CAUTION

Be sure to read the manual before operation of this machine. Pay attention to the following notes.

1. Always be sure to wear safety shoes and goggles during operation.
2. Wear a safety hat, and keep the sleeves and edges of the work uniform tight.
3. Keep head and hands out of moving parts of the machine.
4. Do not operate wearing gloves.
5. Provide adequate light around the machine, and keep the perimeter around the machine dry, clean and in good order. In addition, do not place anything near the machine; otherwise it becomes an obstacle during operation.
6. Do not place tools, workpieces, or other items on the machine, especially on the moving parts.
7. Make sure that the workpiece is completely gripped. And the wrench is removed from the chuck before rotating the spindle.
8. Stop the machine before adjusting the position of the coolant nozzles.
9. During operating and maintenance, care should be taken so that the caution plate is not dirtied or damaged.
10. Disconnect power before servicing.
11. Do not move the carriage longitudinally unless it is released.

CONTENTS

Advice

This machine is suitable for two shift operation with each shift being 8 hours. The continuous working time should not exceed 16 hours. Operation regulations should be strictly observed.

3. MAIN SPECIFICATIONS OF THE MACHINE

1) Max. swing over bed	22”
2) Max. swing over slide	12.6”
3) Max. swing over gap	30.3”
4) Max. cutting dia. for disc parts	16.5”
5) Available length in gap	9.4”
6) Max. length of workpiece	80”
7) Max. cutting length	76.8”
8) Spindle nose	cam lock type D1-8
9) Spindle bore	4”
10)Taper & dia. of spindle bore	Φ113 1：20
11) Steps of spindle speeds	12
12) Range of spindle speeds	36 ~ 1600rpm
13) Number & range of longitudinal feeds	65 kinds
	0.023-0.937in/r
14) Number & range of cross feeds	63 kinds
	0.010-0.404 in/r
15) Rapid feed: Longitudinal	177.1 in/min
Cross	74.8 in/min
16) Thread cutting	
Metric: 22 kinds	1 ~ 14mm
Inch: 28 kinds	28 ~ 2 TPI
Module: 18 kinds	0.5 ~7mm
D.P.: 24 kinds	56 ~ 4 D.P.
17) Leadscrew pitch	12mm（2TPI）
18) Distance from spindle axis to tool supporting surface	1.1”
19) Section of tool shank	1”×1”
20) Max. cross travel	12.6”
21) Max. swivel of top slide	±90°
22) Max. travel of top slide	5.7”
23) Max. Cross slide travel	12.2”
24) Max. cross displacement of tailstock	±0.59”
25) Taper in center sleeve bore of tailstock	Morse No.5
26) Max. travel of tailstock sleeve	6”

27) Center sleeve	3”
28) Main motor power	7.5KW
Main motor speed	1450rpm
29) Coolant pump power	60W
Coolant pump speed	2800rpm
30) Rapid feed motor power	250W
Rapid feed motor speed	1360rpm
31) Overall dimensions （L）	137.8”
（W）	43.3”
（H）	53.1”
32) Net weight	3400 Kg

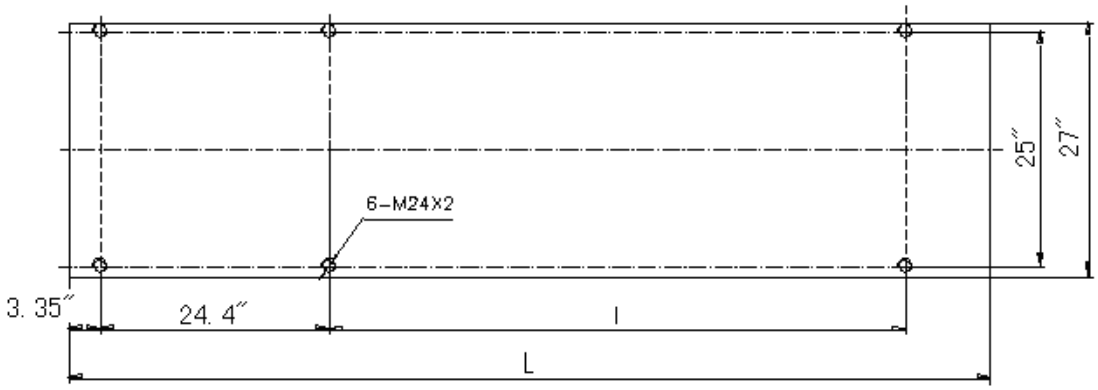
4. TRANSPORTATION AND INSTALLATION OF THE MACHINE

4.1 When machines are craned, be sure to crane one package at a time so as to avoid shocking.

4.2 When rollers are used for transportation, their diameter should be 70 to 80 mm, and the ground slant should be less than 15^{o}.

4.3 Be sue to avoid collision of the operation levers and the surface of the machine.

4.4 To crane the machine, use a steel wire rope to tie on the ribs of the bed. The contact surface should be lined with cotton yarn or wood pieces. To keep the balance of the machine, move the tailstock and apron to the right end and lock them tightly to the bed so as to prevent them from sliding (See Fig 2).



Size	40"	60"	80"
l	61.42"	81.1"	100.8"
L	98.2"	117.9"	137.6"

Fig 3 Drawing of foundation

4.6 Leveling of the machine (See Fig 4)

First move the carriage to the middle of the bed, then set the bed stands by adjusting leveling pads and tightening foot screws so that both ends of the guide ways are at the same level. It is also necessary to rectify the distortion of the bed. So the level gage should be placed as shown in Fig 4. Take the reading in one direction every 250mm. The max. reading should not exceed ±3 scales with the accuracy of the level gage being 0.02/1000 per scale. At cross position the reading should not exceed 2 scales.

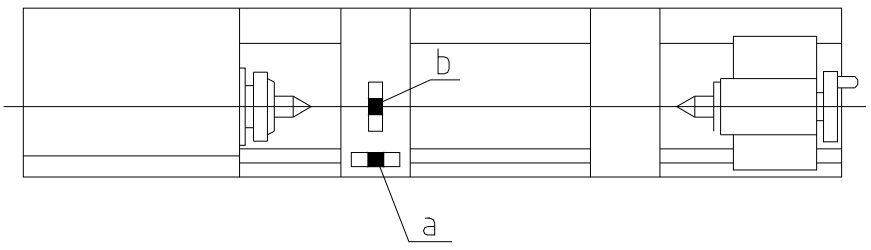


Fig. 4 Leveling of the machine

4.7 Inspection of the machine accuracy

The linearity of the guide ways can be inspected as follows:

a) Remove the compound rest and put the level gage on the cross slide transversally. Move the carriage from the left end to the middle and then to the right end of the bed. Put down the readings. Set the stand supports so that linear error of the guide ways in the same plane is less than 0.04/1000 for the entire inspected length.

b) Put the level gage longitudinally on the carriage near the contact surface with the front guide way. Move the carriage from the left end to the middle and then to the right end of the bed. Put down the readings. Draw the diagram of motion curves of the carriage. The linear error of the guide way in the vertical plane should be less than 0.02 mm for the whole bed length.

