850
PRECISION LATHE SERIES OPERATION & MAINTENANCE MANUAL

YANG IRON WORKS CO., LTD.
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PREFACE

This manual covers the latest information, specifications and features to provide maintenance and operation personnel for safeguards and precise procedures.

This manual consists of 9 chapters. Chapters 1 and 2 gives general introduction to machine specifications and relative accessories. Chapter 3 comprise transporation and installation notice of machine. Chapters 4, 5 and 6 comprise systems and structures inspection, adjustment and lubrication procedures etc.. Chapter 7, 8 and 9 comprise electrical system machine trouble shooting and maintenance, periodic cleaning and preventative operation.

For the sake of security and accuracy, any maintenance and inspection done on the machine should be in agreements with the recommendations mentioned in this manual, **YANG IRON** shall not be liable for errors contained herein or for incidental consequential damages in connection with furnishing, performance, or use of this manual. The data and specifications of this manual are subject to change without any notice as machine improvements is never ceasing.

To serve you with feats is our duty, therefore, if what problems you have encountered, please

1. First contact our local dealer who will be able to provide you with the information you want.

2. If you don't get satisfied answers from your dealer, then directly contact **Yang Iron Works Co., Ltd.** to assist you and we will do our best services for you.

MAIN PRODUCTS

1.Precision High Speed Lathe.

2.CNC Lathe.

3.Cylindrical Grinder.

4.Vertical Machining Center.

5.Horizontal Machining Center.

6.Forklift Truck.

MAINTENANCE NOTICES

1. Only qualified and authorized maintenance personnel should be permitted to maintain, repair, adjust and inspect machine.

2. Maintenance personnel should be on work clothing and avoid wearing slack garb, rings, watch and any metal material as possible.

3. **Yang Iron Works Co., Ltd.** suggest maintenance personnel be on rubber shoes as possible.

CONTENTS

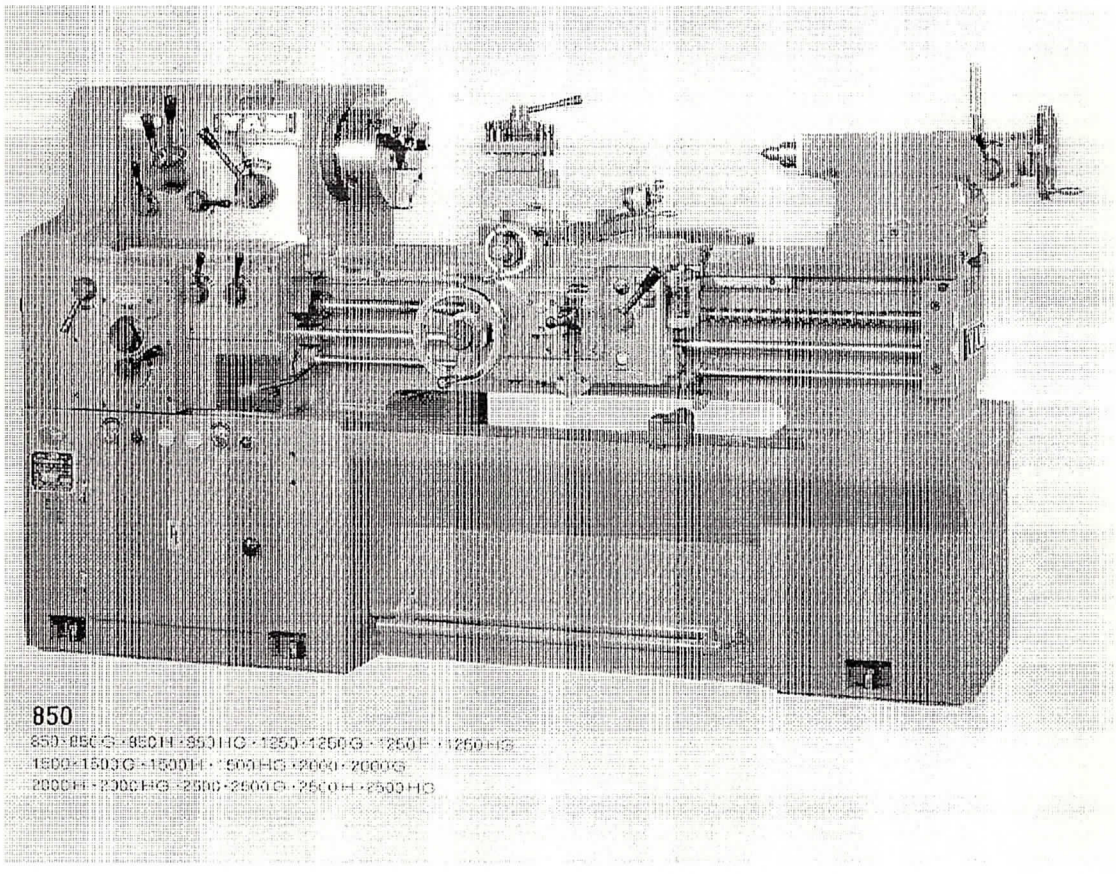
APPENDIX

CHAPTER 1

FEATURES

1.1 FEATURES

1.Wide,rigid Cast iron bed,precision hardened and ground slide ways.
2.Base composed of strong rigid steel weldments,stress relieved for stability.
3.Heat treated optional ASA A-1-6 or ASA D-1-6 spindle noses are available. Spindle gears are induction hardened and precision ground for quiet smooth power.
4.Metric change gears for maximum threading capability.
5.Mono-level feed control is interlocked with thread engagement lever for maximum safety.
6.Safety foot actuated spindle brake for fast stopping.
7.Safety overload device prohibits machine damage during operation.



850
850·850G·850H·850HG·1250·1250G·1250H·1250HG
1500·1500G·1500H·1500HG·2000·2000G
2000H·2000HG·2500·2500G·2500H·2500HG

CHAPTER 2

SPECIFICATIONS

2.1 Machine's specifications

UNIT: mm (inch)

NOMINAL SIZE		850 (1722, 2233) 850 850H 850G 850HG	1250 (1749, 2249) 1250 1250H 1250G 1250HG	1500 (1760, 2260) 1500 1500H 1500G 1500HG	2000 (1780, 2280) 2000 2000H 2000G 2000HG	2500 (17100, 22100) 2500 2500H 2500G 2500HG
SWING AND DISTANCE						
Swing over bed	Standard Type	435 (17-1/8)				
	H Type	560 (22-1/32)				
Swing over cross slide	Standard Type	250 (9-27/32)				
	H Type	375 (14-3/4)				
Swing over gap	Standard Type	615 (24-27/32)				
	H Type	745 (29-11/32)				
Width of gap from face plate (G Type)		A-1-6 270 (10-5/8) D-1-6 255 (10)				
Center Distance		850 (33-15/32)	1250 (49-7/32)	1500 (59-1/16)	2000 (78-3/4)	2500 (98-7/16)
SPINDLE						
Spindle Bore		58 (2-9/32)				
Spindle Nose		ASA A-1-6 or ASA D-1-6				
Spindle Taper		M.T. NO. 6				
Center Taper		M.T. NO. 4				
No. of Spindle Speeds		12				
Spindle Speeds	Standard Type	32, 62, 82, 112, 160, 200, 285, 395, 510, 710, 1010, 1800				
	H Type	25, 51, 68, 93, 133, 166, 237, 330, 425, 590, 840, 1500				
FEEDS AND THREAD CUTTING						
Lead Screw		ϕ32 (1-1/4) (4 T.P.I. or 6mm)		ϕ38 (1-1/2) (4 T.P.I. or 6mm)		
Inch Threads		80 – 4 T.P.I.				
Metric Threads		0.25 – 7mm				
D.P. Threads		112 8				
Module Threads		0.5 – 3.5				
Number of Feed Change		32				
Range of Longitudinal Feed		0.045 – 0.627 (0.0018 – 0.025)				
Range of Cross Feeds	Inch Leadscrew	0.027 – 0.627 (0.0011 – 0.025)				
	Metric Leadscrew	0.045 – 0.627 (0.0018 – 0.025)				
TOOL SLIDE						
Cross Slide Travel		245 (9-21/32)				
Compound Rest Travel		150 (5-29/32)				
Max. Size Cutting Tool		25 x 25 (1 x 1)				
TAIL STOCK						
Diameter of Quill		65 (2-9/16)				
Quill Travel		150 (5-29/32)				
Taper of Center		M.T. NO. 4				
BED						
Length		1880 (74)	2285 (89-31/32)	2540 (100)	3040 (119-11/16)	3540 (139-3/8)
Width		350 (13-25/32)				
Depth		350 (13-25/32)				
Motor		3.75 KW (5HP 4P			5.5 KW (7-1/2HP) 4P	
Floor Space (L x W)		2155 x 980 (85 x 39)	2555 x 980 (101 x 39)	2805 x 980 (111 x 39)	3340 x 980 (132 x 29)	3840 x 980 (152 x 39)
Net Weight (Approx.)		1850 KG	1950 KG	2100 KG	2200 KG	2300 KG
Gross Weight (Approx.)		2050 KG	2200 KG	2400 KG	2550 KG	2700 KG
Packing Size (L x W x H)		230x1020x1570 (92x41x62)	2860x1020x1570 (113x41x62)	3170x1020x1570 (125x41x62)	3630x1020x1570 (143x41x62)	4240x1020x1570 (167x41x62)

2.2 Machine's accessories

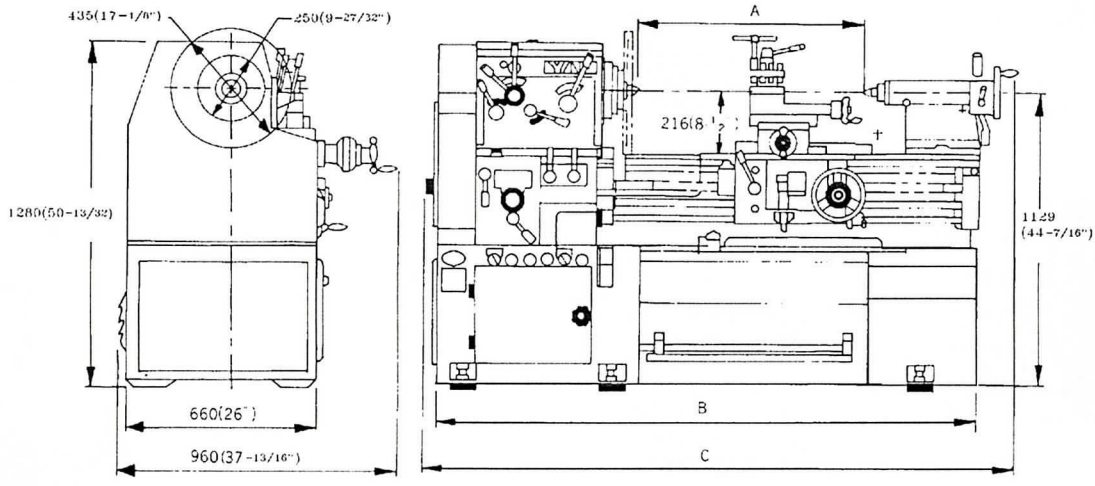
2.2.1 Standard accessories

1. Driving plate (250 mm).....1 pc
2. Steady rest (Ø55- 185 mm).....1 set
3. Follow rest (Ø15- 50 mm).....1 set
4. Coolant pumping equipment.....1 set
5. Change gears (72T).....1 pc
6. Centers (M.T. No.4).....2 pcs
7. Center sleeve (M.T. No.6 X M.T. No.4).....1 pc
8. Leveling bolts & pads .....1 set
9. Oil can.....1 pc
10. Paint can.....1 pc
11. Tool kid.....1 set
12. Worm gear (21T,22T only for metric).....1 pc
13. Operation & maintenance manual.....1 pc

2.2.2 Optional accessories

1. Three jaw scroll chuck (250 mm)
2. Four jaw independent chuck (300 mm)
3. Micrometer carriage stopping device
4. Telescoping taper attachment
5. Square type of rear tool holders
6. Splash guard
7. Face plate
   Standard type series 400 mm
   H type series 560 mm
8. Work lamp
9. Compound rest for longitudinal feed(metric 0.02 mm)

2.3 Outline



SIZE / TYPE	A	B	C
YAM-850 (1733)	850 (33-15/32)	1985 (78-5/32)	2190 (86-7/32)
YAM-1250 (1749)	1250 (49-7/32)	2480 (97-5/8)	2690 (15-29/32)
YAM-1500 (1760)	1500 (59-1/16)	2795 (110-1/32)	2995 (117-29/32)
YAM-2000 (1780)	2000 (78-3/4)	3045 (119-7/8)	3245 (127-3/4)
YAM-2500 (17100)	2500 (98-7/16)	3490 (137-13/32)	3690 (145-9/32)

CHAPTER 3

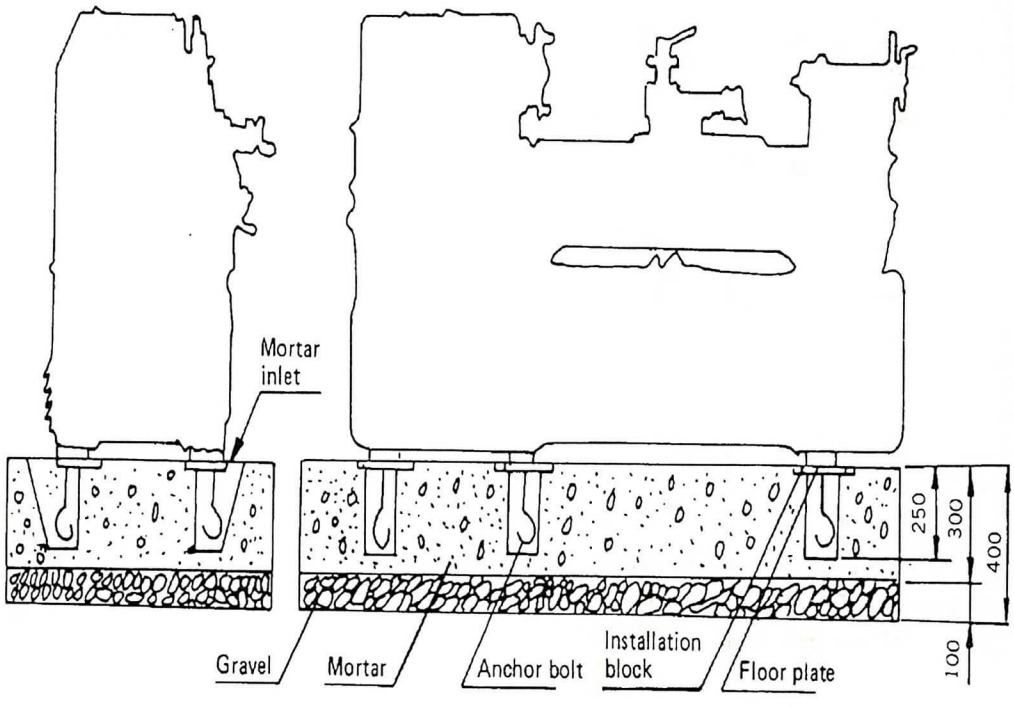
INSTALLATION & TRANSPORTATION

3.1 Foundation work

As search for the foundation, we should pay much attention to the ingredient of mortar and the condition of soil in order to block the variation from around circumstances. Because the phenomena of vibration will greatly effect the accuracy of machining and life of tools, so we must, according to the figure(shown in below) and the explanations, complete the foundation work before the installation of lathe.

1. Items required for foundation work:
   (a) Anchor bolt ½ inch dia.(nut with washer)....8 pcs
   (b) Square cast iron (or iron) plate (5"x7"x1"),....8 pcs
2. Place of installation:

Approximate 40" square open space is required behind the machine for the clearing of chips when copying attachment is to installed, a bigger space is required if machine is equipped with pump system.

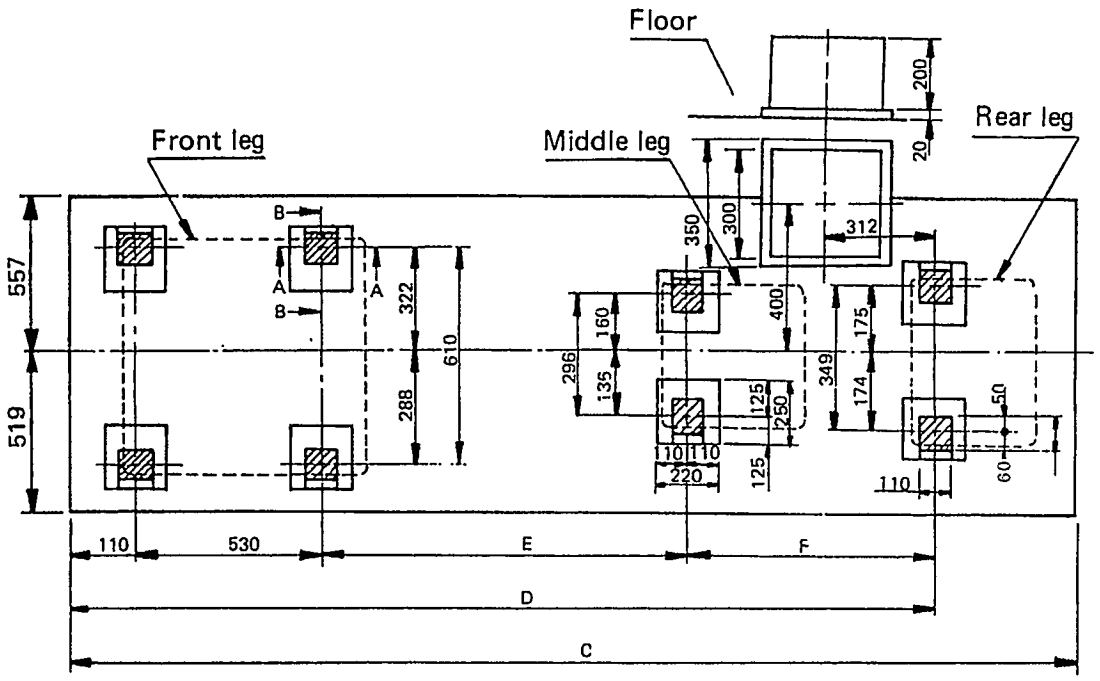


3.2 Unpacking

Before operating, remove the anti-corrosion coating from all slideways and the end gear train using kerosene.Do not use aromatic solvents or keytones as they will damage the paint finish.

