IT IS NECESSARY FOR YOU TO READ THIS BOOK CAREFULLY AND THOROUGHLY BEFORE OPERATING THE MACHINE

THE CHINESE VERSION OF THIS TECHNICAL DOCUMENT IN ENGLISH IS REGARDED AS FINAL.

PREFACE

Thank you for purchasing the machine manufactured by Shenyang No.1 Machine Tool Works.

We provide 《Operation Manual》for this (series) machine(s), the operation manual of the machine provides contents on safety performance, matters needing attention to safety, operation, adjustment and maintenance to guide the customer to install, debug, use, operate, repair and maintain the machine properly to guarantee the safety of person and machine.

This operation manual contains detailed explanation for various safety regulations and measures. It is necessary for you to read this operation manual carefully and thoroughly and be acquainted with all details of the operation manual before operating the machine to avoid any accident due to false operation of the customer.

Although the safety matters needing attention to operation stated in the operation manual is complete and concrete, the matters cannot be forecasted detailedly for 100% due to complexity of the machine and uncertainty of the accident, so the machine should be operated by the technician who has got specialized training.

In addition, the introduction of safety matters needing attention is stated from next page. This content includes matters needing to attention to operation and maintenance. These regulations must be obeyed, otherwise, personal safety of the operator may be breached, and normal running of the machine may be damaged.

The manufacturer should take charge of safety of the machine and the auxiliary implements provided together with the machine.

The customer should take charge of safety of fixture, processing device and auxiliary implements, in charge of the danger of the machine resulting from replacing or modifying the original processing device and auxiliary implements.

The customer should take charge of the danger resulting from installing, operating and maintaining the machine not according to the operation manual.

We would like to call your attention: It is forbidden to copy or transfer the text and the illustration to the third party without permission. Concerned part of the operation manual is not modified according to improvement of local structure during manufacturing of the machine.

We believe firmly that you will be satisfied with this (series) machine(s), please feel free to contact us for us to provide after-sales service when you encounter any indeterminable difficult problem.

Contents

SAFETY  CAUTION

Operators must read Operation Manual carefully, and install, operate, maintain according the requirements to avoid the damage accident from devices or persons!

1. Matters Needing Attention about Safety

1.1 It is the precondition of no-failure operation to fully grasp the performance of the machine and observe all operation requirements. So, we specially emphasize that the operation manual is an important part of the machine, and it is necessary for operators to read the operation manual carefully and seriously, comprehending and grasping the structure and performances of the machine, safety operation specifications and the warning contents on all warning label plate before operating the machine, and operator must strictly observe operation specifications, if or not, serious personal injuries or deaths may occurs.

1.2 The installation, operation, maintenance and overhaul for the machine is performed by qualified person according the specified process in the Operation Manual.

1.3 The operator must wear labor protection clothes, safety cap and put long hair into the cap, and it is forbidden to wear loose overcoat, various accouterment in order to avoid any accident.

1.4 Before starting the machine, inspect the safety protective devices of all parts and surrounding working environment; inspect whether the limit switches functions of all moving parts are normal; inspect whether the travels of moving parts are smooth and unobstructed; check to be sure the machine is always keeping safety status in any time.

1.5 It is forbidden to touch rolling tools during machine running. It is necessary to stop the machine during measuring, adjusting and cleaning the machine, if or not, accidents may occur. In addition, Electric elements such as motors, etc., should be often cleaned to avoid obstructing ventilating (it is forbidden to use air compressor to clean the machine).

1.6 Operators should notice the following matters during machine running : any part of the body is not allowed to close or put on the rotary or moving parts of the machine during machine running; it is forbidden to open the protective door or any protective cover of the machine during machine running; workpieces and cutting tools must be firmly clamped; it is not allowed for overload operation.

1.7 It is necessary to perform relevant safety inspections and know well the function of

every switch before switching on the power supply. It is necessary to switch off the power supply before opening electric cabinet, protective door or maintaining the machine; in addition, if the maintenance for the machine needs hot-line operation, it must be performed by the person who is qualified and professional.

1.8 It is forbidden to pile up tinder around work environment of the machine, and forbidden to use inflammable coolant during turning operation. It is necessary to cut off the general supply of the machine after all operations end to avoid fire occurring under no person taking charge it.

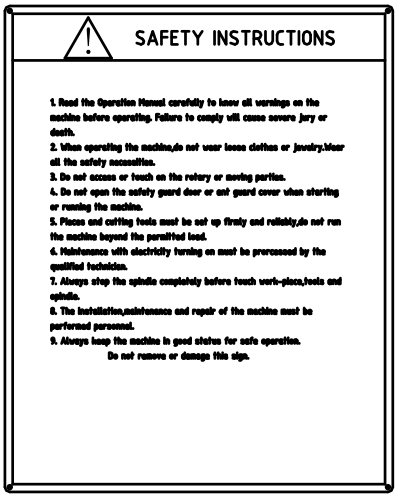
1.9 Operators should be far away from movable parts during machine running.

1.10 The following should be noticed by operators during installing and disassembling equipments: if the weight of the equipment is more than 20kg, it must be operated by two persons, and it is necessary to use lifting rig for heavy equipments, and the lift rig must be certified.

1.11 Maintenance personnel must tie safety belt to avoid high-altitude falling accident while operating at high place.

1.12 The measures, such as installing isolation cover, anti-noise rest room etc.,can be adopted to avoid the damage from noise.

1.13 Safety label plates and their locations.



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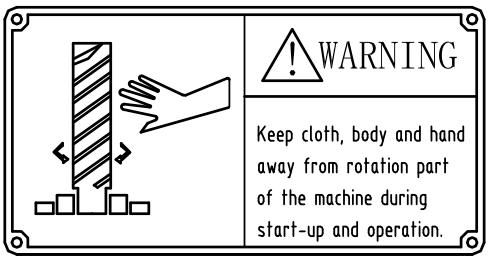
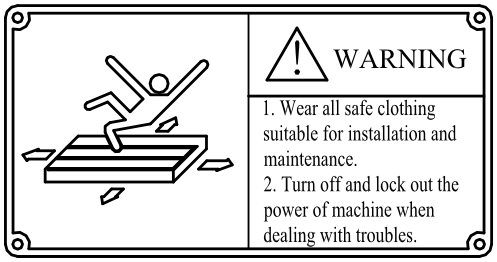


3-100；Eng. Q94-7



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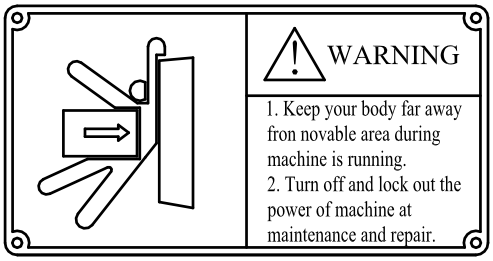


6-100；Eng. Q94-7

Fig.1.1 Models of safety label plates

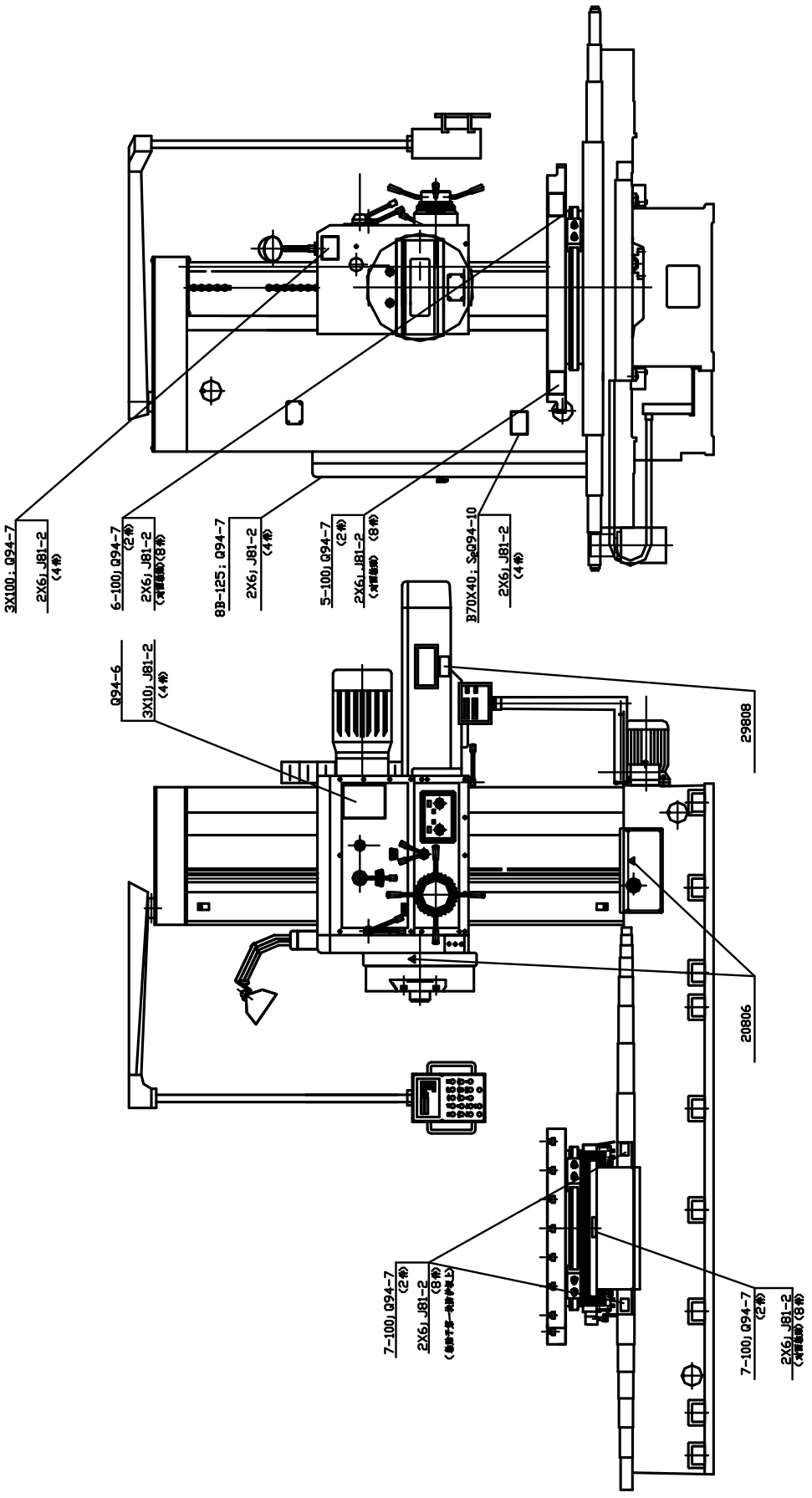
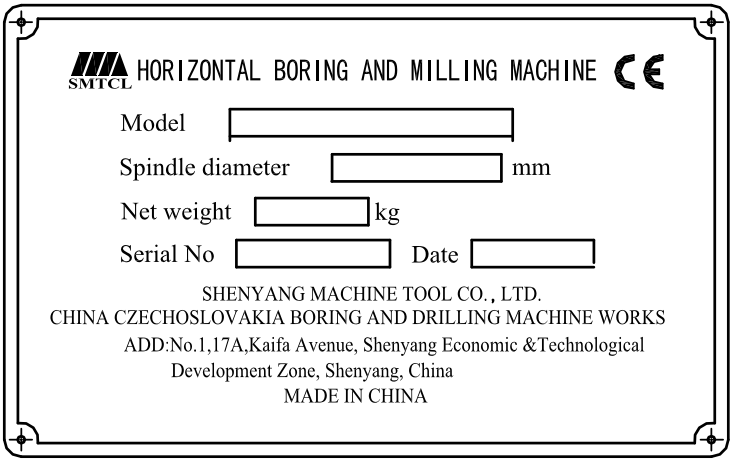


Fig.1.2 Location drawing of safety label plates

2. Major Purpose and Application Conditions of the Machine

2.1 Model of the machine

The series machines includeTPX6111B, TPX6111B/2 and TPX6111B/3



2.2 Major purpose of the machine

This machine is a universal horizontal milling and boring machine. It is suitable for processing large-size work-pieces such as cases, shells, bases, etc. with drilling, boring, expanding, reaming, countering, milling, grooving and threading etc. The machine is widely used as key equipment to machining cases in the field of engine, transportation, heavy type, petroleum machinery etc.

2.3 Environmental Available for the Machine

The machine is to be used in following environment and operating conditions:

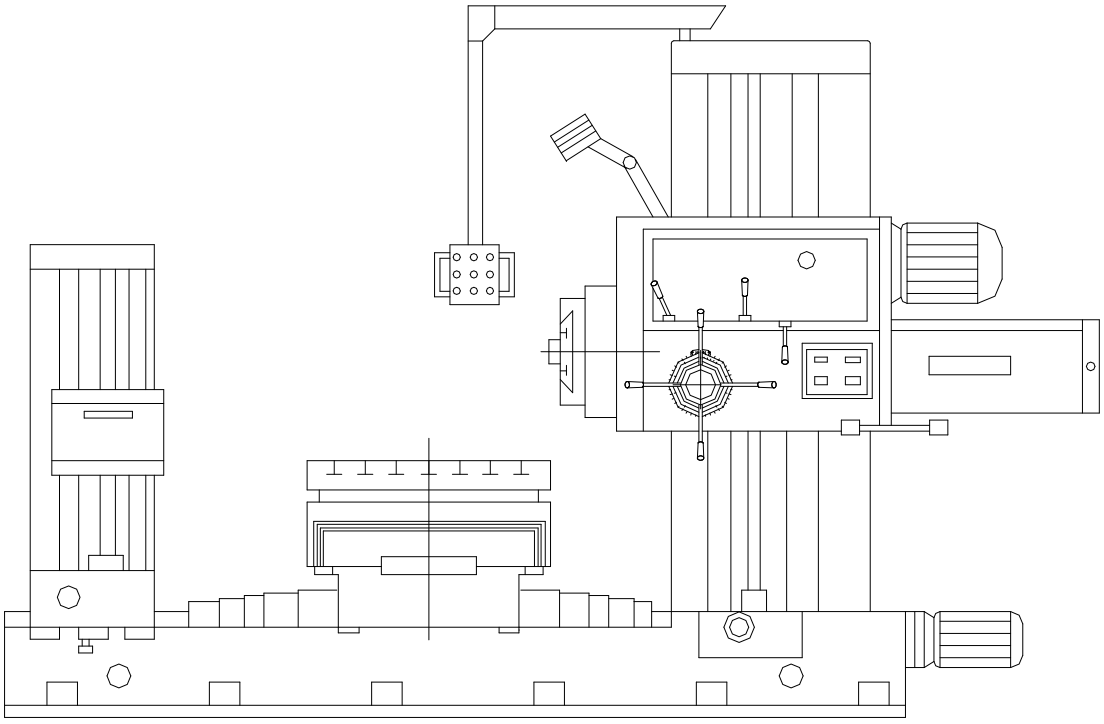
Environmental temperature: the range of environmental temperature of the workshop is 15°C～25°C, the range can be extanded to 5°C ~ 40°C if the accuracy of the workpiece to be turned is allowed.

- Humidity: When under the max. temperature of 40°C, the relative humidity shall not be over the range of 50%, high relative humidity is allowed under low temperature (90% under 20° C).
- Height above sea level: Lower than 2000 m.
- Atmosphere pollution: There is no excessive dust, acid gas, corrosive gas and salt component，i.e., dust concentration is not allowed more than 10mg/m3，and acid, salt and corrosive gas are not allowed containing.
- Radiation: It is necessary to avoid temperature rising of environment due to direct lighting up of the sun for the machine or heat radiation.

