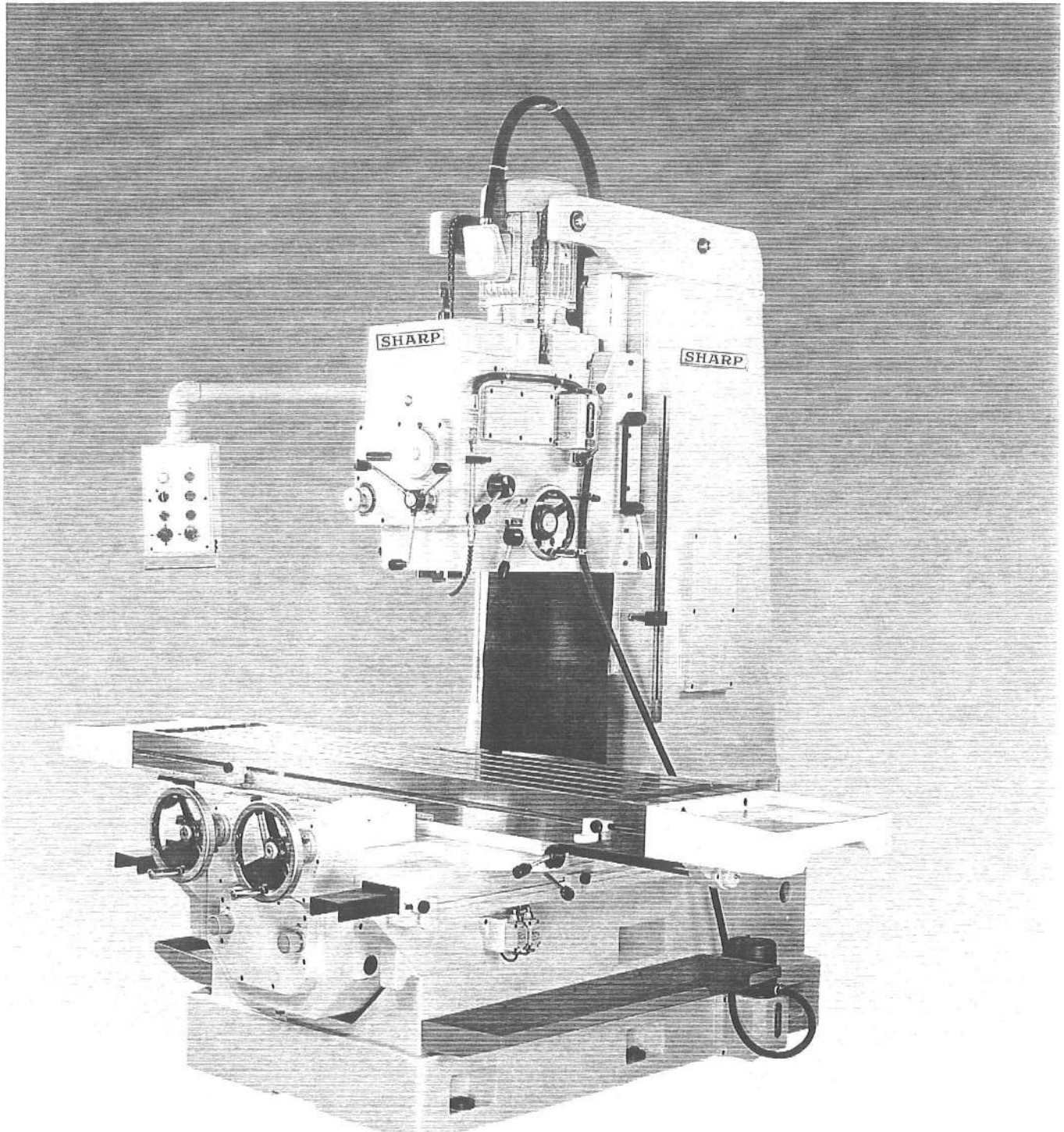


SHARP

PRECISION MACHINE TOOLS

VERTICAL BORING & MILLING MACHINE

OPERATION/PARTS LIST KMA-1



Actual Color Of Machine-Gray

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1. OUTLINE OF MACHINE

1-1 Specifications (Model:KF-VBM-AS) (Table 1)

Table 1. Specifications

Items	Model	KF-VBM-AS
Capacity		
Working surface of table(length x width)		1,700×380mm
Table travel(longitudinal x cross)		1,000×380mm
Distance from table top to spindle end (min. - max.)		100 - 600mm
2.Table		
Size (length x width)		1,700×380mm
T-slot		18mm(H8)×5
Rapid traverse(longitudinal and cross)		2,880mm/min(60Hz) 2,400mm/min(50Hz)
Automatic feed(12-step speed change, longitudinal and cross)		28-875mm/min(60Hz) 23-730mm/min(50Hz)
3.Spindle		
Nose		ISO R297 No. 50
Speeds (12-step speed change)		45-1,500 rpm(60Hz) 35-1,250 rpm(50Hz)
4.Milling head		
Automatic feeds (5-step feed change, forward and reverse)		0.05-0.2mm/rev.
vertical travel		500mm
5.Column		
Distance from column surface to center of main spindle		380mm
Distance from column gap to center of main spindle		485mm
Distance from column gap to center of table (min. - max.)		295-675mm
6.Motors		
For spindle		5.5kw(7-1/2HP)-4P
For table feed		0.75kw(1HP)-4P
For lubricating oil pump		0.2kw(1/4HP)-4P
For cutting fluid pump		0.1kw(1/8HP)-2P
7.Size of Machine		
Height		2,200mm
Overall height (milling head at highest position)		2,410mm
Distance from floor to table surface		800mm
8.Floor area		
		3200×1960mm
9.Net weight (approx.)		
		4,000kg

Standard accessories:

Cutting fluid equipment	1 unit
Hand tool	1 set
Leveling block	6 pcs.
Leveling bolt & nut	6 pcs.
Draw-in bolt	1 pc.

Optional accessories:

Digital scale
Boring bar
Quick change chuck and arbor

Fig. 1 Dime

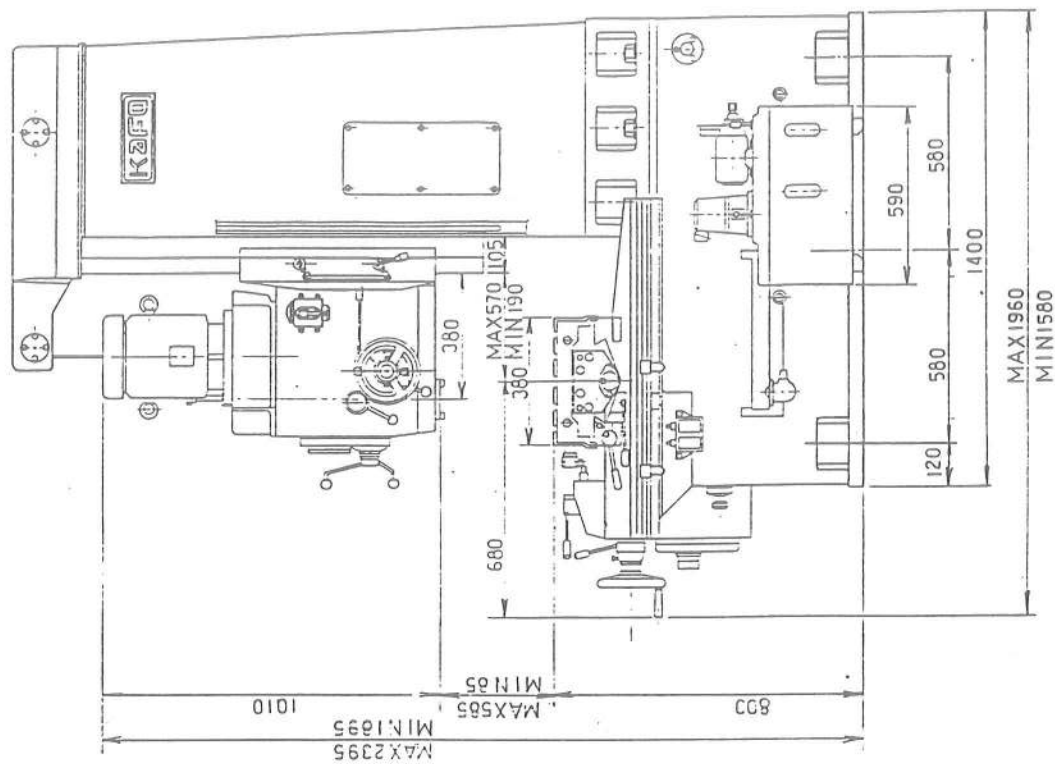
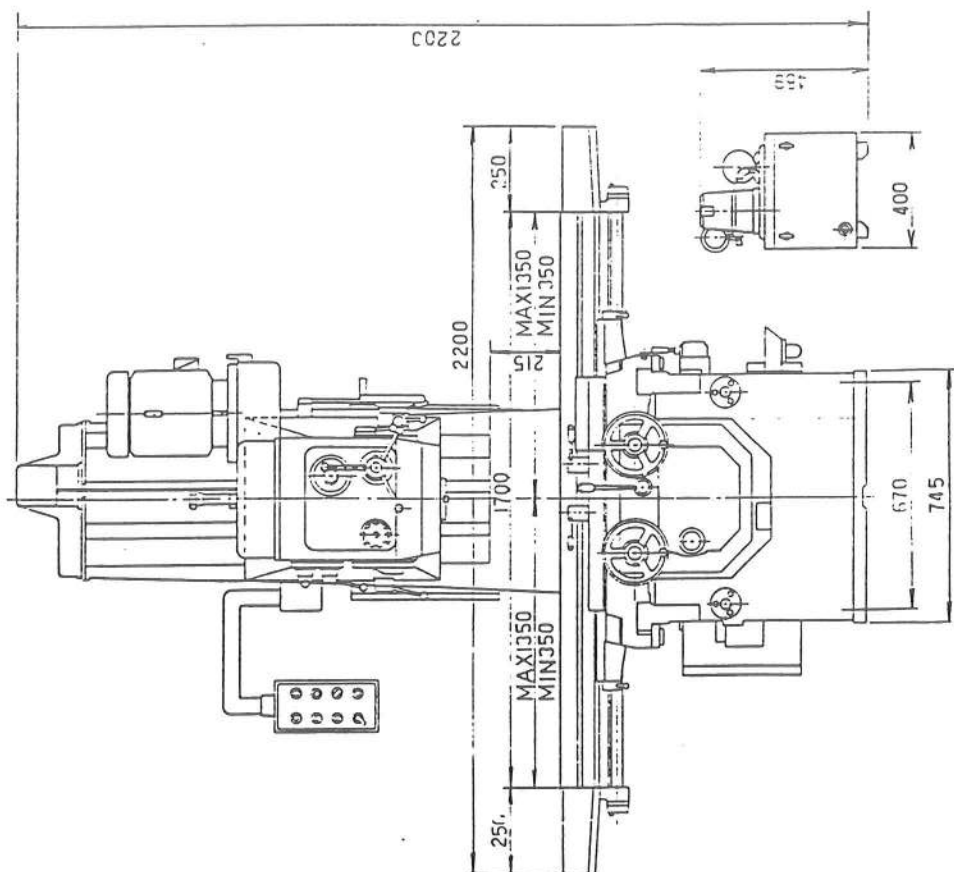