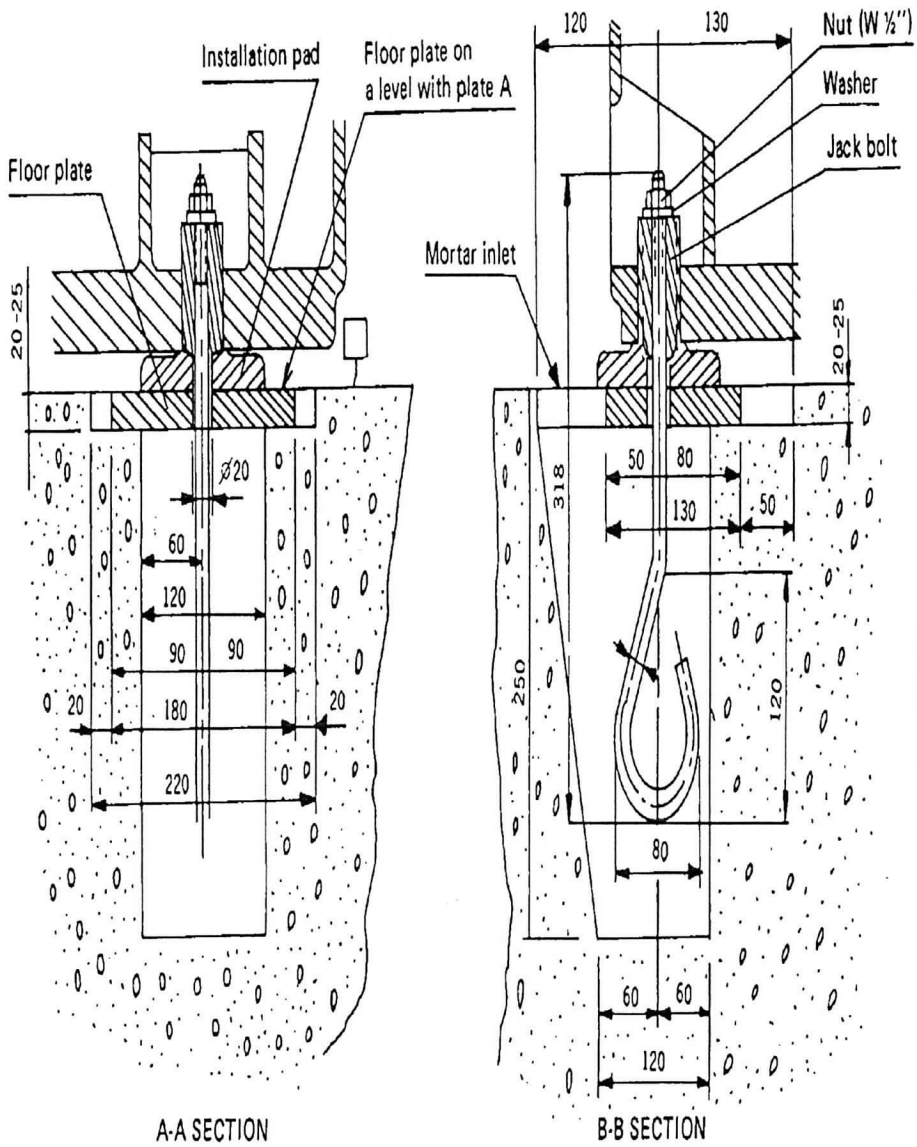
After cleaning,the surface of machine with lubricant and let the gears be covered with a layer of grease.

3.3 Foundation plane



SIZE / TYPE	C	D	E	F
850	2065	1854.5	–	–
1250	2575	2364.5	742.5	981
1500	2865	2654.5	887.5	1126
2000	3293	3082.5	1260.5	1181
2500	3800	3589.5	1362.5	1586

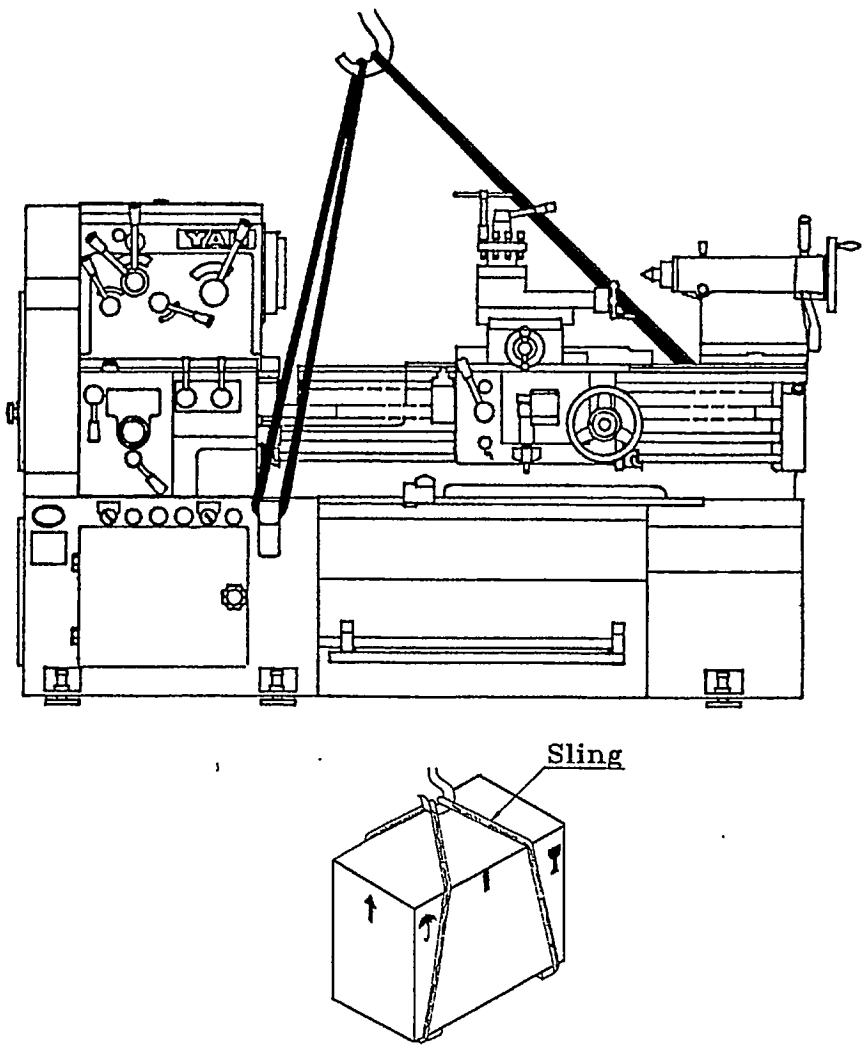
3.4 Foundation construction



3.5 Lifting

Unloading of the machine, packed in the wooden case should be wired from the bottom ties.

Use the bed clamping plates and eyebolt to sling the lathe as shown in below. Position the saddle and tailstock along the bed to obtain balance.



3.6 Installation

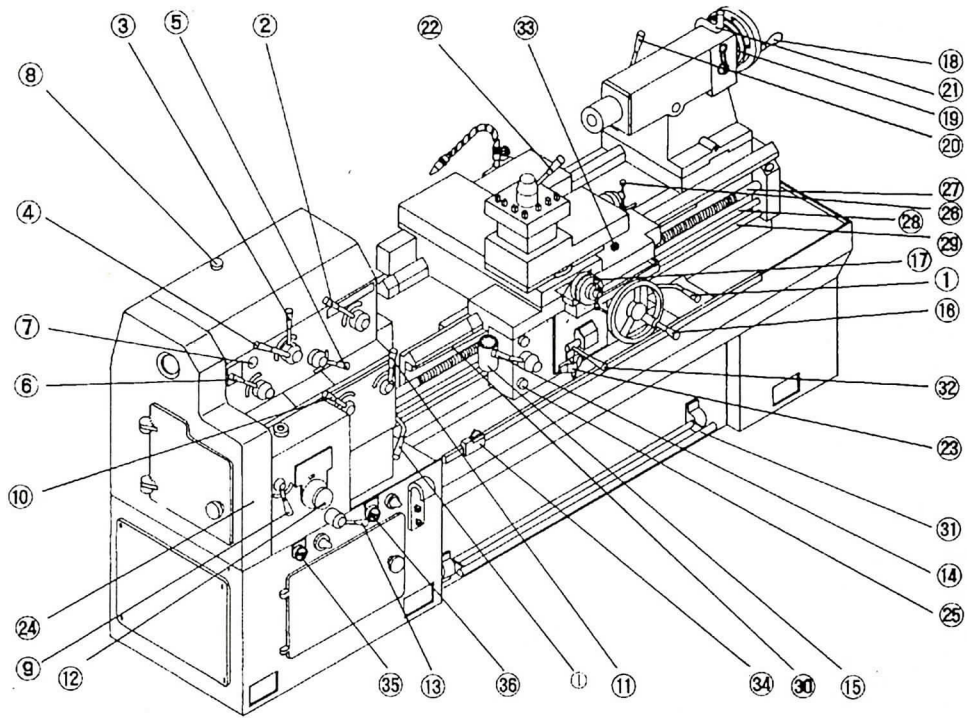
Before the machine is lowered, arrange anchor bolts, floor plates, installation blocks and jack bolts as figure shown in section 3.5 and then machine is lowered down gradually against the anchor holes. Then put mortar around anchor holes and plates. Levelling of the machine is made by jack bolts.

After mortar is completely hardened, lock anchor bolts and jack bolts to integrate the machine and foundation.

CHAPTER 4

MECHANISM

4.1 Designations of mechanism

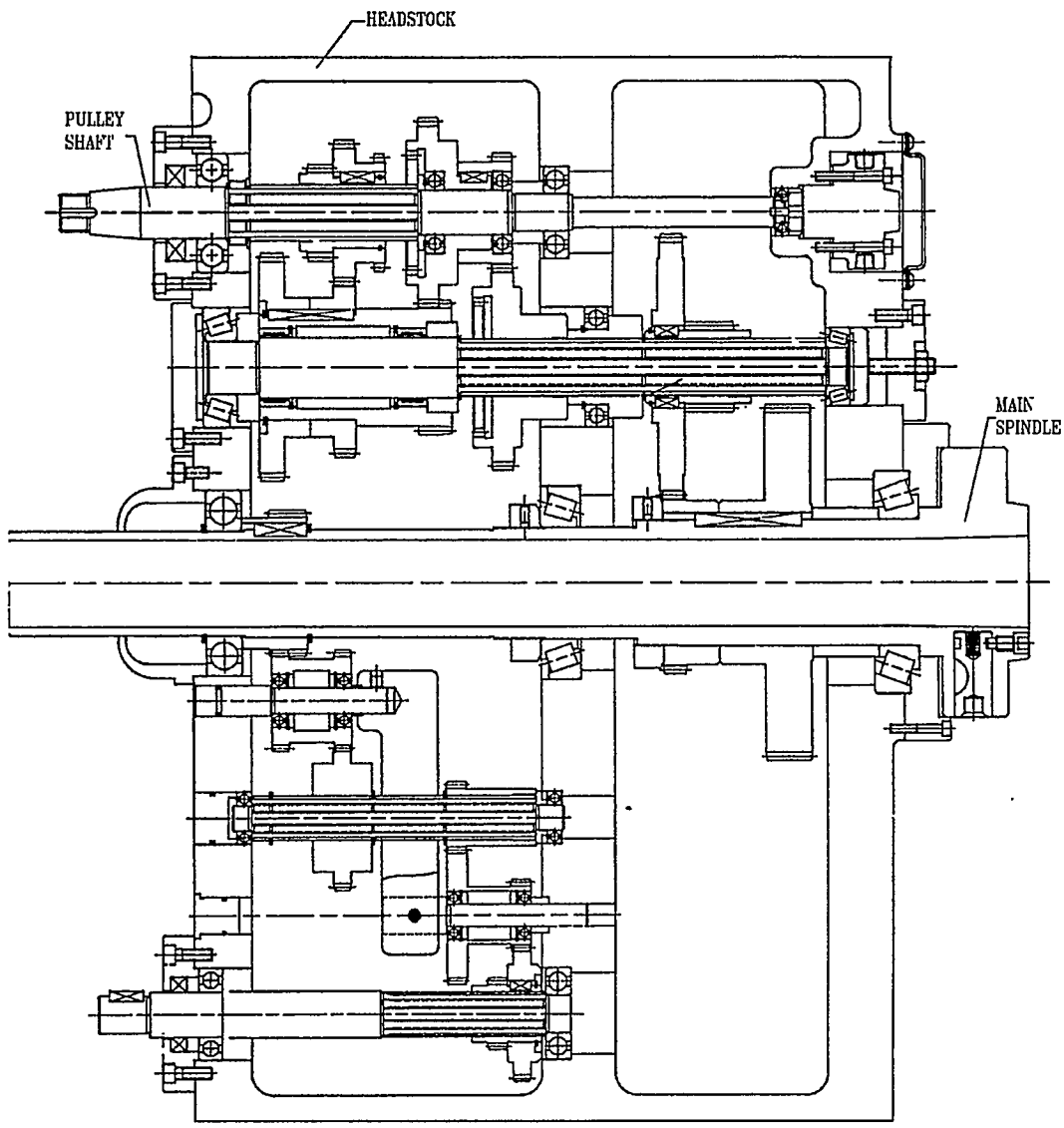


NO.	NAME		NO.	NAME
1	Starting lever		19	Tailstock spindle micrometer collar
2	HIGH-LOW change lever		20	Tailstock center clamp nut
3	Spindle speed change lever		21	Tailstock clamp lever
4	Spindle speed change lever		22	Tool post clamp lever
5	A-B Feed lever		23	Longitudinal feed stop device
6	Leadscrew Forward-Reverse lever		24	Change gear box
7	Oil window		25	Apron oil gauge
8	Oil inlet		26	Tool rest handle
9	Feed box C-D lever		27	Lead screw
10	Feed box G-F-E lever		28	Feed rod
11	Feed box I-STOP-H lever		29	Starting rod
12	Quick changing knob		30	Rack
13	Quick changing clamp lever		31	Brake pedal
14	Half-nut lever		32	Automatic feed lever
15	Thread cutting indicator		33	Carriage clamp nut
16	Longitudinal feed handwheel		34	Longitudinal feed stop
17	Cross feed handle		35	Main switch
18	Tailstock handle		36	Coolant pump switch

4.2 Main spindle headstock

4.2.1 Structure of main spindle

One of the most important parts of a lathe is the main spindle headstock. The designs of corresponding box, bearing, spindle, and gears all have to weight the problems of stiffness, noise, easy dismantle, etc.



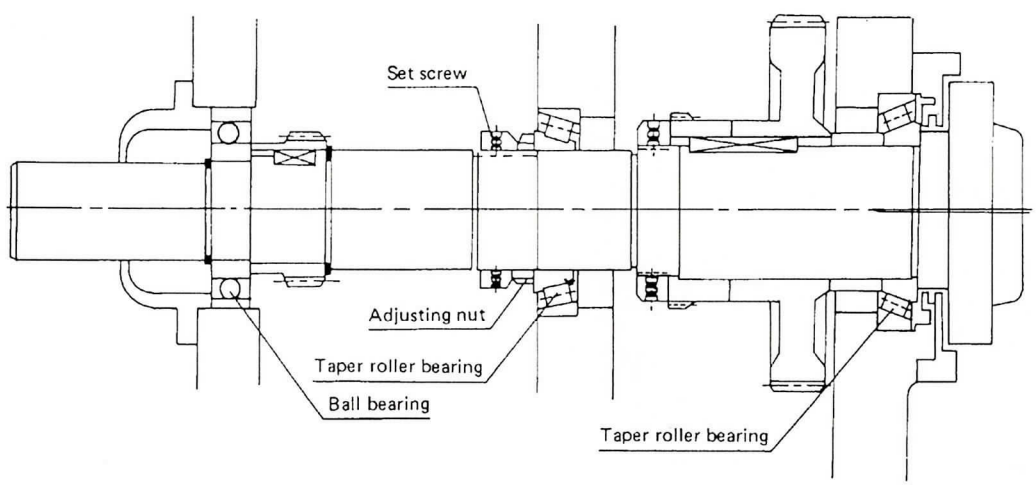
4.2.2 Main spindle

Spindle is supported by one ball bearing and two taper roller bearings. All bearings are of super precision.

After prolonged running,clearance between bearing and main spindle may affect the precision of the machine.The clearance can be adjusted by regulating nuts shown in below.The following process is suggested to adjust clearance between bearings and main spindle:

1. Turn off the power source switch.
2. Open the headstock cover.
3. Release the set screw shown in below,then regulate the adjusting nut shown in below to appropriate clearance and tighten the set screw.
4. Put on the headstock cover and turn on the power source switch.

Note:If the increasing temperature of spindle is above 30° after running for ten minutes in high speed,repeat process (3) again.



4.2.3 Main spindle operation

Turn the main switch (35) on (then red pilot lamp will go on), put the spindle speed change lever (2), (3), (4) at required position according to spindle speed chart, push the starting lever (1) up or down, then the main spindle will rotate accordingly(up-C.W. ,down-C.C.W).The spindle chart affixed on the top of feed gear box gives information about revolution of spindle.

Returning the starting lever to its mid-point will disengage the spindle drive and the spindle will stop. Emergency stop of the machine is accomplished by depressing the foot brake pedal (31). To restart the machine ,return starting lever to desired spindle rotation position.

In order to completely shut off the machine, turn the power source switch(35) to "OFF" position.

4.2.4 Spindle speed Change (for example)

Refer to the R.P.M. chart in below, set levers (3), (4) in neutral position and (2) to the rightmost will get 425 rpm for H type machine and 510 rpm the standard type.

Note: Change the spindle speed only after the spindle has been fully stopped to prevent gears from damage.

H type (1500 rpm.)

		25			237
		51			330
		68			425
		93			590
		133			840
		166			1500

Standard type (1800 rpm.)