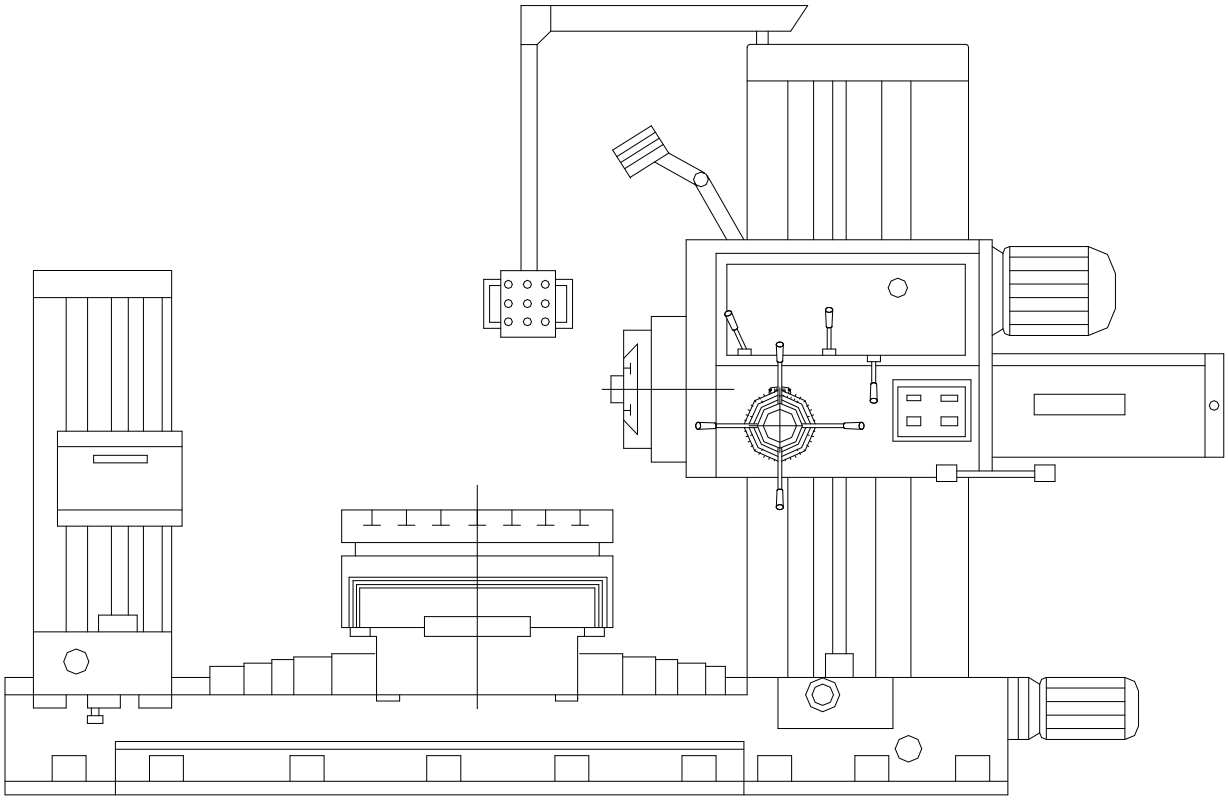
- Location for installation of the machine should be far away from vibrating source, heat source, heat flow, flammable and hazard articles. The shake is less than 0.5G(G is acceleration of gravity)
- Power supply: The stable value of input power supply voltage of the machine is 0.9-1.1 times of rated voltage (380v,50Hz).
- Input power supply frequency of the machine: 0.99-1.01 times of rated frequency (continuous). 0.98-1.02 times of rated frequency (work for a short time).
- Materials forbidden to cut: non-metal material, i.e. graphite, stone; material with low rigidity that cannot be clamped or fixed; metal with low igniting point, i.e. magnesium alloy, etc.; poisonous or flammable material. This machine is suitable for using in practical environment under certain running condition

3. Major construction and performance of the Machine

General view of the machine model TPX6111B



General view of the machine model TPX6111B/2
TPX6111B/3



Note:The rear column of TPX6111B/3 is special supplied

The main purpose of this Operation Manual ia to help the operator and the maintainer to get acquainted with the performance, construction and features of the machine, and to quickly master its operation method so as to enable them to rationally operate, adjust and maintain the machine.

This series of machine is of genenal-purpose, suitable for such operation as drilling, counter-boring,boring,reaming,spot-facing,tapping and milling etc. The horizontal milling and boring Machine type TPX6111B、TPX6111B/2、TPX6111B/3 is equipped with fixed facing plate on which radial facing slide can be radicaly feeded consequently to enable the machine to undertake boring of large-diameter hole, external cutting, end face turning and recessing, etc.

The machine is of the characteristics as follows:

1) The speed change of main motion and feed motion of the machine are all adopted hydraulic pre-selection centralized control, which can save the auxiliary time and increase the working efficiency of the machine. The indicator lamps are lighted up to give the signal during the course of speed and feed changing.

2) The taper of the spindle is 7:24-No.50 and an automatic load and unload tool device is equipped with it, this not only shorts the assistant time of machining but also reduces the labor strength of the worker. The accuracy of the spindle may keep very well.

3) The motion distribution of longitudinal, cross travel and rotation of moving units of the machine such as headstokc and table, clamping and unclmaping of moving units are provided with automatic electrical hydraulic interlocking devices, this make the machine with high automation.

4) The vertical coordinate (headstock lifting direction) and cross coordinate (table transverse movement) and longitudinal coordinate (table longitudinal movement, supplied according to the custom's requirement) are provided with new type Digital Display Unit with memory function, which make the machine with complete function and high accuracy.

5) Main parts of the machine with max.loading of 2500Kg such as bed, front column and guideways of lower saddle are all adopted electric-contract surface heating self-cooling harden, which bring high stiffness of the guideways and extend the using life of the machine. Main parts of the machine with max.loading of 3000Kg such as upper saddle and lower saddle are adopted with guideways pasted with plastic.

6) The horizontal guideway surface of the machine is provided with all pull-board type dust-proof to avoid abrading the guideway surface and at teh same time, making the mahcine more beautiful.

7) Electric-hydraulic interlocking device will be fixed between the moving units and when

a moving unit is moving, the other moving units will be clamped automatically (except spindle, radial facing slide). In the headstock and rapid transverse gearbox, safety clutches are installed to prevent the machine from overload.

8) Electric-control system of machine adopts programmable controller with high reliability.

4. Main Spec and technical parameters

Data / Model / Configuration		TPX6111B	TPX6111B/2	TPX6111B/3
Diameter of spindle（mm）		ϕ110		
Max.torque of spindle（N.m）		1225		
Max.torque of facing slide（N.m）		1960		
Max.axial thrust of spindle（N）		12250		
Spindle taper		morse 6（7：24、50#）		
Worktable travel (mm)	Longitudinal	1400		
	Cross	900	1250	1600
Distance from spindle center line to worktable surface(mm)	Max.	900		1200
	Min.	0		
Max.travel of spindle（mm）		600		
Max.travel of radial facing slide（mm）		180		
Max.permissible load of table（kg）		2500		3000
Speed number of spindle		22 steps		
Speed range of spindle		8-1000r/min		
Speed number of radial facing slide		18 steps		
Speed range of radial facing slide		4-200r/min		
Rapid traverse speed of spindle, headstock, cross & longitudinal saddles		2500mm/min		

Data / Model / Configuration		TPX6111B	TPX6111B/2	TPX6111B/3
Worktable working surface (mm×mm)		1100X960		1250X1100
Rapid speed of rotary table		1r/min		
Feed number of spindle, headstock and table per spindle revolution		18 steps both in the low and high spindle speed		
Feed number of radial slide on facing head, headstock, cross & longitudinal saddles per facing head rotation		18 steps		
Feed range of radial slide on facing head, headstock, cross & longitudinal saddles per facing head revolution		0.08-12mm		
Feed range of spindle, headstock, cross & longitudinal saddles per spindle revolution	When spindle speed is within 8-400r/min	0.04-6mm(0.0016-0.2362")		
	When spindle speed is within 500-1000r/min	0.01-1.88mm(0.0004-0.074")		
Reading accuracy of measuring system	Metric	0.005mm		
	Inch	0.0005"		
Boring accuracy		IT7		
Roughness of boring hole		3.2 — 1.6		
Standard		Boring diameter:∅50-∅240 Distance between original position of spindle and tool tip ≤450mm		
Overall dimension (L×W×H)		4910×2454×2750	4930×2870×2750 (4930×3359×2750)	5117×3359×3079
Machine weight (approx.Kg)		13000	14500	18000

Motor

Data / Application	50Hz	380V	60Hz	220V
	Power(KW)	Rotation(r/min)	Power(KW)	Rotation(r/min)
Main drive motor	7.5	1450	7.5	1740
Rapid motor	3	1430	3	1700
Hydraulic oil pump motor for headstock	0.37	1400		
Hydraulic oil pump motor for worktable	0.75	1400	0.75	1200

5. Transportation, installation and preparation for trial running of the machine

5.1 Transportation of the machine

5. 1.1 Transportation of the whole packed machine

The machine, which is still packed in the case should be handled according to the indication marked on the case for proper hoisting by means of wire ropes. Tilting, violent shocks and collision should be avoid during transportation.

The machine, which is already unpacked should be handled by means of steel ropes which is hanged on two steel bar inserting into the hoisting holes in the machine bed. For details please see fig.5-1

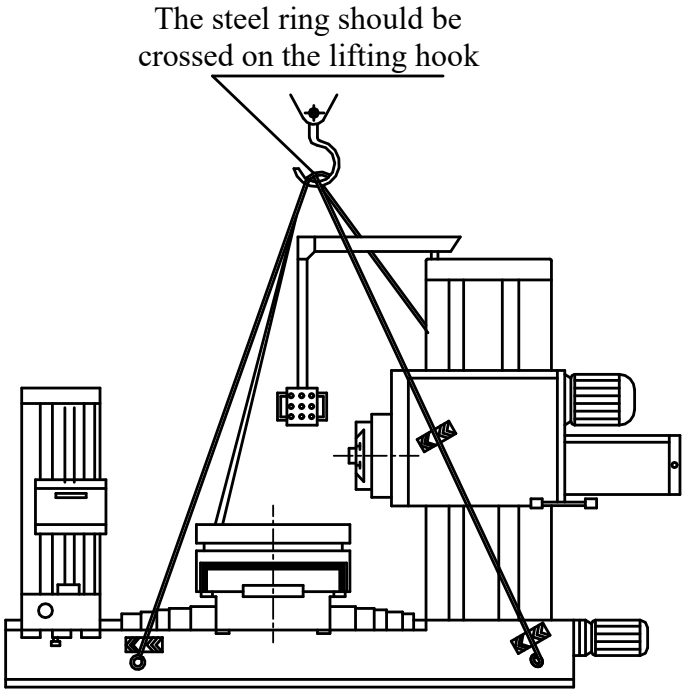


Fig.5-1 Diagram for hoisting the machine

5.1.2 Transportation for separately packed machine

This machine is separately packed in four cases:

The first case: The second case:

The third case: The fourth case:

Tilting, upside-down or heavy collision should be avouided during transportation.While carrying the packed machine you should according to the indication marked on the case for proper hoisting by means of steel ropes.

After unpacking the machine, be sure to check the machine first to see whether any damage is done and then inspect the accessories attached to the machine to see whether they are right and ocmplete according to the packing list. For hoisting the unpacked units and the whole machine please see fig.5-1

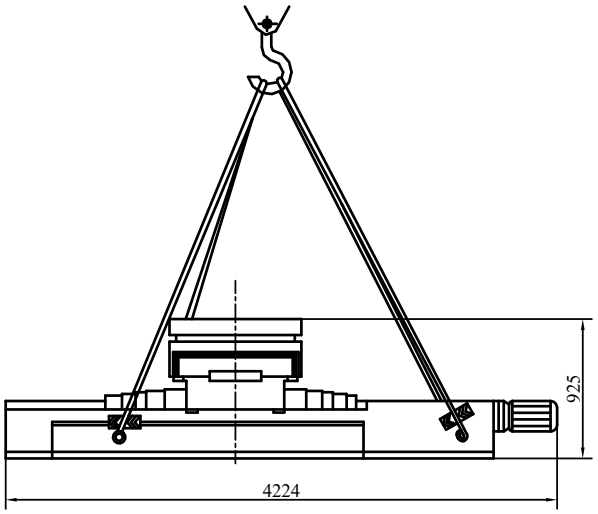


Fig.5-2 Bed and worktable etc. (approx. 8 tons)

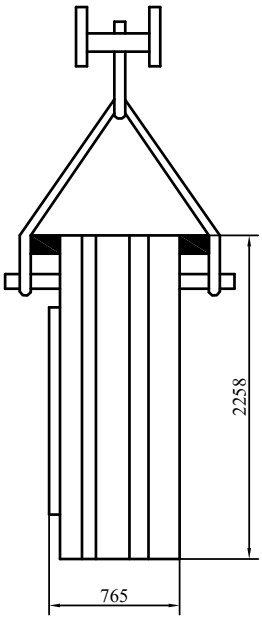


Fig.5-3 Front column (approx. weight 2 tons)

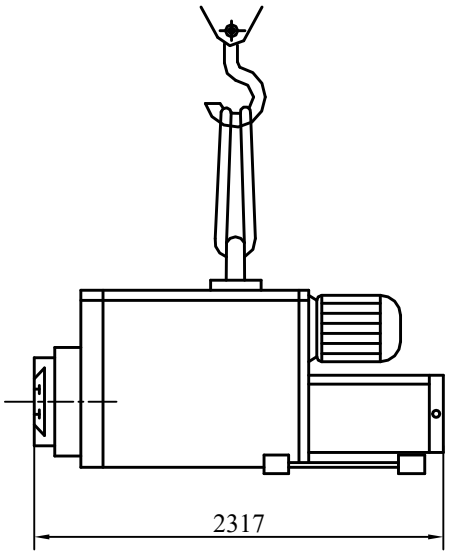


Fig.5-4 Headstock (approx.weight 2.5 tons)

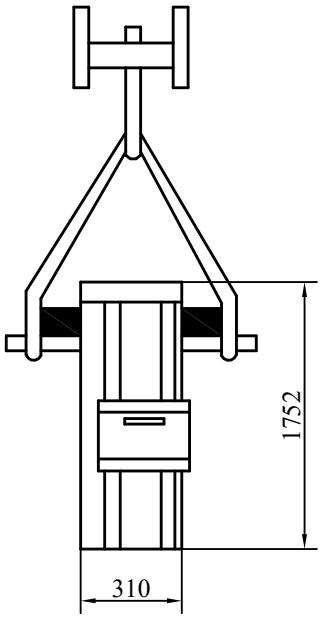


Fig. Rear column (approx. weight 2 tons)

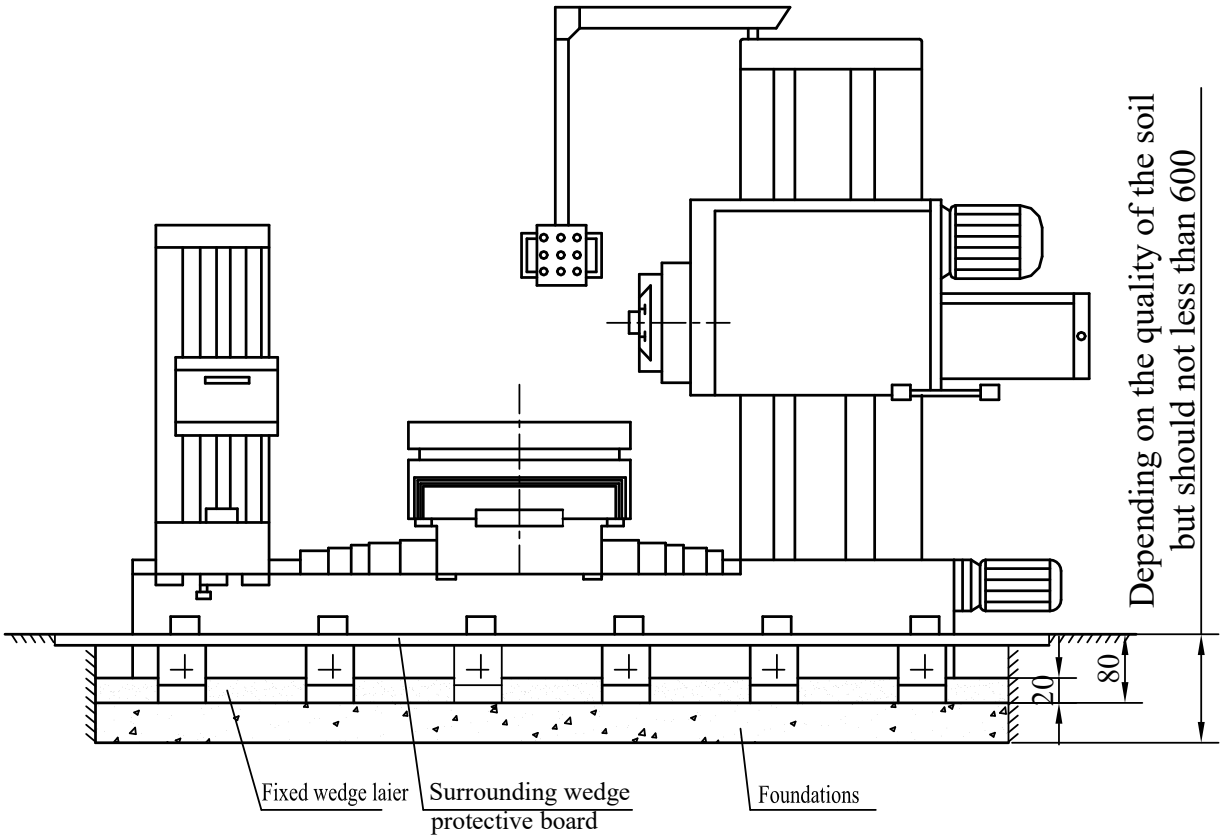
5.2 Installation

5.2.1 Before installing TPX6111B, TPX6111B(with higher column) , the foundation base should be made first in according with the specifications of the foundation plan, (Fig,5-6)

After the cement mortar has completely been solidified, the machine can be installed on the foundation base.