Fig. 2 Dimensions of table

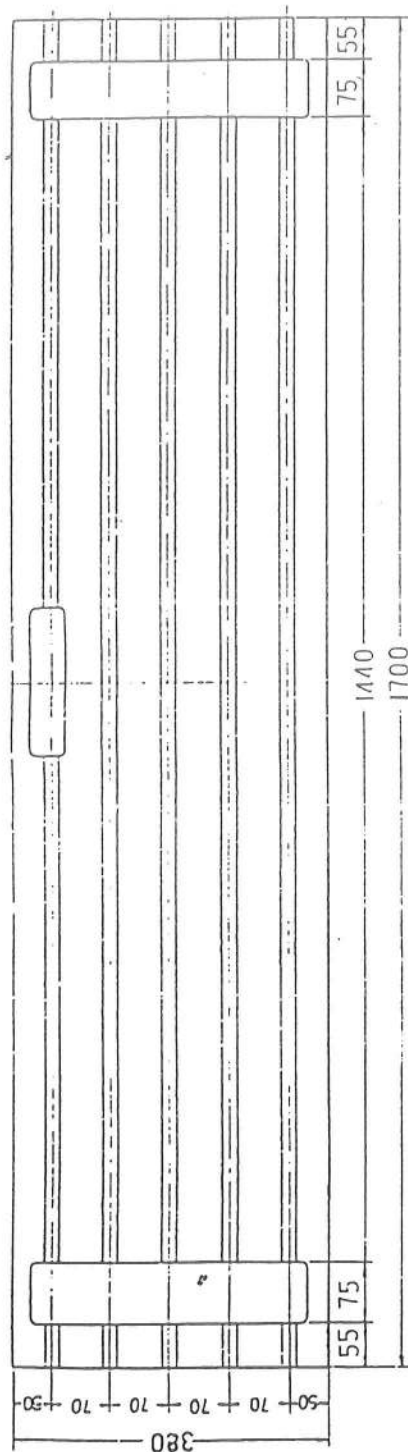


Fig. 4 Dimensions of spindle nose

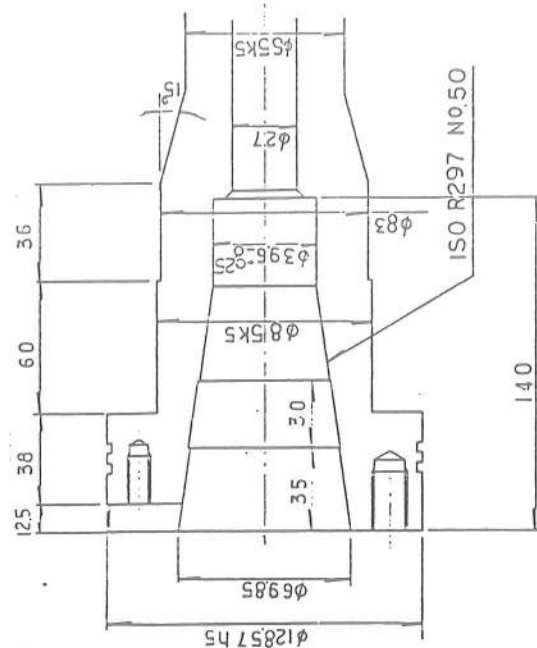
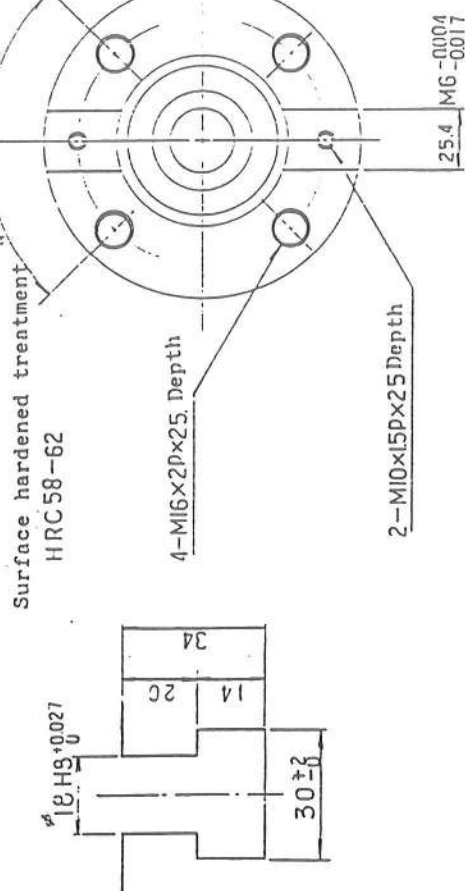


Fig. 3 Dimensions of T-slot



1-3 Name of Mainparts(Fig 5)

1. Upper cover of column
2. Column
3. Cover of main spindle(B)
4. Spindle head
5. Rotating stand for operator's box
6. Lifting lever for operator's box
7. Operator's box
8. Starting switch of main spindle
9. Pilot lamp of power source
10. Stopping switch for main spindle
11. Switch for cutting fluid pump
12. Pilot lamp
13. Inching switch for main spindle
14. Switch for motor in gearbox
15. Switch for emergency stop
16. 2-step speed change lever for main spindle
17. Speed change lever for spindle reverse transmission
18. 3-step speed change lever for spindle head
19. Automatic feeding speed change knob for spindle head.
20. Longitudinal feed lead screw bearing block
21. Side cover of table
22. Lead screw of table feed
23. Working table
24. Clamping bar of working table
25. Feeding hand wheel of saddle
26. Speed change lever for rapid cutting feed
27. High and low speed change lever
28. Saddle
29. Electrical wiring box
- 30.
31. Oil pump for table and saddle sliding surface
32. Bracket for hanging machine
33. Speed change knob for 6-step automatic feed
34. Gear box
35. Bed
36. Drainage plug for gear box
37. Limit switch for saddle feed stop
38. Side cover of bed
39. Cutting fluid pan.

40. Cutting fluid elbow
41. Chain
42. Motor for main spindle
43. Top cover of main spindle(A)
44. Adjusting plate for spindle motor
45. Micro feeding graduation dial for spindle head
46. Clamping lever for main spindle
47. Rapid feed hand wheel for spindle head
48. Micro feed speed change lever for spindle head
49. Micro feed hand wheel for spindle head
50. Automatic feed speed change lever for spindle head
51. Cutting fluid valve
52. Feed speed change lever for saddle and working table
53. Feed hand wheel for working table
54. Front cover
55. Clamping lever for saddle
56. Cover of column sliding surface
57. Cover of oil tank
58. Cutting fluid pump
59. Oil tank
60. Motor for oil pump
61. Adjusting valve for lubricants
62. Pressure gage
63. Oil catcher
64. Oil feeding pump for sliding surface of spindle head
65. Side cover of column.
66. Nameplate for manufacturing serial No.
67. Nameplate

Fig. 5 Name of main parts

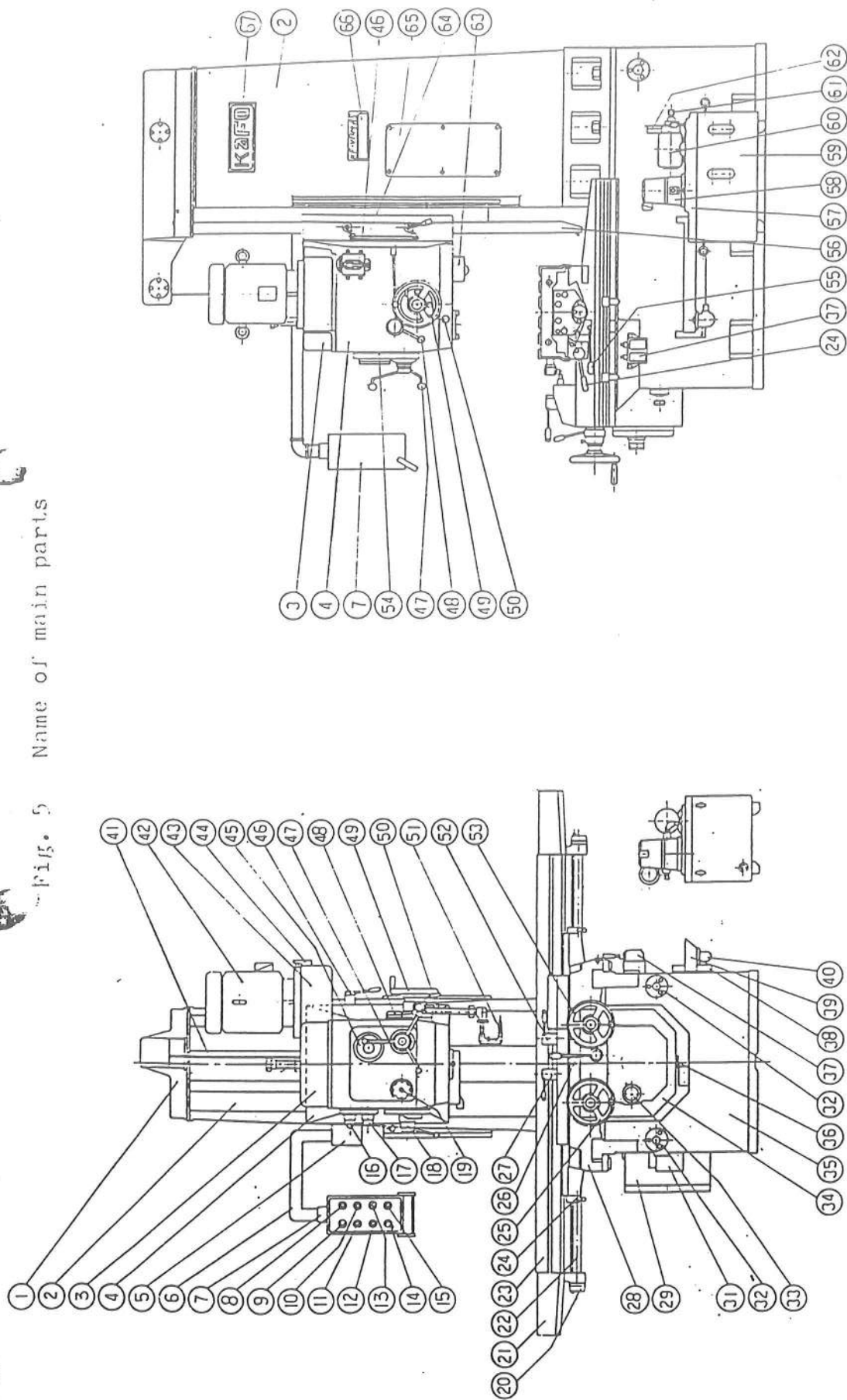
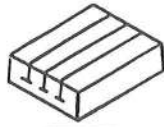


Table 2 Symbols

Symbols	Description	Symbols	Description
	Starting switch "on"		Cutting fluid pump
	The switch is "ON" while depressed		Lubricant pump
	Stopping switch "off"		Danger (Electrical device)
	Automatic longitudinal and transverse feed		Automatic longitudinal and transverse feed
			
	Rapid feed		Automatic vertical feed
	Normal feed		
	Low speed feed		Feed amount per rotation
	Increase of spindle speed		Feed amount per minute
	Decrease of spindle speed		Revolutions per minute
	Main spindle		Working Table

2. Installation of the machine

2-1 Transportation(Fig 6)

Fix every part of the machine before hanging it. Especially pay attention to the fixation of spindle head and balancing weight ①.

Put the balancing weight at the position of side window of column by using the hand wheel for spindle head rapid feed ②. then use bolts ③ to fix balancing weight from the holes of window.

Place the table to the middle position of machine, and move saddle close to the side of column.

Move spindle head about 50mm upward by hand wheel for spindle head rapid feed and insert the support bar ④ between table and spindle head, hence the chain ⑦ is at loose condition. Both end of support bar should be cushioned with cloth or rubber to avoid unnecessary damage of machine.

Clamp saddle, table and spindle head in sequence in order to improve the stability of spindle head, and make the operating rapid feed lever, micro feed speed change lever ⑤ and automatic feed lever ⑥ in "feed" position.