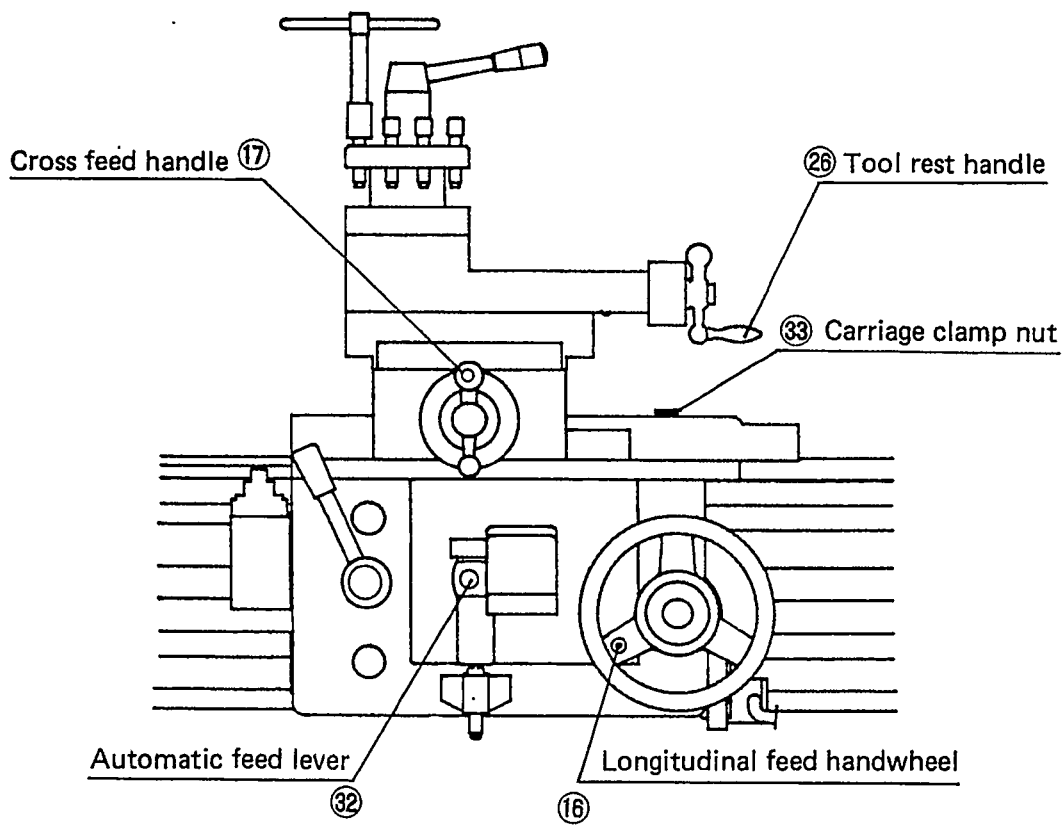
		32			285
		62			395
		82			510
		112			710
		160			1010
		200			1800

4.3 Feed mechanism

4.3.1 Manual feed

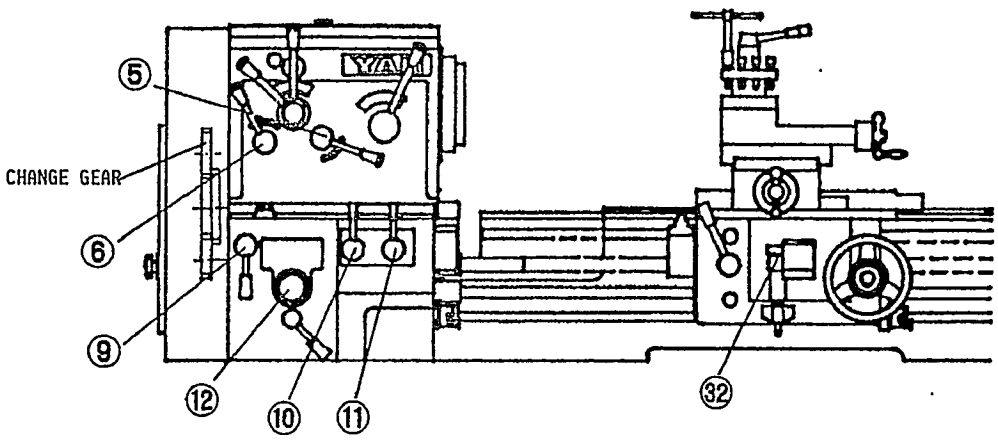
Saddle sits across the slide way, V ways in the front and flat ways in the rear at the top of the bed,and can move in longitudinal direction. The compound rest which mounts on the cross slide above saddle moves in a direction perpendicular to that of saddle.Above the compound rest is the tool post which is used to clamp tools.The movement of saddle, cross slide and compound rest can be made manually Handle (16),(17),(26) are used for this purpose.Handle (32) is used for automatic feed operation. Both handle (17),(26) are equipped with micrometer collar.In handle (17) we have 200 increment each represents 0.05mm so it travels 10mm for each revolution (in English unit, 250 increments each represents 0.001" then 0.25"/rev.).

In handle (26) there 150 increments each represents 0.02mm and travels 3mm each revolution (in English unit, 125 increments each represents 0.001" then 0.125"/rev.). Clamp nut (33) is used to lock saddle.



4.3.2 Automatic feed operation

The automatic feed operation can be controlled by lead screw,forward-reverse lever (6) and automatic feed (32). When you pull lever (32) leftward and upward, the saddle with apron can be moved in right or left direction.i.e longitudinal feeding.When you pull this lever right- ward and downward, the tool post with cross slide can be moved back or forth.ie. cross feeding.



4.3.3 Choice of feed rate

The travel of tool post within one revolution of spindle is called the feed rate which is recommended in feeding chart. Operation of feed setting is recommended as following:

Pull feed box C-D lever (9) to position "C", feed box L-STOP-H lever (11) to position "STOP", A-B feed lever (5) to position "A" or "B", feed box G-E-F lever to position "G" or "F". Change quick changing knob (12) according to feeding chart you will get the expected feedrate. Exchanging the 36-teeth change gear for 72-teeth change gear will give the double amount of feed rate shown in feeding chart.

1.Feeding table for inch lead screw (only use for U.S.A)

FEED INDEX

CHANGE GEARS		PORT NO. / HANDLE	1	2	3	4	5	6	7	8
A 36T, 120T, 127T, 72T B	← →	A-C-F	.0250	.0220	.0200	.0180	.0170	.0165	.0160	.0140
		A-C-G	.0125	.0110	.0099	.0090	.0086	.0080	.0076	.0070
		B-C-F	.0062	.0055	.0049	.0045	.0043	.0040	.0038	.0035
		B-C-G	.0031	.0027	.0025	.0023	.0022	.0020	.0019	.0018
	↕	A-C-F	.0154	.0137	.0125	.0112	.0106	.0100	.0095	.0085
		A-C-G	.0077	.0068	.0062	.0056	.0053	.0050	.0047	.0042
		B-C-F	.0038	.0034	.0031	.0028	.0026	.0025	.0023	.0021
		B-C-G	.0019	.0017	.0015	.0014	.0013	.0012	.0011	.0010

$\frac{a72}{b72}$ CHANGE GEARS WILL DOUBLE ALL FEEDS

2.Table of feed rate of metric lead screw

MM

CHANGE GEARS		PORT NO. / HANDLE	1	2	3	4	5	6	7	8
36T A, 120T, 127T, 72T B	WW ← → ↕	A-C-F	.627	.558	.528	.502	.456	.418	.386	.359
		A-C-G	.314	.279	.264	.251	.228	.209	.193	.179
		B-C-F	.157	.139	.132	.125	.114	.105	.097	.090
		B-C-G	.079	.070	.066	.062	.057	.052	.048	.045

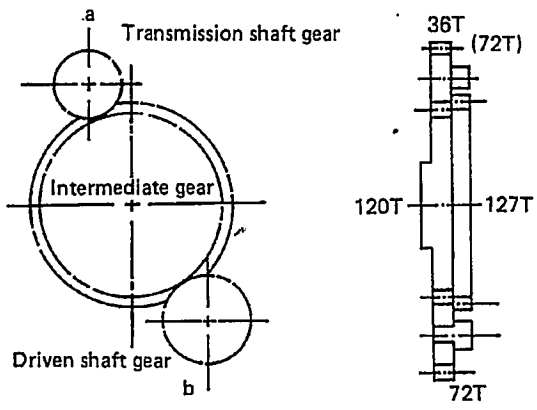
BUT CHANGE GEAR $\frac{A}{B}$ WITH $\frac{72}{72}$ THE ABOVE VALUE BECOME TO DOUBLE

3.Feeding table for inch lead screw (only use for inch lead screw in bed)

MM

CHANGE GEARS		PORT NO. / HANDLE	1	2	3	4	5	6	7	8
36T A 120T 127T 72T B	WW	A-C-F	.627	.558	.528	.502	.456	.418	.386	.359
		A-C-G	.314	.279	.264	.251	.228	.209	.193	.179
		B-C-F	.157	.139	.132	.125	.114	.105	.097	.090
		B-C-G	.079	.070	.066	.062	.057	.052	.048	.045

BUT CHANGE GEAR $\frac{A}{B}$ WITH $\frac{72}{72}$ THE ABOVE VALUE BECOME TO DOUBLE



4.4 Thread cutting operation

Operate L-STOP-H lever(11) of feed box to either " L " or "H" position to rotate lead screw. Operate thread cutting half-nut lever(14)downward to engage with lead screw, this enables longitudinal travel of the carriage for thread cutting. Direction of thread cutting is decided by Forward-Reverse lever (6). The "Forward" position of lever (6)is used for cutting right-hand threads, the "Reverse" position of lever is used for cutting left-hand threads. There are two kinds or lead screw lathes: Inch lead screw lathe (4 teeth/inch) and Metric lead screw lathe (6mm/pitch). The difference between their operation can be distinguished as following:

4.4.1 Range

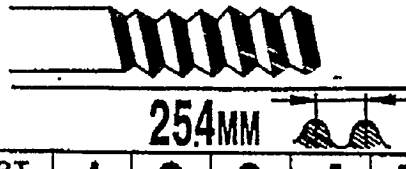
METRIC SCREW RANGE UNIT : mm / pitch	ENGLISH SCREW RANGE UNIT : teeth / inch
7	4
6	4-1/2
5	5
4.5	5-1/2
4	6
3.5	6-1/2
3	7
2.8	8
2.5	9
2	10
1.8	11
1.75	12
1.6	13
1.5	14
1.4	16
1.25	18
1	19
0.9	20
0.8	24
0.75	26
0.7	28
0.5	32
	36
	40
	44
	48
	56

4.4.2 Lathe with 4 T.P.T. inch leadscrew (4/25.4mm)

1) Inch thread cutting

For inch thread cutting,mesh 36-teeth of transmission shaft with 72-teeth of driven shaft while 120-teeth intermediate between them. After positioning quick changing knob (12), lever operation of A-C-F-H, A-C-G-H, B-C-G-H, inch threads 4-80 T.P.I are available. To get threads of 4,41/2...7 T.P.I., mesh 72-teeth of transmission shaft gear (a) with 72-teeth of driven shaft gear (b), when employing the half-nut lever (14) of the apron,refer to screw cutting indicator explained in section 4.5.

4 TPI leadscrew

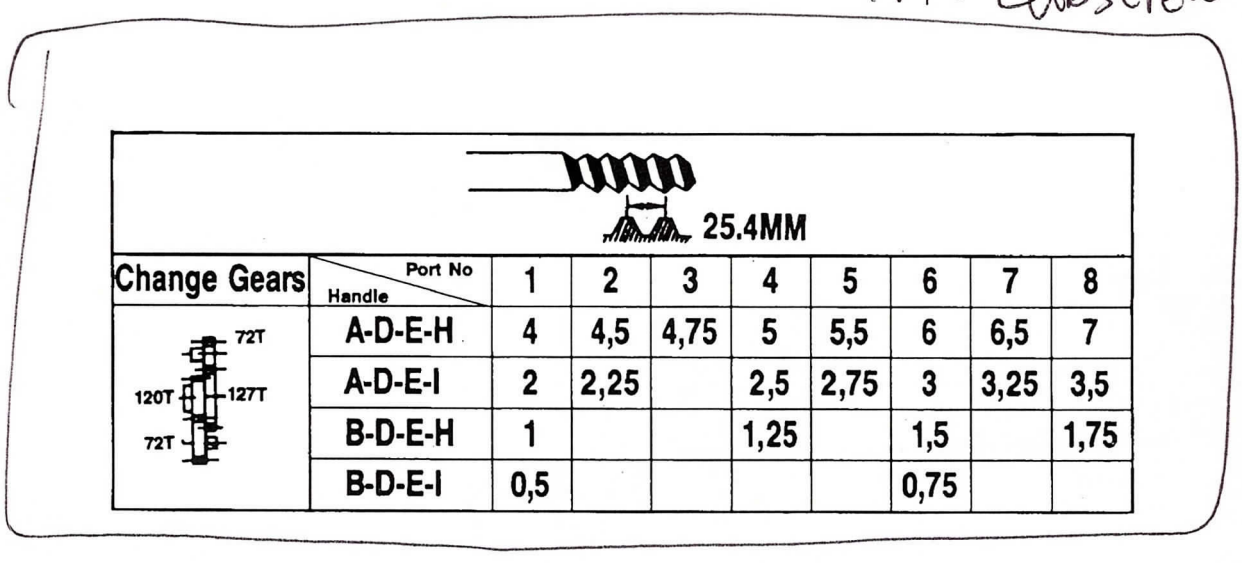


CHANGE GEARS	PORT NO. / HANDLE	1	2	3	4	5	6	7	8	PORT NO. / HANDLE
A 36T 72T		4	4½	4¾	5	5½	6	6½	7	A-C-F-H
	A-C-F-H	8	9	9½	10	11	12	13	14	A-C-G-H
120T 127T	A-C-G-H	16	18	19	20	22	24	26	28	B-C-F-H
	B-C-F-H	32	36	38	40	44	38	52	56	B-C-G-I
	B-C-G-H	64	72		80					B-C-G-I
72T B	36/72	CHANGE GEAR A/B CONDITION								72/72

2) Metric thread cutting

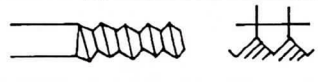
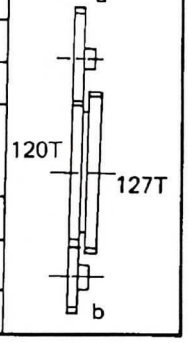
For metric thread cutting,transmission shaft gear (a) of 72-teeth mesh with 127-teeth intermediate gear, and 72-teeth driven shaft gear (b) meshes with 120-teeth intermediate gear. The change gear arrangement and lever position are recommended in lever position table and pitch table which are affixed inside the door of change gearbox (24). To get thread pitches of 0.7, 0.8, 0.9 1.4, 1.6, 1.8, 2.8 etc. A special accessory for cutting metric thread is necessary.Arrangement of change gears is shown below in which (a), (b) change gear can be ordered from us.

4TPI LEADSCREW



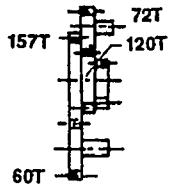
25.4MM

Change Gears	Port No / Handle	1	2	3	4	5	6	7	8
	A-D-E-H	4	4,5	4,75	5	5,5	6	6,5	7
	A-D-E-I	2	2,25		2,5	2,75	3	3,25	3,5
	B-D-E-H	1			1,25		1,5		1,75
	B-D-E-I	0,5					0,75		

SPECIAL ACCESSORY FOR CUTTING METRIC THREAD				
				
a	80	90	70	
b	50	50	50	
PORT NO.	1	1	1	
HANDLE /  mm				
A-D-E-I			2.8	
B-D-E-H	1.6	1.8	1.4	
B-D-E-I	0.8	0.9	0.7	

3) D.P. (Diameter pitch) thread cutting

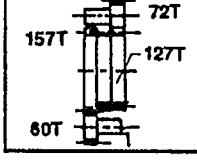
For D.P. thread cutting, fit 157-teeth gear to intermediate gear, 72-teeth transmission shaft gear (a) must be engage with 120-teeth intermediate gear and 60-teeth driven shaft gear (b) should be engaged with 157-teeth gear.

Change Gears	Port No / Handle	1	2	3	4	5	6	7	8
	A-C-F-H	8	9		10	11	12	13	14
	A-C-G-H	16	18		20	22	24	26	28
	B-C-F-H	32							56
	B-C-G-H								112

4) M.P. (Module pitch) thread cutting

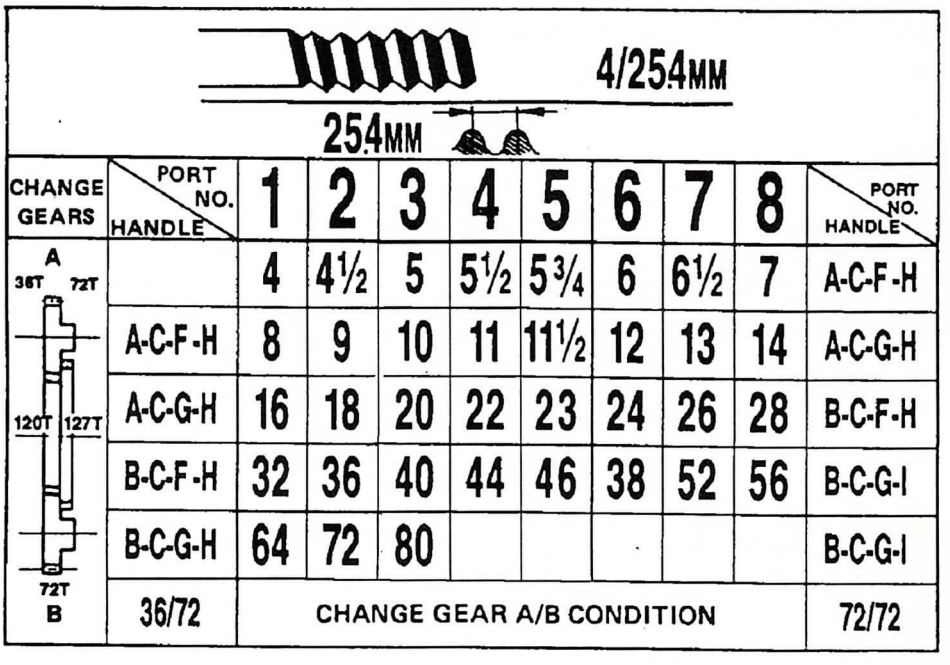
For M.P. thread cutting, fit 157-teeth gear to intermediate gear, 72-teeth transmission shaft gear (a) must be engage with 127-teeth intermediate gear and 60-teeth driven shaft gear (b) should be engaged with 157-teeth gear.