4.8 Try running of the machine

Before operating the machine, read carefully the directions about the machine construction, control levers and lubrication system, and check the working conditions of each part manually.

Before connecting the machine to the shop mains, check if the electric system is in proper order, especially with respect to moisture. After turning on the power, check if the motor runs in correct direction. If it is all right, proceed with trial running without load. First run the machine at the lowest speed for a certain period, then gradually raise the speed. Check the conditions of each part such as lubrication, operating, electrical and coolant system. Only when the machine runs smoothly with full lubrication and reliable control and braking, can the machine be put into production.

5. OPERATION SYSTEM OF THE MACHINE

5.1 All controls on the lathe are illustrated in Fig 5.

5.2 Spindle speeds are made by using the speed change lever 21 and 2.

Twelve steps of speeds are available if moving lever 21 to anyone of its four positions while lever 2 to a position with the same colour as lever 21. See Table 1.

Table 1　Table of spindle speeds

No.	Position of lever		Spindle speeds（r/min）
	2	21	
1	white	white	36
2			50
3			70
4	blue	blue	100
5			140
6			200
7	yellow	yellow	280
8			400
9			560
10	red	red	800
11			1120
12			1600

5.3 To obtain different thread pitches and different feed settings, four handdes 1,23,22 and 20 must be used together.

a. Handle 1 is used to select the hand of thread leads. Because of the overrunning clutch in the apron, the tool post does not feed unless the thread being cut is a right hand one.

 Right hand thread, feed

 Left hand thread, no feed

b. Handle 23 is a thread change control. But it can be used for the purpose of altering the feed setting.

t ------ Standing for Metric threads

n ------ Standing for Inch threads

m ------ Standing for Module threads

DP ------ Standing for Diametral pitches

-Ц**-** ------ Driving the leadscrew directly, not through any thread change device.

c. Move handle 22 for selecting the pitch and feed.

d. Handle 20 doubles the pitch or feed differently at the following positions:

I, II, III, IV:　Leadscrew works to cut threads.

A, B, C, D: Rod works to do feeding.

Ratios between them:

I: II: III: IV = A:B:C:D = 1:2:4:8

Using the methods mentioned above, any of the motions listed in Table 3 can be obtained.

To make the machine always work well, here is a principle for you to follow. That is fine feed is based upon high speeds and coarse feed upon low speeds.

When a thread excluded from Table 3 is to be cut, you need move handle23 to "-II-" position, handle 20 to "IV" position, then reset the change gears.

Table 2 Directions for the function of control elements

No.	Description and function
1	Thread Pitch Lever
2	Speed change Lever
3	Emergency Stop button
4	Push-button of cooling Pump
5	Main Motor Start button
6	Lamp Switch
7	Tool Post Clamp Lever
8	Coolant Delivery cock
9	Compound-rest knob
10	Quill Clamp Lever
11	Tailstock Clamp Lever
12	Tailstock quill Hand wheel
13	Switch Lever
14	Feeding and rapid speed Lever
15	Half Nut Lever
16	Main Motor Button
17	Cross feed Lever
18	Carriage Hand wheel
19	Power Switch
20	Feeding Speed Lever
21	Speed Change Lever
22	Feed Change Lever
23	Thread Selector Lever

Table 3

Inch Lead And Feed Table

n	t				m	n	t				m	82/97	t				m				DP				n/1"				!	n/1"					
A	A	B	C	D	D	A	A	B	C	D	D	81	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		I	II	I	II	I	II
0.023	0.033	0.067	0.134	0.264		0.010	0.015	0.029	0.057	0.113		1	1	2	4	8	0.5	1	2	4									1						
0.026	0.037	0.074	0.149	0.298		0.011	0.016	0.032	0.064	0.128		2		2.25	4.5	9			2.25	4.5									2						
0.027		0.078	0.156	0.309		0.012		0.034	0.068	0.132		3																	3						
0.029	0.041	0.082	0.164	0.331			0.018	0.036	0.072	0.143		4	1.25	2.5	5	10		1.25	2.5	5									4						
0.030		0.086	0.171	0.342		0.013				0.147		5									56	28	14	7	28	14	7	$3\frac{1}{2}$	5						
0.031	0.045	0.089	0.179	0.353			0.019	0.038	0.076	0.151		6													27	$13\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{3}{8}$	6	19	$9\frac{1}{2}$	23	$11\frac{1}{2}$	26	13
0.032		0.093	0.183	0.365		0.014	0.020	0.039	0.079	0.159		7		2.75	5.5	11			2.75	5.5									7						
	0.048	0.100	0.197	0.398	0.625		0.022	0.043	0.087	0.174	0.272	8	1.5	3	6	12	0.75	1.5	3	6	48	24	12	6	24	12	6	3	8						
	0.052	0.108	0.215	0.435	0.684		0.023	0.047	0.091	0.185	0.295	9									44	22	11	$5\frac{1}{2}$	22	11	$5\frac{1}{2}$	$2\frac{3}{4}$	9	82/97/57		82/97/69		82/97/78	
	0.056	0.112	0.223	0.450	0.703		0.024	0.048	0.095	0.192	0.302	10																	10						
		0.115	0.230	0.465	0.729		0.025	0.050	0.098	0.200	0.314	11	1.75	3.5	7	14		1.75	3.5	7									11						
	0.061	0.119	0.238	0.480	0.751		0.026	0.052	0.102	0.208	0.325	12									40	20	10	5	20	10	5	$2\frac{1}{2}$	12						
	0.063	0.126	0.252	0.513	0.804		0.028	0.055	0.109	0.219	0.348	13																	13						
				0.531	0.833					0.227	0.359	14									36	18	9	$4\frac{1}{2}$	18	9	$4\frac{1}{2}$	$2\frac{1}{4}$	14						
				0.599	0.937					0.257	0.404	15									32	16	8	4	16	8	4	2	15						

5.4 Controlling the motions of the carriage

a. Automatic feed lever 14 is used to move or feed the carriage back and forth or the cross slide in and out. The button on it is used to speed up the motion.

b. when threading, half nut lever 15 is used to move or feed the carriage crosswise.

c. Handwheel 18, knob 17 and 9 are all manual controls. The graduations on each help the operator to measure the distance moved.