The adjusting wedges, foundation bolts and nuts, etc. used for installing the machine, are placed in the accessory case.

The grounding resistance of the machine is less than 4Ω



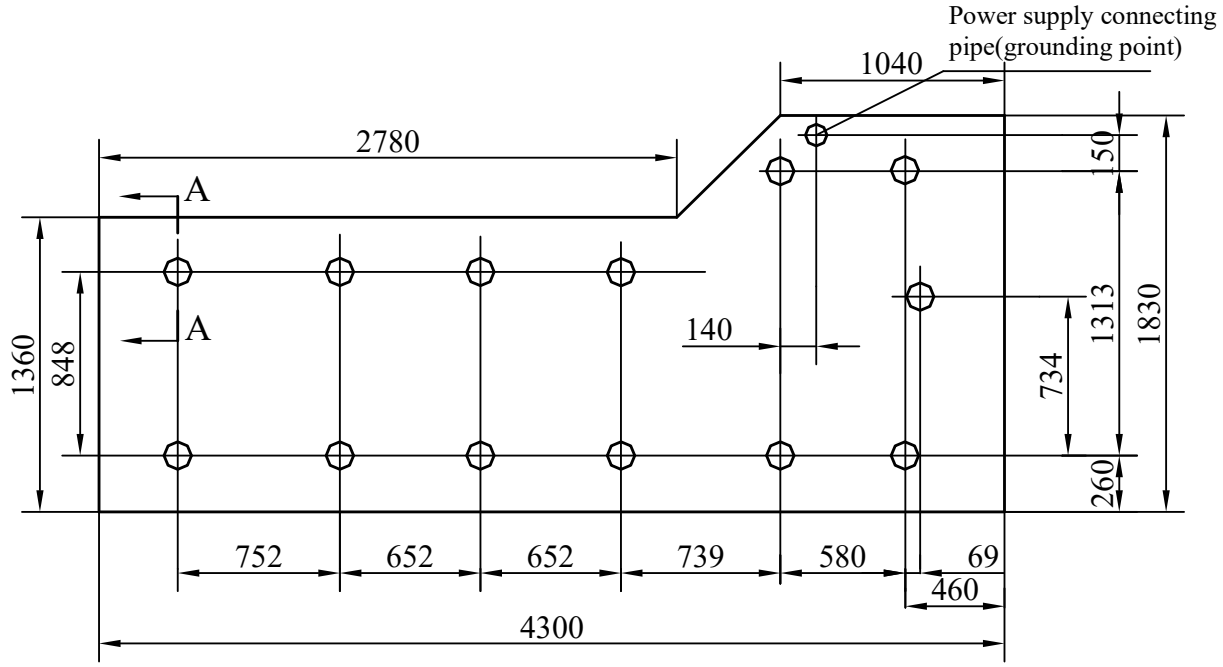
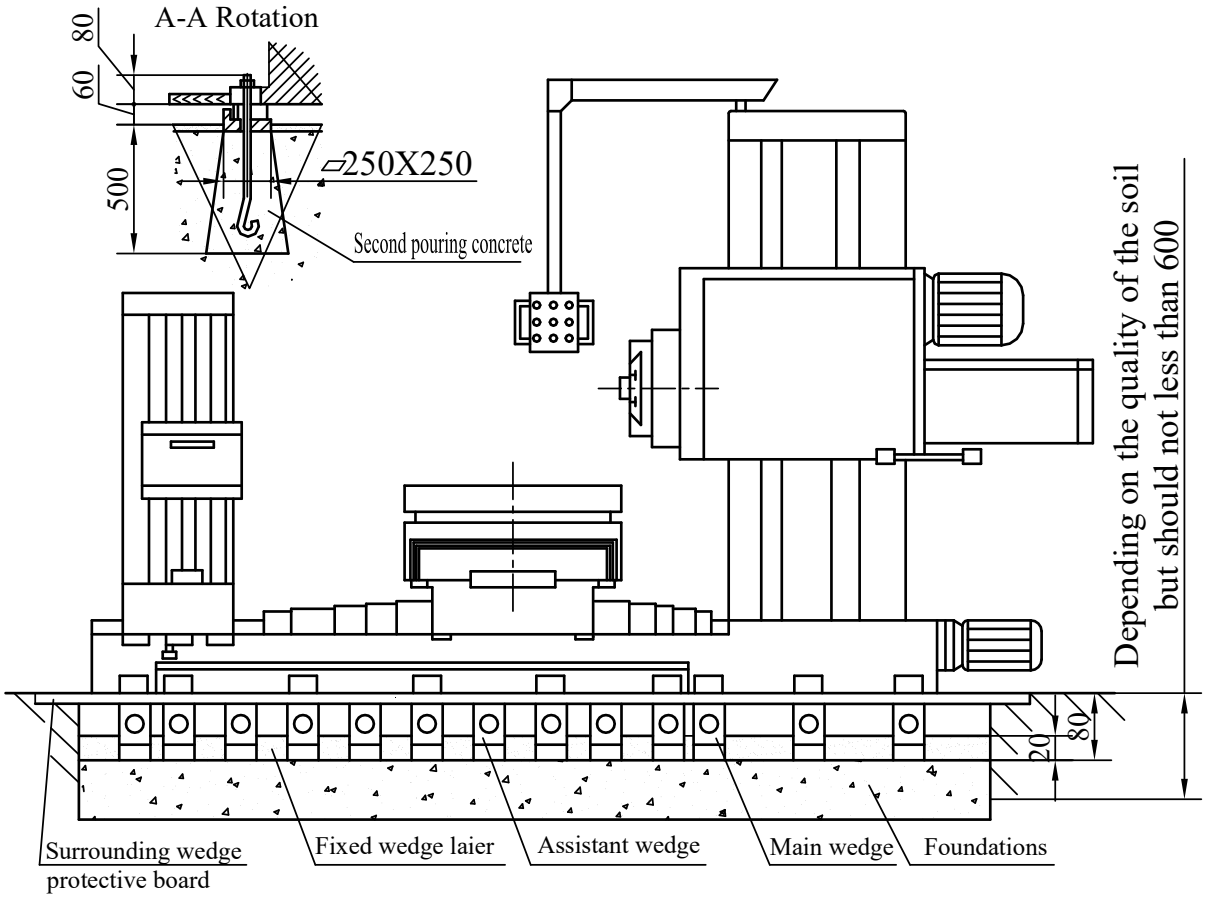


Fig.5-6 TPX6111B


A-A Rotation
80
60
500
250X250
Second pouring concrete
Depending on the quality of the soil
but should not less than 600
20
80
Surrounding wedge
protective board
Fixed wedge laier
Assistant wedge
Main wedge
Foundations

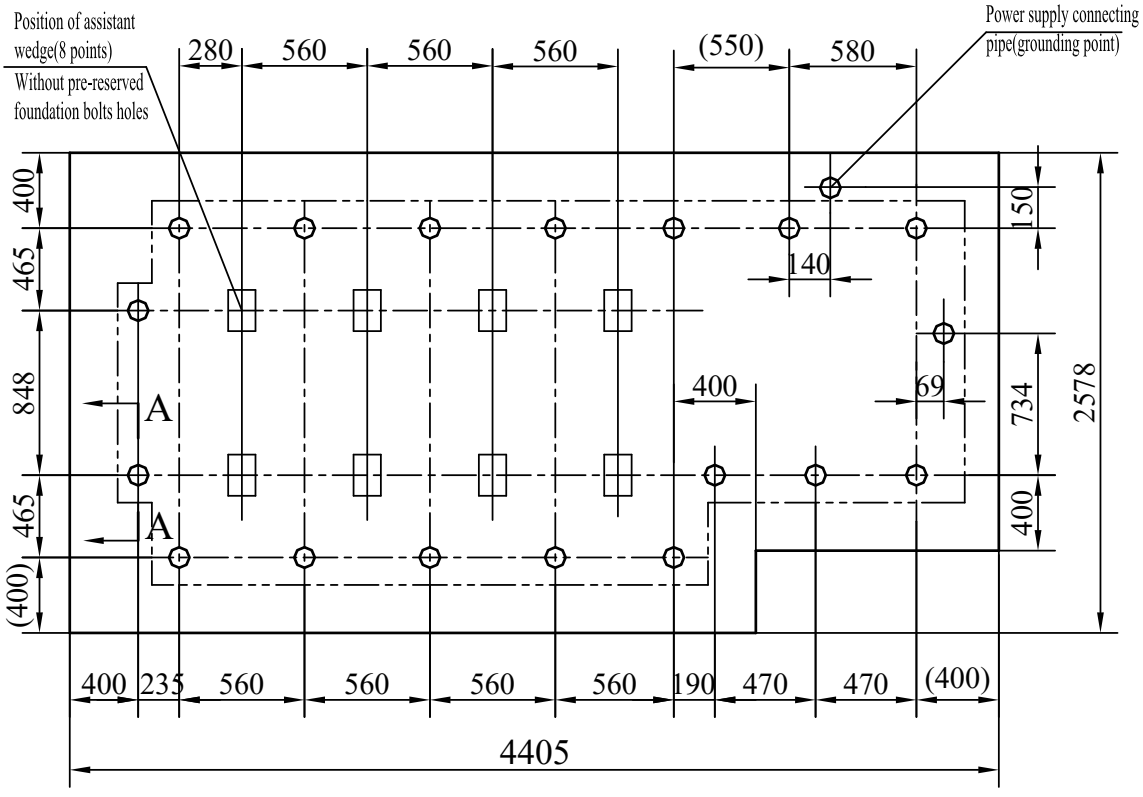

Position of assistant
wedge(8 points)
Without pre-reserved
foundation bolts holes
Power supply connecting
pipe(grounding point)
280
560
560
560
(550)
580
400
465
848
465
(400)
A
A
140
150
400
69
734
400
2578
400
235
560
560
560
560
190
470
470
(400)
4405

Fig.5-7 TPX6111B/2&TPX6111B/3

5.2.2 Before installing the machine, the foundation base should be made first in accordance with the specifications on the foundation plan as shown in Fig.5-7, and the foundation bolts holes should be pre-reserved(18 in total) as shown in A-A rotation drawing to perform second pouring concrete according to the actual positions of the foundation bolt hols on the machine bed after it has arrived. Put main and assistant wedges of the machine and fix them with concrete after the concrete poured the second time having solidified.

The adjusting wedge, foundation bolts and nuts etc. used for installing the machine are place in the accessory box.

Note：The assistant wedges are the same with the main wedges of the machine except that the former are not equipped with foundation bolts.

Install the auto-lubrication pump, electric distribution terms and protective pull-board on the relative positions at the back of the lower saddle.

The grounding resistance of the machine should be less than 4Ω.

5.2.3 As the machine is separately packed, the two trapped level keys in the hole of vertical feed shaft and leadscrew of headstock may have shocken off during separately packing or transporting,thus the users must pay attention to that whether the two keys have fallen off before installing the machine. The method to install the keys should according to the illustration on page 21 in the list of Spare Parts.

5.2.4 When installing the separately packed machine, first adjusting the machine bed with precision spirit level. Installing front column, headstock and rear column only after the bed has been leveled. Final adjustment should be carried out in both longitudinal and transverse directions of the bed guideway surfaces by precision spirit level and bridge-type base when all the units have been installed. The leveling accuracy of the machine beds should remain within 0.04mm/1000mm, and at the same time the auxiliary guideway must be paralled to the bed guideway with the paralism within 0.02mm/1000mm. As the working accuracy of the machine depends upon its installationh, the results of accuracy test carried out after installation must conform to the actual measured errors of the machine accuracy and working accuracy recorded in the Test Certificate provided by the manufacturer.

Observing the spirit level range while tighten the foundation bolts, cause improper tighten may bring deformation of the machine.

5.3 Preparation for trial running

Before trial running the machin, be sure to clean off the dirt and to fill oil in each lubrication points, headstock, hydraulic tank and the surface of sliding guideways.For the

whole-packed machine, Fist hand drive the headstock to lift it a little up ， then take off the support padding under the headstock. Hand drive the headstock to make it down until the balance weight lift, and then take out the steel pipes for supporting the balance weight as shown in Fig.5-8.Motor drive the machine for trial running can only be performed after every moving units has been checked normally by hand. For the machine of separately packing, motor drive can only be performed after adjustment of the clamping device ,inspection of every moving units and everything is on normal condition. While beginning the motor-driven trial running, process it as increasing speed from lower speed to higher without any loading, the inspection can be processed when all the things are in normal state.

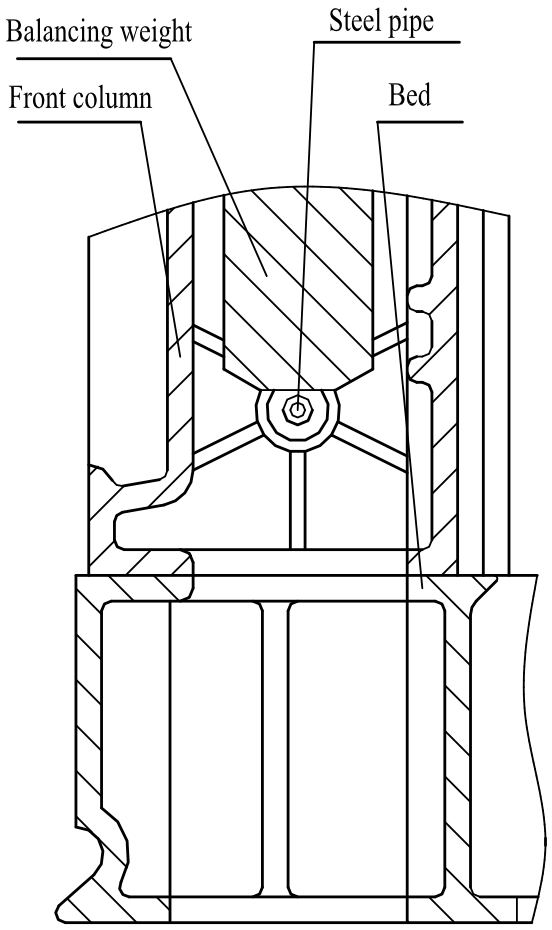


Fig.5-8 Simple diagram of supporting balance weight

6. Lubrication of the machine

6.1 The lubrication oil for gears and bearings inside the headstock is coming from the gear pump in tail-bracket.There is a oil-watch window on the upper front side of the headstock to check oil supply conditions,and a oil leveler on the headstock surface that connected with the tail bracket. Removing the top cover from the headstock to fill in oil when it is necessary to fill in.