Use steel rope to lift the machine shown on Fig 6.

Cloth or rubber should be cushioned between the rope and machine Surface. Steel rope should not be touched the weakparts of the machine.

2-2 Loosening the different units of machine(Fig 6) after the transportation is completed. Loosen the different units of the machine and be careful to remove the support bar & to stretch the chain ⑦ slowly. Put the automatic feed lever ⑥ of spindle head in loose condition, rapid and micro feed lever ⑤ in "feed" position. Loosen the clamp ⑧ of spindle head. At this time, check the chain whether contact the sprocket ⑨ tightly or not due to transportation. Before removal of support bar and the chain in good condition. Grasp the hand wheel ⑫ of spindle head micro feed to move the spindle head upward for removing the support bar. Then move the spindle head downward slowly and smoothly until the chain is properly stretched. NOTE the chain can not stand impact load or it would be broken.

Examine the chain in good condition once more, then loosen and remove the bolts (side window of column) for fixed balancing weight. But remember during spindle head downward before chain is stretched, the bolts of fixed balancing weight is absolutely not allowed to take out. Finally loosen the clamp of the saddle and table ⑩ ⑪.

2-3 Levelling and Foundation(Fig 7)

The machine can be located at 200mm thick concrete floor or set on 350mm thick concrete foundation, to ensure the accuracy of the machine and prevent cutting vibration. shown on Fig 7 move the table to the middle position and clamp spindle head at the middle position of the column, then put the precision level (accuracy 0.02-0.05 mm/1000mm) on the table to adjust the levelling of machine. After finishing the levelling. Pour the concrete into the anchor bolt holes, tighten the bolt after the concrete is completed rigid, check the machine levelling once more, clean the machine base(sands & scraps ets) then pour concrete between machine base and floor.

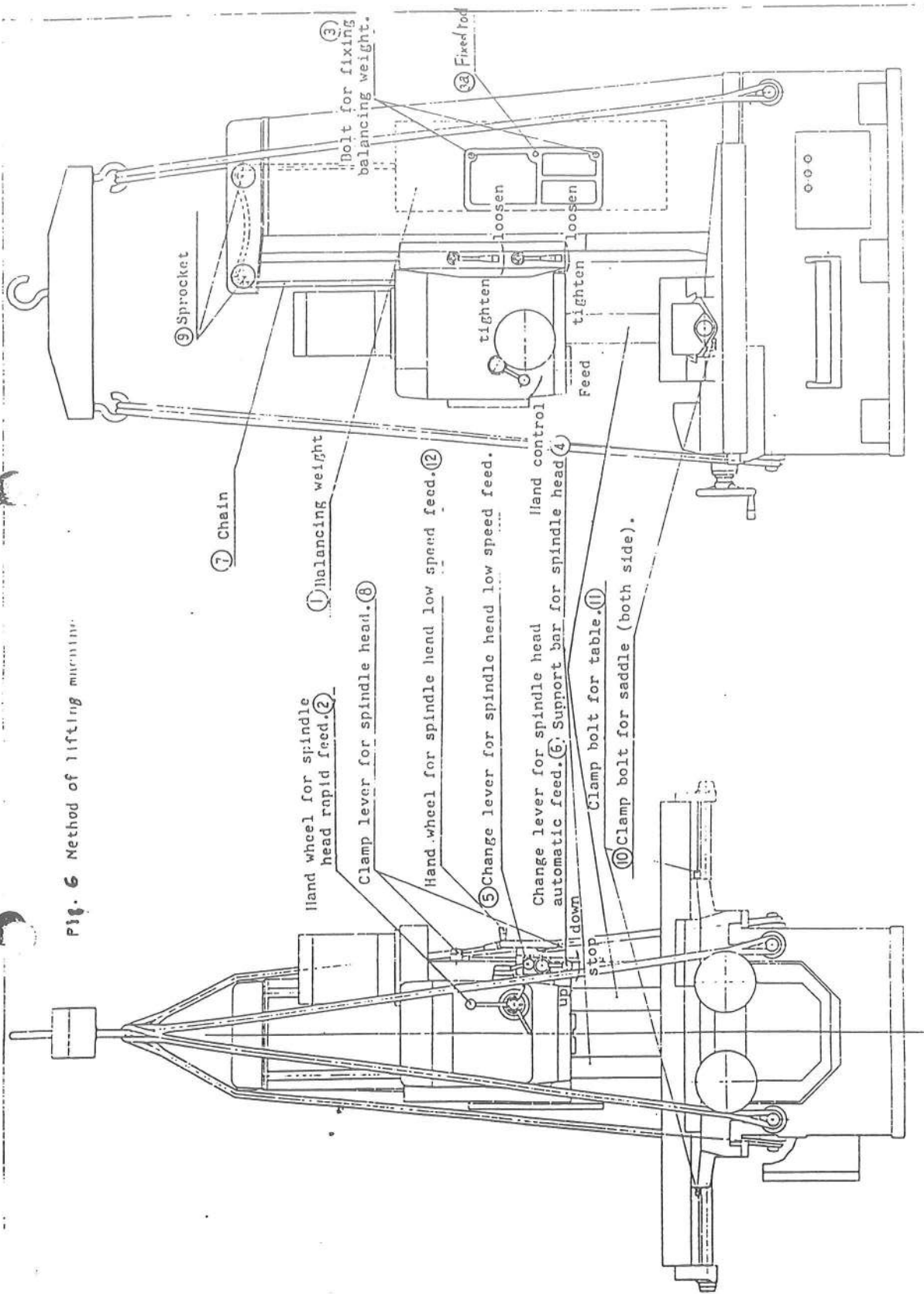
2-4 Cleaning the machine

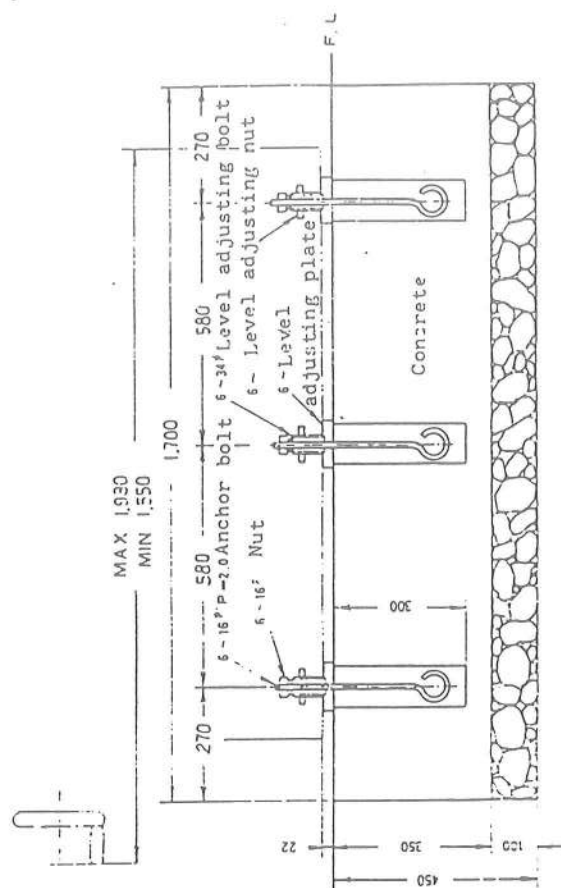
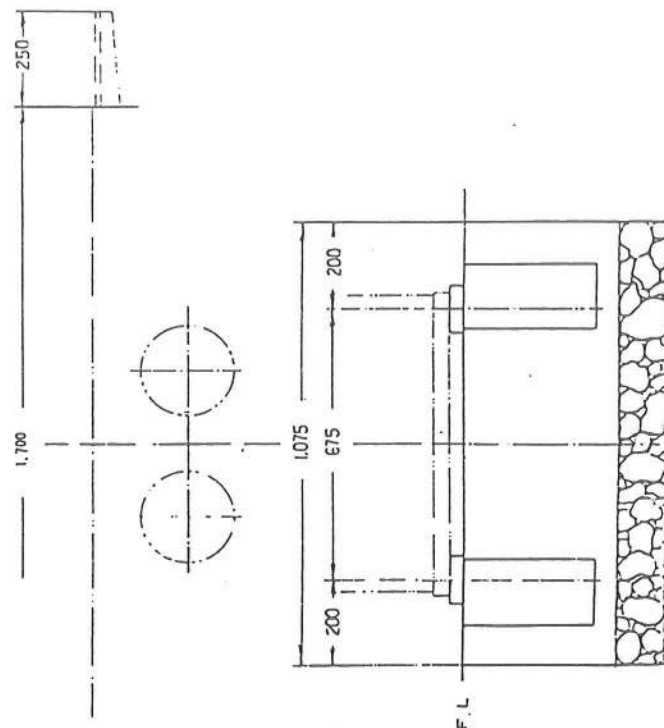
The machine is protected by grease or antirust oil before shipment. But the machine should be cleaned with gasoline before putting the protecting oil.

2-5 Removal of pad-bond coating agent.

The covers should be applied with pad-bond coating agent if need be. During taking them apart and putting them together again, you should remove all of the used pad-bond coating agent and replace with new ones.

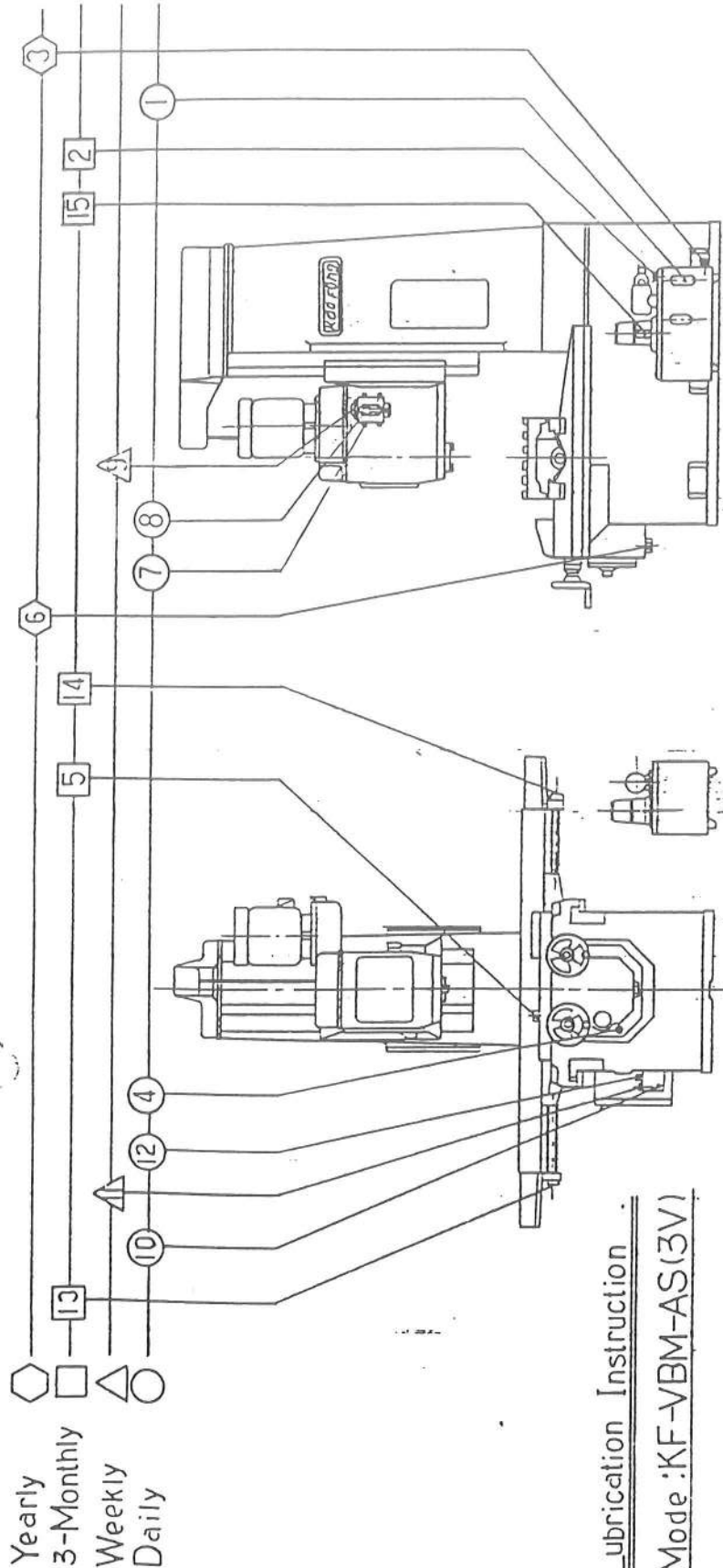
Fig. 6 Method of lifting machine





3.Lubrication

3-1 Refer to Fig 8 & 9 and Table 3, check all of the different lubricating portions of the machine which should be applied with suitable amount of oil in compliance with the regulation. When the machine is in operation, inspect again all of the different moving parts in good lubricating condition in order to ensure the superior function.