5.5 Lever 13 can be used to stop the spindle or to turn it either clockwise or counter-clockwise.

Operations of other controls are shown in Fig.5.

6. MAIN STRUCTURAL PROPERTY AND ADJUSTMENT OF THE MACHINE

6.1 Bed

The part of machine bed consists of front and rear stands joining together with bolts. The guide ways of the machine, having undergone supersonic frequency hardening, are high in durability. The main motor is inside the front stand and coolant system inside the rear stand. Behind the bed is the electric system. The tightness of the belts for main drive should be suitably adjusted by means of adjusting nuts (See Fig 6).

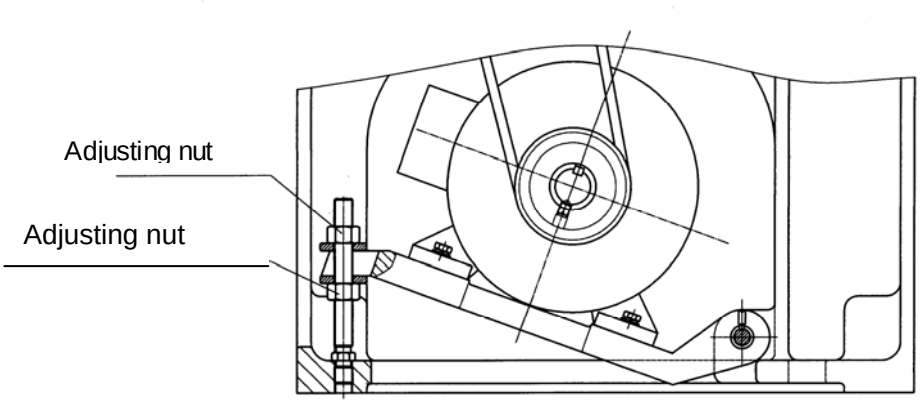


Fig 6 Diagram of adjusting driving belts

6.2 Headstock

The machine adopts gear centralized drive. The power of the main motor is transmitted to axle I through V-belts. Through a multi-disc friction clutch and different gear pairs, the power is further transmitted to the spindle. The spindle's forward or reverse motion is also controlled by the clutch. To ensure normal working of the spindle, the clutch must be suitably adjusted. If the clutch is too loose, it outputs less power and is easy to get slip and hot. If it is too tight, it becomes difficult to operate and loses the function of protection (See Fig 7).

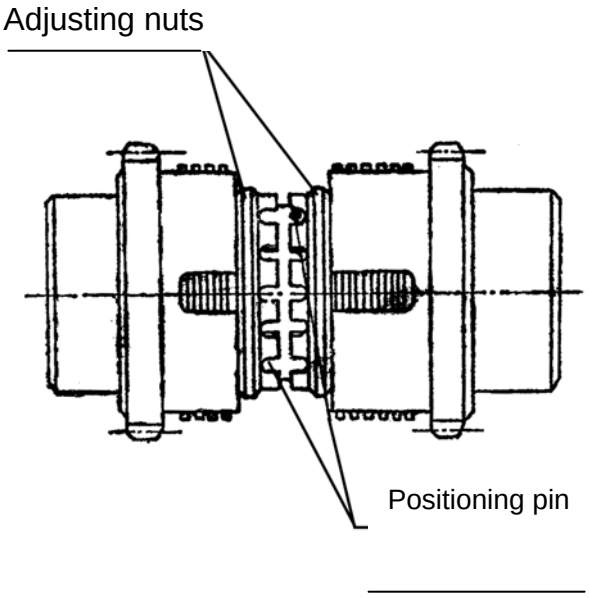


Fig 7 Diagram of adjusting friction clutch

After the clutch is disengaged, the main drive can be stopped by the brake. If the spindle could not be stopped in a short period, the braking strap of the brake should be adjusted through adjusting nuts. Be sure not to distort the strap (See Fig 8).

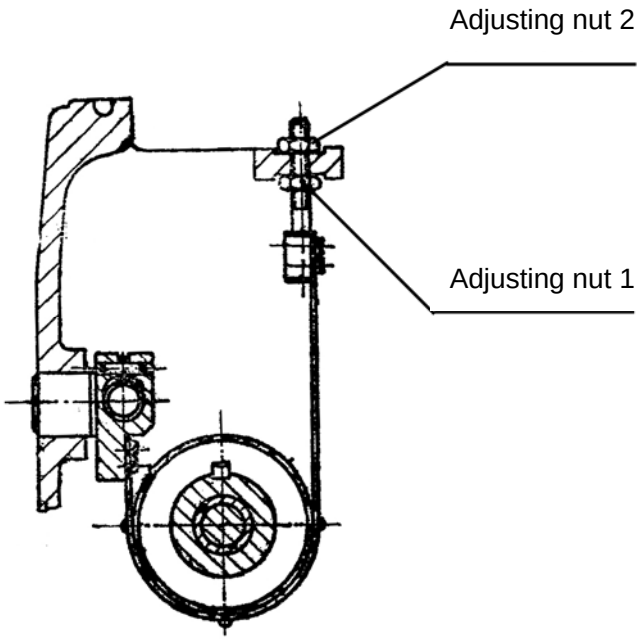


Fig 8 Diagram of adjusting braking strap

The spindle system is supported by three bearings with the rear bearing serving as an auxiliary support (See Fig 9).

To ensure the machining precision and cutting function of the spindle, the play of the spindle bearings should be carefully adjusted so that the radial and axial run-out of the spindle meets the requirement of the machine standard.

If the spindle precision can not meet the above requirement, first loosen nuts 1 and 2. Loosen lock ring before loosening nut 2. Adjust the play of the front and middle bearings through nuts 3 and 4. After the adjustment tighten the loosened nuts one by one.

After the adjustment, make an idle running of the machine at the highest speed for more than two hours. When the temperature rise is stable it should not exceeds 70^{o}C, otherwise the machine must be adjusted again.

To avoid machine rocking during idle running, gears 5 and 6 are attached with balance blocks. The spindle system has been balanced before delivery of the machine. (If it is already balanced by itself, there will be no such block.)