NOTE:Half-nut lever (14) must stay engaged in this case.

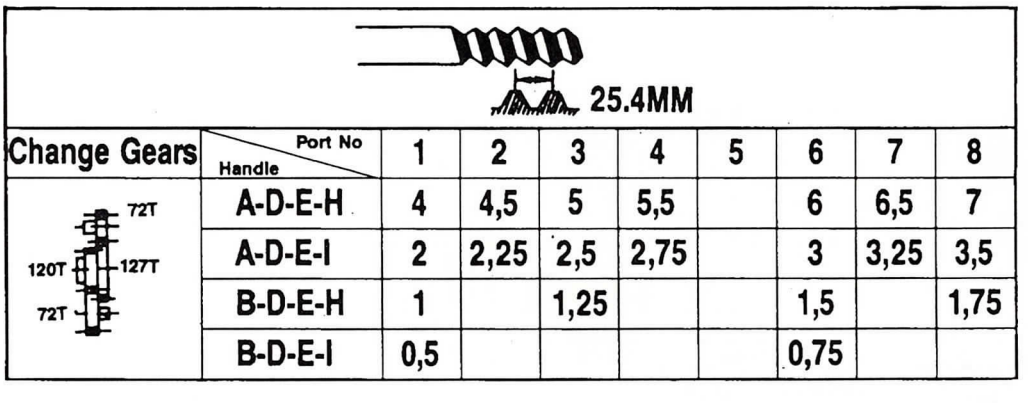
Change Gears	Port No / Handle	1	2	3	4	5	6	7	8
	A-D-E-H	2	2,25		2,5	2,75	3	3,25	3,5
	A-D-E-I	1			1,25		1,5		1,75
	B-D-E-H	0,5					0,75		

4.4.3 Lathe with 4 T.P.I. inch leadscrew (Only for U.S.A.)

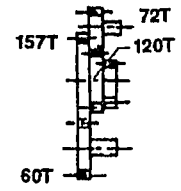
1) Inch thread cutting



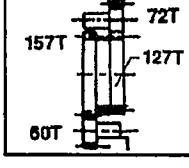
2) Metric thread cutting



3) D.P. (Diameter pitch) thread cutting

Change Gears	Port No / Handle	1	2	3	4	5	6	7	8
	A-C-F-H	8	9		10	11	12	13	14
	A-C-G-H	16	18		20	22	24	26	28
	B-C-F-H	32							56
	B-C-G-H								112

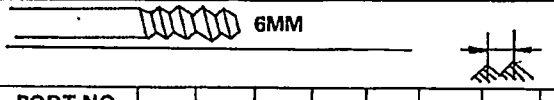
4) M.P. (Module pitch) thread cutting

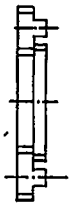
Change Gears	Port No / Handle	1	2	3	4	5	6	7	8
	A-D-E-H	2	2,25		2,5	2,75	3	3,25	3,5
	A-D-E-I	1			1,25		1,5		1,75
	B-D-E-H	0,5					0,75		

4.4.4 Lathe with 6mm pitch metric leadscrew

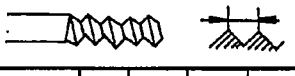
1) Metric thread cutting

For metric thread cutting, transmission shaft gear (a) of 36-teeth mesh with 72-teeth of driven shaft gear while 120-teeth intermediate between them. To get thread pitch above 4mm, transmission shaft gear (a) must change to 72-teeth. When employing half-nut lever (14) of apron refer to screw cutting indicator explained in section 4.5. To get thread pitches of 0.7, 0.8, 0.9 1.4, 1.6, 1.8, 2.8 etc. A special accessory for cutting metric thread is necessary.Arrangement of change gears is shown below in which (a), (b) change gear can be ordered from us.

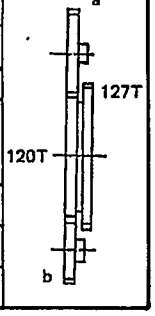


CHANGE GEARS	PORT NO. / HANDLE	1	2	3	4	5	6	7	8	PORT NO. / HANDLE
		4	4.5	4.75	5	5.5	6	6.5	7	A-D-E-H
	A-D-E-H	2	2.25		2.5	2.75	3	3.25	3.5	A-D-E-I
	A-D-E-I	1			1.25		1.5		1.75	B-D-E-H
	B-D-E-H	0.5					0.75			B-D-E-I
	B-D-E-I	0.25								
	36/72	CHANGE GEAR CONDITION								72/72

SPECIAL ACCESSORY FOR CUTTING METRIC THREAD



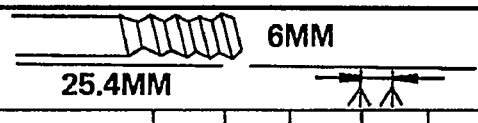
a	80	90	70
b	50	50	50
PORT NO. / HANDLE	 mm		
A-D-E-I			2.8
B-D-E-H	1.6	1.8	1.4
B-D-E-I	0.8	0.9	0.7

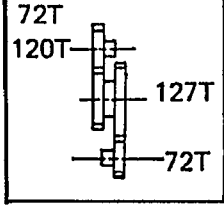


2) Inch thread cutting

For inch thread cutting,transmission shaft gear (a) of 72-teeth meshes with 120-teeth intermediate gear, and 72-teeth driven shaft gear (b) meshes with 127-teeth intermediate gear. The change gear arrangement and lever position are recommended in the lever operation table and pitch table which are affixed inside the door of the change gear box (24).

NOTE:Half-nut lever (14) must stay engaged in this case.

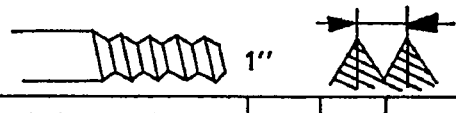


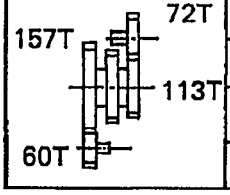
CHANGE GEAR	HANDLE PORT NO.	1	2	3	4	5	6	7	8
	A-C-F-H	4	4½	4¾	5	5½	6	6½	7
	A-C-G-H	8	9	9½	10	11	12	13	14
	B-C-F-H	16	18	19	20	22	24	26	28
	B-C-G-H	32	36	38	40	44	48	52	56

3) D.P. (Diameter pitch) thread cutting

For D.P. thread cutting, fit 157-teeth gear to intermediate gear, 72-teeth transmission shaft gear (a) must be engage with 113-teeth intermediate gear and 60-teeth driven shaft gear (b) should be engaged with 157-teeth gear.

NOTE:Half-nut lever (14) must stay engaged in this case.

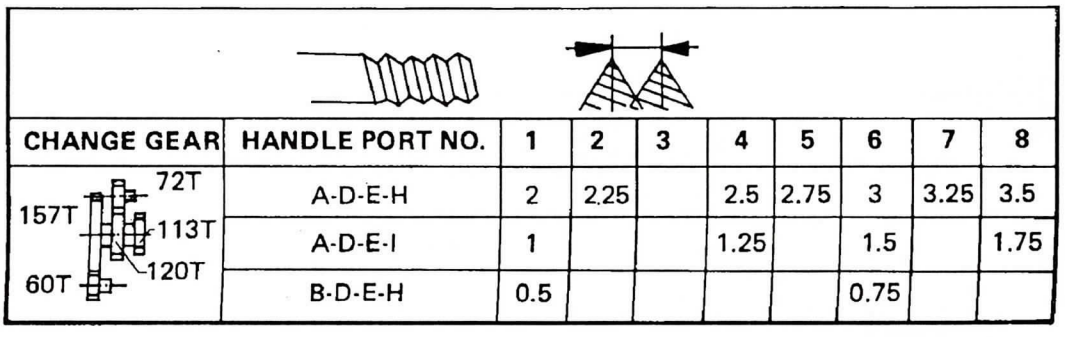


CHANGE GEAR	HANDLE PORT NO.	1	2	3	4	5	6	7	8
	A-C-F-H	8	9		10	11	12	13	14
	A-C-G-H	16	18		20	22	24	26	28
	B-C-F-H	32							56
	B-C-G-H								112

4) M.P. (Module pitch) thread cutting

For M.P. thread cutting, fit 157-teeth gear to intermediate gear, 72-teeth transmission shaft gear (a) must be engage with 120-teeth intermediate gear and 60-teeth driven shaft gear (b) should be engaged with 157-teeth gear.

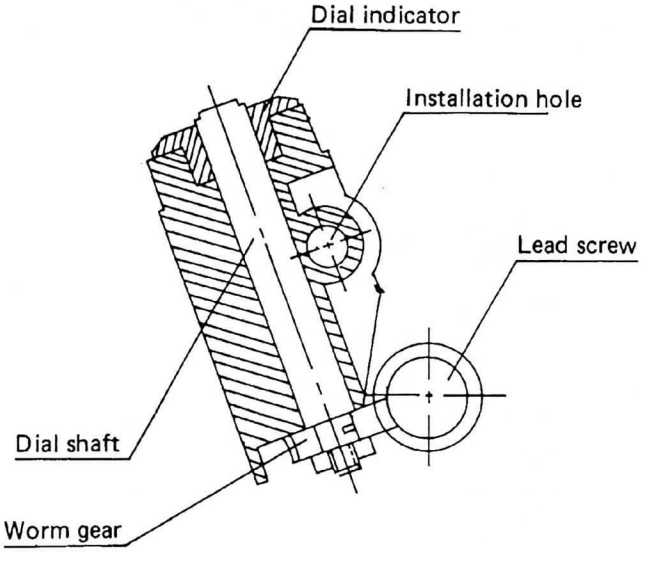
NOTE:Half-nut lever (14) must stay engaged in this case.



CHANGE GEAR	HANDLE PORT NO.	1	2	3	4	5	6	7	8
72T 157T 113T 120T 60T	A-D-E-H	2	2.25		2.5	2.75	3	3.25	3.5
	A-D-E-I	1			1.25		1.5		1.75
	B-D-E-H	0.5					0.75		

4.5 Threading dial

The threading dial on the left side of the apron is used for half-nut matching with the leadscrew. In case of inch thread cutting the threading dial equipped with a 16-teeth worm gear can fit various clutching point to get different pitches of inch threads. In the case of metric thread cutting 20-teeth,21-teeth and 22-teeth worm gears are required to suit various clutching points. Different kinds of threads and their corresponding clutch point are shown in the following charts.



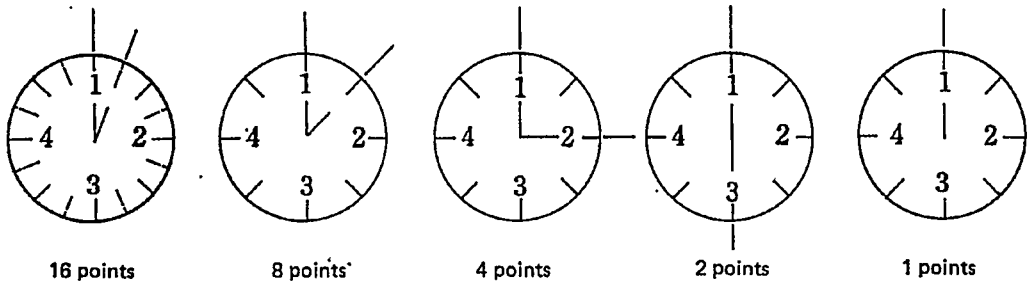
1) Inch thread by inch leadscrew lathe (16T worm gear)

KINDS OF INCH THREAD (T.P.I)	CLUTCH POINT
4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 56, 64, 72, 80	16
6, 10, 14, 18, 22, 26, 38	8
5, 7, 9, 11, 13, 19	4
4½, 5½, 6½, 9½	2
4¾	1

2) Inch thread (Only for U.S.A.)

KINDS OF INCH THREAD (T.P.I)	CLUTCH POINT
4,8,12,16,20,24,28,32,36,40,44,48,52,56,64,72,80	16
6,10,14,18,22,26,46	8
5,7,9,11,13,23	4
4-1/2,5-1/2,6-1/2,11-1/2	2
5-3/4	1

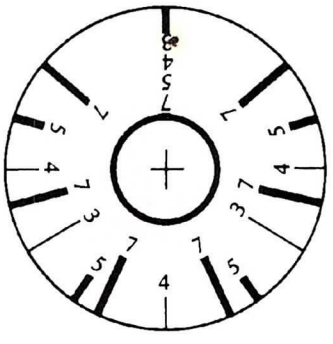
CLUTCH POINTS:



3) Metric thread by metric leadscrew lathe

KINDS OF METRIC THREAD (PITCH IN mm)	CLUTCH POINT NO.	WORM GEAR (TEETH)
7, 3.5, 1.75, 2.8, 1.4, 0.7	3	21T
4.5, 0.9, 1.8, 2.25	7	
6, 3, 1.5, 0.75, 2, 1, 0.5, 0.25	ANY NO.	20T
4, 1.6, 0.8	5	
5, 2.5, 1.25	4	
5.5, 2.75	2	

CLUTCH POINTS:



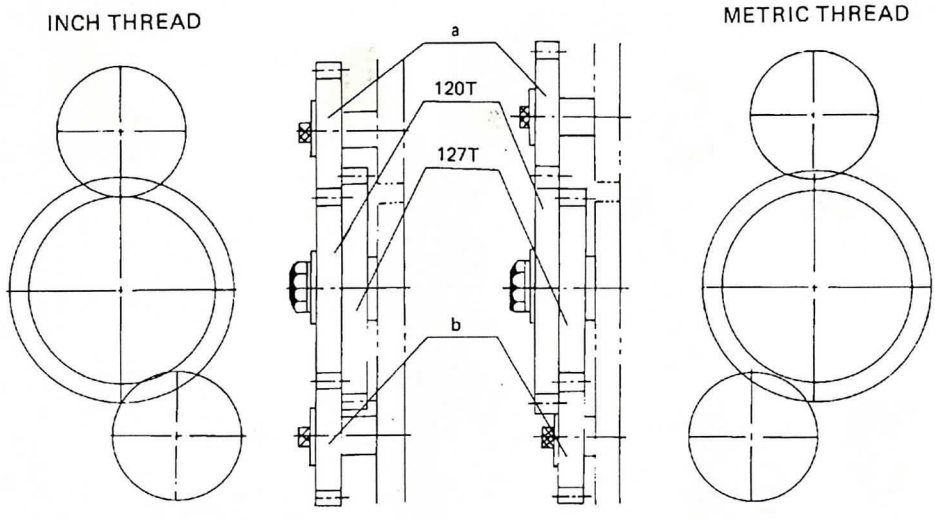
4.6 Examples of thread cutting

1) Lathe with 4 T.P.I. inch leadscrew

Operating Process	Examples		Right Thread 4½ T.P.I.	Left Thread 44 T.P.I.	Right Thread Pitch = 3.5mm
1	Change Gears	a	36	36	72
		b	72	72	72
2	Change gear system		Inch Thread	Inch Thread	Metric Thread
3	Lever 12		2	4	8
4	Lever 5		A	B	A
5	Lever 9		C	C	D
6	Lever 10		F	G	E
7	Lever 11		H	H	I
8	Lever 6		Forward	Reverse	Forward

FOR Metric Thread

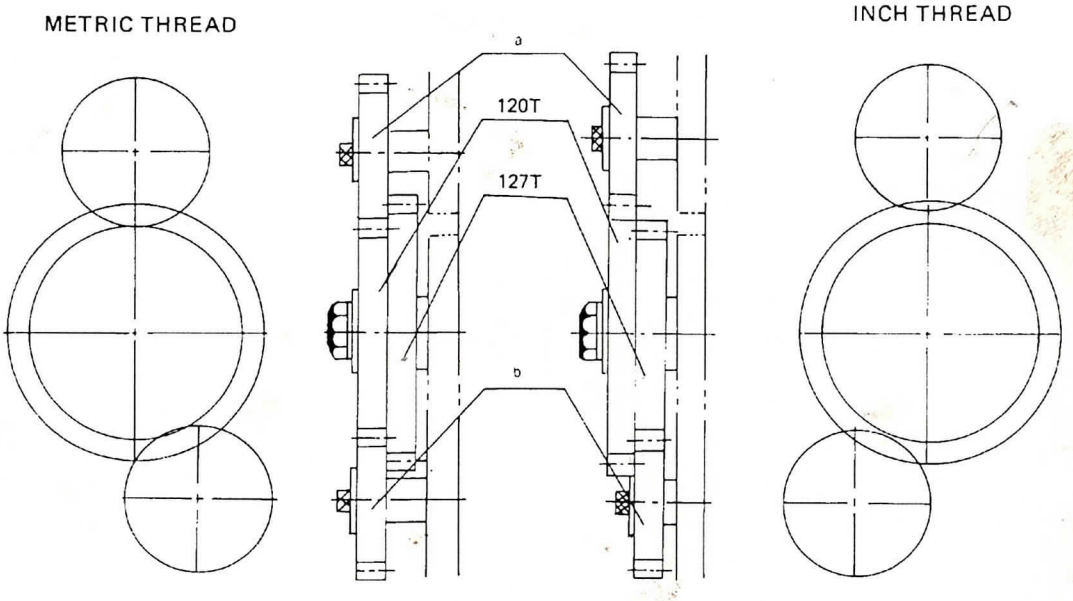
CHANGE GEAR SYSTEM



2) Lathe with 6 mm pitch metric leadscrew

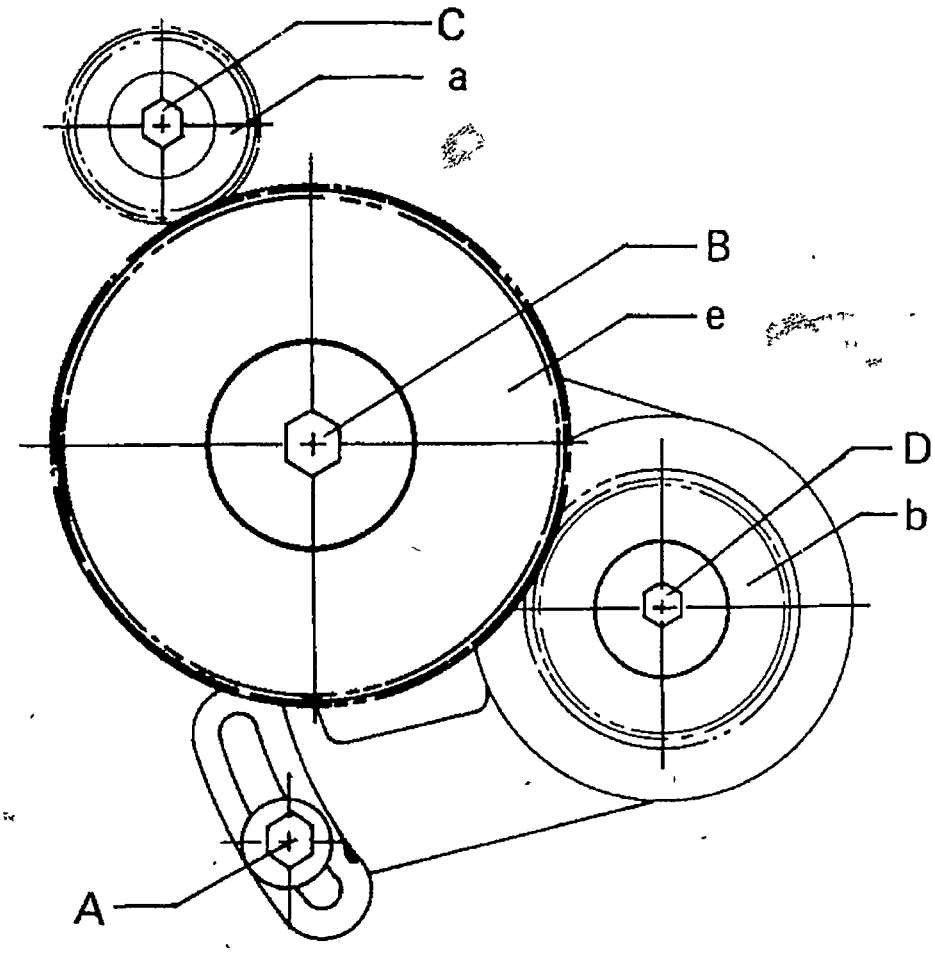
Operating Process	Examples		Rigit Thread Pitch = 5mm	Left Thread Pitch = 0.7mm	Right Thread 9 T.P.I.
1	Change Gears	a	72	70	72
		b	72	50	72
2	Change gear system		Metric Thread	Metric Thread	Inch Thread
3	Lever 12		4	1	2
4	Lever 5		A	B	A
5	Lever 9		D	D	C
6	Lever 10		E	E	G
7	Lever 11		H	I	H
8	Lever 6		Forward	Reverse	Forward