Lubrication Instruction

Model: KF-VBM-AS(3V)

Machine Component	Spindle Head Gears			Feed Box			Spindle Head & Slide Ways				Slide Ways & Feed Screw		Bearing for Lead Screw		Oil Filter
Action Points	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Symbol															
Item															
Check	Daily			Daily			Daily			Daily					
Fill		3-M.			3-M	Yearly		Daily	Weekly		Weekly	Daily	3-M.	3-M.	
Clean & Replace			Yearly												
Clean & Replace															
Lubricant		CB 32		CB 68			G 68				G 68		XM2		3-M.
Quantity		6 l	12 l		1.2 l	5 l		0.02 l	0.3 l		0.5 l	0.02 l	Drops	Drops	
Remarks								Furnished Oil Hand				Furnished Oil Auto			on the Back Side

TABLE 3 Instruction for Select Lubricant

	Application Fields	Properties	Symbol and Viscosity Grade	Kinematic Viscosity cSt(40°C)			REMARKS
				Nom.	min.	max.	
GEARS	Enclosed moderately loaded gear (spur gear, bevel gear)	Refined mineral oils with good oxidation stability	CB 32	32	28.8	35.2	Pinion speeds (motor output) 2000 - 5000 rpm (within 3.7kw) 1000 - 2000 rpm (within 7.5kw) - 1000 rpm (within 15kw)
			CB 68	68	61.2	74.8	
			CB 150	150	135	165	
	Enclosed heavily loaded gears (worm and wheel)	Refined oils with good oxidation stability and with improved load-carrying ability	CC 150	150	135	165	Worm speeds 2000 - rpm 1000 - 2000 rpm - 1000 rpm
CC 320			320	288	352		
CC 460			460	414	506		
BEARINGS	Spindles bearings and associated clutches	Refined mineral oils with superior anticorrosion and anti-oxidation performances.	FC 2	2.2	1.98	2.42	Shaft speeds (shaft dia.) 10000 - rpm (- 30mm) 2000 - 10000 rpm (30 - 150mm) - 2000 rpm (150 - mm)
			FC 10	10	9.00	11.0	
			FC 22	22	19.8	24.2	
SLIDEWAYS	Slide ways	Refined mineral oils with improved lubricity and tackiness performance preventing stick-slip	G68	68	61.2	74.8	Slide way (surface pressure) Horizontal (under 4kgf/cm ²) Vertical (under 4kgf/cm ²)
			G220	220	198	242	
HYDRAULIC SYSTEMS	Hydraulic systems	Refined mineral oils with superior anti-corrosion and anti-oxidation performance	HL32	32	28.8	35.2	Oil temperature (Rated pressure) 0 - 50°C (under 35kgf/cm ²) 15 - 65°C (under 35kgf/cm ²)
			HL68	68	61.2	74.8	
		Refined mineral oils with superior anti-corrosion, anti-oxidation and anti-wear performances.	HM32	32	28.8	35.2	Oil temperature (Rated pressure) 0 - 50°C (under 140kgf/cm ²) 15 - 65°C (under 140kgf/cm ²)
			HM68	68	61.2	74.8	
		Refined mineral oils of HM type with anti-stick-slip properties	HG 32	32	28.8	32.2	Oil temperature (Rated pressure) 0 - 50°C (under 70kgf/cm ²) 15 - 65°C (under 70kgf/cm ²)
			HG 68	68	61.2	74.8	
GREASE	Hydraulic and Slide ways	Premium quality greases with superior anti-oxidation and anti-corrosion properties	Viscosity (25°C) SSU				Centralized systems Cup or hand gun
			XM 1	310 - 540			
			XM 2	265 - 295			

Table 4 THE GENERAL LUBRICANTS FOR MACHINE TOOL

	SYMBOL	CPC	ESSO/EXXON	SHILL	MOBIL	DAIICHI
GEARS	CB32	R32	Teresso 32	Tullus Oil C32	DTE Oil Light	Mechanic Oil 32
	CB68	R68	Teresso 68	Tullus Oil C68	DTE Oil Heavy Medium	Mechanic Oil 68
	CB150	R150	Teresso 150	Tullus Oil C150	DTE Oil Extra Heavy	Mechanic Oil 150
	CC150	R150	Spartan EP150	Omala Oil 150	Gear 629	CE Compound 150S
	CC320	R320	Spartan EP320	Omala Oil 320	Gear 632	CE Compound 320S
	CC460	R460	Spartan EP460	Omala Oil 460	Gear 634	CE Compound 460S
Bearings	FC2			High spin Oil C2	Velocite Oil No. 3	Mechanic Oil 2
	FC10	R12	Spinesso 10	Tellus Oil C10	Velocite Oil No. 6	Mechanic Oil 10
	FC22	R22	Spinesso 22	Tellus Oil C22	Velocite Oil No. 10	Mechanic Oil 22
Slide Ways	G68	Slide way oil	Febis K68	Tonna T68	Vactra Oil No. 2	Multiway 68C
	G220	Slide way oil	Febis K220	Tonna T220	Vactra Oil No. 4	Multiway 220C
Hydraulic System	HL32	R32	Teresso 32	Tellus Oil C32	DTE Oil Light	Hydraulic Fluid 32
	HL68	R68	Teresso 68	Tellus Oil C68	DTE Oil Heavy Medium	Hydraulic Fluid 68
	HM32	32AW	Nuto HP32	Tellus Oil 32	DTE 24	Super Hydraulic Fluid 32
	HM68	68AW	Nuto HP68	Tellus Oil 68	DTE 26	Super Hydraulic Fluid 68
	HC32		Powerex DP32	Tonna Oil T32	Vacuoline Oil 1405	Multiway 32
	HC68		Powerex DP68	Tonna Oil T68	Vacuoline Oil 1408	Multiway 68
GREASE	XM1	Gulferown Grease E.P. NO.1	Listan 1	Alvania Grease 1	Mobiluz EP1	Cornex Grease No. 1
	XM2	Gulferown Grease E.P. No.2	Listan 2	Alvania Grease 2	Mobilux 2	Cornex Grease No. 2

C.P.C. — China Petroleum Co., Ltd.

4. Cutting fluid pump device (Fig 9&10)

Install the cutting fluid pump (P1) on the oil tank (O1) at right side of machine. Turn switch on the control box (P2) to left direction to start or stop with spindle together; turn switch to right direction to start fluid pump only. Spindle oil and cutting fluid are separated in the oil tank. The temperature rise of lubricants can be reduced by coolant (cutting fluid).

Volume can be poured from pan (P3) until to reach the gauge level. Cutting fluid nozzle (P6) equipped at right side of spindle head and hold by nozzle clamber (P4)

Nozzle can be rotated up and down, right and left freely and easy to take apart. The out let amount of fluid can be adjusted by the valve (P5). CCW turn for larger quantity and CW turn for smaller.