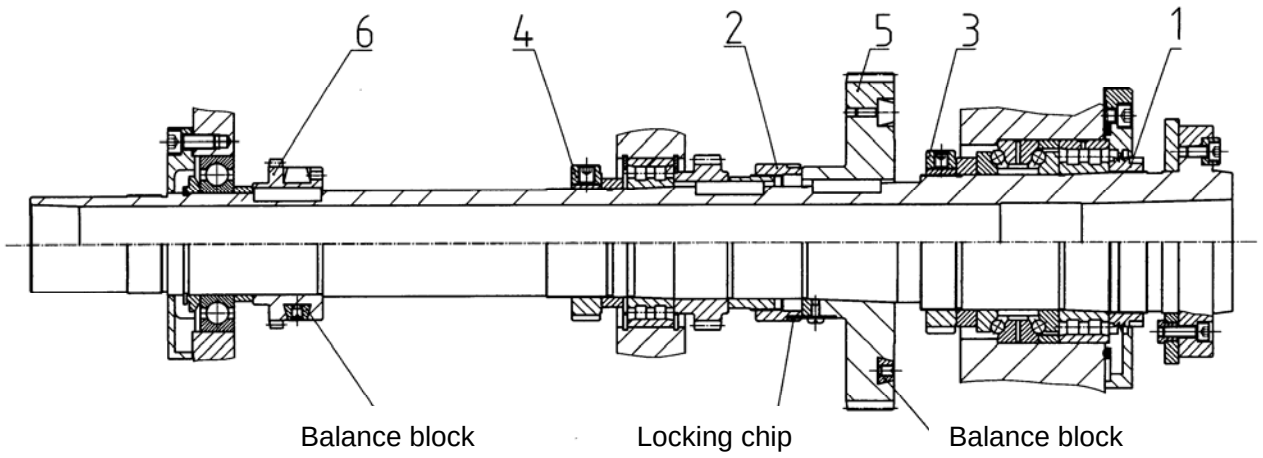


Fig 9 Diagram of adjusting spindle bearings

The speed control mechanism of the basic group of the main drive adopts chain connection. After the chain becomes elongated and loose, the position of the speed label may become inaccurate, so just tighten the chain by means of the adjusting screw (See Fig 10).

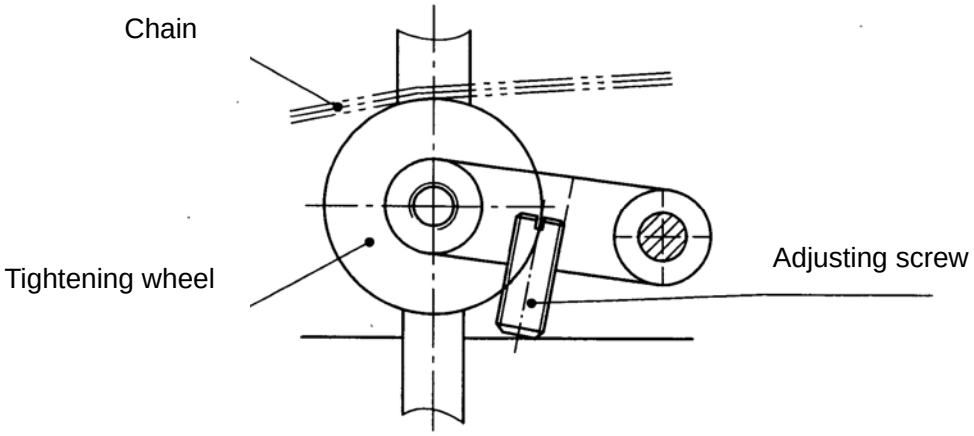


Fig 10 Diagram of chain tightening mechanism

6.3 Feedbox

This machine adopts “three axle sliding” common gear mechanism together with thread variety change mechanism and double mechanism, which enable it to cut common threads without the need for change fears.

In order to ensure the pitch accuracy in cutting threads, the axial run-out of the lead screw must be eliminated. This can be realized by adjusting thrust bearings 2 and 3 through nut 1 (See Fig 11).

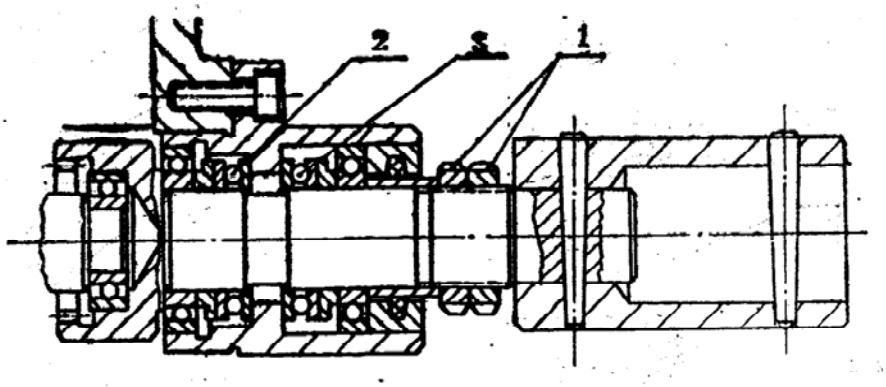


Fig 11 Diagram of adjusting thrust bearings on lead screw

6.4 Apron

Feed drive route is from feed rod to apron, through safety clutch to worm, through gear drives to longitudinal or cross movement of the tool post.

To realize rapid feed of the tool post at any time, an overstep clutch is equipped on the worm axle. When the rapid feed motor drives the worm axle, it oversteps the feed rod in one direction.

To ensure operation safety, longitudinal feed hand wheel can be automatically disengaged when the tool post is under rapid feed or longitudinal automatic feed. When the above movements have stopped, it is automatically engaged again.

When the cutting force cannot reach the rated max. value, juts remove cover 1, adjust the safety clutch through adjusting screw 2 (See Fig 12). Be sure not to set it too tight, otherwise there would be no protection function and the machine may be damaged.

To avoid feed rod and lead screw being engaged at the same time, there is an interlocking mechanism between longitudinal feed operation axle and half nut operation axle.

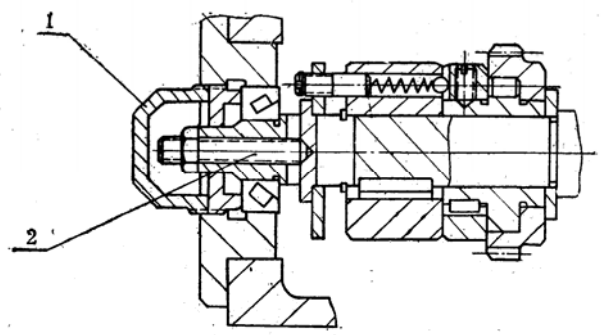


Fig 12 Diagram of adjusting safety clutch

6.5 Tool post

Tool change can be realized by a one way tooth jacking up a cam and pin which raises the upper tool post together with a positioning pin (See Fig 13). During tool change, the tool rest is just slightly raised. After repeated tool changes, the raised distance remains the same. In any case, to clamp the tool rest, just turn the lever clockwise less than a complete round and it can be tightly clamped.

During tool change, if the tool rest cannot reach the desired position, just loosen the spring and steel ball. If it over travels, just tighten the spring and steel ball.