CHANGE GEAR SYSTEM



4.7 Change gear operation and adjustment

1) Transmission shaft gear
   To exchange transmission shaft gear (a),loosen screw nut (A), then loosen screw nut (C) and remove the washer. Now the gear will be taken off.
2) Driven shaft gear
   To exchange driven gear (b), loosen screw nut (B) then loosen screw nut (D) and remove the washer.Now the gear will be taken off.
3) Intermediate shaft gear
   To exchange intermediate gear (e),loosen screw nut (A),(B) represent and remove the washer.
4) Clearance adjustment
   Appropriate clearance between, gears is about 0.25mm. The proper process is to loosen screw nut (B) to adjust the clearance between intermediate gear (e) and driven gear (b). After tightening screw nut (B) loosen screw nut (A) to adjust the clearance between intermediate gear and transmission gear, then tighten screw nut (A).



4.8 Safety device

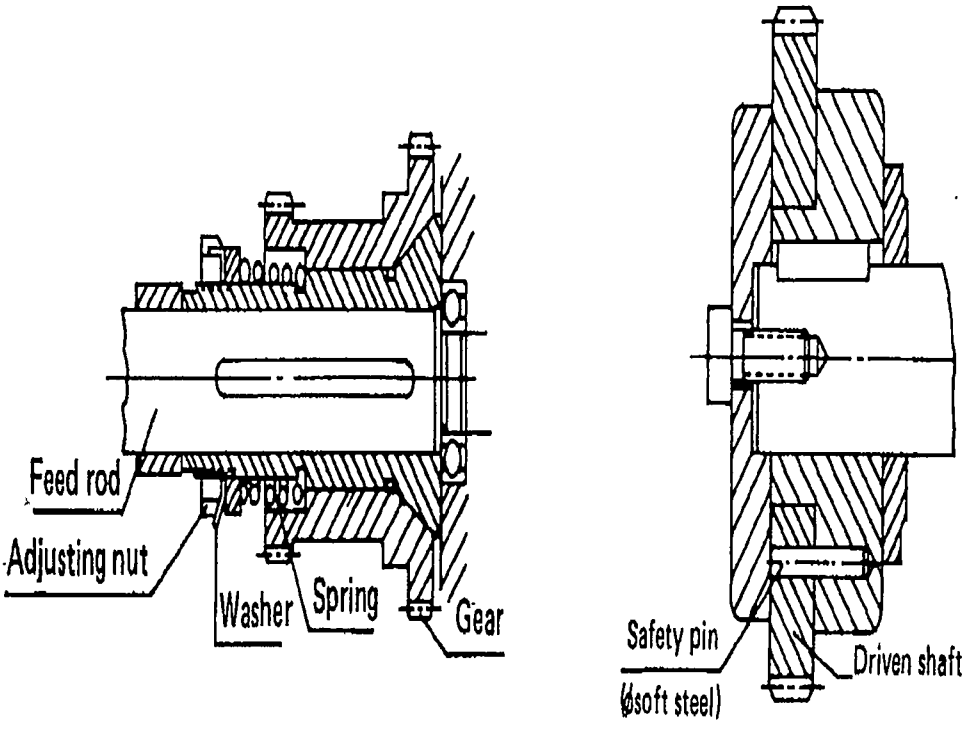
4.8.1 Automatic feed safety device

Feed rod is automatically stopped when excessive cutting force occurs. The device is furnished on the gear inside the cover of feed box where lever (14) and (16) are installed. Adjustment instruction: When feed rod does not rotate or is stopped by light-load,take off feed box cover where levers (14) and (16) are installed, and you will find a washer between the collar and nut. One of the blades of washer is bent toward the channel of nut to prevent the nut from loosening.

And clamping the nut, then feed rod can rotate normally. Do not clamp it too tight for avoiding failure. After proper adjustment,rest protection nut by the washers.

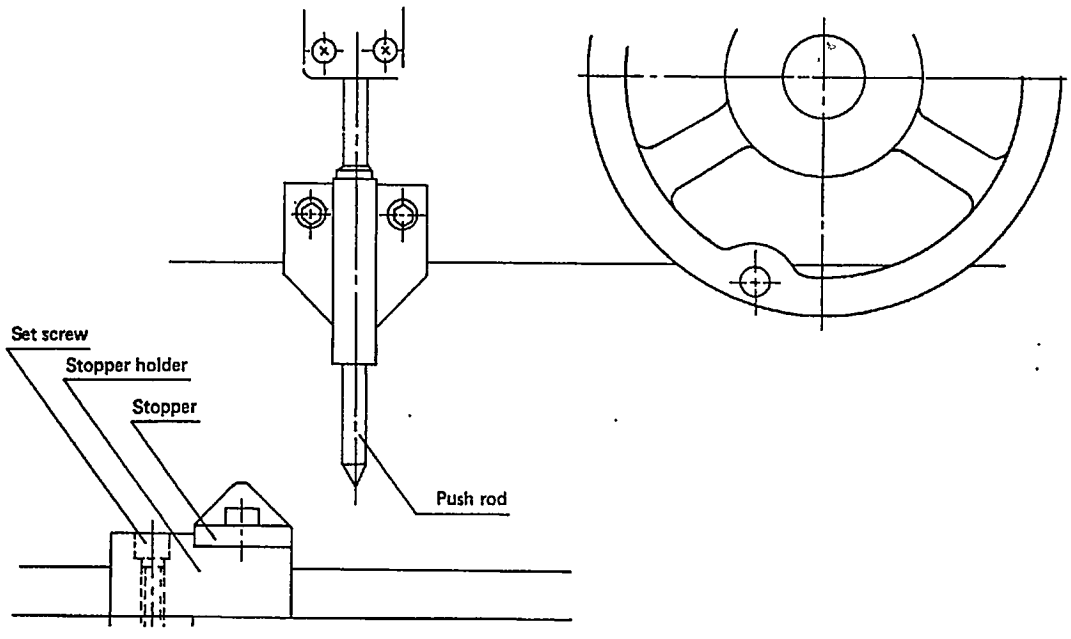
4.8.2 Safety device for heavy cutting

This device is attached to the 72-teeth changer used for driven shaft (or 60-teeth gear of optional equipment). In case of overload in feed & thread cutting,the built-in safety pin will break and gear slips to avoid damage to other parts. The snapped pin can be replaced by a new one. Diameter of pin is 4mm*25mm, ordinary solid, drawn steel (soft steel) is good for replacement. Beware that stronger material may affect the safety factor.



4.8.3 Automatic longitudinal feed stop device

By resetting automatic feed lever (32) into neutral position,longitudinal feed of carriage stops. During thread cutting operation feed lever (32) must be in neutral position.Adjustment of stop position is made by adjusting set screw on stopper holder after loosening clamp nut.



4.9 Tailstock

If workpiece is very long, vibration may occur during rotation, tailstock is used to increase the stability of operation.

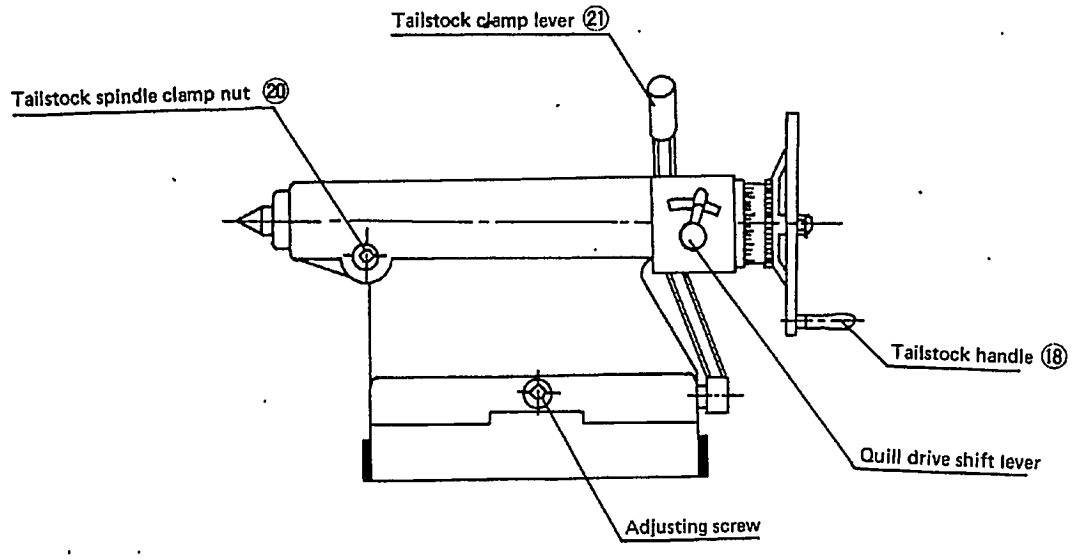
4.9.1 Operation

Pull down level (21) to loosen the clamp, tailstock now can slide along the bed. Push it by hand to proper position, bend lever (21) up to clamp the tailstock. To ensure workpiece is clamp firmly, loosen tailstock spindle clamp nut (20) and rotate hand wheel (18) C.C.W gradually, the quill will withdraw to the end, and center can be taken out easily. there are two shifts on quill drive 1/2 and 1/2.5 to enable a lighter quill feed. It should be noted that the withdrawing of the quill must be done slowly, screw and nuts may be badly damaged due to any impact caused by fast withdrawing.

NOTE:Operating the two-stage lever (37) will get tailstock velocity 1:1 or 1:0.4.

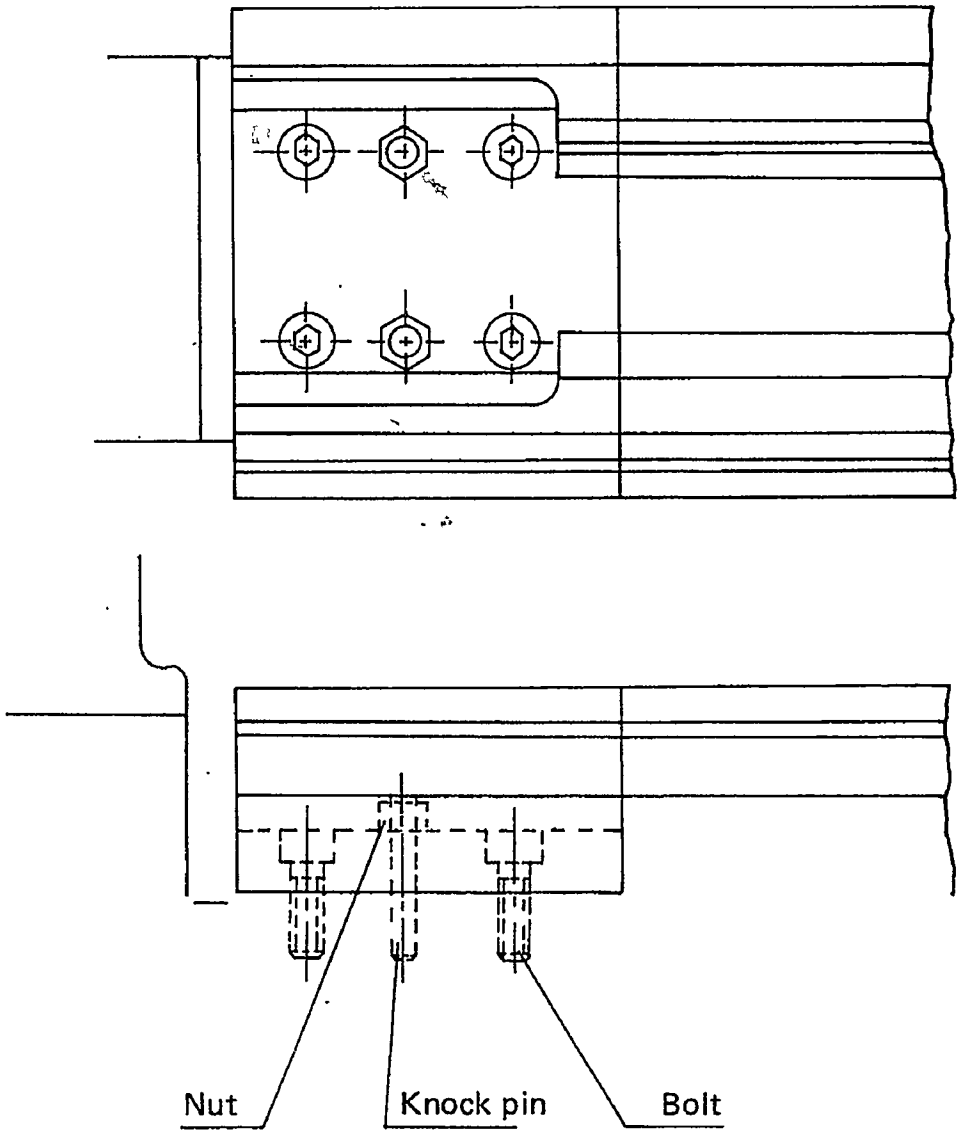
4.9.2 Adjustment

When the centers of main spindle and tailstock are not in the same line, loosen the front and rear adjusting screws, regulating the screws until the two centers are in the same line. Lock the screws and ensure the tightness of adjusting screws.



4.10 Gap bed

The bed is distinguished as standard bed type and gap bed type. There is one removable section which is on the left-hand end part of gap bed, large workpieces are possible when this section is removed. The removable section is fastened by two pins and four screws. To get higher accuracy you must clean the contacting parts before reinstalling the removed section.