6.2 The oil for lubricating tail bracket is coming from the tube-type distribution located inside the headstock. The oil reservoir on the tail bracket is connected with the headstock.

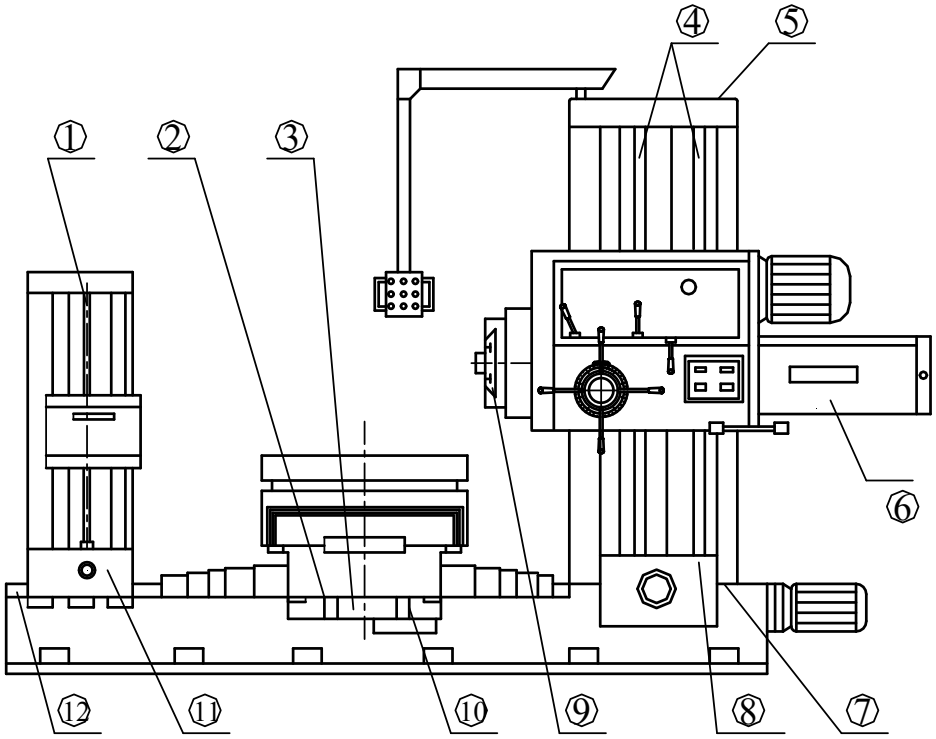
6.3 The lubrication inside the rapid transverse gear box adopts the means of splash-lubrication. An oil leveler hole is equipped on the upside of the rapid transverse gear box to measuring oil level. The upest and downest graduated lines on the oil leveler is the limited highest or lowest oil lever respectively. The hole of oil leveler is also for filling oil.

6.4 The guideways and various lubrication points of the cross & longitudinal saddles and rotary worktable (not including rear column parts) is lubricated and suppilied by the fixed quantity lubrication pump mounted on the back side of the longitudinal cross. The fixed quantity pump is equipped with hole for filling oil and as well as oil leveler, see Fig.6-2. Lubrication for the gear box in the front of longitudinal saddle adopts splash-lubrication ways, and oil leveler and filling hole are supplied on the side of the gear box.

6.5 Before moving the boring stay saddle and the boring bar bearing, giving them artificial lubrication.

6.6 Lubrications for the others please according to Fig.6-1 or to the lubrication mark plate which is provided on the tail bracked.

Fig.6-1 Distribution diagram of lubrication



No.	Lubrication points	Lubrication period	Oil number
1	Leadscrew of boring bar support and bearings	Decided by the actual consumption	No.30 mechnical oil
2	Transmission gears of worktable and oil tank	Supply oil according to oil level	No.30 mechnical oil
3	Hydraulic oil tank	Decided by the actual consumption	No.20 hydraulic oil
4	Vertical feed shaft,ballscrew and bearings	Once every three months	Calcium base grease
5	Balance weight pulleys	Once every six months	Ditto
6	Lubrication oil pool for headstock speed change	Supply oil according to oil level	No.30 mechnical oil
7	Rapid transverse safety bearings	Once every workday	No.20 mechnical oil
8	Rapid transverse gear box	Decided by the actual consumption	No.30 mechnical oil
9	Radial slide and gears on facing head	Splash oil before using	Ditto
10	Automatic lubrication pump for the whole machine	Supply oil according to oil level	Guideway lubrication oil
11	Saddle mechanism of rear column	Decided by the actual consumption	No.30 mechnical oil
12	Horizontal feed shaft bearings	Once every three months	Calcium base grease
Oil inside every lubrication oil tank should be changed once every 6 months			

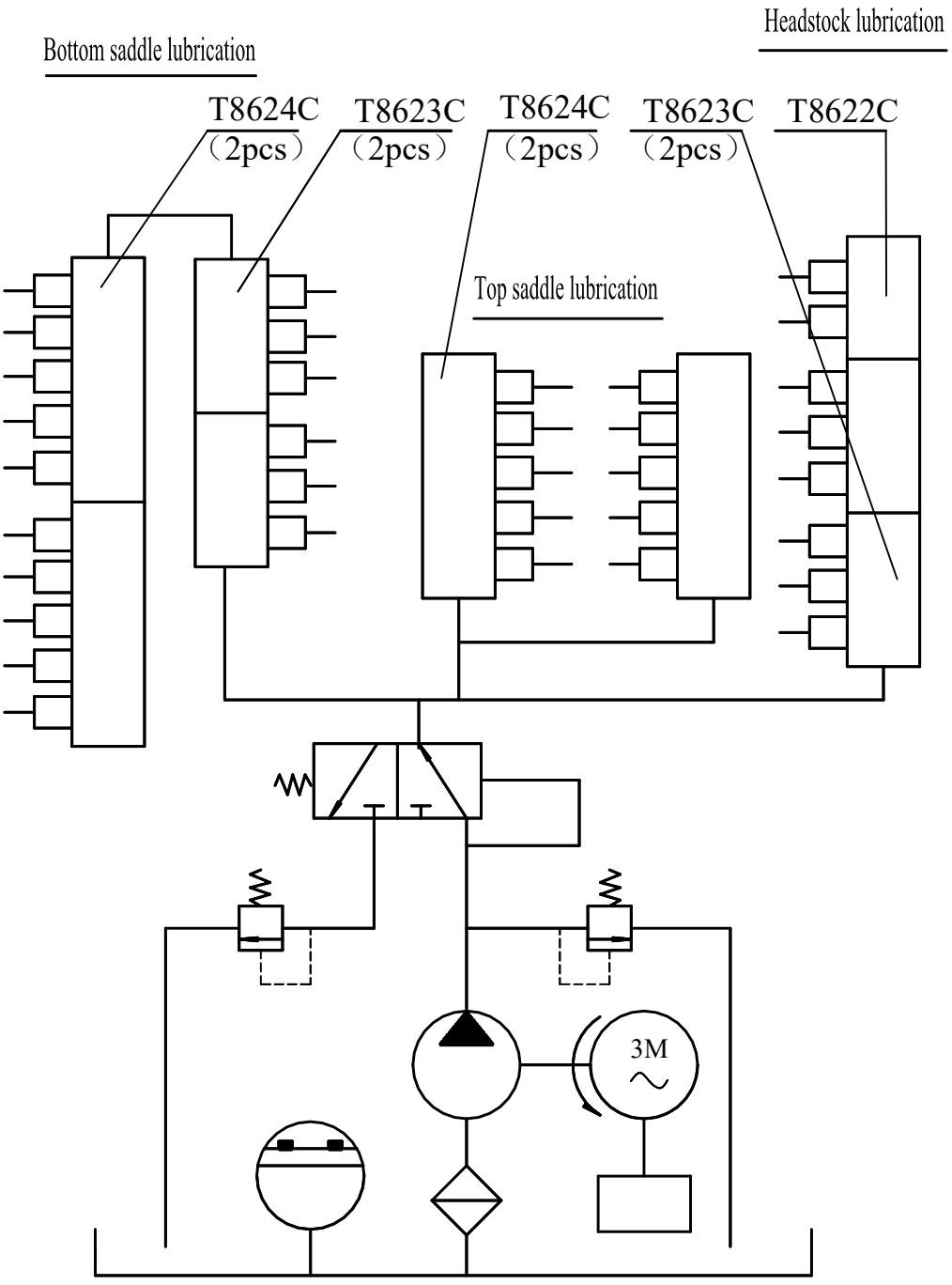


Fig.6-2 Lubrication principle diagram of the machine

7. Transmission system of the machine

7.1 Main transmission

The rotation movement of boring spindle of TPX6111B, TPX6111B/2, TPX6111B/3 are driven by AC motor type Y132M-4-B5 through shaft coupling via the gears on shaft Ⅰ, Ⅱ, Ⅲ, Ⅳ and Ⅴ to shaft Ⅵ (boring spindle). There are four groups of sliding gears in this main transmission system, which is pushed via rotary valve controlling main transmission by four main speed change oil cyclinder mounted in the headstock and enable them to located in different position and enable the spndle to obtain 22 step speed change. The power from shaft V is transmitted through shaft LII, LIII to the facing head, enable it to obtain 18 step speeds. (See Fig.7-1)

7.2 Feed motion

The feed motion of all moving units of this machine is feeding per spindle revolution (e.g. traverse rate of spindle, headstock, table per spindle revolution). The power of various moving units comes from shaft Ⅴ driven by main driven motor. It can be transmitted through gears of speed-change device to shaft Ⅻ(the feed safety mechanism). After that the motion will be transmitted further through the forward and reverse mechanism, to the feed shaft XIII, then to the leadscrews or gear racks of various moving units, enable the spndle, headstock, cross & longitudinal saddles to obtain each 18 steps feed rates at low and high gear respectively.

The feed motion of the radial slide on the facing head comes from feed shaft through differential mechnism to worm racks, enable it to obtain 18 kinds of feed rates.

7.3 Rapid traverse

The rapid traverse of the spindle, headstock, cross & longitudinal saddles of the machine, the rapid rotation of the rotary table and rapid travserse of the radial slide on the facing head are driven by AC motor type Y100LA-4-B5 mounted at the right side of the bed. Power from the motor is transmitted from shafts coupling and friction clutch to each moving units respectively, enable the spindle, headstock, cross & longitudinal saddles and the radial slide on the facing head to obtain the rapid traverse speed of 2500mm/min, the rapid rotation of table to 1r/min.

7.4 Hand feed

7.4.1 Hand rough feed

For obtaining the hand rough feed of spindle, first shift the turnstile for hand rough feed into the mid-position(see Fig.8-1 on page 802) and then turning it. Hand rough feed of radial

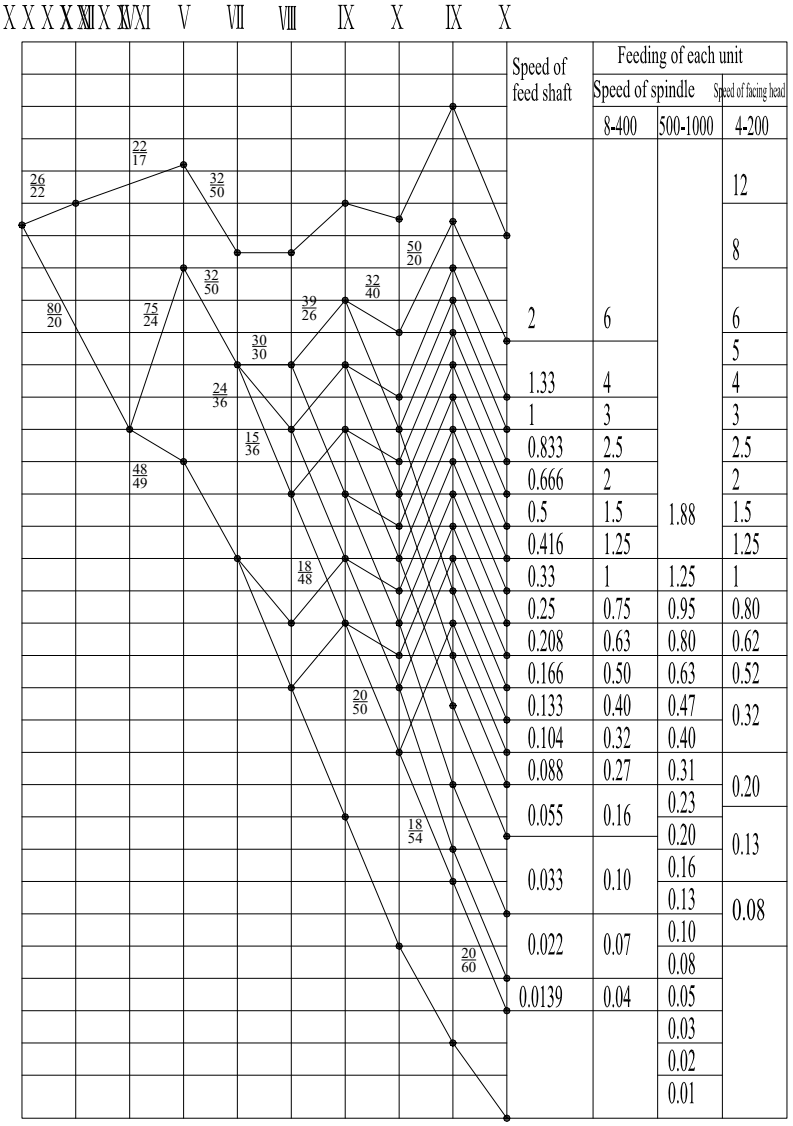
facing slide on facing head is as the same as above operation of spindle.

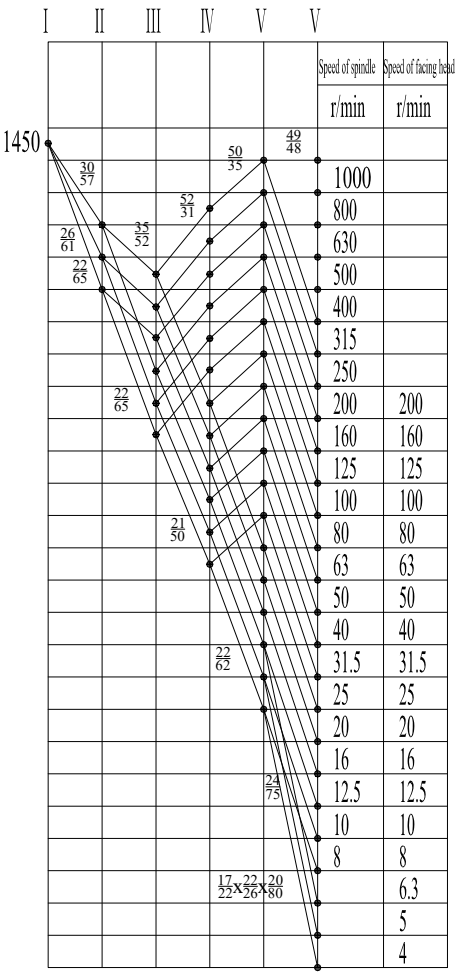
Hand rough feeds of headstock, longitudinal and cross and rotary of table, longitudinal of boring stay and boring bar bearing could be carried out by actuating a special purpose lever (necessary accessories).

