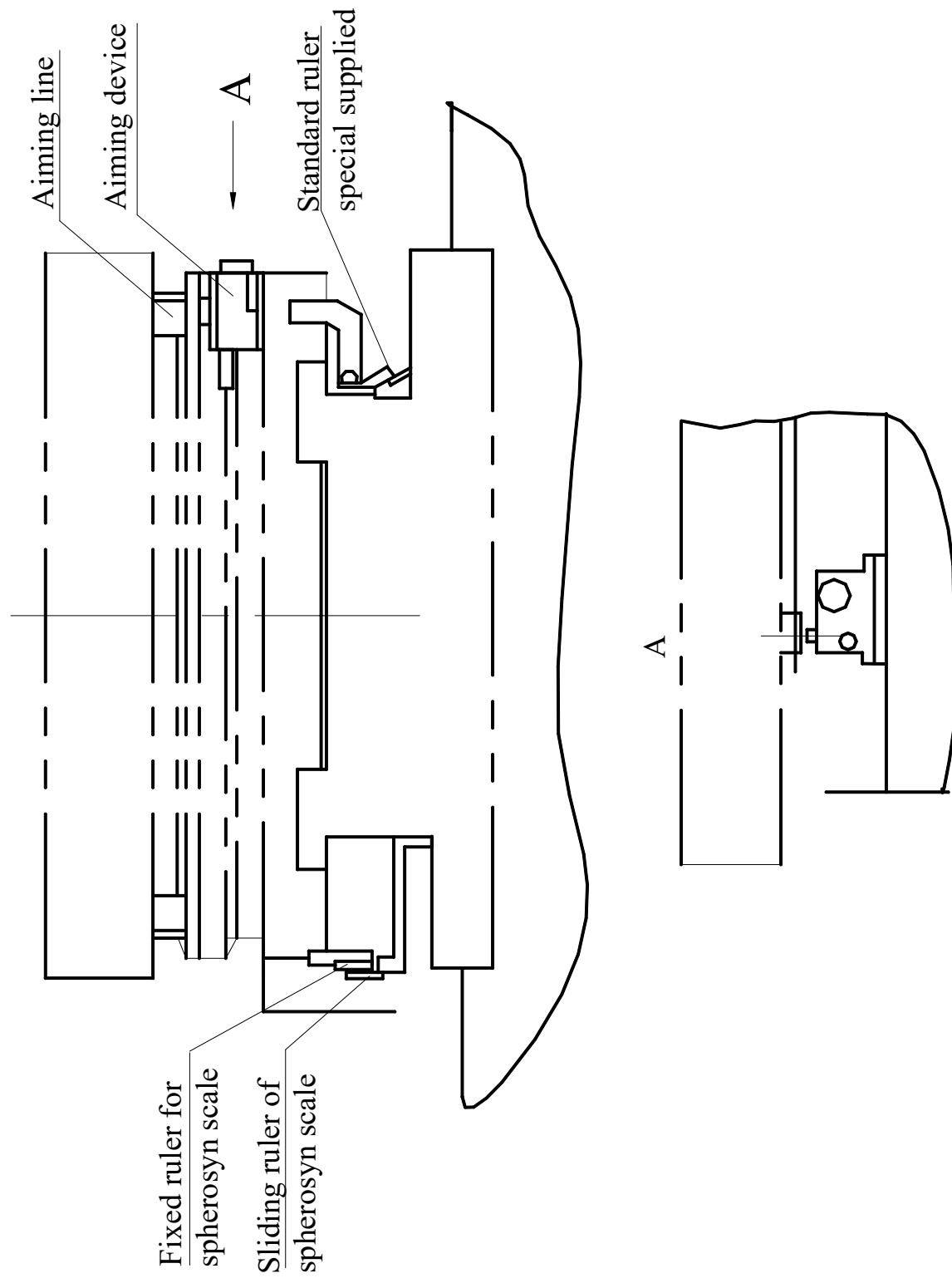


Fig. 10.2 Positioning of worktable  $4 \times 90^\circ$  and spherosyn scale