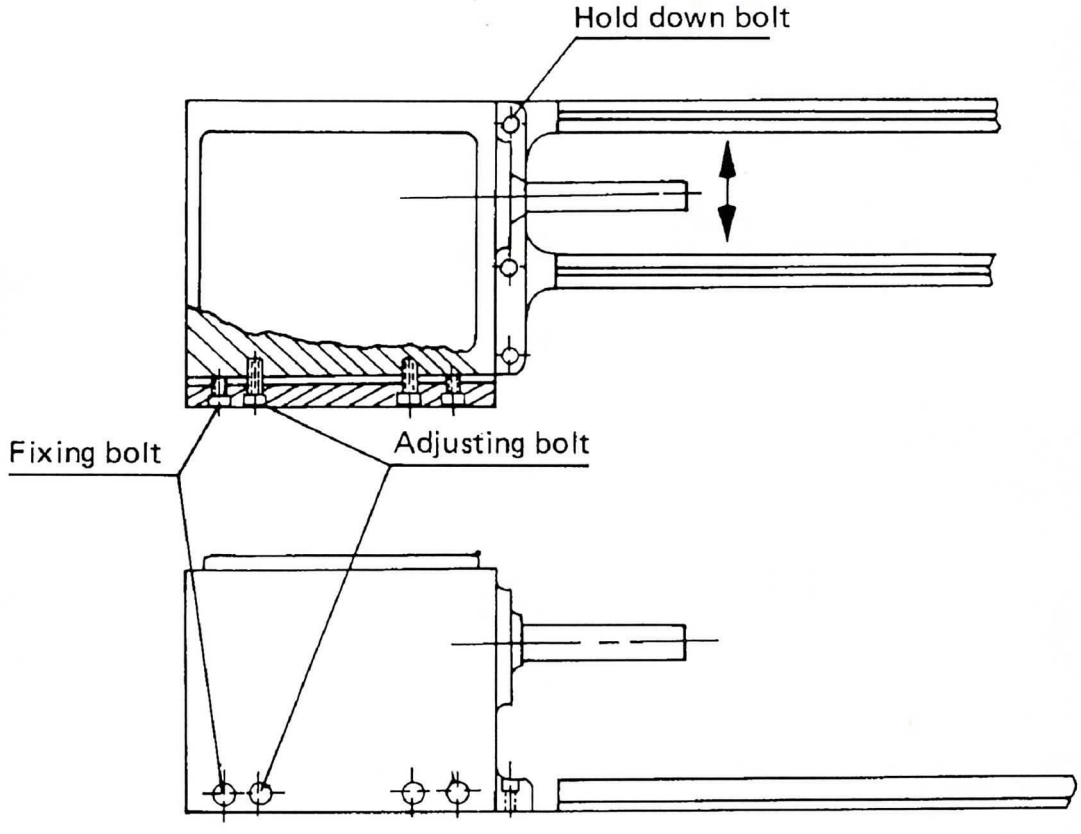
CHAPTER 5

ADJUSTMENT

5.1 Adjustment of headstock

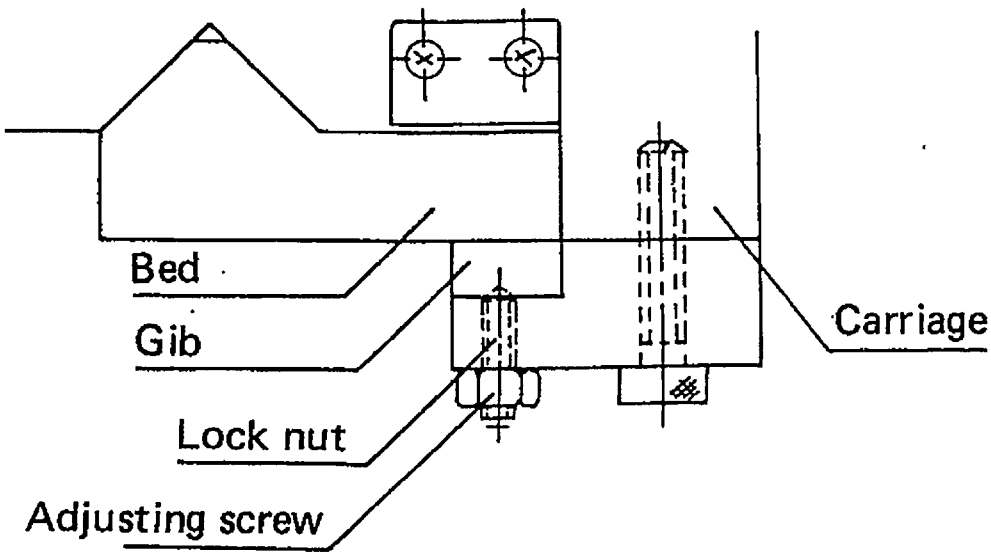
If the headstock needs to be realigned with the lathe bed way, the following procedure should be used:

1) Loosen the three hold down bolts on the right, and the three hold down bolts on the left(open the door on the left hand end of the headstock to access these) end of the headstock.
2) At the rear of the headstock, locate the four set screws, the two outer fixing bolt are used to push the headstock towards the front of the lathe. The two inner adjusting bolts are used to pull the headstock towards the rear.
3) Turn the fixing bolts and adjusting bolts in conjunction with each other to obtain the required movement to align the headstock.
4) After obtaining the proper alignment, tighten the fixing bolts, then tighten the six hold down bolts.



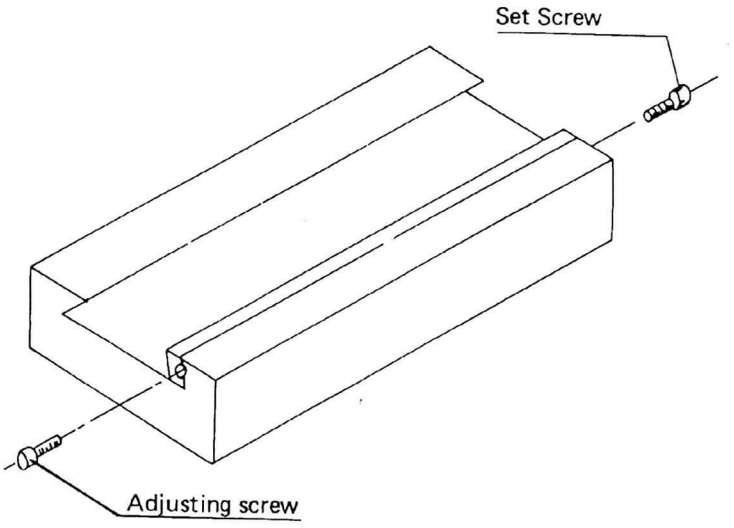
5.2 Adjustment of saddle gib

Underneath the saddle at the rear part is a straight gib which bears against the underside of the main bed way. After a period of use, clearance between gib and bed-way may become excessive, this can be reduced by loosening the lock nuts, tightening the adjusting screw to a proper amount and tighten the lock nuts.



5.3 Adjustment of cross slide gib

A tapered gib is used to adjust wear between the saddle and compound rest. This adjustment is made by loosening the set screw in the rear of the slide, and tightening the screw in front of the slide, until excessive clearance between saddle and cross-slide is eliminated. Finally, tighten the rear set screw to lock the gib in place.



5.4 Backlash adjustment of saddle leadscrew

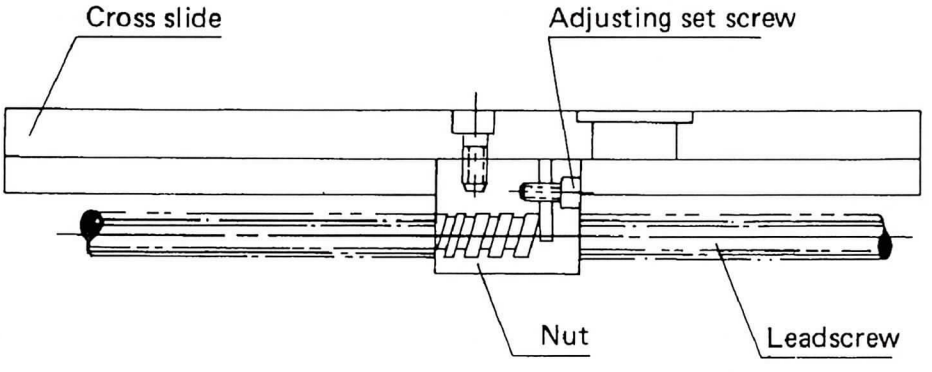
When adjustment is necessary to reduce the backlash in the movement of the cross-slide, the following procedure should be used.

1) Remove cover plate at the rear of the saddle(requires four set screws to be removed).

2) Turn cross feed handle (13) to move the compound rest to the rear of lathe.

3) Tighten set screw at the end of leadscrew nut until excessive backlash is eliminated.

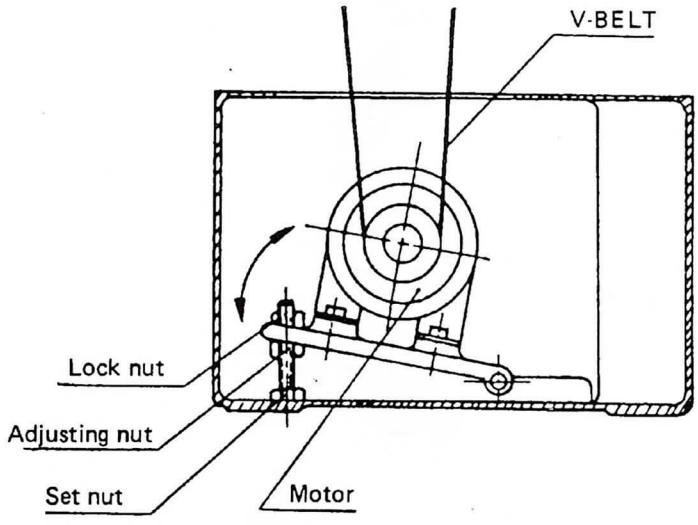
4) Assemble end cover with four set screws.



5.5 Belt adjustment

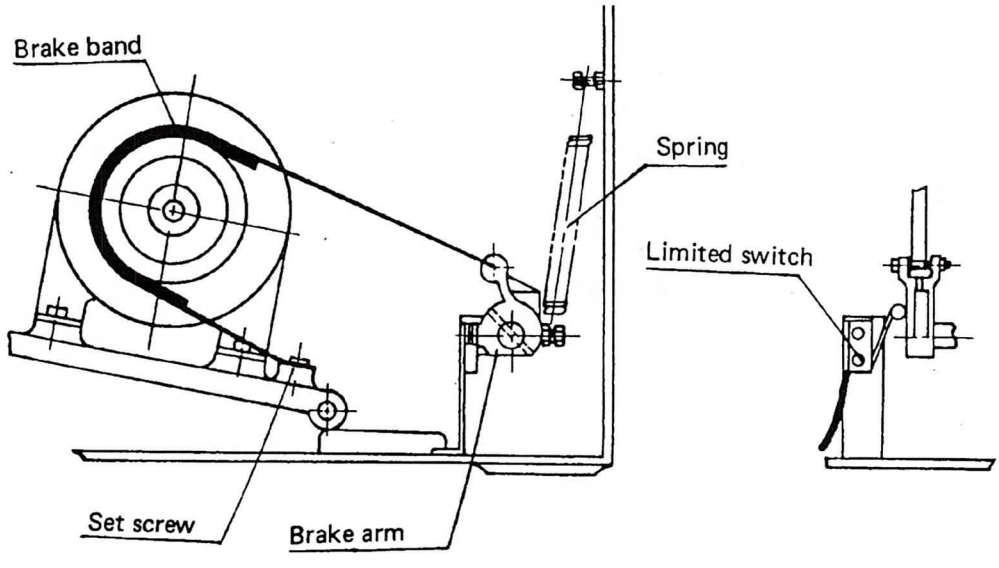
Excessively high tension in V-belt increases the friction of power transmission which not only shortens the lives of bearing and V-belt, but also generates heat. Loose tension will cause slip during heavy cutting.

Belt adjustment can be done by adjusting the bolts located on the motor base. First, unlock the nuts then set them to proper position along the bolts until a desired tension is made. Always keep the motor in level, then lock nuts.



5.6 Braking system adjustment

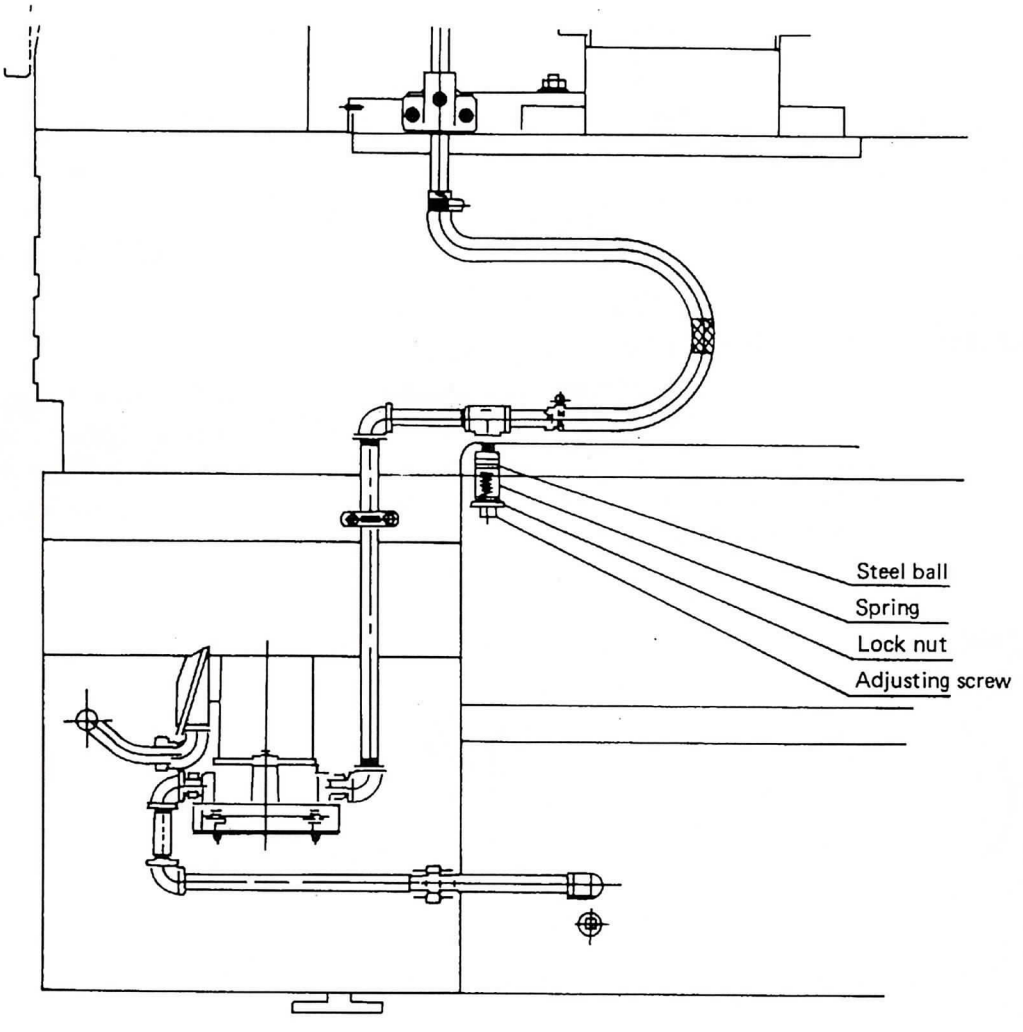
The braking instrument consists of pedal, brake arm, limited switch, brake band, and spring. Threading the brake pedal enable the brake arm to touch the limited switch which cuts off the power supply and pulls the brake band so that it will be in contact with the pulley of motor, thus stops the motor and the spindle. Brake band can be adjusted by setting screw to a proper position.



5.7 Coolant flow adjustment

The adjustment of coolant flow is for the need of cooling grade of work by operator's sense,the process as follows:

1) Enlarge the flow:
   a) Loosen lock nut.
   b) Rotate C.W. adjusting screw.
   c) Tighten lock nut until get the desired flow.
2) Reduce the flow:
   Process as (1) item,except to rotate C.C.W. adjusting screw.



CHAPTER 6

LUBRICATION

Keep sufficient lubricant in the rotating, sliding and gear meshing portions of the machine is the most effective method to maintain the accuracy and ensure the life of this machine.

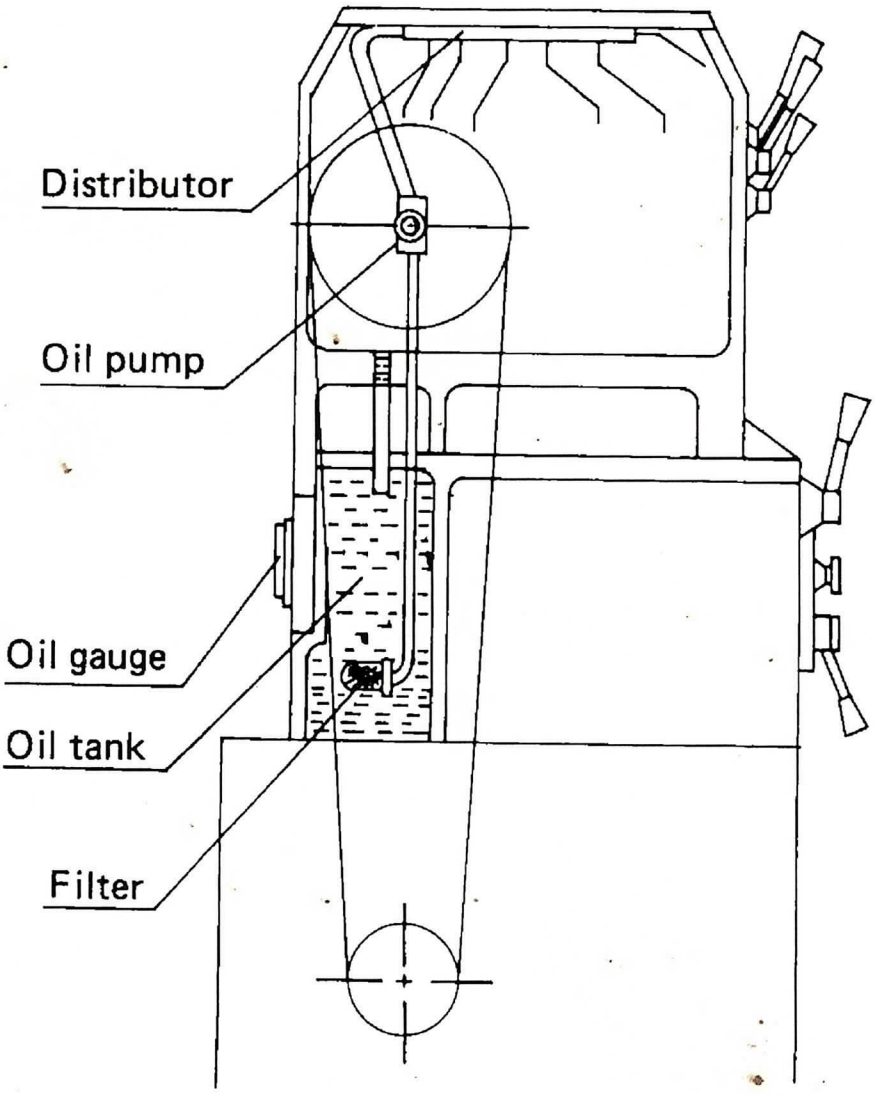
6.1 Parts of lubrication

6.1.1 Headstock

In headstock, lubricant is splashed over gears and each bearing receives sufficient oil through special designed distributing tubes.