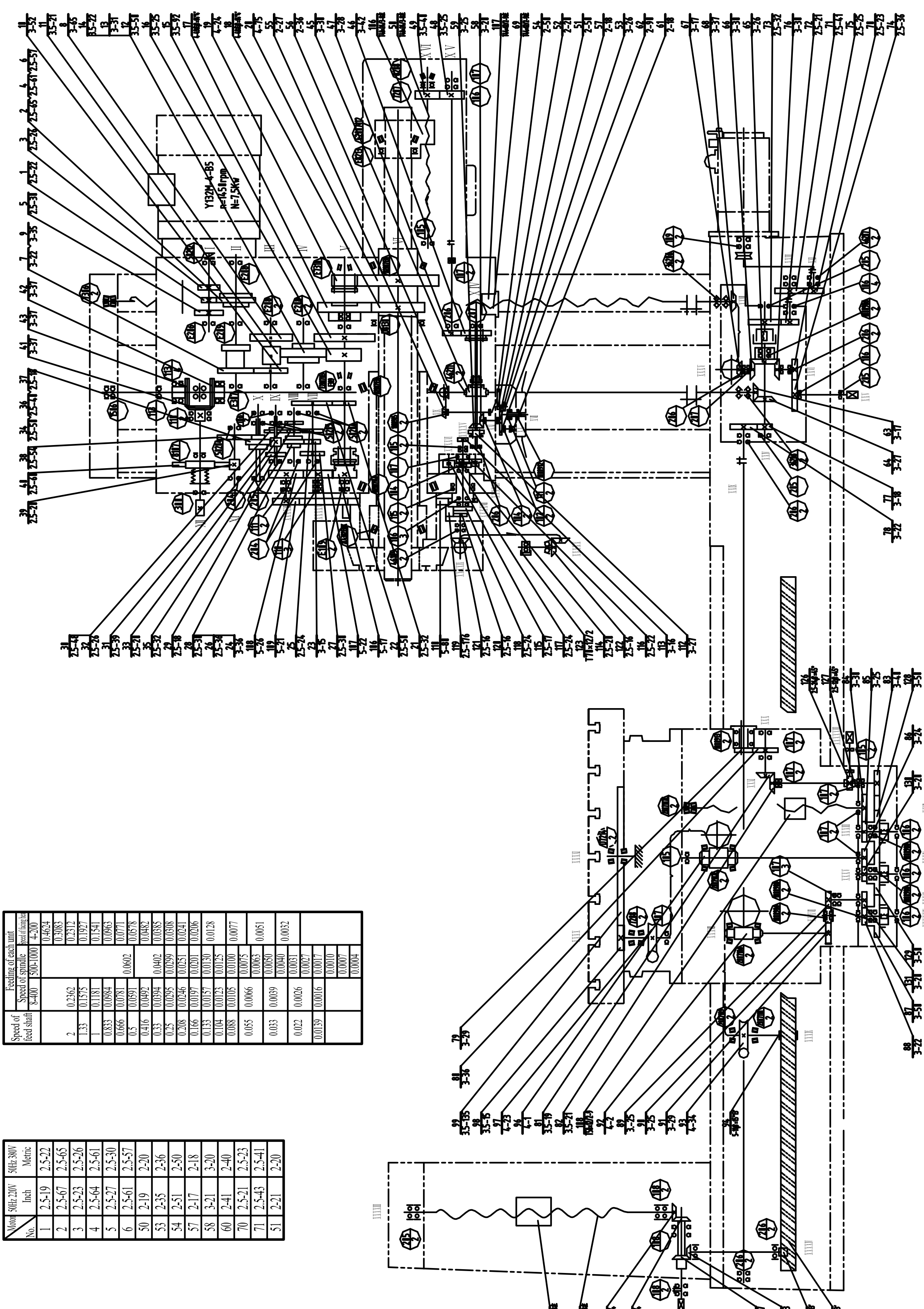
7.4.2 Hand fine feed

The hand fine feed of each moving units (spindle, headstock,longitudinal & cross of table, radial facing slide in the facing head) can be obtained by shifting the turnstile to the innermost position and turning it.

Note:The above transmission relation refers to transmission system diagram.







list of gear

No. \ Motor	50Hz 220V Inch	50Hz 380V Metric
1	2.5-19	2.5-22
2	2.5-67	2.5-65
3	2.5-23	2.5-26
4	2.5-64	2.5-61
5	2.5-27	2.5-30
6	2.5-61	2.5-57
50	2-19	2-20
53	2-35	2-36
54	2-51	2-50
57	2-17	2-18
58	3-21	3-20
60	2-41	2-40
70	2.5-21	2.5-23
71	2.5-43	2.5-41
51	2-21	2-20

inch

Speed of feed shaft	Feeding of each unit		
	Speed of spindle		Speed of facing head
	8-400	500-1000	4-200
			0.4624
			0.3083
2	0.2362		0.2312
1.33	0.1575		0.1927
1	0.1181		0.1541
0.833	0.0984		0.0963
0.666	0.0781	0.0602	0.0771
0.5	0.0591		0.0578
0.416	0.0492		0.0482
0.33	0.0394	0.0402	0.0385
0.25	0.0295	0.0299	0.0308
0.208	0.0246	0.0251	0.0241
0.166	0.0197	0.0201	0.0206
0.133	0.0157	0.0130	0.0128
0.104	0.0123	0.0125	
0.088	0.0105	0.0100	0.0077
0.055	0.0066	0.0075	
		0.0063	0.0051
0.033	0.0039	0.0050	
		0.0040	0.0032
0.022	0.0026	0.0031	
		0.0027	
0.0139	0.0016	0.0017	
		0.0010	
		0.0007	
		0.0004	

Fig.7-1 Diagram of tramission system

8. Hydraulic system of the machine

The hydraulic system of this kind of machine is composed of two parts: one is in the tail bracket and upper and inner part of heasdstock which is used for spindle speed change and feed speed chagne and headstock internal lubrication, the principle diagram please see Fig.8-1; another is in the inner part of lower saddle of the machine, which is used for the transverse of headstock, longitudian & cross movement and rotation of table, the principle diagram please see Fig.8-2.

8.1 Main transmission, feed speed change and internal lubricatin of headstock

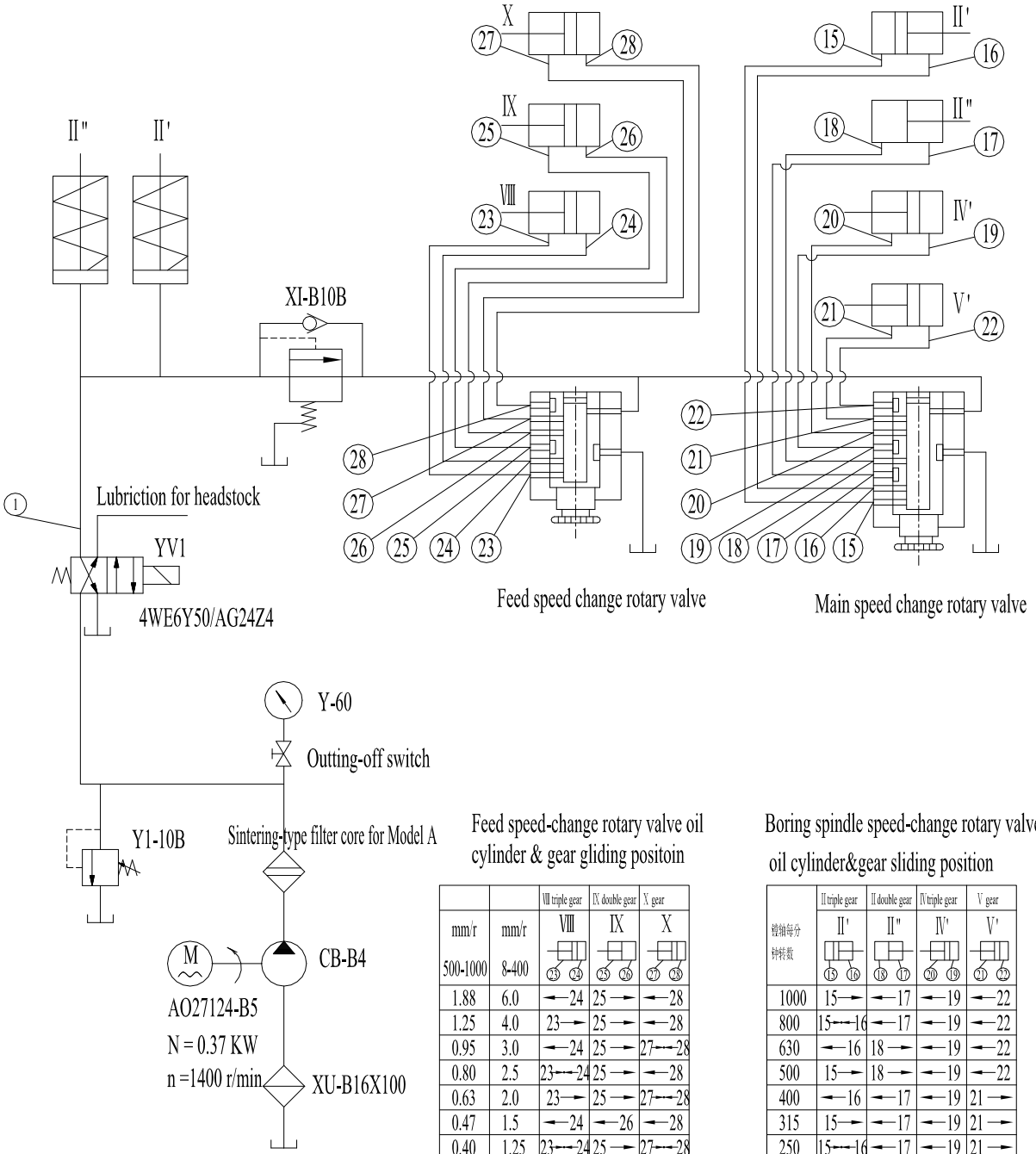
This hydraulic system consists of gear pump, flood valve, 2-position 4-way sliding valve and rotary valve for speed change.The working pressure is set to 2.5MPa by means of flood valve type Y1-10B. Spindle speed change could be realized through a 24-posiiton (or 23-position) 10-way rotary valve that controls three 3-position differential oil cylinders and one 2-position oil cylinder. Feed speed change could be obtained via an 18-position 8-way rotary valve that controls two 3-position differential oil cylinders and one 2-position oil cyclinder.

4WE6Y50/AG24Z4 shown in Fig.8-1 is used for speed change control and lubrication conversion.

8.2 Hydraulic system of clamping headstock,longitudinal & cross traverse of table and table rotation

This system is composed of vane pump, flooding valve and electromagnetic valve,etc.The working pressure should be set to 5MPa by means of flooding valve of Y1-10B, the four electromagnetic valves (4WE6L50/AG24Z4) control the four oil cylinders respectively by which the clamping and unclaming operation of each moving unit, headstock, longitudinal & cross traverse and rotation of the worktable could be accomplished. During operation of the machine, the clamping device of the desired motion will be automatically unclamped by pressing the correspinding push-button (see Fig.8-2), while the clamping device of the prior motion will be automatically clamped.

Note:Delaying of each moving unit during the changing of speed and direction is normal phenomenon, not a breakage.



Feed speed-change rotary valve oil cylinder & gear gliding positoin

		VIII triple gear	IX double gear	X gear
mm/r	mm/r	VIII	IX	X
500-1000	8-400	23 24	25 26	27 28
1.88	6.0	←24	25 →	←28
1.25	4.0	23→	25 →	←28
0.95	3.0	←24	25 →	27←→28
0.80	2.5	23←→24	25 →	←28
0.63	2.0	23→	25 →	27←→28
0.47	1.5	←24	←26	←28
0.40	1.25	23←→24	25 →	27←→28
0.31	1.0	23→	←26	←28
0.23	0.75	←24	←26	27←→28
0.20	0.62	23←→24	←26	←28
0.16	0.5	23→	←26	27←→28
0.13	0.4	←24	25 →	27 →
0.10	0.31	23←→24	←26	27←→28
0.08	0.26	23→	25 →	27 →
0.05	0.16	23←→24	25 →	27 →
0.03	0.10	←24	←26	27 →
0.02	0.06	23→	←26	27 →
0.01	0.04	23←→24	←26	27 →

Boring spindle speed-change rotary valve oil cylinder&gear sliding position

	II triple gear	II double gear	IV triple gear	V gear
镗轴每分钟转数	II'	II"	IV'	V'
	15 16	18 17	20 19	21 22
1000	15→	←17	←19	←22
800	15←→16	←17	←19	←22
630	←16	18 →	←19	←22
500	15→	18 →	←19	←22
400	←16	←17	←19	21 →
315	15→	←17	←19	21 →
250	15←→16	←17	←19	21 →
200	←16	18 →	←19	21 →
160	15→	18 →	←19	21 →
125	15←→16	18 →	←19	21 →
100	←16	←17	20←→19	21 →
80	15→	←17	20←→19	21 →
63	15←→16	←17	20←→19	21 →
50	←16	18 →	20←→19	21 →
40	15→	18 →	20←→19	21 →
31.5	15←→16	18 →	20←→19	21 →
25	←16	←17	20 →	21 →
20	15→	←17	20 →	21 →
16	15←→16	←17	20 →	21 →
12.5	←16	18 →	20 →	21 →
10	15→	18 →	20 →	21 →
8	15←→16	18 →	20 →	21 →
0				21←→22

Permissible pressure of this system is 2.5MPa

Fig.8-1 Diagram of hydraulic system

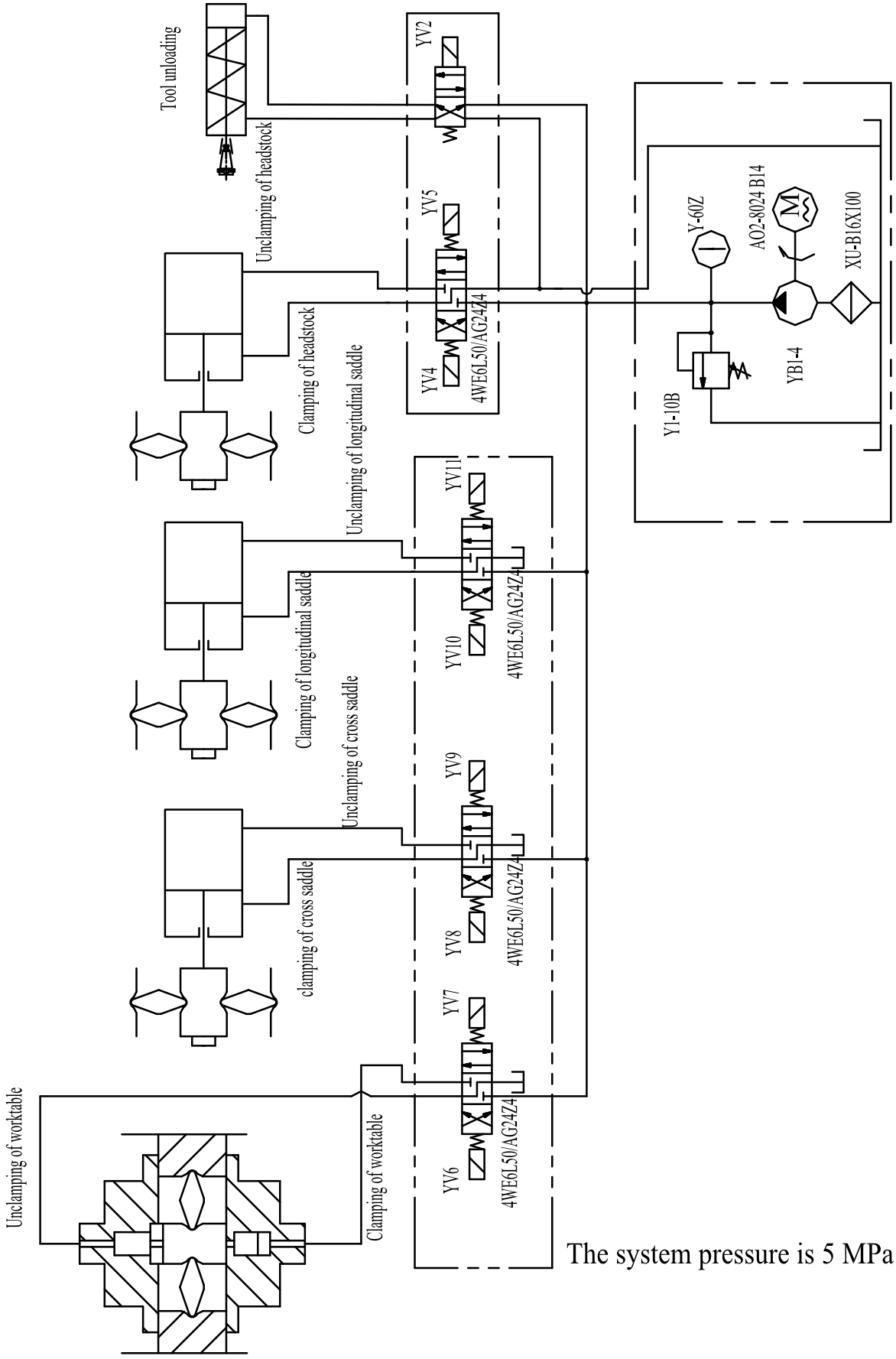


Fig. 8-2 Hydraulic system diagram

9. Measuring device of the machine

There are three kinds of measuring devices for detecting the travelling distance of the lift movement of headstock, the transverse and longitudinal (special provided) movement of worktable of this machine: ① spheroidal synchro and Digital Display Unit type Sapphive ② Raster Display Scale and Digital Display Unit type KN7023L③Induce synchro and Digital Displacement Display meter type SFW31. Optical aiming device with 7 magnifying power is adopted for detecting the four rotary positions 90°, 180°, 270°, 360°(0°)of the worktable.