Remove screw 1 and 2, take out spring 3 and steel ball 4, then the lever and the tool rest can be removed. When reassemble the tool rest, do it as the section drawing shown in Fig 13.

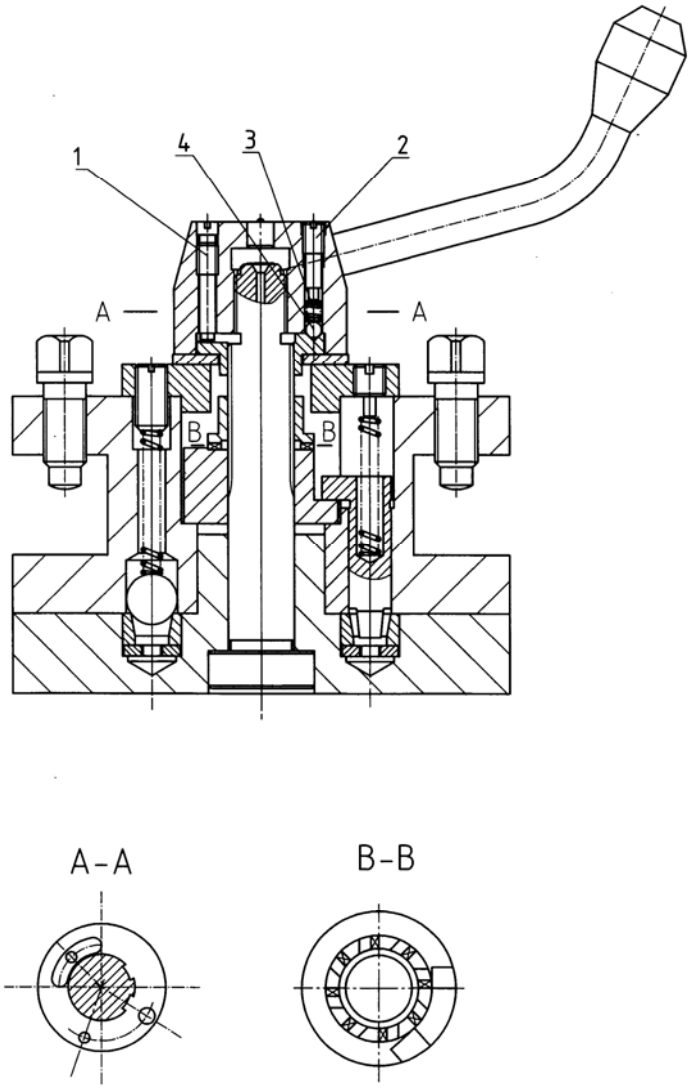


Fig 13 Diagram of tool post structure

The movement of bottom tool post is realized by a lead screw driving a nut on it. The nut is a half split whole nut. In this way driving clearance can be adjusted. First

loosen screw 1, then set screw 2 until the clearance is eliminated. Finally tighten screw 1 again. When the adjustment is finished, put on the dust cover 3 (See Fig 14).
When the guide ways between upper and bottom tool post have too much clearance, or slide not smoothly, the adjusting screws on both ends of the gib can be adjusted.

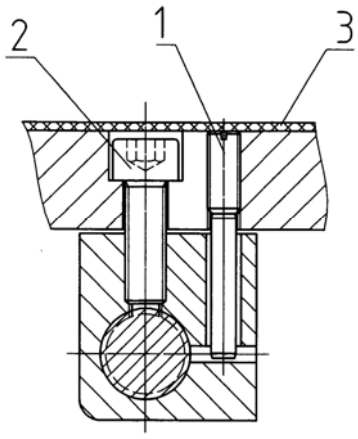


Fig 14 Diagram of adjusting lead screw and nut for bottom tool post

6.6 Tailstock

At the bottom of the tailstock sleeve taper hole, there is a block 4 to prevent the tool from turning. Cross displacement of the tailstock can be realized by adjusting screw 1. Before adjusting, loosen set screw 2. After adjusting, tighten it (See Fig 15).
After longitudinal movement of the tailstock, it can be clamped by an eccentric shaft. The clamping force can be adjusted by nut 3. On releasing clamping shaft, the tailstock floats 0.05-0.15 mm up the guide ways of the bed through four elastically supported bearings so that the tailstock is easy to move. The float amount can be adjusted by screw 5. Since the adjusted amount is very little, to ensure contact rigidity between bed and tailstock and prevent the bearings from being crashed, the adjustment should be carried out when the tailstock is clamped.