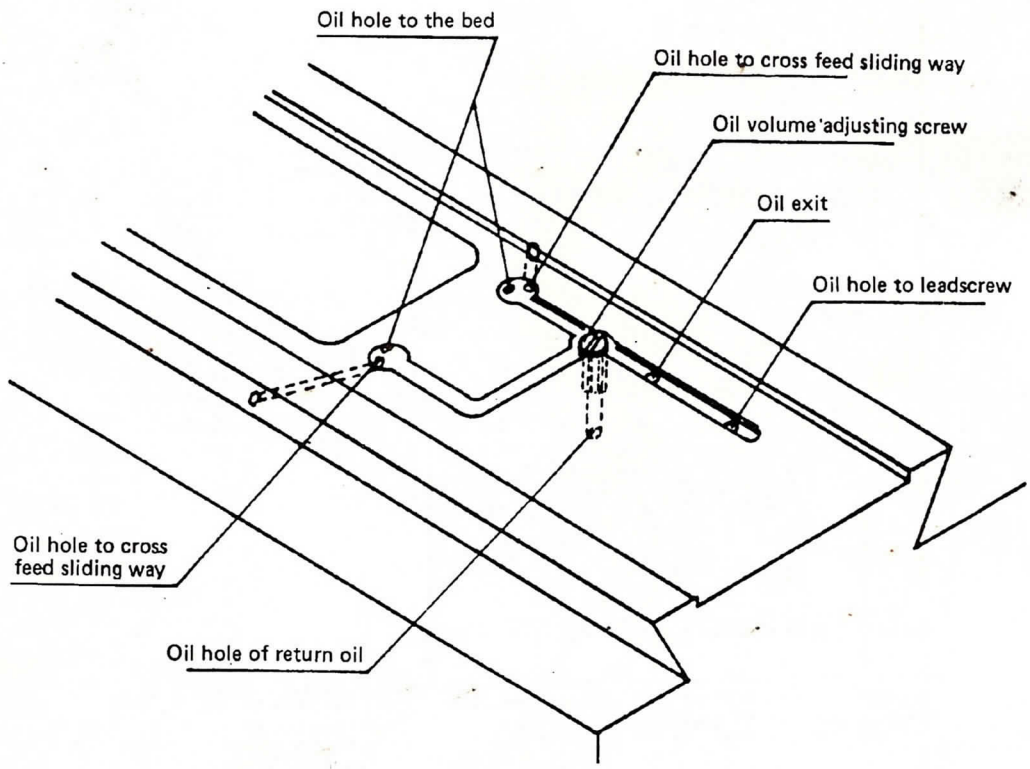
The circulating oil is filtered and can be check by looking at the oil-window. After starting the machine, oil level is indicated by the oil gauge in the rear side under the headstock, the level must over the "Red Line" during machine running. Replacement is done by refilling oil into the oil cup which is under headstock over.

The plug behind the headstock is used for oil draining.



6.1.2 Force lubrication system for carriage sliding ways

1) The lower part of the apron is an oil reservoir. While the apron handle is rotating,oil which is reserved in the tank will be distrdistributed to each sliding surface.(bed carriage and cross slide surface)
2) Control of oil flowrate, is made by regulating the adjusting sting screw after removing the cover on the saddle. When the adjust adjusting screw is turned counter-clockwise,the volume of oil flowing to the return route is reduced and volume of oil flowing to the sliding surface is increased. On the contrary, when the screw is lower the flow to the sliding surface is reduced. The control of oil flow to the sliding way is made by regulating the adjusting screw. The return oil reaches the upper part of the apron oil groove and then sent to each rotating part before returning to the oil tank.
3) Refilling can be made through the oil inlet (indicated "OIL") on right front of the apron after removing the cap of the oil level should be maintained in center line of the oil window at the right front of the apron. Because the oil sent to sliding ways will not return to the oil tank,frequent of refilling is necessary.Replacement of oil is made by removing the plug at the lower part of apron.



6.1.3 Feed gear box

An oil reservoir is installed at the feed gear box, the lubricating system sends oil to each bearing and gear through distributing tubes. Once the oil is sent will not return, hence to replenish the tank twice a day is suggested.

6.1.4 Apron

The lower part of the apron resides an oil tank, apron is pump-lubricated. Replacement or replenishment is done by refilling oil through the oil inlet at the front of apron, the amount of oil added should be according to the red line of the oil window. Oil-draining plug lies at the bottom of the apron.

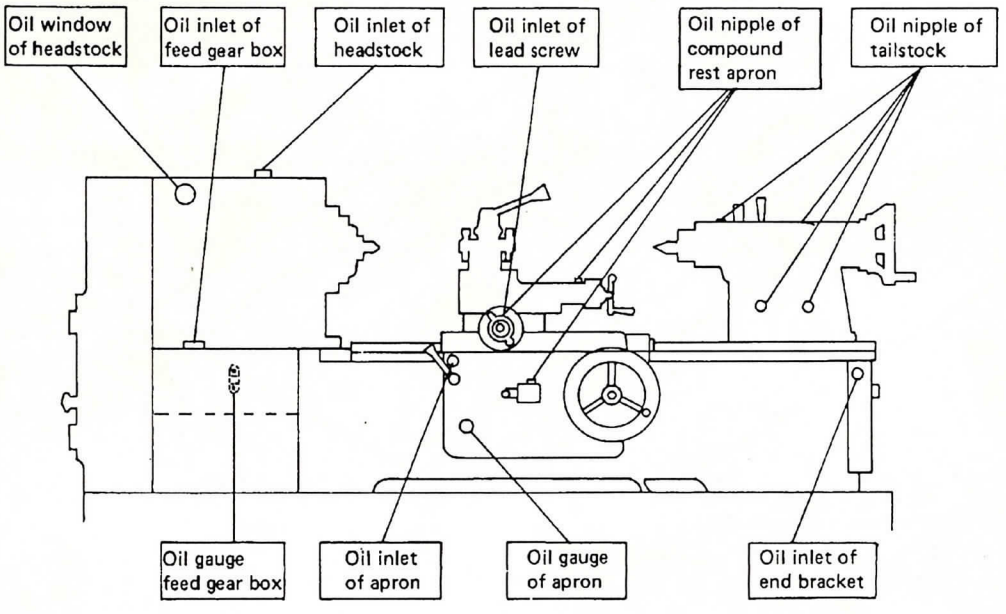
6.1.5 Saddle and bed way

Two oil inlets are located on the saddle, through which oil can be filled for lubrication of the sliding surface between saddle and bed way.

6.1.6 Other parts

There are oil inlets in compound rest, cross leadscrew, bracket of longitudinal leadscrew, feeding rod and tailstock. Replenishment of these parts is required from time to time.

NOTE: Incorrect use of lubricant is liable to cause damage through overheating. Do not put lubricant on V-belt to prevent it from sliding.



6.2 Lubrication chart

Position	Instruction	Interval	Volume	Recommended lubricant	Lubricant characteristic
Headstock	Fill after the cover is off. Fill till oil shows in window indicator	Maintain oil level above window indicator. Change oil after three months,then every year.	10 liters	1.B.P ENERG oil HP 32 2.MOBIL VELOCITE 12 3.SHELL TURBO oil T 32	1.ISO viscosity grade 32 2.Viscosity index above 95 3.Anti-rust,anti-foam,anti-oxidation and anti-corrosion
Feed gear box	Fill at cover oil inlet	Twice minimum each work day	Appropriate	1.MOBIL D.T.E oil light 2.SHELL TONA oil 33	1.ISO viscosity grade 32 2.Viscosity index above 95 3.Anti-rust,anti-foam,anti-oxidation and anti-corrosion
Apron **Bed slideway** **Cross slideway**	Fill at inlet on the right side of apron,till oil shows window indicator	Maintain oil level above window indicator Change each year	1.5 liters	1.MOBIL VACTRA oil No.2 2.SHELL TONA oil 56	1.ISO viscosity grade 56 2.Anti-wear,anti-foam,anti-oxidetion,anti-corrsion
Change gear box	Apply to end gears directly	At least once each month	Appropriate	1.GULFCROWN Grease No.2 2.MOBILUX Grease No.2	Lithium base grease NLGI No.2
Transverse feed,Compound rest,Tail sleeve, Lead screw rest,Cross lead screw		Replenish every other day	Appropriate	1.MOBIL D.T.E oil light 2.SHELL TONA oil 33	1.ISO viscosity grade 32 2.Viscosity index above 95 3.Anti-rust,anti-foam,anti-oxidation and anti-corrosion
Feed screw,, **Lead screw** **Sliding surfaces and Revoluting surfaces**	Apply to exposed surface	Replenish every other day	Appropriate	1.MOBIL D.T.E oil light 2.SHELL TONA oil 33	1.ISO viscosity grade 32 2.Viscosity index above 95

CHAPTER 7

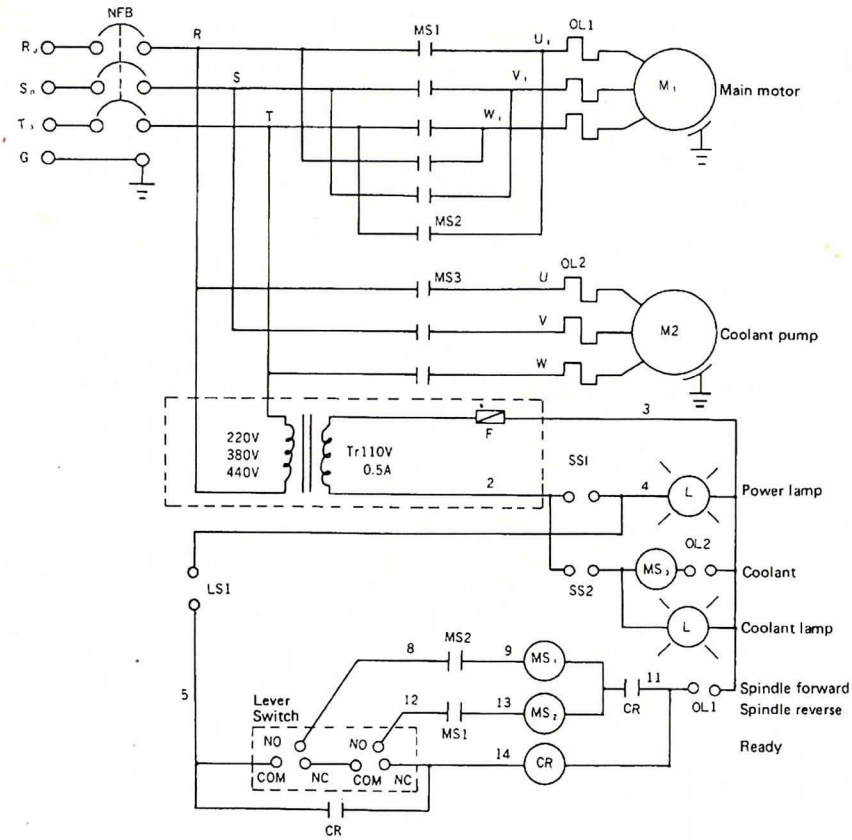
ELECTRICAL SYSTEM

7.1 Composition

The electrical system of YANG IRON-series lathes composes of: Main spindle motor,coolant pump switch.Controller station,electro-magnetic control panel.Micro-switch and transformer for controller circuit.

1) For the main spindle prime motor,a casing type induction motor is employed. Output capacity is 3.7KW(5HP) 4 poles.
2) On the control station,devices are control switch for controller circuit, pilot lamp (power source),coolant pump switch and pilot lamp(coolant equipment).
3) In the electro-magnetic control panel,built in are reversible electro-magnetic switch for main spindle,subsidiary magnetic transistor and magnetic switch for coolant equipment.
4) The starting level is connected with a reversible switch,i.e. normal reverse rotation switch for stop-motion indicator.
5) Micro-switch is connected with brake pedal to shut power off through electro magnetic switching.

7.2 Circuit diagram



SS1 Control circuit power source selected switch
SS2 Coolant select switch
LS1 Limit switch for braking
TR Transformer
F Fuse

7.3 Notices

1) Power source capacity is 2.5 times of rated capacity of main motor.
2) The wires between power source and machine should be qualified products and with enough current rating.
3) The voltage, frequency of power source that used should be compatible with the specification of this machine.
4) The rotating direction of main spindle should be in accordance with forward-reverse lever.
5) Well ground the power source.
6) Turn off control circuit before treading footbrake.

7.4 Trouble shooting

Trouble	Probable cause	Remedy
Poor starting	1.Incorrect power supply, main switch jumps off. 2.Control circuit fuse burn out. 3.Overload thermal relay jumps off. 4.Forward-reverse lever positioned improperly.	1.Correct power supply. 2.Replace fuse. 3.Reset relay. 4.Adjust the position.
Low power,overheating motor	1.Overload. 2.Low voltage,less phase(use 2 phase). 3.Poor magnetic switch,contact segment burn out. 4.Overload thermal relay break down. 5.Bad motor.	1.Reduce cutting load. 2.Correct power supply. 3.Repair or replace. 4.Replace relay. 5.Replace motor.

CHAPTER 8

MACHINE TROUBLE AND MAINTENANCE

8.1 Machine trouble shooting

Trouble	Probable cause	Remedy
Overheating of headstock bearing	1.Insufficient oil. 2.Incorrect oil viscosity. 3.Oil line blocked or leaking. 4.Filter ineffective. 5.Clearance between bearing and main spindle is too small.	1.Check the oil level. 2.Use recommended oil. 3.Check and repair it. 4.Clean or replace it. 5.Adjust the clearance.
Oil leakage at shaft cover,box cover,spindle bore or bolt	1.Loose bolt. 2.Broken washer. 3.Oil over flow. 4.Broken seal. 5.Roughened contact surface.	1.Fasten it firmly. 2.Replace washer. 3.Reduce the amount. 4.Replace seal. 5.Finish it.
Vibration of cutting	1.Loosely clamped workpiece. 2.Incorrect cutting tool. 3.Over length to the left of chuck. 4.Tip of cutting tool is not aligned with spindle center line. 5.Unsuccessful chip-disposal. 6.Overlength workpiece.	1.Clamp it tightly. 2.Select correct tool according to the material,diameter of workpiece and cutting speed. 3.Reduce the workpiece left of chuck. 4.Align tool bit on the same level with spindle center. 5.Install chip-breaker or regulate the cutting angle. 6.Clamp workpiece with center rest.
Bending while cutting long workpiece	1.Excessive cutting depth. 2.Overheat of workpiece. 3.Frictional heat between center and workpiece.	1.Reduce. 2.Cooled by cutting oil. 3.Use high speed rolling center.
Loss of accuracy	1.Unbalanced workpiece. 2.Workpiece bumped by hammer. 3.Centers of tailstock and spindle not in the same line. 4.Machine no longer level	1.Check balance. 2.Do not bump again. 3.Adjust the tailstock. 4.Check the level periodically.

8.2 Maintenance schedule

The following schedule is recommended for the efficient maintenance of the machine under normal conditions of use. Operators should, however, adapt their maintenance schedule to suit operating conditions in accordance.

8.2.1 Daily

1) Clean the machine, remove the chips from machine and surroundings. Apply oil to the sliding surfaces and turn off the power source at the end of the day.
2) Check the oil levels through oil level windows in all reservoirs and refill as necessary. Hand oil all required parts twice per day.
3) If trouble happens, stop the machine to correct the trouble causes to avoid further damage.

8.2.2 Monthly

1) Clean the cutting oil filter and oil pipe, remove the sediments from oil tank.
2) Adjust the gibs if necessary.
3) Clean the change gears, apply the recommended oil to gears again. Take care not to apply oil to V-belts.
4) Whenever the lubricant is considered contaminated, drain, clean and refill the tank.
5) Clean the leadscrew and leadscrew bearings, apply oil with clean oil brush.

8.2.3 Yearly

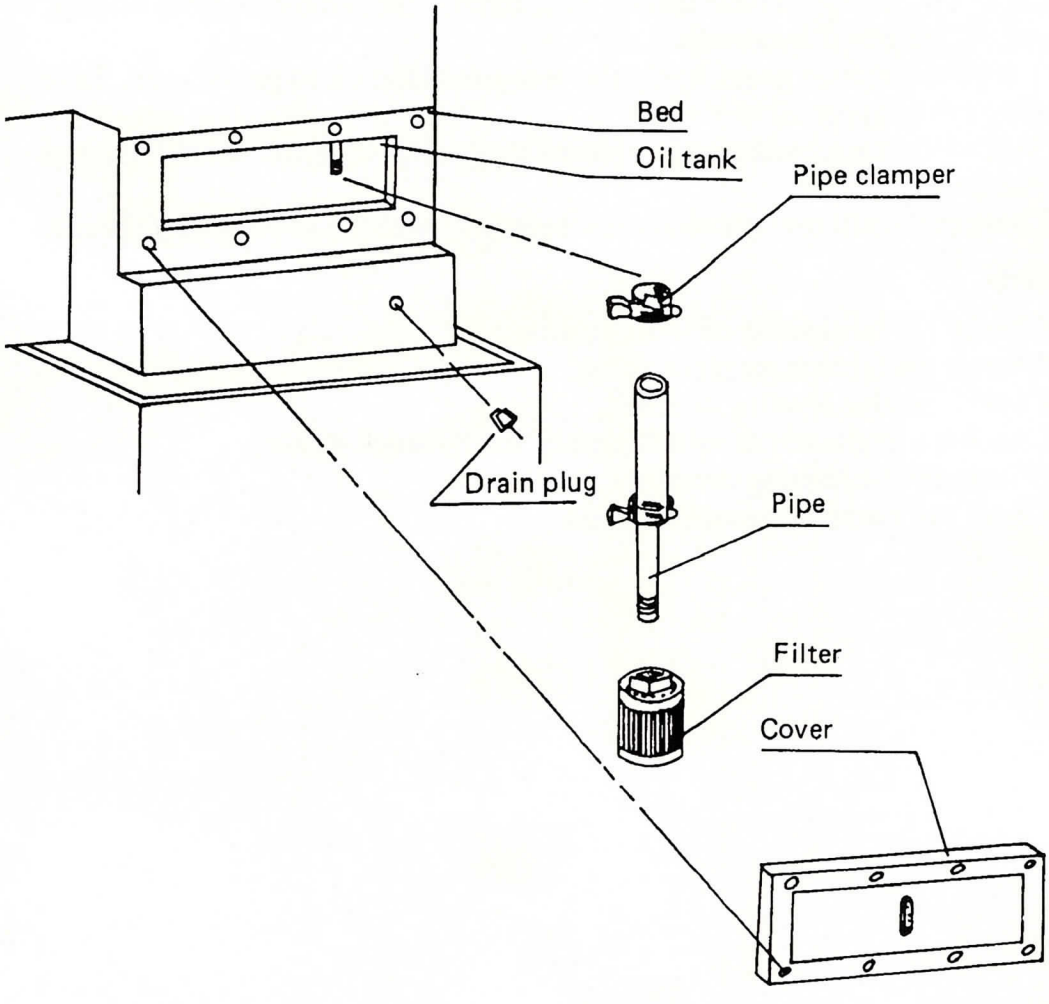
1) Change the lubricating oil in headstock.
2) Change the lubricating oil in apron.
3) Check machine leveling accuracy.
4) Check the alignment of spindle center and tailstock center.
5) Check spindle bearing clearance.
6) Check the electric connection joints.