9.1 Digital Display Device

9.1.1 Mounting method

The digital display unit for the vertical movement of the headstock and the cross transverse of the worktable should be mounted as follows: the measuring scale should be fixed on the base plate in the column and cross saddle respectively; the reading head should be fixed on the through frame to the related base plate of headstock and longitudinal saddle; the digital display unit should be fixed on the frame behind the machine bed, as shown in Fig.9-1 and Fig9-2

9.1.2 Using method

For details, please see

<Linear Encoders Installation Manual>

<Operation Instructions for Digital Readouts >

<Operation Instruations for Digital Readout System by Inductosyn>

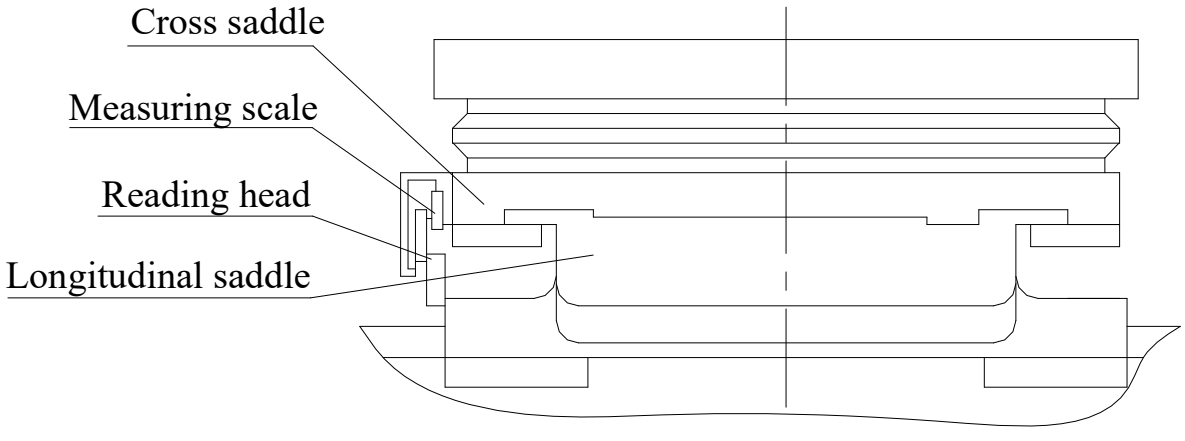


Fig.9-1 Display scale installing diagram

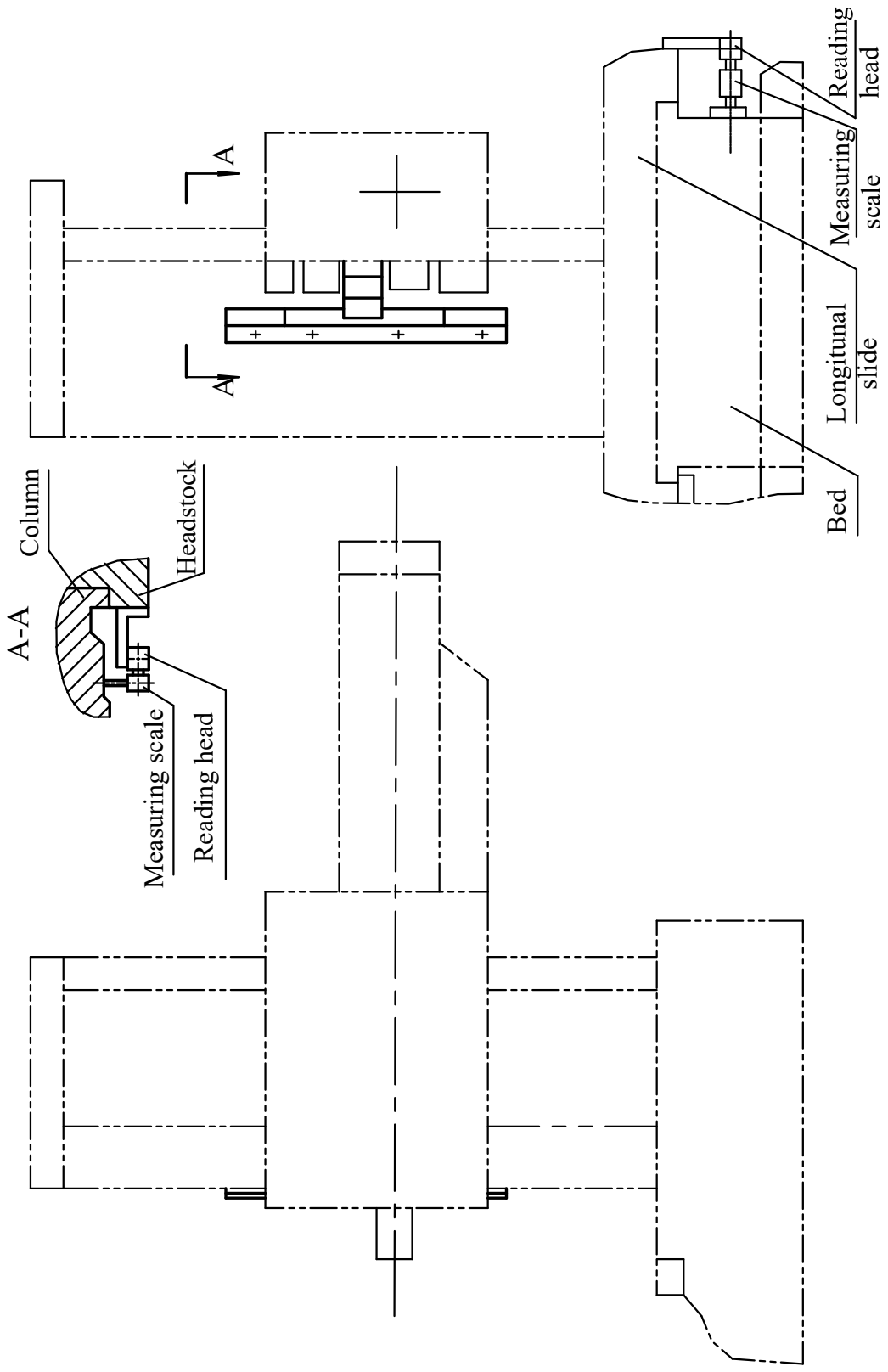


fig.9-2 Digit display metre installing diagram

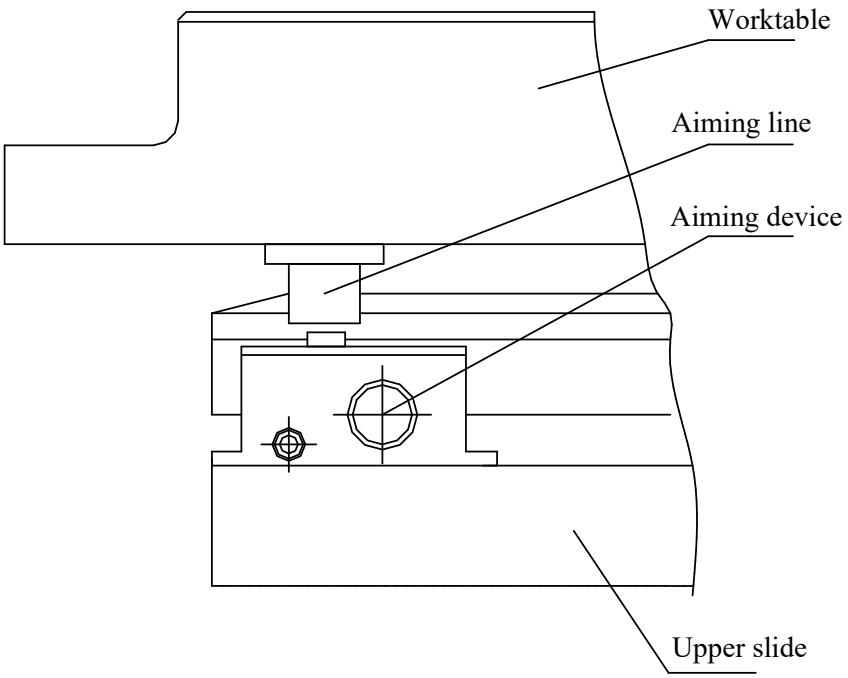
9.2 The positioning of the rotary worktable

9.2.1 The positioning of the rotary worktable at 90°,180°,270°,360° is performed with 4X90° optical aiming device. Four aiming blocks with graduation are mounted separately on the correspinding four positions of the worktable. When turning on the power, fine rotating the worktable to enable the graduation in the aiming block to be in between the double lines of the screen, which means the worktable is located to a nicety. Operation can be done after clamping the worktable.

9.2.2 Positioning of the rotary worktable at any positions (special accessories)

The positioning of the rotary table at any position for machine model TPX6111B/3 is performed with spinning inductive synchro, whose stator and rotor are separately mounted on the centering spindle of the worktable and the upper cover of the worktable. The digital display unit is installed on the holder.

For details of operation methods please see Operation Manual for Digital Dispaly Unit on the Spheroidal Deductive Synchro.



10. Operation of the machine

The series of operation for this machine is composed of handle levers and push-buttons (or switches). The position and action of handle levers please see Fig.10-1, for those of push-buttons (or switches) please see Fig.10-2. Push-buttons (or switches)are arranged on the pendulous push-button station.

The machine is equipped with electrical hydraulic interlocking device for the movements of each moving units,thus only allows one moving unit to move in only one moving mode (manual,automatic or rapid traverse) in the operation of the machine. Among each moving unit, the headstock elevating, and the table longitudinal and cross traversing and its rotation and clamping device are automatic release, while other undistributed movement will be in the state of clamping. In order to improve the performance of the machine, the axial moving of boring spindle and the radial moving of the facing slide adopt hand clamping mode instead of interlocking of automatic clamping.Pay attention to use it in right way.

Specific directions with regard to the operation of the machine are as follows.

10.1 Power-on of the machine

The machine can be powered on with a key inserted in ⑦ß,the indicator lamp ① lights up, showing that the machine is ready for operation.

10.2 Rotation of spindle

Push the button ⑤ or ⑪Ï as shown in Fig.10-2. the forward or reverse continuous rotation of spindle can be obtained repectively. When the button ⑭ or ⑬Ñ in Fig10-2 is pressed down,the forward or reverse inching rotation of spindle can be carried out.

10.3 Rotation of facing head

Locate the hand lever ② in Fig.10-1 in the engaging position of facing head, and then press button ⑤ or ⑪ in Fig.10-2 to obtain the continous forward or reverse rotation of facing head respectively; while the button ⑭ or ⑬ in Fig.10-2 is pressed down, the forward or reverse inching rotation is realized. If spindle and facing head are not required to rotate synchronously, the rotary valve ⑦ (Fig.10-1) for spindle speed change should be turned to "0" position before the above operation, the rotation of facing head can be obtained by depressing the speed-change button ② (Fig.10-2).

10.4 Changing of spindle and feed speed

10.4.1 Spindle speed change

First, the rotary valve ⑦ (Fig.10-1) for spindle speed change should be turned to preselected speed position required. The desired speed is obtained by pushing the

speed-change button ②(Fig.10-2). Another method is called pre-selected method. First, the rotary valve for spindle speed change should be turned to pre-selected speed position required in the next step;the desired speed can be obtained by pushing speed change button.

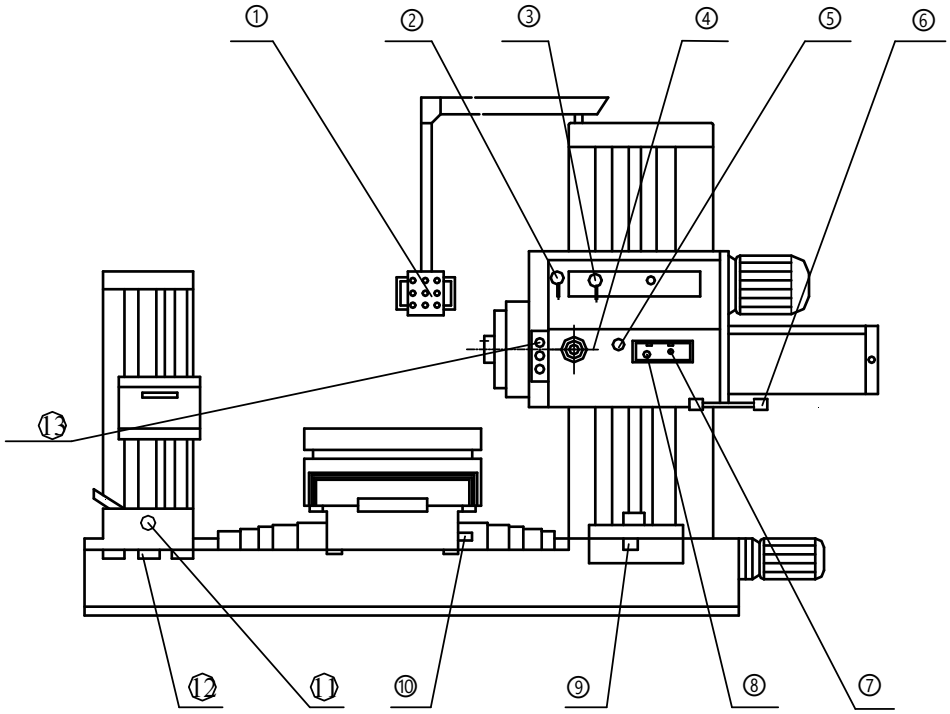


Fig.10-1 Arrangement of the operation system of the machine

No.	Name of the operation mechanism
1	Button station
2	Lever for engaging and disengaging of the facing head rotation
3	Lever for forward and reverse feed
4	Distributing lever of auto,micro and spindle feed(including radial slide)
5	Distributing lever for the movement of spindle or radial slide on the facing head
6	Clamping lever of spindle
7	Rotating valve lever for the main movement speed change
8	Rotating lever for feed rate change

No.	Name of the operation mechanism
9	Lever hole for hand rough elevation of headstock
10	Lever hole for hand-driven rotation and longitudinal and cross movements of table
11	Lever hole for hand-driven longitudinal traverse and elevation of rear column
12	Clamping points of rear column (each points at back and front)
13	Dis tribution lever for longitudinal transverse of boring stay and elevation of boring stay slide
14	Emergency stop button (for 7:24 50#)
15	Tool unclamping button (for 7:24 50#)
16	Tool clamping button (for 7:24 50#)