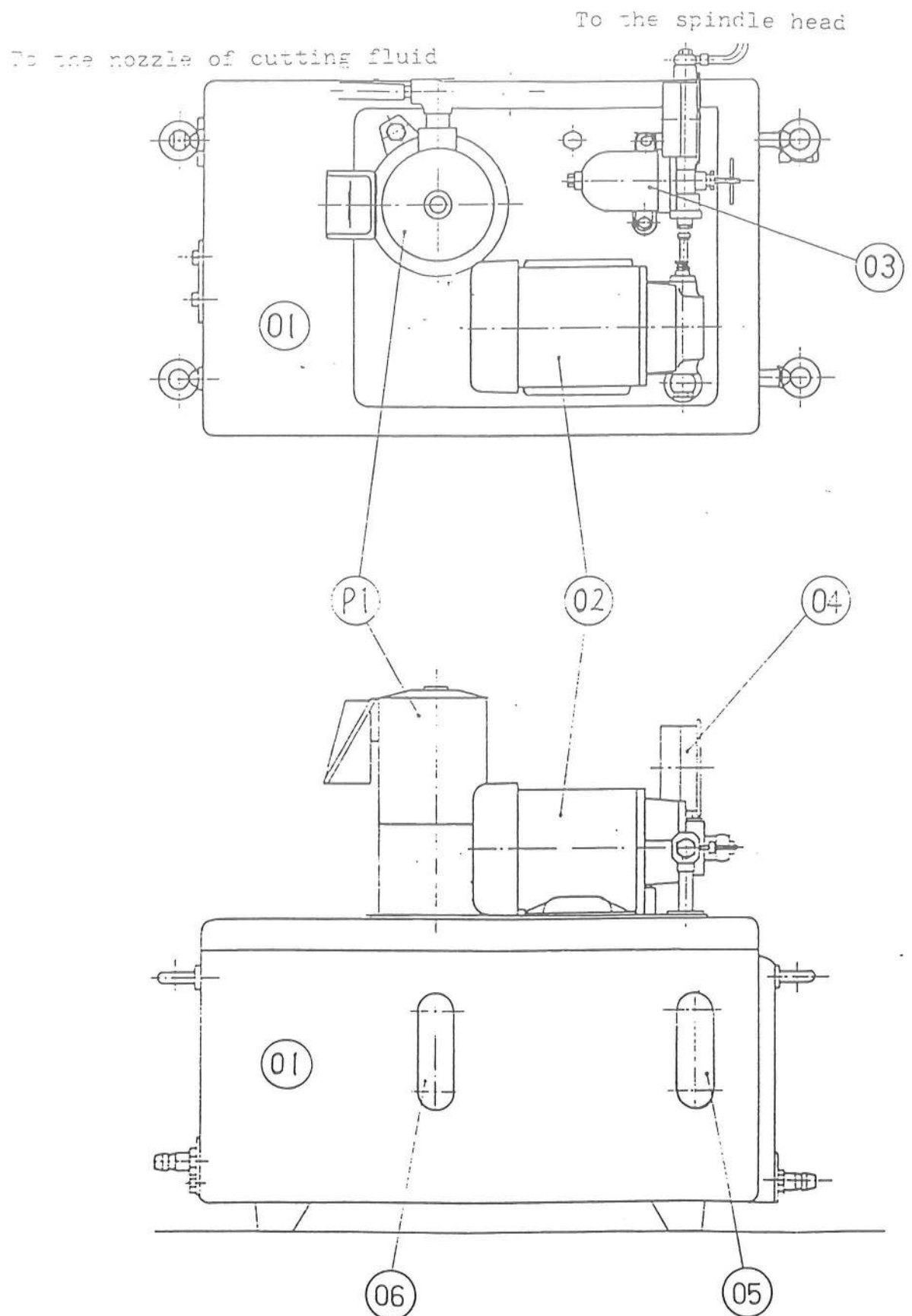
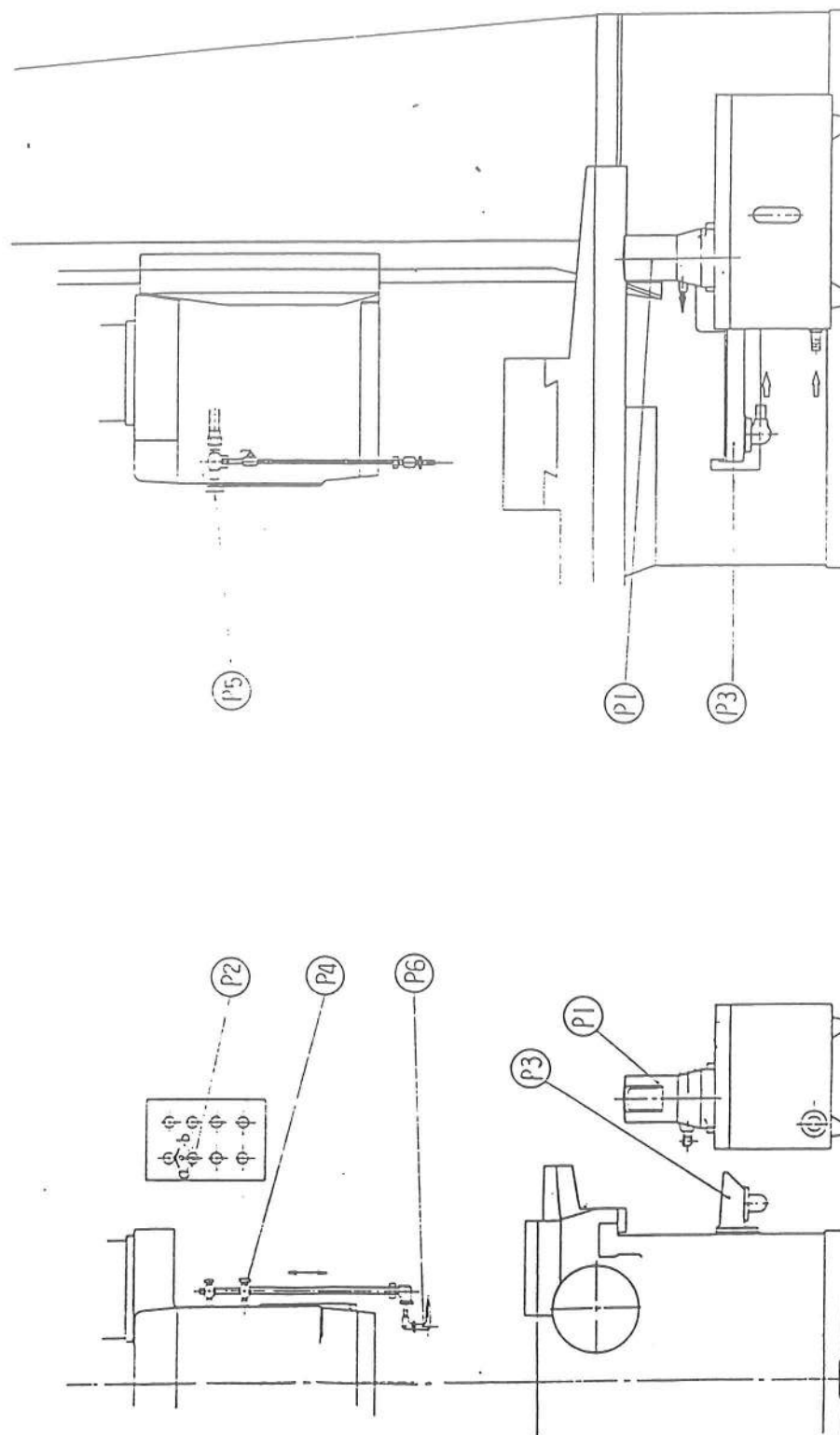


Fig. 9 Configuration of lubricant pump and cutting fluid pump

Fig. 10 Cutting fluid pump system



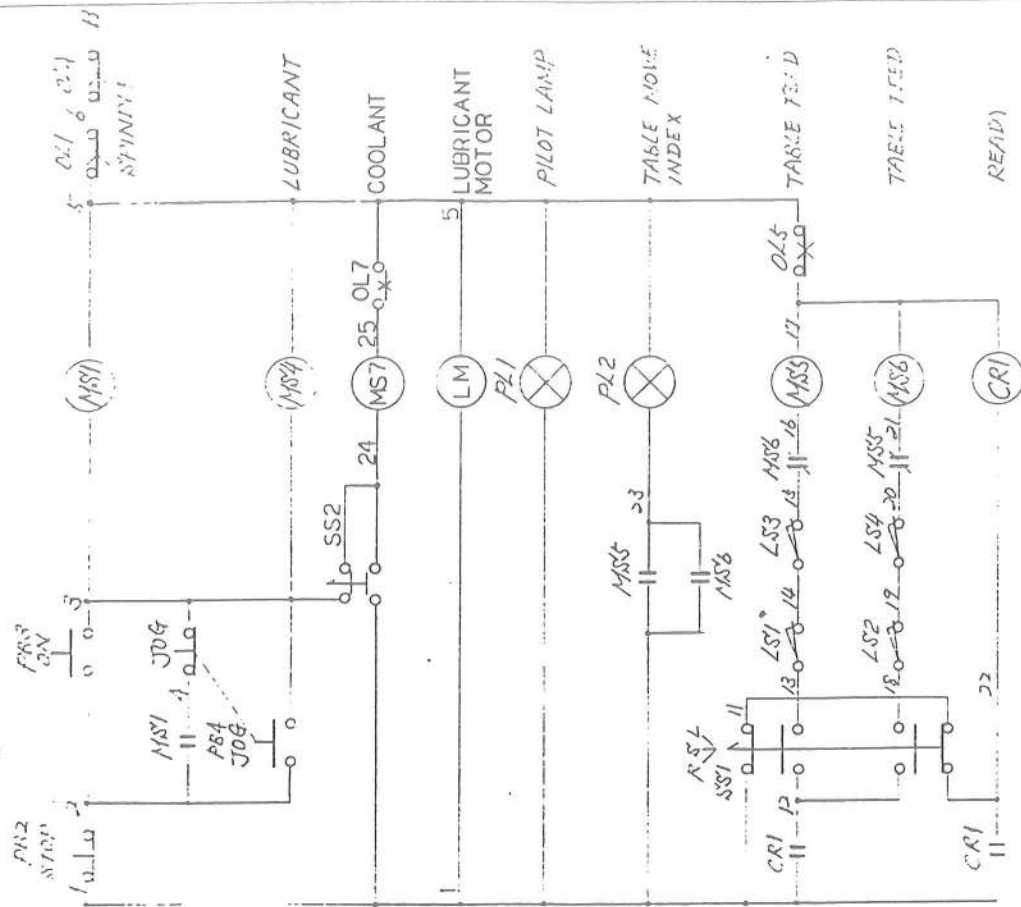
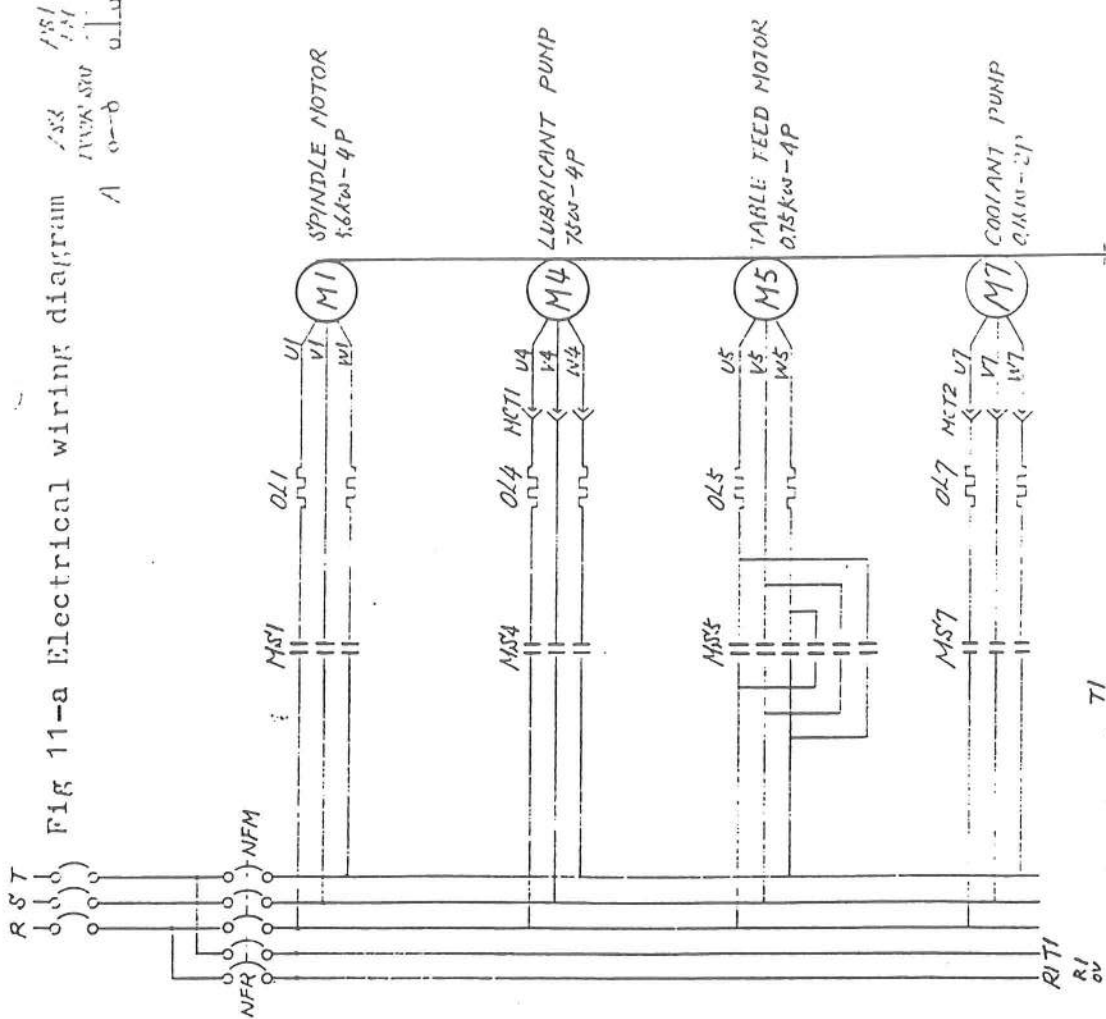
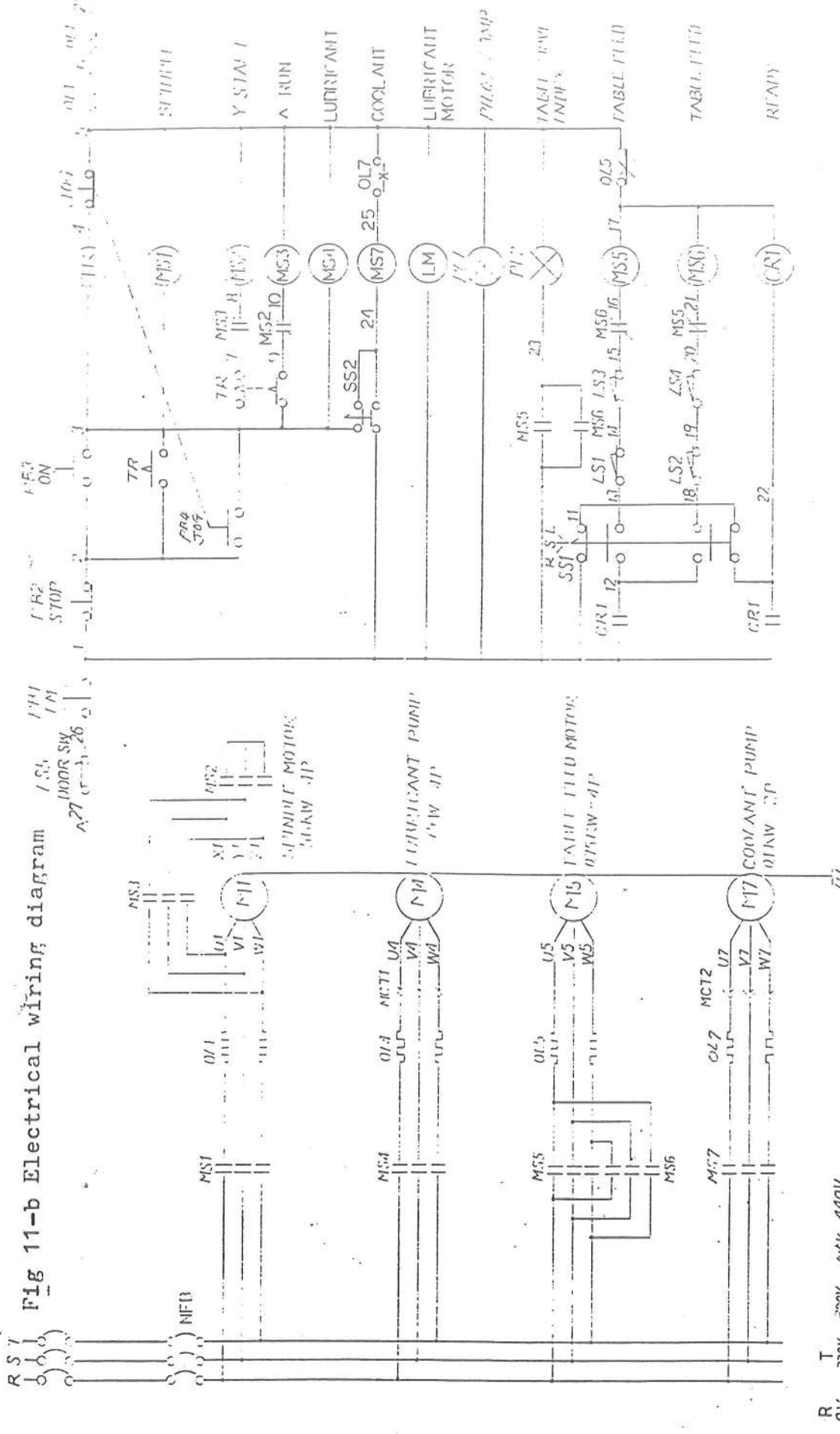