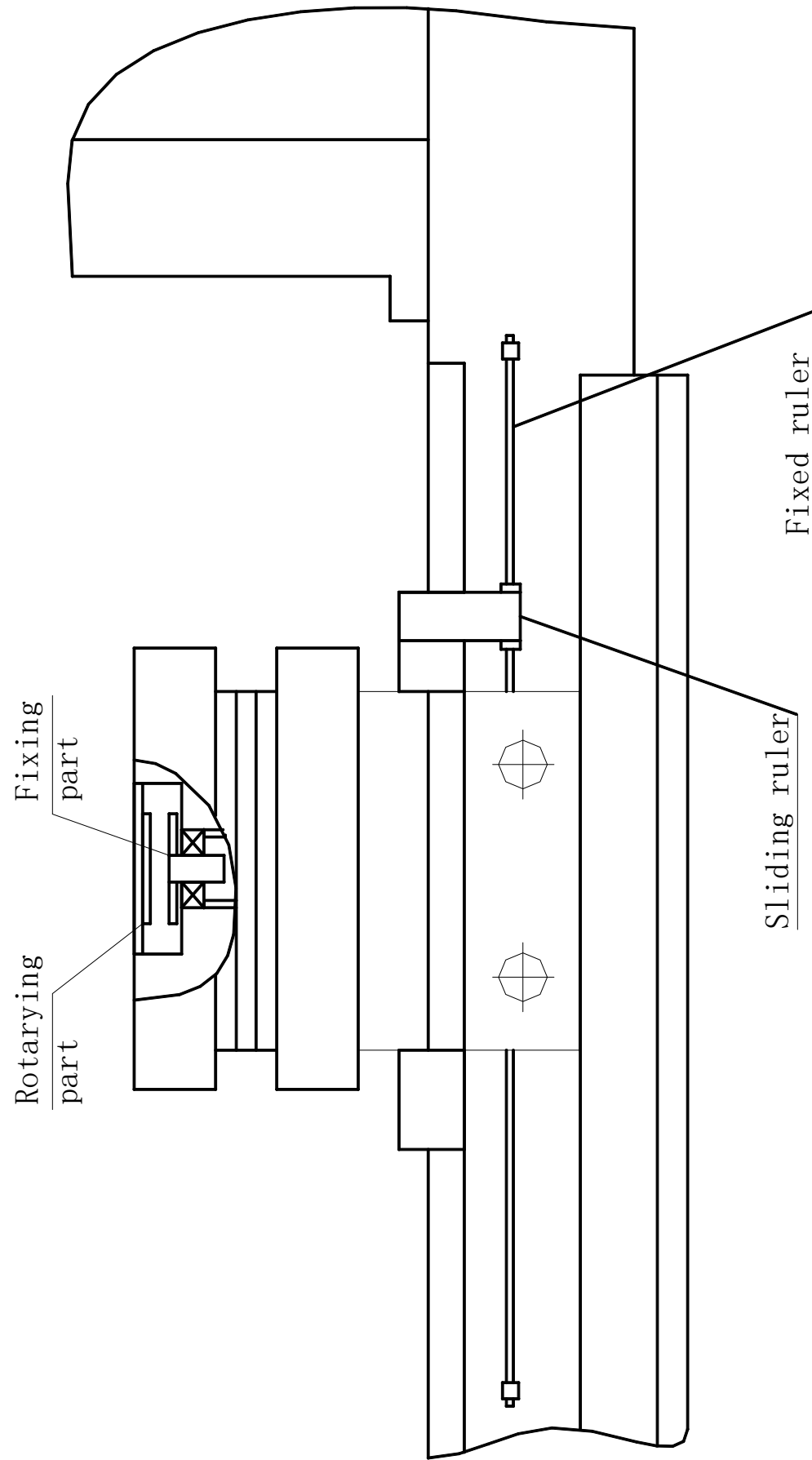


Fig. 10.3 Measuring device diagram for table rotation angle and for longitudinal movement of saddle