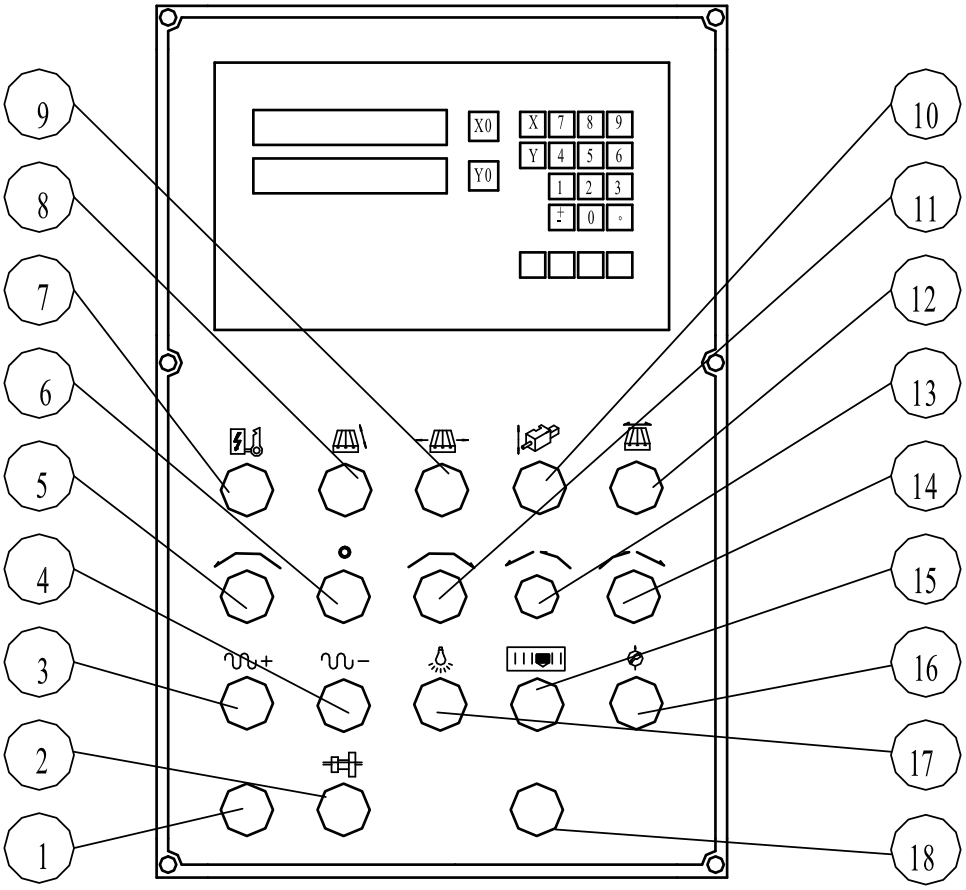


Fig.10-2 Arrangement of buttons and switches on the button station

No.	Description	No.	Description
1	Power supply indicator	10	Button for lifting movement of headstock(with indicator)
2	Button for executing speed change	11	Button for spindle or facing head rotating negtively
3	Forward rapid button	12	Button for rotation of table(with indicator)
4	Reverse rapid button	13	Button for forward inching of spindle or facing head
5	Button for spindle or facing head rotating positively	14	Button for reverse inching of spindle or facing head
6	Button for stopping main motor	15	Button for optical illumination
7	Key switch	16	Push-button for lubrication guideways
8	Button for transverse movement of table(with indicator)	17	Switch for illuminating lamp
9	Button for longitudinal movement of table(with indicator)	18	Emergency stop button

10.4.2 Spindle feed change

When rotary valve ⑧ (Fig.10-1) is set to the required position, the desired feed rate can be obtained according to the above process. It also has pre-selected function for feed speed change.

10.5 Power feed and rapid transverse of each moving unit

10.5.1 When power feed is needed, first set the lever④ (Fig.10-1) to the outermost position, and set the lever③ to the engagement position, forward or reverse power feed of spindle canbe obtained by shifting the lever ⑤ (Fig.10-1) to the forward or reverse feed position.

Rapid traverse of spindle: The feed and rapid traverse lever ③is set to the middle position on the basic of above process, the forward (reverse) rapid traverse button③,④on the operation panel.

10.5.2 Power feed and rapid traverse of facing slide

The operation course of the power feed anfrapid traverse of facing slide is as similar as that of the power feed and rapid traverse of spindle. The difference lies in that the lever ⑤ (Fig.10-1) must be truned tothe engagement position of facing slide according to the above method.

10.5.3 Power feed and rapid traverse of headstock and longitudinal & cross saddles of table

Three kinds of power feed operation are as follows:

First,set the lever ③ (Fig.10-1) to the middle position (i.e. hand rough feed position of spindle anf facing slide). Then shift the lever ⑩(Fig.10-1) to forward (reverse) feed position, at this time, if pressing push-button ⑨ on the push-button station, power feed of headstock an be obtained.If pressing push-button ⑧ on the push-button station, the longitudinal power feed of worktable can be carried out; if pressing push-button ④ on the push-button station, the transverse power feed of wroktable can be realized.

Three kinds of rapid traverse operation are as follows:

First, set the lever ③(Fig.10-1)to the middle position, and shift the lever ⑩ to the middle position, the rapid traverse of three kinds of movement can be obtained respectively be pressing the forward (reverse)push-button ③and ④ on the operation panel.

10.5.4 Rapid rotation of the worktable

By operatin the feed and rapid traverse lever described above (Fig.10-2)according to the

above method, rapid rotation of worktable can be performed.

Note: The table doesn't have power rotation.

10.6 Hand driven iperation of each moving unit

10.6.1 Hand jog feed

Hand jog feed of spindle (or facing head):

First put the lever ④(Fig.10-1) to the innermost positon, then turn the lever ⑤ (Fig.10-1)to the spindle (or facing slide)feeding position, the hand jog feed of spindle (or facing slide) can be accomplished by turning the lever ④ (Fig.10-1).

Hand jog feed of four kinds of movement (i.e. spindle, longitudinal and transverse feed of worktable, rotation of worktable):

First, push the lever ④ (Fig.10-1)to the innermost position, and shift the lever ⑤ (Fig.10-1) to the "0" position. Then press any one of the push-buttons ⑧⑨⑩and⑫, the hand jog feed for four kinds of movements canbe performed accordingly by turning the lever④(Fig.10-1).

Note: When the operation of hand jog feed motion is performed, the lever③(Fig.10-1)should be put to the mid-position.

10.6.2 Hand rough feed

By setting turnstile④(Fig.10-1)tothe mid-position and turning it, hand rogh feed of spindle (or facing slide) is obtained. By inserting a special-made lever (necessary accessory) into hole ⑨ (Fig.10-1) and turning it, hand rough feed of headstock is obtained. By inserting a special-made lever (necessary accessory) into hole ⑩(Fig.10-1) and turning it, one of two movements can be carried out by shifting the lever ③(Fig.10-1) and turning it, three kinds of hand rough feed of worktable can be obtained accordingly:

Note: Before the above operation, shift the lever (3) to mid-pisition, and select specific movement by pressing one of push-buttons ⑧ ⑨ ⑩ and ⑫(Fig.10-2)

10.6.3 Traverse of boring stay saddle and boring bar beraring upon inserting the long special-made lever (necessary accessory) into hole ⑪Ï (Fig.10-1) and turning it, one of two movements can be carried out by shifting the lever ⑬(Fig.10-1).

10.6.4 Hand feed value of each moving unit

On the turnstile ④ (Fig.10-1) of headstock, there are two graduated discs. One of them is a big disc which is used for spindle/facing slide rough feed with 1mm per graduation adn 200mm per revolution in Metric system and 0.02" per revolution in English system, anotehr is small one for hand jog feed of each moving unit with 0.01mm per graduation and 0.5mm per revolution in Metric system, and 0.0005" per graduation and 0.02" per revolution.

The graduation disc on the lever hole ⑨ (Fig.10-1) is for measuring the vertical movement of headstock. In Metric, the headstock moves 0.05mm per graduation of the disc, and 8mm per graduation. In English, the headstock moves 0.002" per graduation of the disc, and 0.3" per revolution.

The graduation disc on teh lever hole⑩ (Fig.10-1)is for measuring transverse and longitudinal movements of worktable. In Metric, the worktable moves 0.05 mm per graduation of the disc, and 4mm per revolution.

The lower circular part of worktable is graduated in 1 and 360 per revolution.

10.7 Loading and unloading the tools

Press the unclamping push-button that shown in Fig.10-1 when unloading a tool, the tool may be unloaded from the spindle.

When loading tools, insert the tool into the spndle taper hole and press teh clamping push-button ⑬(Fig.10-1),the tool may be clamped automatically.

10.8 Emergency stop of the machine

In emergency, the machine can be shut down by pressing the push-button ⑱ (Fig.10-2) or by pressing the push-button ⑭(Fig.10-1)for emergency stop. Once these push-buttons are used, the machine ahs to he restarted by pull the power-up switch to TURN OFF pjosition and then push it to TURN ON position again.

11. Adjustment and maintenance of the machine

As the adjustment of the machine performs important function to the accuracy, performance and service life of the machine, especially, the adjustment of the mahcine will decide the mahcining quality of the workpiece;the machine must therefore be correctly adjusted as the correct methods introduced on the follows:

11.1 Adjustment of the spindle bearing on the facing head

The spindle structure of the machine is shown in Fig.11-1(or Fig.11-2). When the machine need an adjustment after the taper roller bearings of spindle on the facing head have been worn out, first, remove the protective cover plate in the front of headstock and then loosen the screw ③to readjust the nut ① . After adjustment, turn the nut② to make the screw holes of the nut ② and the locking nut ① be in alignment and tighten the screw③ again (see Fig.11-1 or Fig.11-2)

11.2 Adjustment of spindle bearing (for with plate facing)

If it is necessary to make an adjustment after the taper roller bearings of the hollow

spindle have been worn out, be sure to remove in advance the protective cover plate of tail bracket. Then remove the tightening screw ⑥ (Refer to Fig.11-1 or Fig.11-2) and readjust the locking nut ④. After adjustment, turn the nut ⑤，to make the screw holes of the nut ⑤ and the thread hole of teh locking nut ④ being aligned, and renew to tightyen screw ⑥.

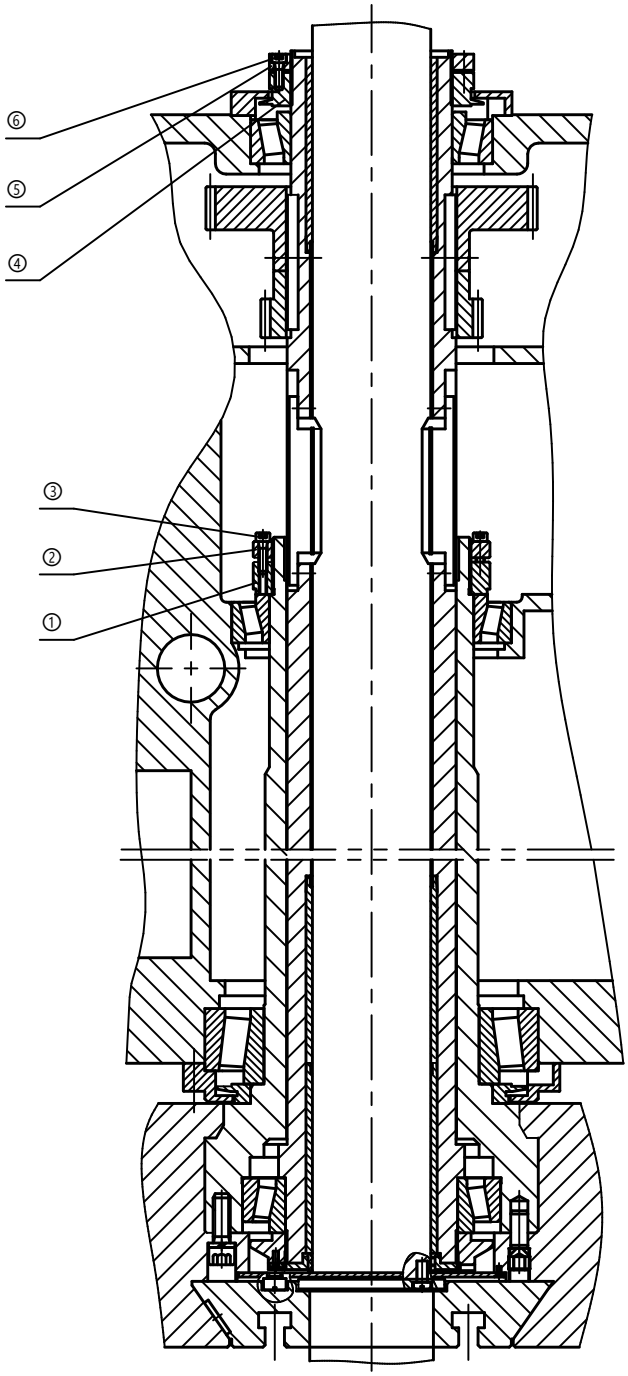


Fig.11-1 Diagram of spindle structure for machine model TPX6111B,TPX6111B/2,TPX6111B/3

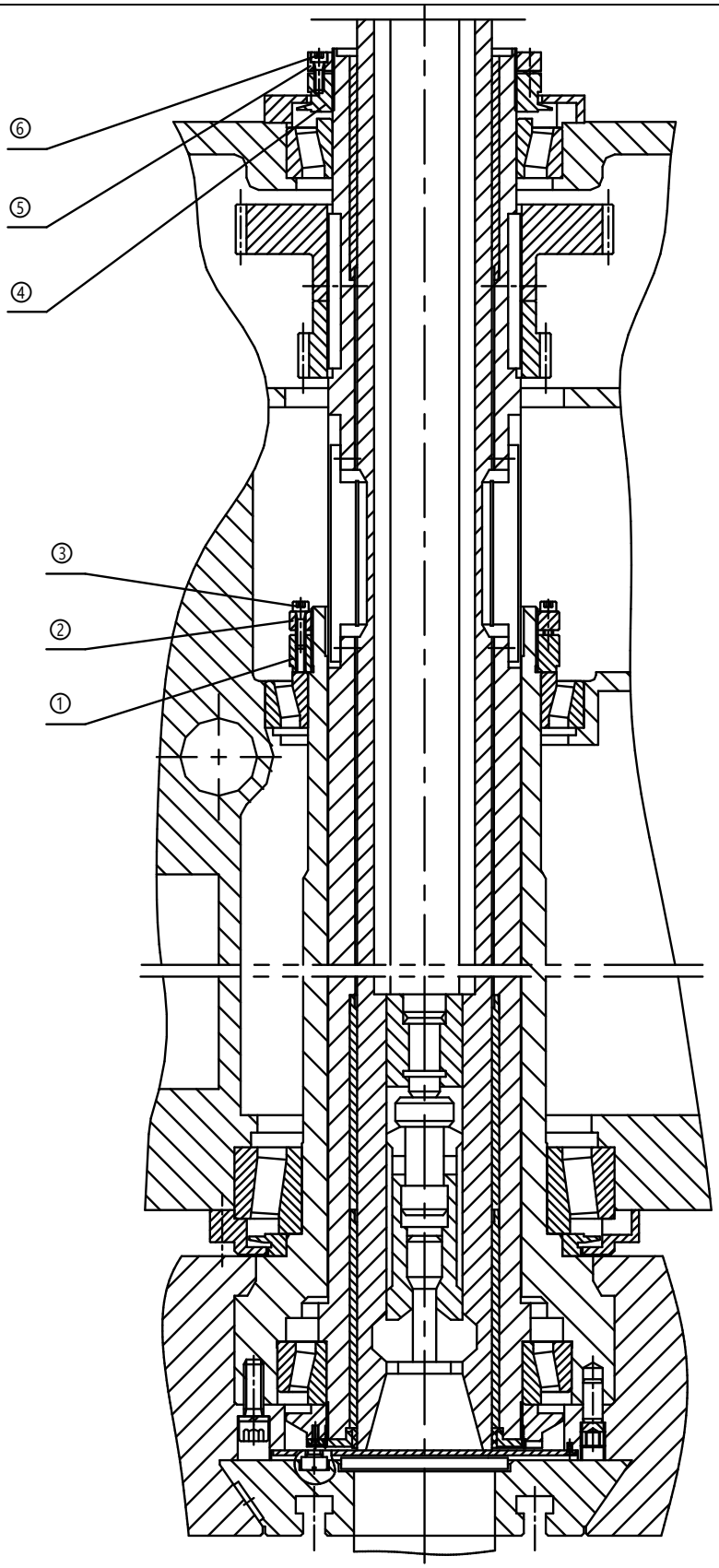


Fig.11-2 Diagram of spindle structure for 7:24 50#

11.3 Adjustment of transmission clearance of the radial slide on the facing plate for machine model TPX6111B,TPX6111B/2,TPX6111B/3

Please refer to Fig.11-3. First release the screw① and ②, and then remove the plug ③ and screw off the lockimg screw rod ④. After that,turn the regulating screw rod ⑤, then push the press sleeve ⑥ and the needle bearing ⑦. Then push bearing socked ⑧and the thrust bearing ⑨, press the screw rod ⑩ to eliminate the clearance between the screw rod ⑩ &⑪ and the rack⑫. After adjustment, install all the parts removed again.