Fig 11-b Electrical wiring diagram



5.

Electrical System

Table 5 Electric parts

No	Symbol	Name	Specification	Q'ty	Remark
1	NFM	No fuse breaker	SA53 3P30A	1	
2	NFR	No fuse breaker	SA52 2P15A	1	
3	MS1	Magnetic Switch	Ho-20G ^{RH-18} / ₂₀	1	
4	MS2	Magnetic Switch	C-18G	1	
5	MS3	Magnetic Switch	C-20G	1	380V, 440V, No use for 550V
6	MS6	Magnetic Switch	C-18G	1	⚡
7	CR1	Magnetic Switch	C-11G	1	
8	MS4	Magnetic Switch	Ho-11G ^{RH-10} / _{2.2}	1	
9	MS5	Magnetic Switch	Ho-18G ^{RH-18} / ₄	1	
10	MS7	Magnetic Switch	Ho-11G ^{RH-10} / _{0.8}	1	
11	TB1	Terminal Board	STB 30E 4P	1	
12	TB2	Terminal Board	STB 20 15P	1	
13	TB3	Terminal Board	STB 20 24P	1	
14	TR	Timer	STP-N 10S	1	380V, 440V, No use for 550V
15	T1	Transformer	PT-40	1	
16	PL1	Pilot lamp	SP-301(White)	1	
17	PL2	Pilot lamp	SP-301(Red)	1	
18	LS5	Micro Switch	Z-15GW2	1	
19	LS1 LS2	Limit switch	Z-15GDB	2	
20	LS3 LS4	Limit switch	WL-D	2	
21	SS1	Optional Switch	RCa470-H32	1	
22	SS2	Optional Switch	ST-302	1	
23	PB1	Emergency switch	SB-309	1	
24	PB2	Button switch	SB-305 (Red)	1	
25	PB3	Button switch	SB-305 (Green)	1	
26	PB4	Button switch	SB-305 (Black)	1	
27	MCT ₂ ¹	Socket	3 cores	2	
28	M1	Spindle motor	5.5Kw-4P	1	
29	M4	Lubricating motor	75W-4P	1	
30	M5	Feeding motor	0.75Kw-4P	1	
31	M7	Motor for cooling pump	0.1Kw-4P	1	

6. Running Operation

6-1. Preparation for operation

1. Before starting this machine, you should clean up the following items; (a) sliding surfaces (b) circumference and bore of spindle (c) table surface.
2. According to oil recommendation (Fig. 8 Table 3-4) check the amount oil storing in various vessels and inspect the lubricating condition of different sliding parts.
3. According to the electrical wiring program (Fig. 11) The power source (220V, 60Hz) may connect to the R.S.T. terminal board of electrical control box.
4. Push the two no fuse breakers to "ON" position, the pilot lamp of control panel in front of spindle head should be bright.

6-2. Running operation of spindle (Fig. 12 13 & 14).

Loosen the clamping of spindle head (C1) (Fig. 13) before operation, clamping in left "A" direction and unclamping in right "B" direction.

(A). Rapid feed of spindle head (by hand).

Turn the hand wheel (H7) of spindle head rapid feed to right side to move spindle head downward and to left side to move it upward. 30mm displacement per revolution of hand wheel. Each graduated scale is 0.5mm on the collar (H9) of hand wheel. Above the hand wheel there is another collar (H10) of 0.02mm each graduated scale. First rotate the collar (H10) and out collar to the "0" position. Then fixed take the readings of displacement.

(B). Micro speed feed for spindle head.

Micro feed change lever (H6) of spindle connects to downward "B" direction and disconnects to upward "A" direction. To turn micro feed hand wheel (H8) of spindle to right side to move spindle head upward and left side to move spindle head downward. The displacement of each revolution is 30mm.

(C). The stop and start of spindle

There are three switches (S2, S3, S4) used for control. (S2) is starting switch. (S3) is inching switch. (S4) is stopping switch. (The rotation of spindle one direction only. Can't be reverse).

First push (S3) switch several times to make sure the spindle head lubricated inside by oil pump. Then start the (S2) switch for normal operation. You can stop the machine by switch (S4) if necessary. (The start and stop switches spindle would be linked with oil pump).

(D) Rotating speed change of spindle

The rotating speed change of spindle will be controlled by three change levers (H1) (H2) and (H3) positions. If you want to change the speed, first stop the motor of spindle.

If you intend to turn the main spindle by hand. First put the speed change lever (H3) in neutral position.

(E) Automatic feed of spindle head

Whenever the spindle is running or stopping you can operate automatic feed of spindle head by using automatic feed change lever. (H5)

((A) upward; (B) downward, middle is neutral position) When upward "A" is in neutral position, push change lever (H6) downward "B" direction.

In rotation of spindle, automatic feed of spindle head could be carried on.

(F) Automatic feed speed change of spindle head.

Speed change handle (H4) turns to the right or left for changing automatic feed speed of spindle head, and obtain 5 step feed speed.

The speed change handle can be operated during the rotation of spindle or automatic feed.

(G) Stopping of spindle head automatic feed

This operation could be used only when the spindle is downward. After the adjustment of automatic feed device of spindle head is finished, push the piston rod (D2) to right "B" direction. and the stop block of spindle is fixed on determined position (Fig 14).

The spindle head stops feed automatically when spindle head goes down to the piston rod (D2) and contact the stop block (D1).

When automatic feed stops, you can feed by hand to make the stop block (D1) and piston rod separately.

Before operation, loosen the clamping lever (C2) of table and clamping bolts (C3) of saddle.

6-3 A. Hand feed of table and saddle

1. The feed change lever (E3) of table and saddle, and rapid feed change lever of table will be placed in neutral position. Then push the feed hand wheel and mesh clutch for rotation. The table is moving according to the hand wheel direction.

2. Push the feed hand wheel (E2) of saddle and mesh the clutch forward by turning handwheel right, and backward by turning hand wheel left.

3. Each revolution of hand wheel makes table or saddle to move 6mm distance.

4. Every hand wheel with graduated scale 0.025mm on the graduation collar (E7) and (E8). The "0" position of graduation collar aim at the arrow head properly. The attached bolt fix it on the hand wheel shaft. Hence you may know the displacement of table or saddle.

B. Starting and stopping operation of automatic feed of table

1. Adjust and fix the feed stop block (D3)(D4) of saddle and limit switch (Li1)(Li2) of table feed. And put the stop block (D5)(D6) of saddle and limit switches (Li3)(Li4) of saddle on the desired position.

2. When starting switch (S5) on the gear box moving to left "a" or right

(b) position, the table will move right or left. If the starting switch is in neutral position, the table will stop the feeding.

In the case of emergency, push the emergency switch (S6), all of the power lines will be interrupted.

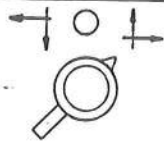
C. Automatic feed direction and rapid movement of table.

When feed change lever (E3) of table and saddle turns to left "a" direction. The saddle will get the forward or backward movement, if lever turns to right "b" direction the table will get the left or right movement.

After the lever (E3) is fixed on certain position, push the handle switch (S5) on the control panel to the left side, the saddle will be toward to backward (↓) or table toward to right direction (→). If push the handle of switch to the right side, the saddle will be toward to forward (↑) or table toward to left direction (←).

At the normal condition of speed feed, may push rapid change lever (E6) to right "b" direction. If you want table to move rapidly, turn lever (E6) to left "a" direction, But the lever is in neutral position no action at all.

The position of lever (E3) and switch (S5), and the feed direction of saddle and table. The relation between them is as follows.

The position of feed change lever (E3)		
The position of switch (S5)		
Feed direction	↓ forward	↑ backward
	right (→) direction left (←) direction Saddle Table	

D. Cutting speed change of table

Put the different position of lever to change high to low speed feed of table.

To use the different rotating position of the handle (E5) can make 6 speed changes, This speed change can be carried on under running operation of the machine.

E. Identification on automatic feed of table

1. If levers (E3) and (E6) either one or two are in neutral position, the switches of motor can be worked.
2. During operation, Levers (E3, E4, E5, E6) can be changed each other freely.
3. During rapid movement of saddle and table, The positions of cutting feed change lever (E4, E5) have no relation with them and keep original speed going on.

F. How to stop the automatic feed.

F-1 How to stop the feed of table moving toward left side.

When the elbow block (D3) devices on the right side in front of table touch the limit switch (Li1) the electrical circuit of feed motor will be interrupted. And the movement of table will stop at once. If you want to withdraw the table, the switch (S5) of motor turns from left "a" position to right "b" position, the direction of motor rotation will be reverse. The table will be withdrawn immediately.