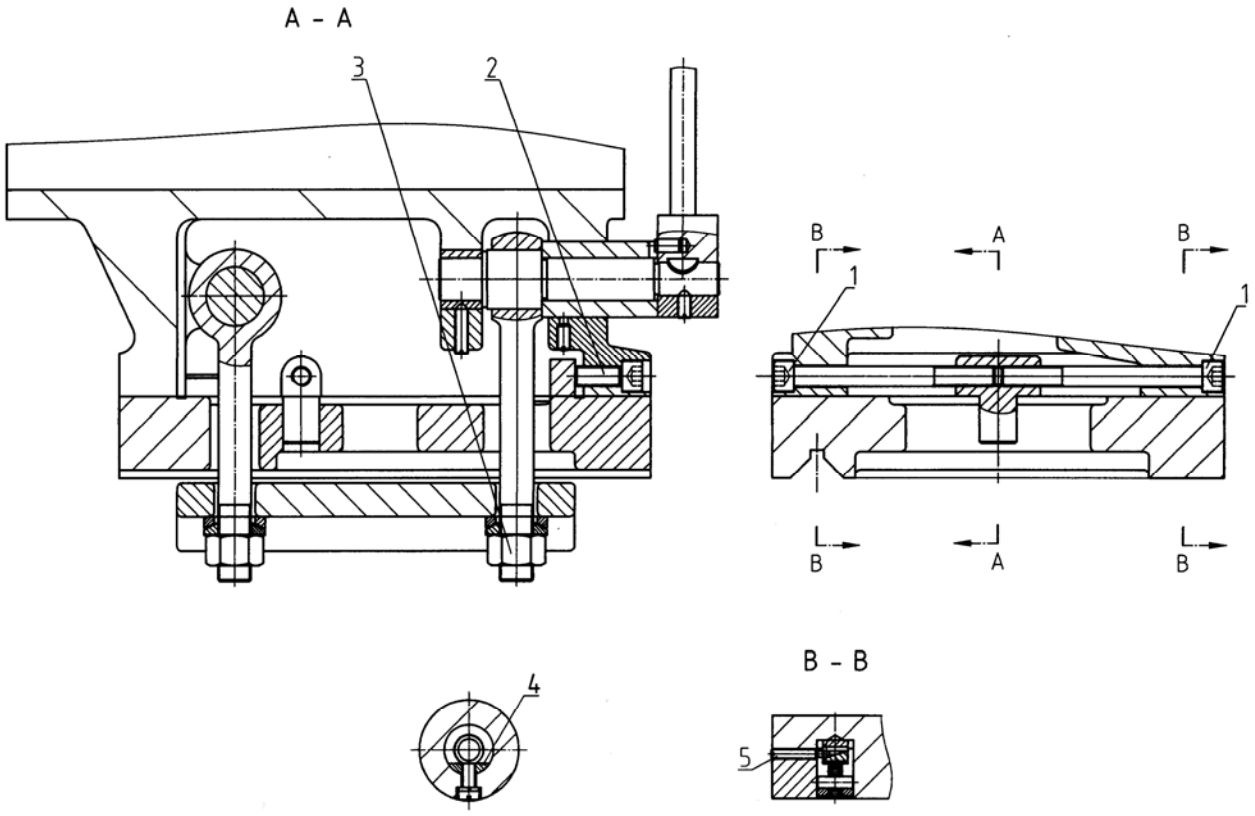
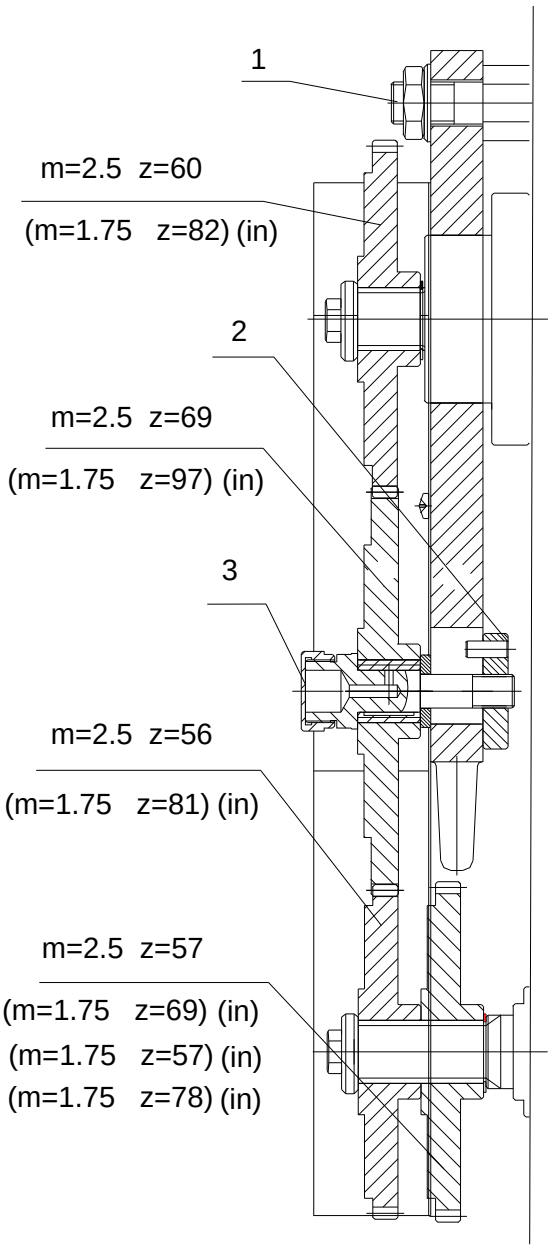
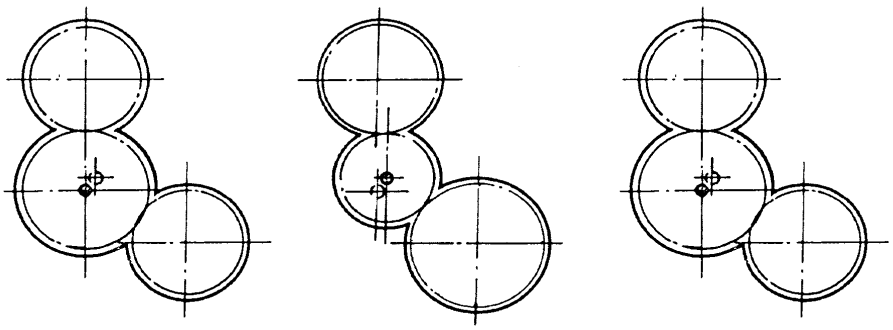


Fig 15 Diagram of adjusting tailstock

6.7 Change gear bracket

The driving gear on the change gear bracket has 60 teeth. It is ready to cut by separated threading multi-head threads with head number of 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 and 60. Under normal conditions, there is no need for change gears, only when 19 or $11^{1}/_{2}$ TPI thread is to be cut, does the change gears need be exchanged, as shown in Fig 15.





82/97×97/57 19T.P.I

82/97×97/69 $11\frac{1}{2}$ T.P.I

82/97×97/78 13T.P.I

Fig 16 Diagram of changing gears

7. LUBRICATION SYSTEM OF THE MACHINE

As for the requirement of the machine lubrication, please refer to Diagram of machine lubrication (Fig 17).

To ensure normal working and long service life of the machine, it is necessary to keep each moving part of the machine well lubricated.

Purified machine oil N32 should be used for the lubrication of the machine, with its viscosity being 28.8 ~ 35.2 Cst (40^{o}C). This may vary a bit according to the working conditions.