8.3 Oil purification

8.3.1 Recirculation oil tank

The recirculation oil tank is housed under the headstock. This system sends oil to lubricate each part of headstock, Because the circulating oil may be contaminated and may causes excessive wear of the mechanical parts, it is necessary to clean the oil tank frequently. This process is recommended as following:

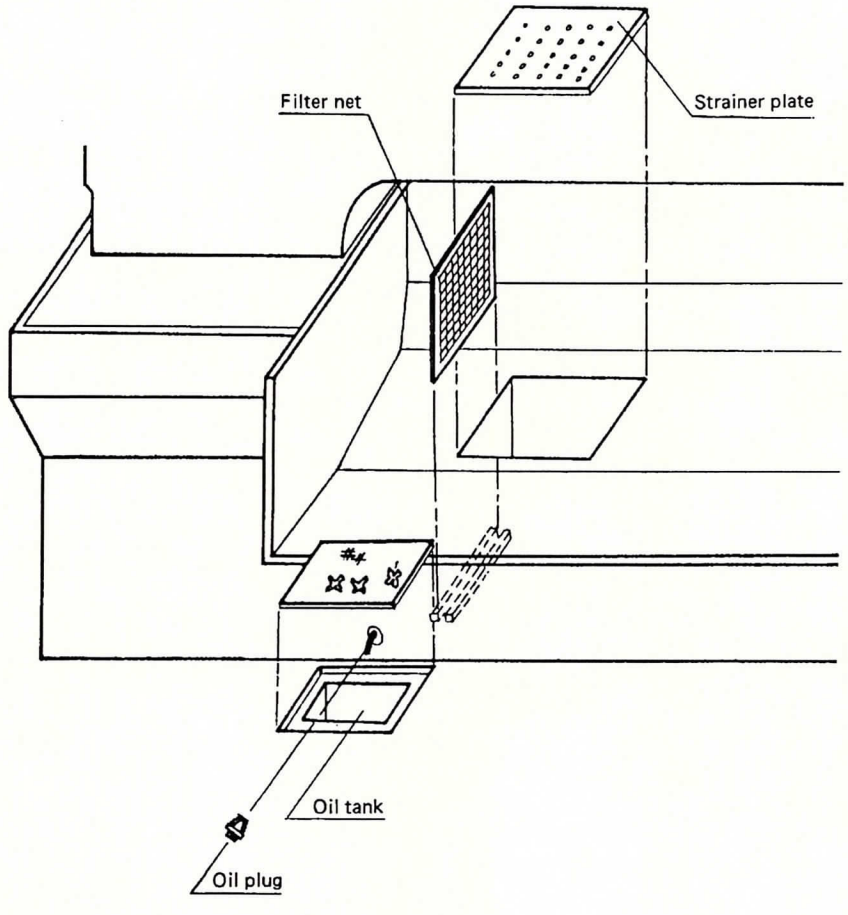
1) Release drain plug to drain the oil in tank.
2) Take out the oil tank cover and the filter.
3) Clean off contamination attached to filter, then clean it by compressed air.
4) Remove sediments from oil tank.
5) Put on the dry filter, oil tank cover and drain plug.
6) Refill oil tank with clean oil.



8.3.2 Coolant reservoir

The coolant reservoir is located inside the base of the machine. Due to constant running, chips and other matter may pile up inside the coolant reservoir. To keep effective cooling of the workpiece and cutting tool, clean the reservoir frequently. The process is recommended as following:

1) Clean chips on top of the machine, release the plug to drain the coolant.
2) Take out strainer plate and filter net to clean chips.
3) Remove sediments from reservoir.
4) Put on filter net, strainer plate and plug.
5) Refill the tank with coolant.



CHAPTER 9

NOTICE OF OPERATION

Operators should read carefully through the manual before operating the machine. Operate this machine according to the following to ensure lasting accuracy.

9.1 Before operation

1) Check if the oil supply of each part were right.
2) Check the starting system and emergency braking system.
3) Check that workpiece be clamped firmly and correctly balanced.
4) Check that the workpiece material, too grade and form are compatible with the working speed and feedrate.
5) Power supply wiring.
   a) Power should be supplied through a separate isolator, the input wires being connected to main terminal of the electrical panel at the back of the headstock.
   b) Main motor rotation must be clockwise, viewed from the pulley end. If motor runs in wrong direction, interchange any two of the three phase lines, a wiring diagram is included in this manual.
6) Identification before operation
   a) Check all handles and levers to ensure operation safety.
   b) Put lever 3 and lever 5 in neutral position, lever 2 in low speed position.
   c) Turn the main spindle by hand to make sure it can be rotated easily.
   d) Open gear change box cover 25 to check if the tension of V-belt is proper.
   e) Make necessary adjustment to ensure that the clearances between change gears are under normal condition.
   f) After all the above are done, turn lever 9 upward to start the motor.
   g) Turn lever 3 to low-speed position to let the spindle rotate, first in low speed, then in high speed.
   h) After spindle idle running, test feed operation from low to high speed gradually.

9.2 During operation

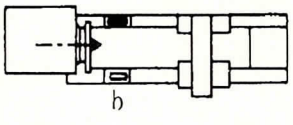
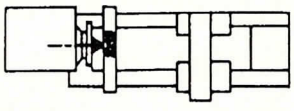
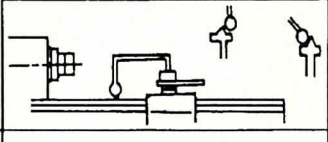
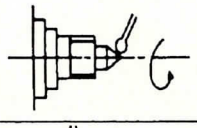
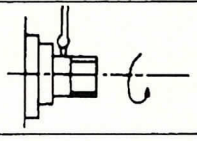
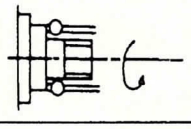
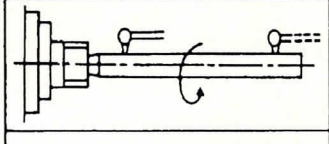
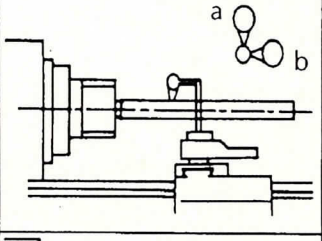
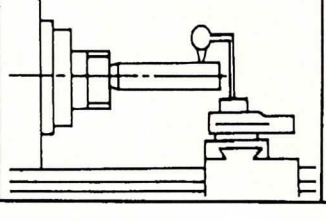
1) Do not shift speed levers when spindle is still rotating.
2) Do not bump the workpiece in chuck.
3) Do not use "forward-reverse" lever as brake to stop the spindle.
4) Stop the spindle when measuring the workpiece.

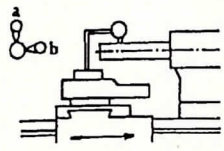
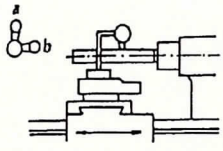
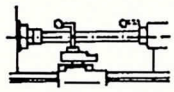
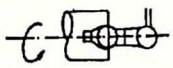
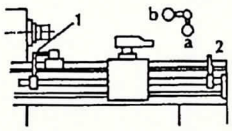
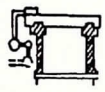
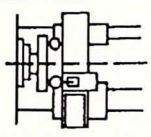
9.3 After operation

1) Move starting lever to off position.
2) Turn off the power source.
3) Clean the machine, remove chips.
4) Apply oil to the sliding surfaces.
5) Store all cutting tools, wrenches, gauges at a safe place.

APPENDIX

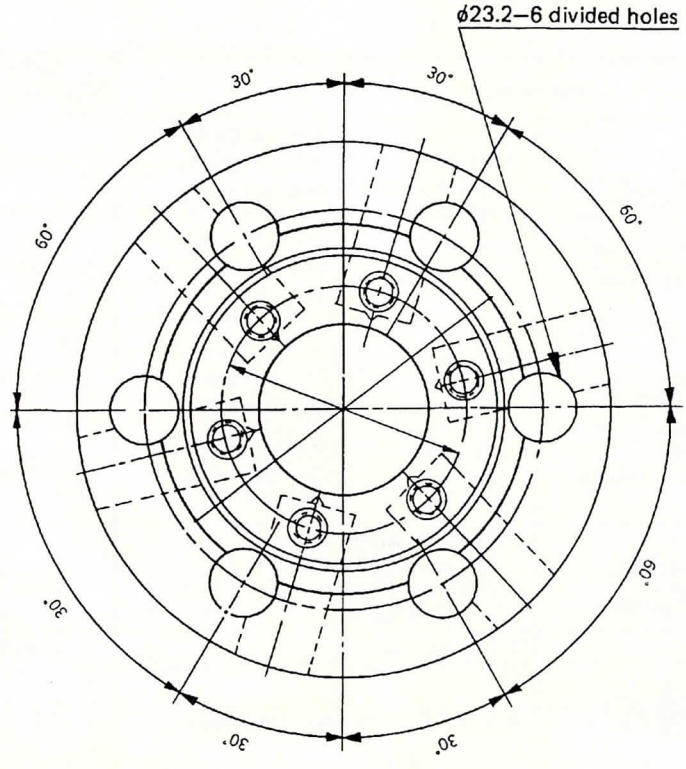
1. Lathe inspections chart

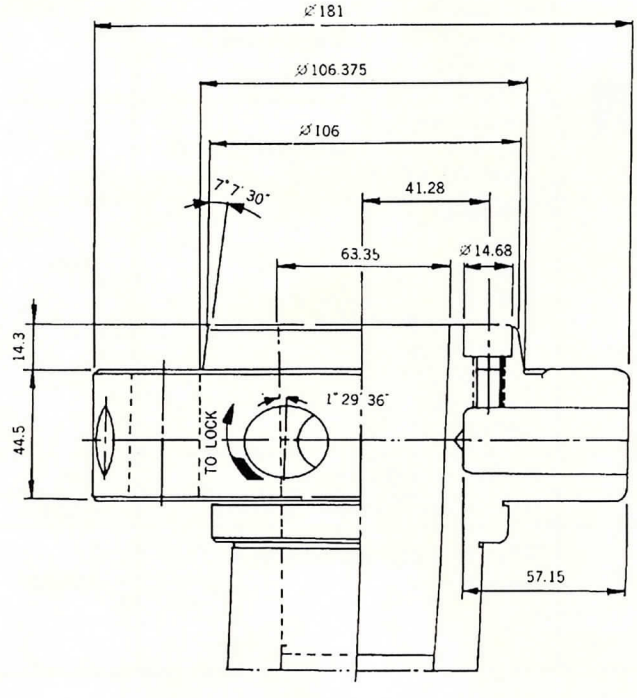
	INSPECTION ITEM			CNS 94 Permissible error (mm)
BED		1. Longitudinal straightness	Tool side (only central comexity allowable)	0.02/1000
			Against tool side (Longitudinal)	+0.01 -0.02 1000
		2. Level (Transverse)		± 0.04/1000
		3. Parallelism of slideways		0.02/1000
SPINDLE		4. Spindle center runout		0.015
		5. Spindle nose runout		0.01
		6. Cam action of spindle		0.015
		7. Spindle taper runout a 300mm length		0.02
		8. Parallelism between spindle and slideway	Imertical plane (only a higher outer end allowable)	0.025/300
			In horizontal plane (only allow tilt to tool side)	0.025/300
TOOL SLIDE		9. Parallelism between upper tool slide and spindle in vertical plane.		0.02/300

	INSPECTION ITEMS			CNS94 Permissible error (mm)
TAILSTOCK		10. Parallelism between tailstock tailstock spindle and slideway	In vertical plane (a) (only outer test bar end higher allowable)	0.015/100
			In horizontal plane (b) (only toward tool side allowable)	0.015/100
		11. Parallelism between tailstock taper and slideway	In vertical plane (a) (only outer test bar end elevation allowable)	0.02/300
			In horizontal plane (b) (only toward tool side allowable)	0.02/300
		12. Parallelism between test bar (between centers) and slideway in vertical plane. (only tailstock elevation allowable)		0.025
LEADSCREW		13. Lead accuracy		0.03/300
		14. Longitudinal transverse of lead screw		0.01
		15. Parallelism between lead screw bearing and slideway (taken at position 1 & 2)	In vertical plane (a)	0.1
			In horizontal plane (b)	0.0
		16. Parallelism between lead screw and lock nuts (Based on the centering of saddle after engagement of lock nuts)		0.15
				0.15
CUTTING		17. Roundness of O.D. Turning		0.01
		18. Cylindricity of turning (between center)		0.02/300
		19. Face flatness (only central concavity allowable)		0.02/300

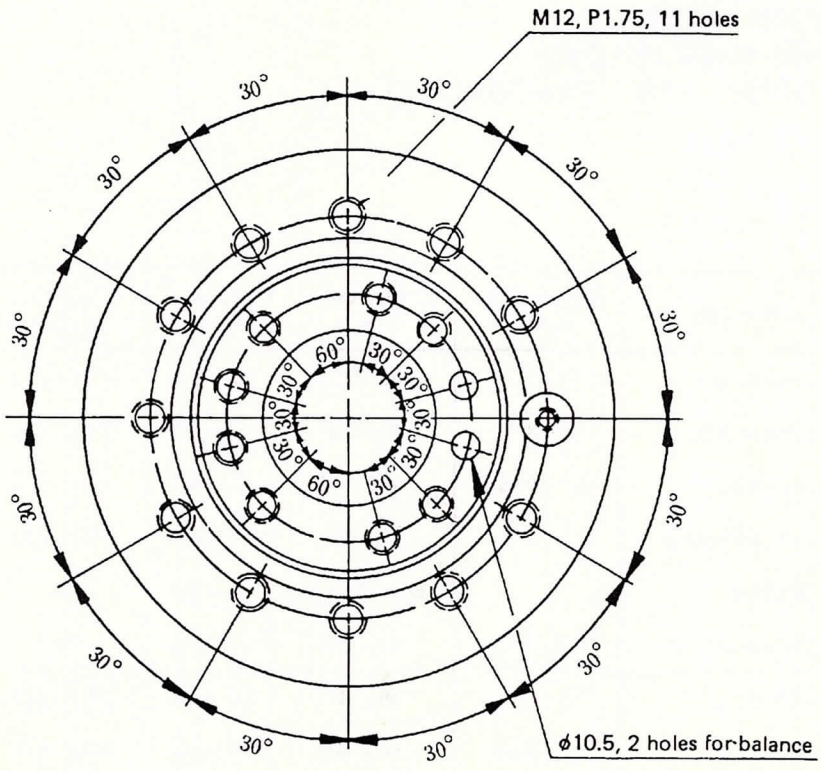
2. Spindle flange type

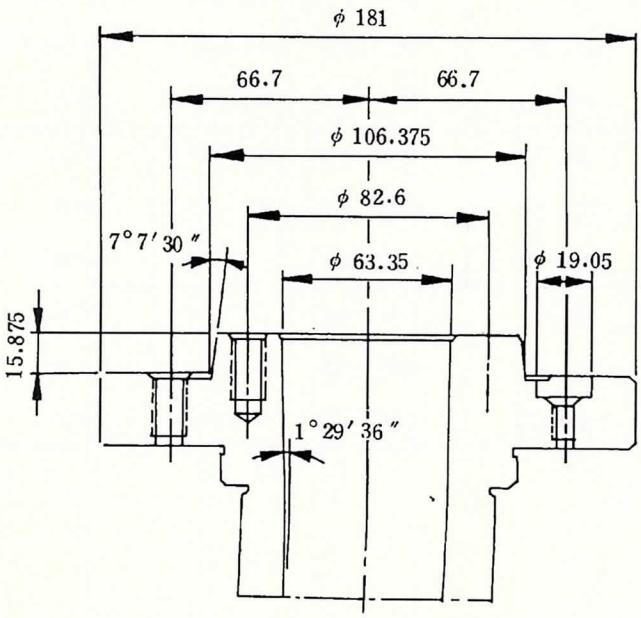
1) End view of spindle ASA-D-1-6





2) End view of spindle ASA-A-1-6





3. Chart for general cutting information

The formula for the relation between diameter of workpiece, cutting speed and main spindle speed:

Diameter of workpiece: D(mm)
Cutting speed: V(m/min.)
Main spindle speed: N(r.p.m.)
$V = \pi.D.N/1000$ or $N = 1000.V/\pi.D$

Material of workpiece	Cutting condition	Cutting depth (mm)	Cutting speed (mm)	Feed (mm/rev.)	Material of cutting tool
Carbon Steel	Roughing	5 – 7	60 – 100	0.2 – 0.4	P10 – P20
	Fine cutting	2 – 3	80 – 120	0.2 – 0.4	P10 – P20
	Finishing	0.1 – 0.15	120 – 150	0.1 – 0.2	P10 – P20
	Thread cutting		70 – 100	Lead	P10 – P20
	Drilling		500–800 r.p.m.	0.1 – 0.2	P20
	Grooving	with < 5	70 – 100	0.1 – 0.2	P20
Alloy steel	Roughing	3 – 5	50 – 80	0.2 – 0.4	P10 – P20
	Finishing	0.1 – 0.15	60 – 100	0.1 – 0.2	P10 – P20
	Grooving	with < 5	40 – 70	0.1 – 0.2	P20
Cast iron	Roughing	5 – 7	50 – 70	0.2 – 0.4	K10 – K20
	Finishing	0.1 – 0.15	70 – 100	0.1 – 0.2	K01 – K10
	Grooving	with < 5	50 – 70	0.1 – 0.2	K20
Aluminium	Roughing	2 – 3	600 – 1000	0.2 – 0.3	K10
	Finishing	0.2 – 0.3	800 – 1200	0.1 – 0.2	K10
	Grooving	with < 5	600 – 1000	– 0.1	K10
Brass	Roughing	2 – 4	400 – 500	0.2 – 0.3	K10
	Finishing	0.1 – 0.15	450 – 600	0.1 – 0.2	K10
	Grooving	with < 5	400 – 500	– 0.1	K10

4. Chart for cutting speed

Example:

Cutting conditions:

1) Diameter of workpiece 18mm
2) Cutting speed 100m/min.
3) Spindle speed 1800 r.p.m.
4) Feed rate 0.04mm/rev.

Then, as the above chart shown, the time required for cutting 10mm of workpiece is 8.3 seconds.