F-2. How to stop the table moving toward to right side.

When the elbow block (D4) on the left side in front of table, touch the limit switch (Li2), The electrical circuit of feed motor will be interrupted. The movement of table will stop at once. If you want to withdraw the table, the switch (S5) of motor turns from right "b" position to left "a" position the direction of motor rotation is reverse, The table will be withdrawn in no time.

F-3 How to stop the saddle moving toward to forward. When the elbow block (D6) on the right side in the rear of saddle contact the limit switch (Li4), The electrical circuit of feed motor will be interrupted. The saddle stop moving at once. If you intend to withdraw the saddle the switch (S5) of motor turns from left "a" position to right "b" position, the direction of motor rotation is reverse, The saddle will be backward suddenly.

F-4 How to stop the saddle moving toward to backward.

When the elbow block (D5) on the right side in the front of saddle, contact the limit switch (Li3), the electrical circuit of feed motor will be cut. The saddle stop moving at once. If you are willing to withdraw the saddle, the switch of motor turns from right "b" position

to left position. The direction of motor rotation will be reverse the saddle will be backward suddenly.

G. Identification on automatic feed stop.

1. The operation method is same between the automatic rapid moving stop and automatic feed stop of saddle and table.

2. In the every respect of automatic feed you can continue to operate by hand under motor switch in neutral position. Otherwise when elbow block and limit switch are separate the electrical circuit of motor is automatically connected. The operation of automatic feed will be recovered again. But you should pay much attention to this point.

3. The elbow blocks and limit switch are under following cases, the motor switch (S5) has no action at all.

a. (D3)(Li1) and (D5)(Li3) operating same time

b. (D4)(Li2) and (D6)(Li4) operating same time.

If you meet above cases, you may operate to feed by hand make the elbow block and limit switch separate. Then motor switch (S5) can be recovered to start.

7. Clamping devices

In order to maintain better finishing and accurate surface, the following portions should be clamped tightly before cutting operation.

7-1 Spindle head clamping (Fig 13)

The clamping operation of spindle head should be carried out by right side clamping lever (C1) turning to left "A" direction (But loose in right "B" direction)

7-2 Table clamping (Fig 16)

The clamping operation of table should be carried out by the attached wrench screwing the bolts (C2) of table's sliding parts tightly. (In the case of boring or drilling operation).

7-3 Saddle clamping (Fig 16)

The clamping operation of saddle should be carried out by the attached wrench screwing the bolt (C3) of saddle under table. (in case of boring or drilling operation)

8. Adjustment:

After installation of the machine or in operation, you find the condition of the machine is abnormal. The following steps should be taken. (Inspection or adjustment).

8-1 The level adjustment of the machine (Fig 17)

1. Place the two levels of 0.02-0.05mm/1000mm accuracy on the table perpendicular to each other.
2. Loosen the nuts (A1) of anchor bolts (A2)
3. Loosen the leveling fixed nuts (L3)
4. Loosen the leveling bolts (L2) and adjust the level (6 leveling bolts to be adjusted). Until the leveling is accurate.
5. Locking the leveling fixed nuts (L3) (don't rotate the leveling bolts)
6. Locking the anchor bolts with nuts (A)
7. Recheck the air bubbles displacement on the level, If no movement that is right, or should be readjusted.

8-2 Adjustment of spindle (Fig 18)

If you find loose spindle or temperature rise of spindle bearing. The readjustment should be taken carefully.

1. Take apart the cover of spindle head (HC1)
2. Loosen the fixed nuts (N1)
3. Screwing the adjustable nuts (N2) not so loose, not so tight (because of temperature rise of bearing)
4. Screwing the fixed nuts (N1), (preventing the adjusted nuts (N3) from loose)
5. Reassembling the spindle head

8-3 Adjustment of V-Belt of spindle transmission (Fig 19)

After longtime service the V-Belts will be loose, so the adjustment should be taken according to the following steps.

1. To take the window cover (HC3) of spindle head apart and observe the situation of V-Belt.
2. Loosen the 4 installation bolts (T1) of motor
3. Through the window, loosen the adjustable bolts (T2) and move the position of motor (M1), you can feel the tension of V-Belts by finger suitable or not, If it is right, screw the installation bolts of motor tightly.
4. Reassembling the window cover (HC3)

8-4 Replacement of V-Belts of spindle transmission (Fig 19)

The replacement of V-Belts should be taken when it is worn or broken. The following steps should be carried.

1. Open the window (HC3) of spindle head and observe the situation of V-Belts.
 2. Take out the 4 installation bolts (T1) and adjustable bolts (T2) of motor.
 3. Move the motor and take off the 4 used belts.
 4. Replace with the new belts.
 5. Move the motor to original position, and reinstall the installation bolts (T1) and adjustable bolts (T2).
 6. Adjust the belt tension by adjustable bolts (T2), until it is suitable condition (not loose or tight), if you find the 4 belts either loose or tight change loose one or tight one.
 7. Reassemble the window cover (HC3)
- 8-5 Adjustment of automatic feed V-Belts of spindle head. (Fig 18 & Fig 20)

1. Take the cover (HC1) of spindle head apart
2. Loosen the tension strength of support locking nuts (FT1)
3. One hand use the wrench to screw the tension support FT2 and make the belt tension to moderate condition. Other hand, tighten the support locking nuts (FT1).
4. Reassemble the cover of spindle head.

8-6 Adjustment of sliding surfaces of gib. (Fig 21, Fig 23)

When sliding surfaces are loose, make a suitable adjustment.

A. Adjustment of side gib of spindle head (Fig 21)

1. Loosen all of locking nuts (K3)
2. Screw all of locking bolts (K2) to make moderate tight for side gib (not too tight to slide the spindle head up and down, the condition of tightness should be consistent).
3. Tighten the fixed nuts (K3).
4. Try to ascend and descend the spindle head and observe the tightness.

B. Adjustment of gib inside of spindle head (Fig 21)

1. Tighten the locking bolts (K8) of pressing bar.
2. Screw the bolts (K5) to adjust the inside gibs (K4).
3. Try to ascend and descend the spindle head and observe the tightness.

C. Adjustment of gibs for table (Fig 23)

1. Loosen the locking nuts of bolts (KT2)
2. Screw the lock bolts (KT2) gibs to adjust the position of gibs (KT1).
3. Tighten all of the lock nuts (KT4).
4. Try to swing the table and observe the degree of tightness

D. Adjustment of gib of saddle (Fig 23)

1. Loosen the locking nuts (KT7) of gibs' bolts (KT6)
2. Screw the locking bolts (KT7) of gibs to adjust the position of them (gibs)
3. Tighten all of the locking nuts (KT7)
4. Try to swing the saddle and observe the degree of tightness.

8-7 Adjustment of all feed lead screws (Fig 22, Fig 24)

After long time service the feed lead screw has been worn out and backlash increased gradually the adjustment should be taken if necessary.

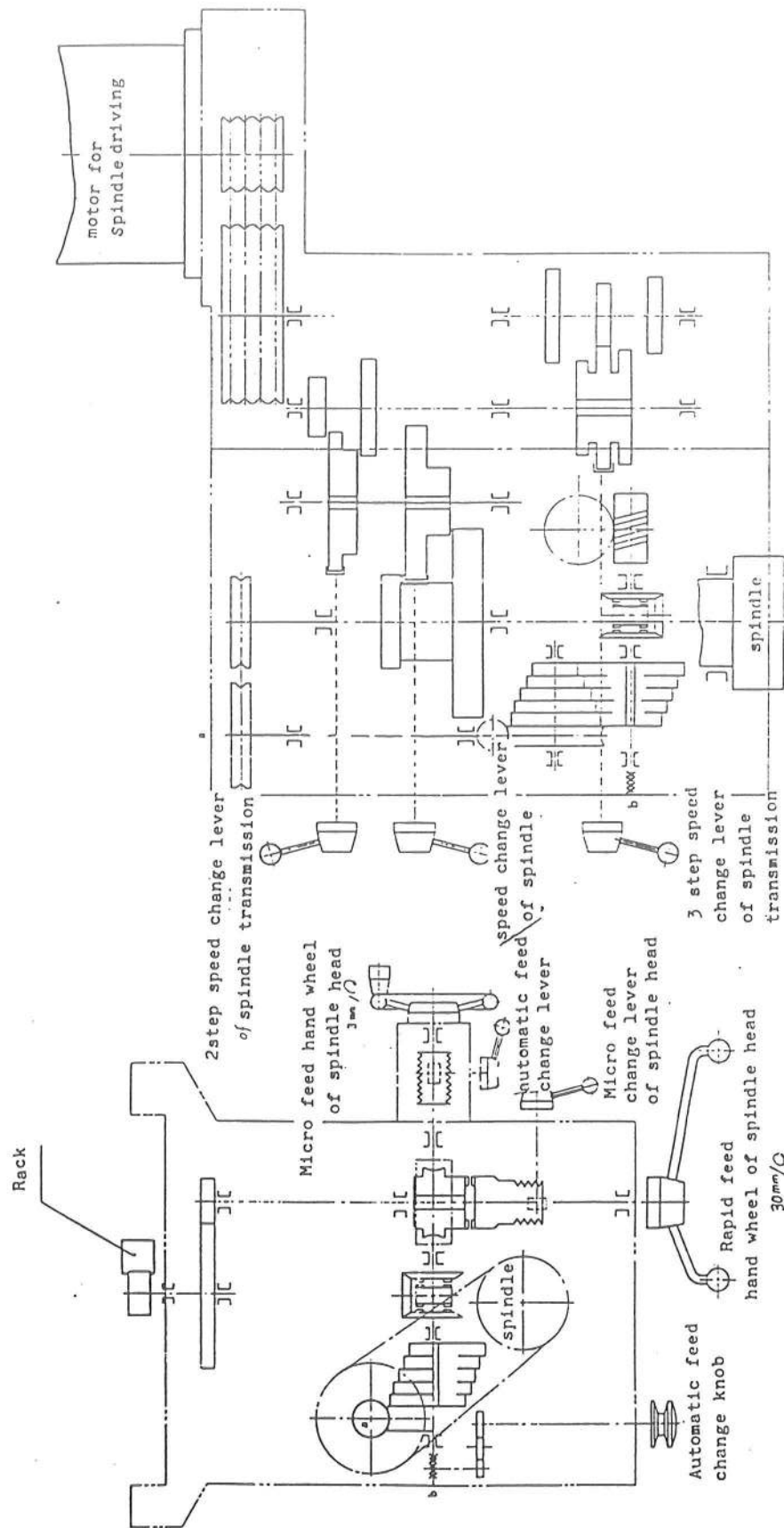
8-7-1 Adjustment of feed lead screw of table (Fig 24)

1. Disassemble the side cover (TS1) of table and right & left feed lead screw support (TS2)
2. Push the table toward to left side to expose the feed nuts (N3).
3. Loosen the adjustable nuts (N3) of 3 bolts (N4) and adjust the position.
4. Screw the adjustable nuts (N3) toward "B" direction, and make the feed lead screw only for rotation without looseness see Fig 24.
5. Tighten the adjustable nuts of 3 bolts
6. Push the table to original position
7. Reassemble the support (TS2) of feed lead screw and side cover (TS1) of table

8-7-2 Adjustment of feed lead screw of saddle (Fig 22)

1. Move the table to extreme front position.
2. Disassemble the bolts of end bearing of feed lead screw, and rotate the bearing downward.
3. Loosen the adjustable nuts of fixed bolts (N9).
4. Use the 5 mm diameter of steel bar (200 mm long) to insert the outside hole of adjustable nut (N3), and rotate the nut to "A" direction (left hand) to reduce the backlash to minimum.
5. Try to swing feed hand wheel of saddle and observe the moderate amount of adjustment.
6. Tighten the adjustable nuts of fixed bolts (N9).
7. Recover the original position of bearing and lock it tight.