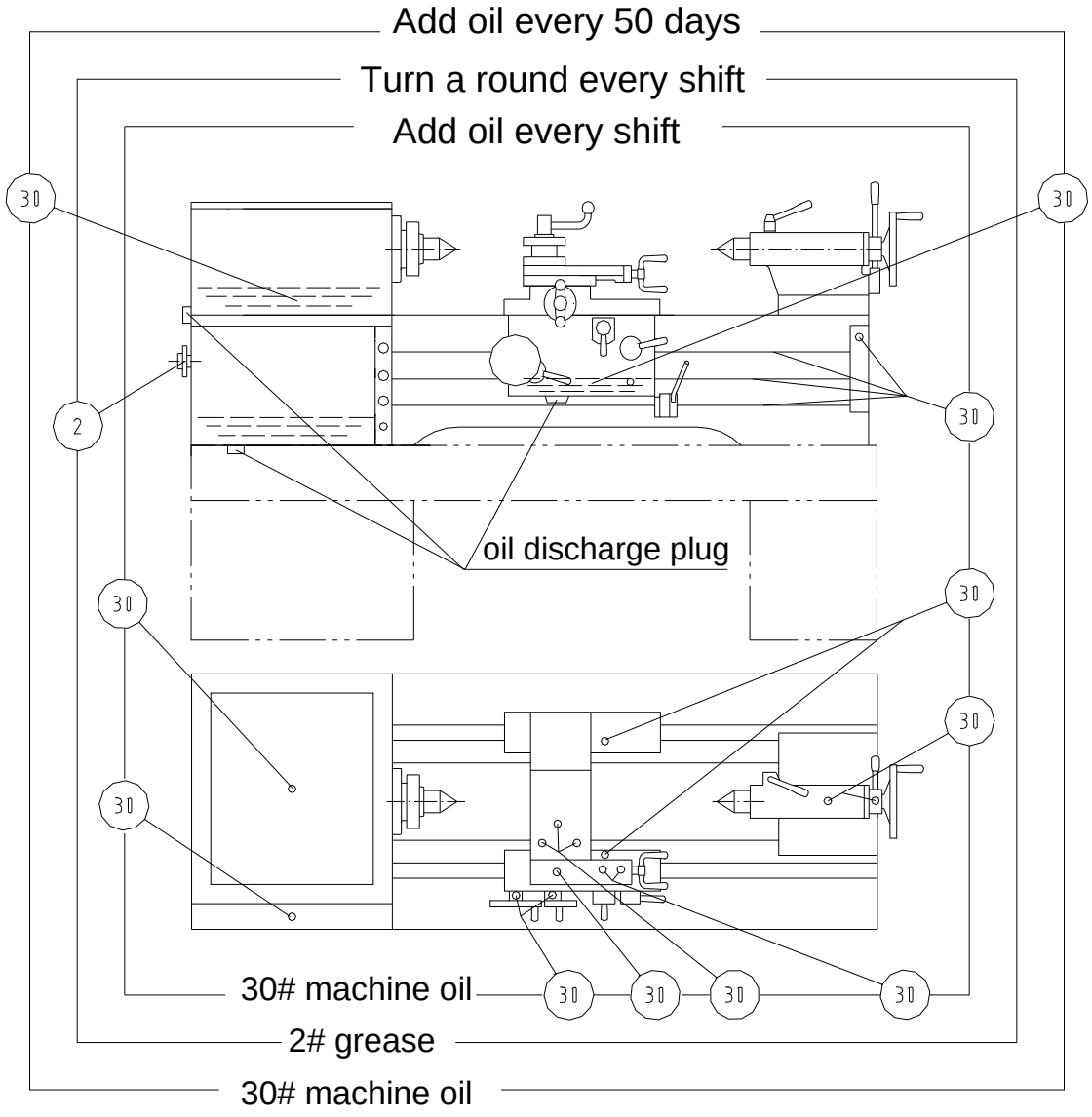


Fig 17 Diagram of machine lubrication

7.1 Headstock: An oil pump is driven by axle I to supply oil to the headstock case (Fig.18). The oil from the pump goes through a filter and then gets to oil pan and oil pool to lubricate gears, axes and bearings inside the headstock in circulation (Fig 19).

The working condition of the oil pump can be observed through the oil glass in the front of the headstock. The oil level can be observed from the oil indicator behind the headstock.

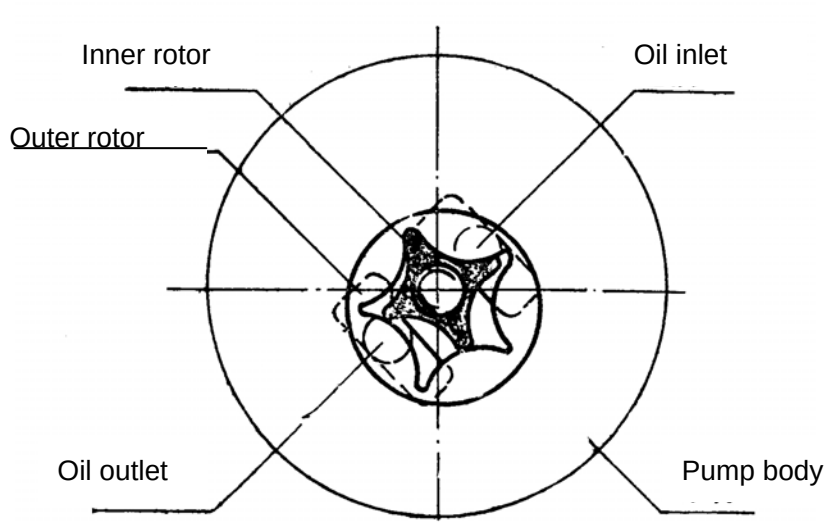


Fig 18 Diagram of oil pump working

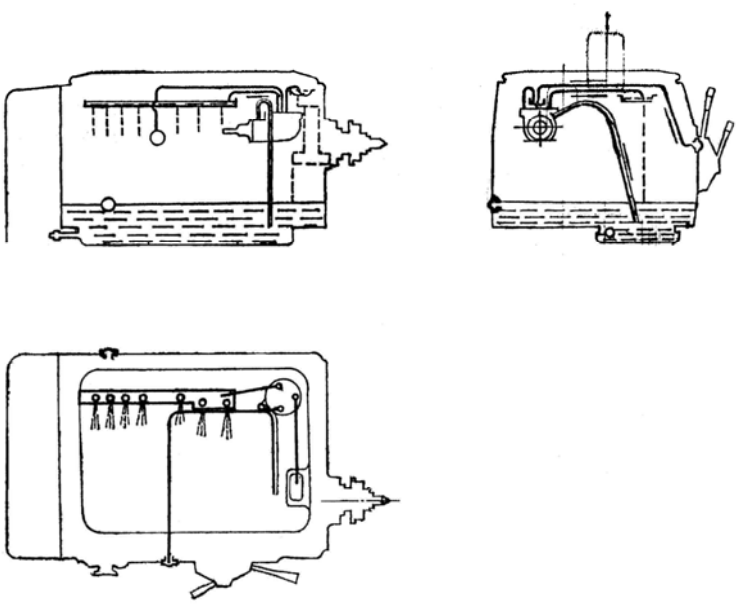


Fig 19 Diagram of headstock lubrication

7.2 Feedbox: Oil is stored in an oil pool and led through woolen lines for drop lubrication (Fig 20). After a period of working, used oil should be discharged according to the oil indicator.