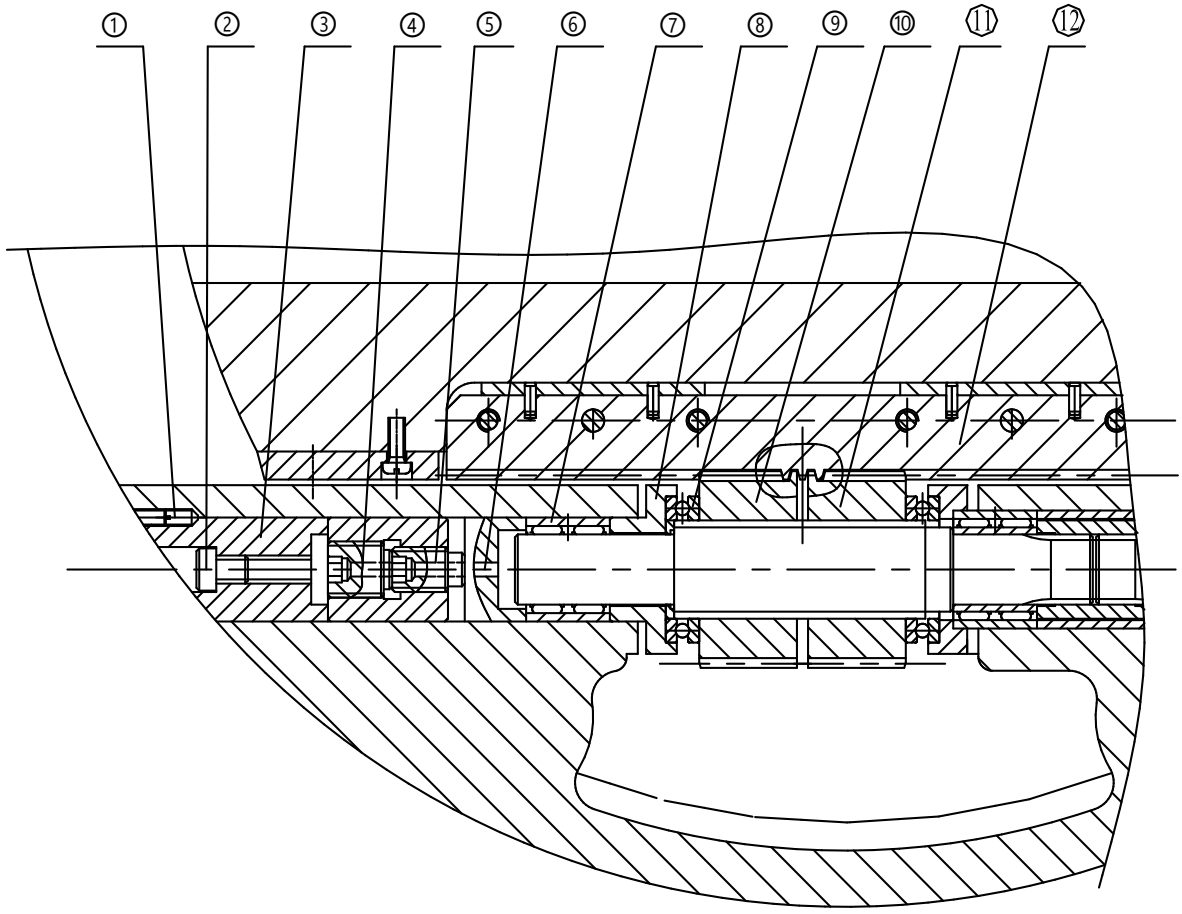


Fig11-3 Simple diagram for radial slide on facing head

11.4 Adjustment of feeding safety clutch(Referance to Fig.11-4)

Remove the adjusting indicating plate ① of feed safety clutch, which is mounted on the front plate cover of the headstock, and then loosen the locking nut ② so that the spring will be compressed or extended by regulating the screw ③.

For adjusting the spring to a proper degree, there are two methods as follows:

11.4.1 A pressure gauge with a workpiece can be secured on the table then starts feeding by table. If the gauge indicates is not more than 12250N, the safety clutch should be able to work normally. But if the gauge indicates is more than 16600N, the safety clutch should be able to disengage, so as to perform the function of safety.

11.4.2 Cutting test. The materrial of test piece to be cut is case iron with hardness of HB150-180, and is drilled by a high-speed steel drill of 50mm in diameter. When using spindle speed of 50r/min with table feed of 0.31mm/r (0.0123, the machien should be working normally. When the table feeds in 0.50mm/r(0.0197in/r) the safety clutch should be disengaged so as to perform the function of safety.

Tighten the nut② after adjusting.

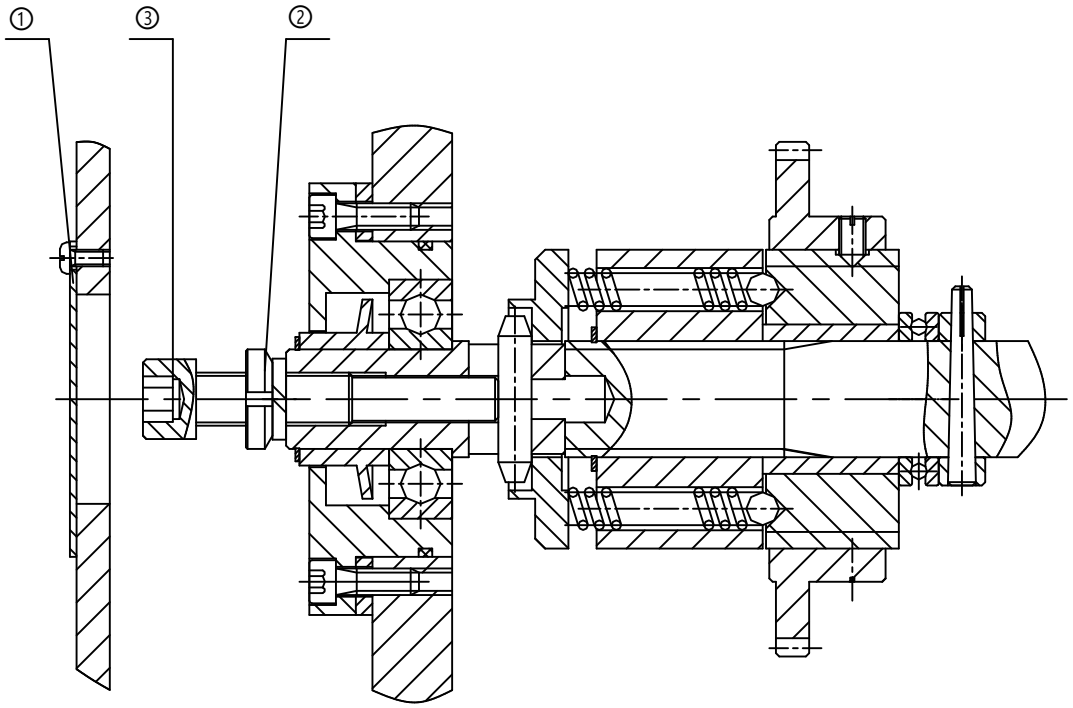


Fig.11-4 Simple diagram of safety clutch

11.5 Adjustment of safety device in the rapid transverse mechnism (Refer to Fig.11-6) After uncovering the iron cover on the bed, the pressure spring ②will be compressed or extended by regulating the adjusting nut ①so as to achieve the purpose of adjustment. When rapid traversing the table with a heavy matter of 2500kg on it, for the table with larger load should be 3000kg, the safety clutch device should be working properly. when continuously increasing the weight of the heavy matter, the friction disk③ of the safety clutch should be able to slip, thus achieving the purpose of the adjustment.

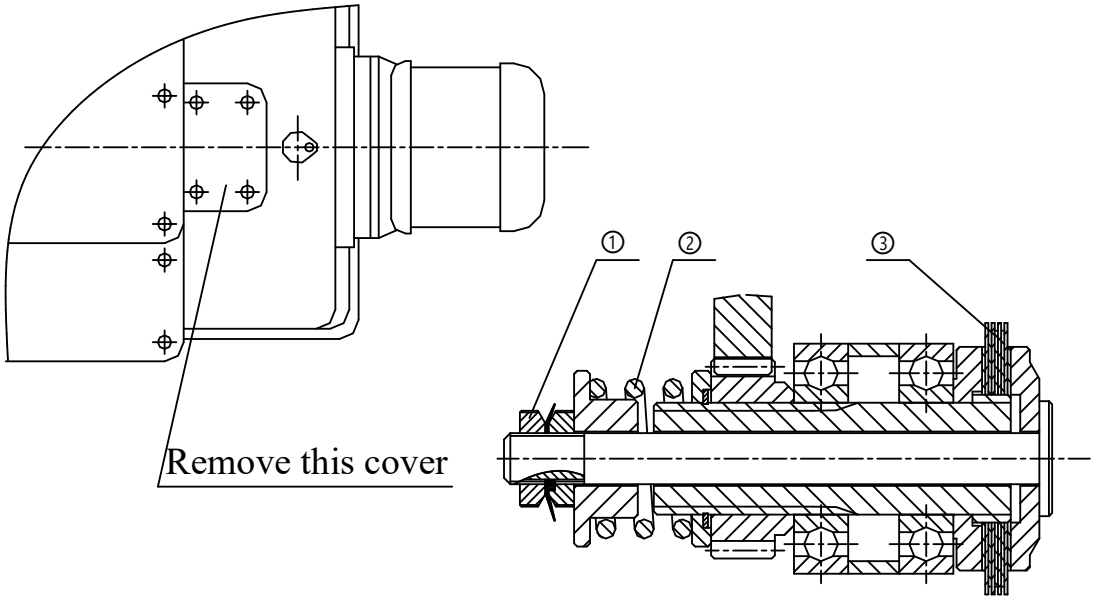
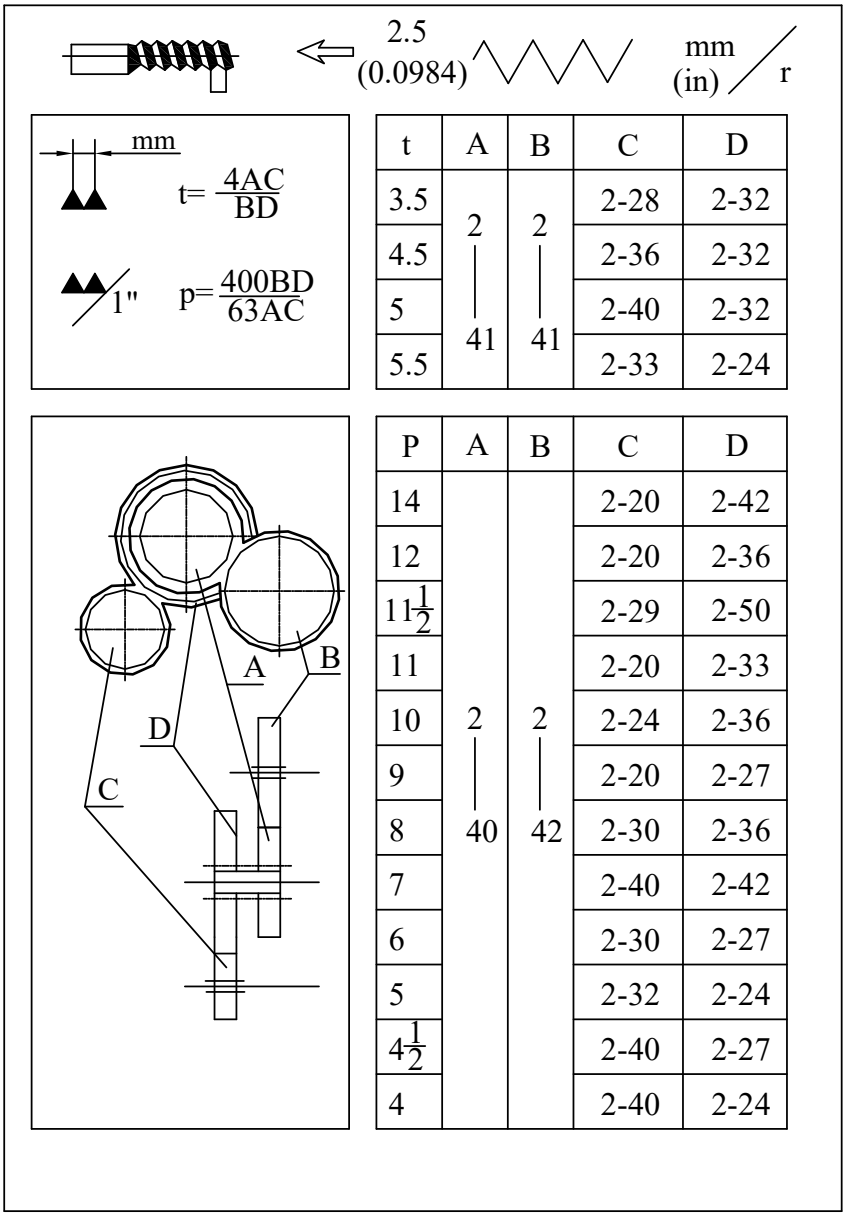


Fig.11-5 Simple diagram of rapid safety device

11.6 Adjustment of boring threads (Refer to Fig.11-6). 12 kinds of Metric threads and 12 kinds of Imperial threads can be tapped with this machine.To match and change the change gears please refer to Fig.11-6(among which the 8 kinds of metric threads of 1,1.25,1.5,2,2.5,3,4,6 mm are within the range of spindle feed).

Metric feed rate mm/r	1.00	1.25	1.50	2.00	2.25	3.00	4.00	6.00
Imperial feed rate in/r	0.0394	0.0492	0.0591	0.0787	0.0984	0.1181	0.1575	0.2362

When both the Metric and Imperial threads are tapped by changing the change gears, the feed change rotary valve ⑧must be put at the position of feed rate of 2.5mm/,10.0984in/r. According to required pitches, change gears A, B, C, D can be arranged as listed in Fig.10.1.



t	A	B	C	D
3.5	2 — 41	2 — 41	2-28	2-32
4.5			2-36	2-32
5			2-40	2-32
5.5			2-33	2-24

P	A	B	C	D
14	2 — 40	2 — 42	2-20	2-42
12			2-20	2-36
11 1/2			2-29	2-50
11			2-20	2-33
10			2-24	2-36
9			2-20	2-27
8			2-30	2-36
7			2-40	2-42
6			2-30	2-27
5			2-32	2-24
4 1/2			2-40	2-27
4			2-40	2-24

Fig.11-7 Gears change list for boring screw pitches

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