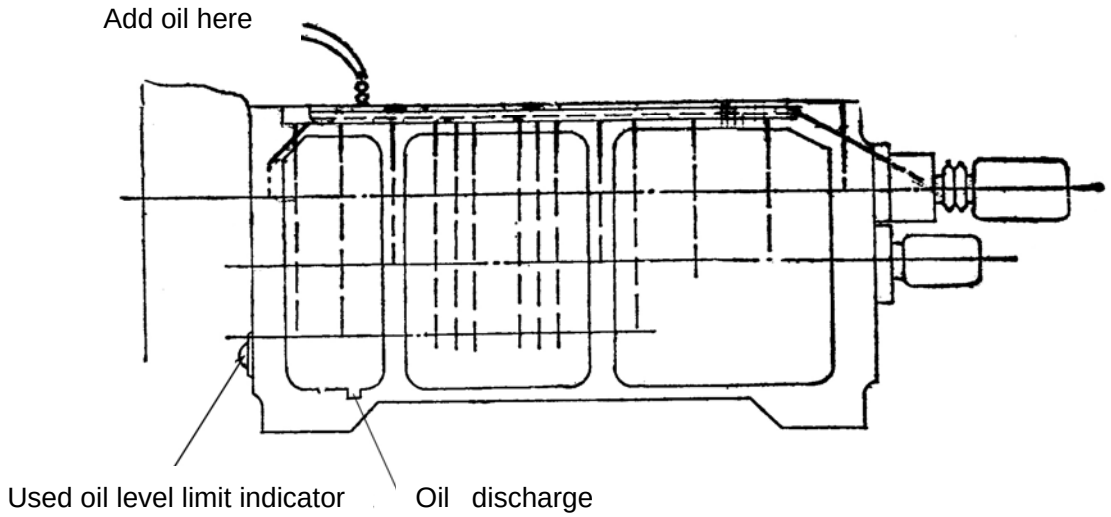


Fig 20 Diagram of feedbox lubrication

7.3 Apron: An oil pool in the apron casting is used for lubrication. During rapid feed, the stirring blade splashes oil for lubrication of the driving parts in apron. The bearings are lubricated by the ball oilers on the saddle. Use an oil gun to inject oil into the ball oilers. They can also be lubricated by splashed oil or drops from woolen lines (Fig 21).

The oil level can be observed from the oil indicator in the front of the apron.

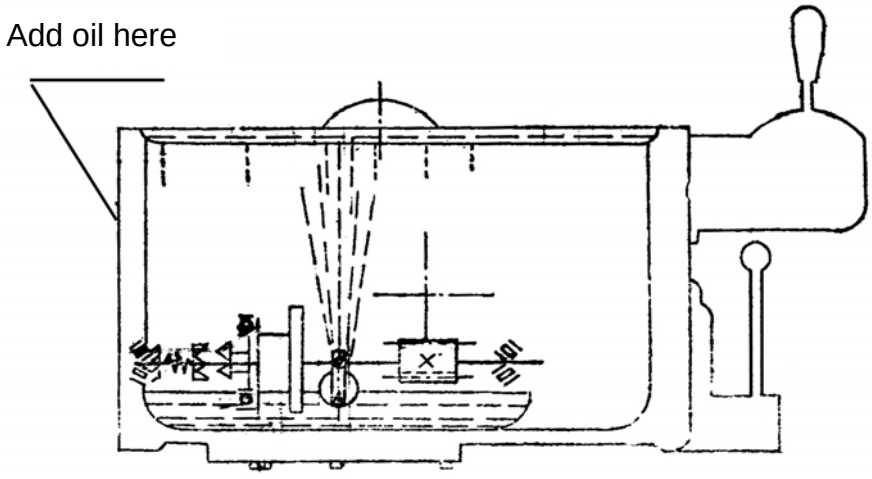


Fig 21 Diagram of apron lubrication

7.4 The guide ways under the saddle are lubricated by two ball oilers. Oil is filtered through felt for lubrication.

7.5 The guide ways on upper part of the saddle, cross lead screw, top slide lead screw, tool rest, tailstock sleeve and lead crew are all lubricated by an oil gun.

7.6 The lead screw, feed rod, forward/reverse control axle neck are all lubricated from the oil pool on the rear bracket through woolen lines.

7.7 The idle gear axle and its sleeve are lubricated with grease pressed into the axle end plug.

8. COOLANT SYSTEM OF THE MACHINE

The coolant of the machine is stored in the rear bed stand. AOB-25 three phase motor is used to supply coolant. The flow of coolant can be adjusted by a tap on the coolant hose.

9. ELECTRIC SYSTEM OF THE MACHINE (see electrical manual)

10. MAINTENANCE OF THE MACHINE

10.1 Lubrication

To ensure normal working of the machine and reduce parts wear, all friction surfaces of the machine parts should be properly lubricated. Attentions must be paid to the following points:

(a) Each part must be lubricated according to the diagram of machine lubrication. The oil added must be clean.

(b) The oil level of each case should not be less than middle of the oil indicator to ensure full lubrication. It should not be too high either. Otherwise there may be leakage. Therefore, be sure to check oil level often.

(c) The oil in the headstock and apron should be changed every 2 ~ 3 months. Since the parts of a new machine wear more, the first and second oil change should be made after 10 and 20 days respectively to clean dirt in time. After discharge of the used oil, rinse the casting case with kerosene.

(d) The filter in the headstock, woolen lines and filtering felt should be cleaned every month. The anti-dust felt on both ends of the guide ways of the underside of the saddle and that on left side of tailstock base should be cleaned with kerosene every week. If the felt is damaged, be sure to change it.

（e）For the spindle front bearing lubrication .there are two types-oil tubes or

grease. Grease can last 3 years. If the spindle works abnormal because of inadequate lubrication, be sure to add grease. Clean the spindle and bearing. Add 300 gram grease. Run-in before operation.

10.2 Operation

During operation, attentions should be paid to the following points:

(a) On starting the main motor, check the oil glass on the headstock if the oil pump works normally. Only when oil is observed from the oil glass can the spindle be started.

(b) When the spindle runs at a high speed, never turn any handle or lever. Spindle speeds can be changed only when the main motor stops. Feed rate can be changed only when the spindle runs at a low speed or stops.

(c) Before starting the spindle, check if each handle or lever is at a correct position to ensure normal engagement of driving gears.

(d) When the brake becomes ineffective, adjust it right away. Never reverse the friction clutch for braking.

(e) When operating forward/reverse control lever, be sure to turn it to the right position. Never use “pre-position” for cutting at a reduced speed.

10.3 Application of the machine

To keep the machine accuracy and prolong service life of the machine parts, please pay the following attentions:

(a) Regularly check and adjust the tightness of V-belts to prolong the service life of them.

(b) Regularly clean the dirt and coolant round the tool post to keep its re-positioning accuracy.

(c) Lead screw is used only for threading instead of longitudinal feeding so that its accuracy can be maintained and service life prolonged.

In threading, the lead screw drives the apron directly and the safety clutch of the apron has lost its protection function. To avoid the machine parts being damaged, be sure to select suitable cutting depth so that P_x will not be too big.

(d) When loading or unloading the workpiece or getting away from the machine, the operator must stop the main motor.