Fig 12 Spindle head driving



Control panel

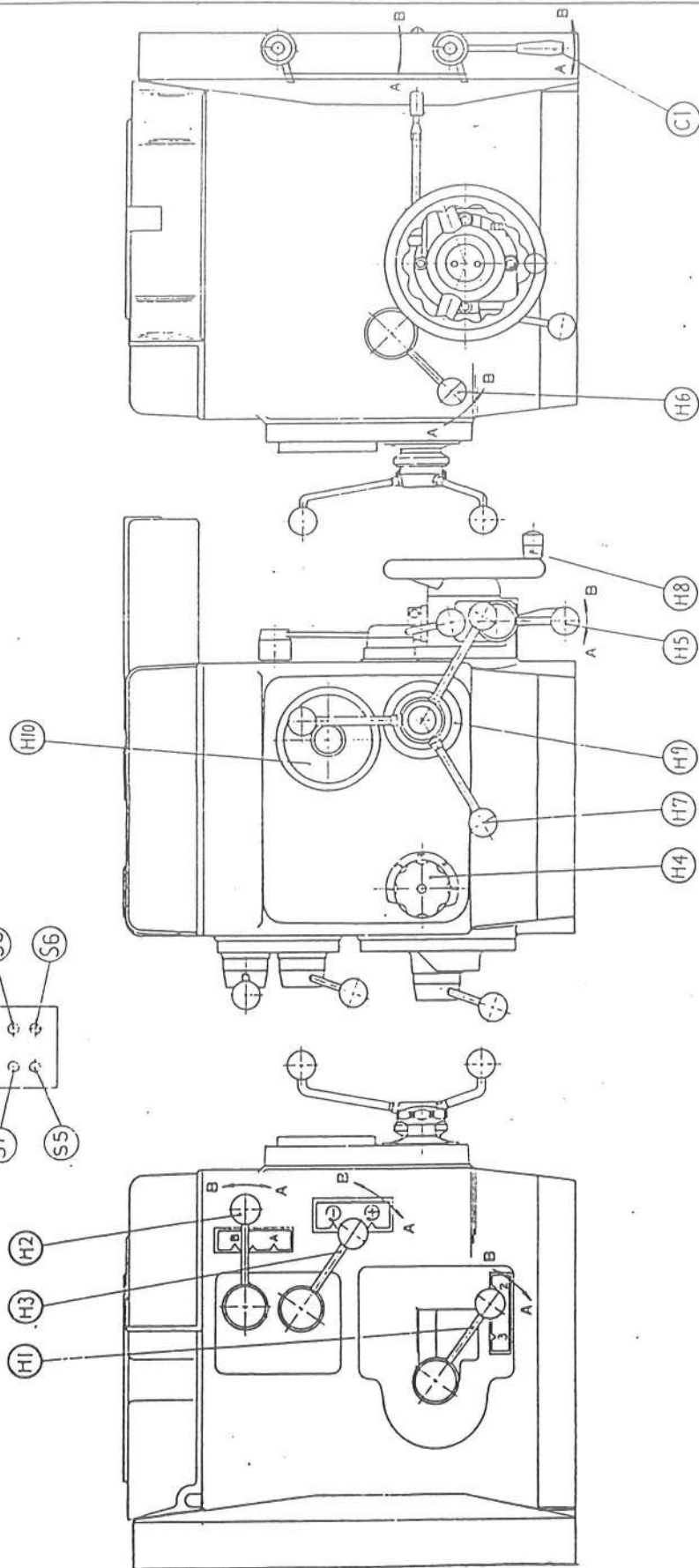
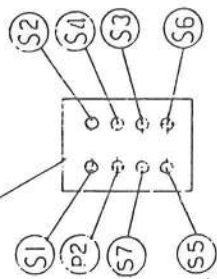


Fig 13 Operation illustration of spindle head

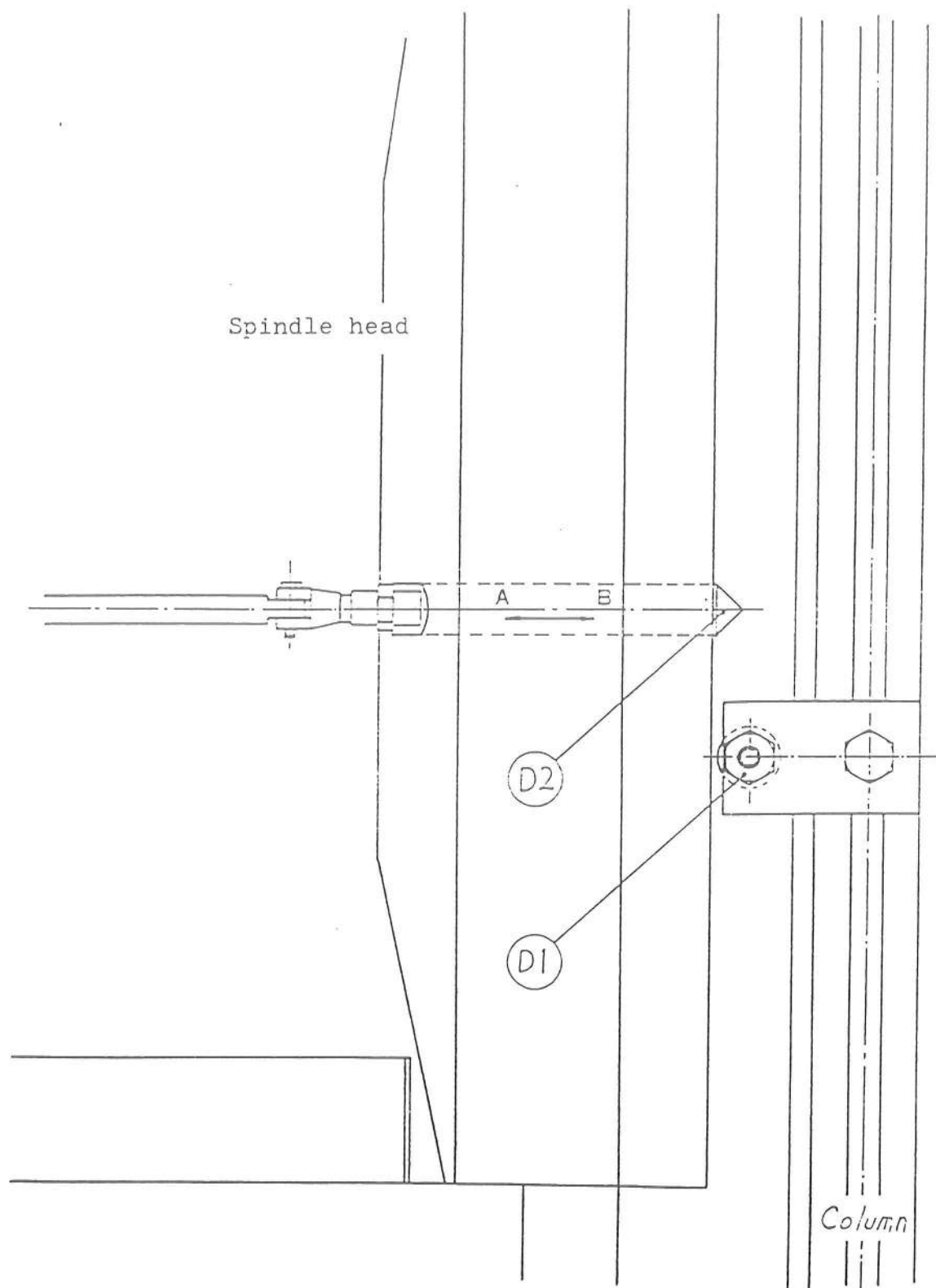


Fig 14 Setting relation of spindle head

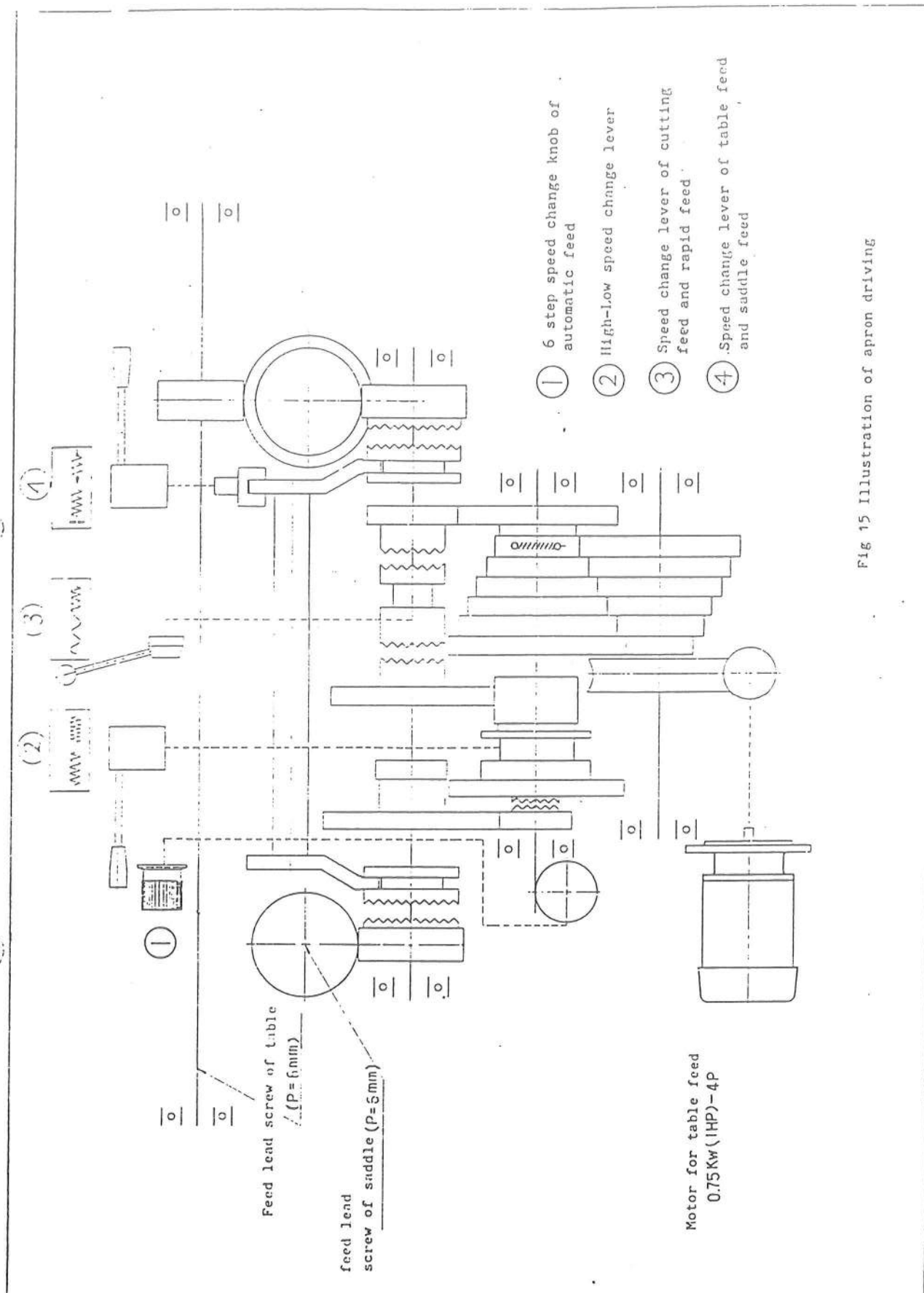


Fig 15 Illustration of apron driving

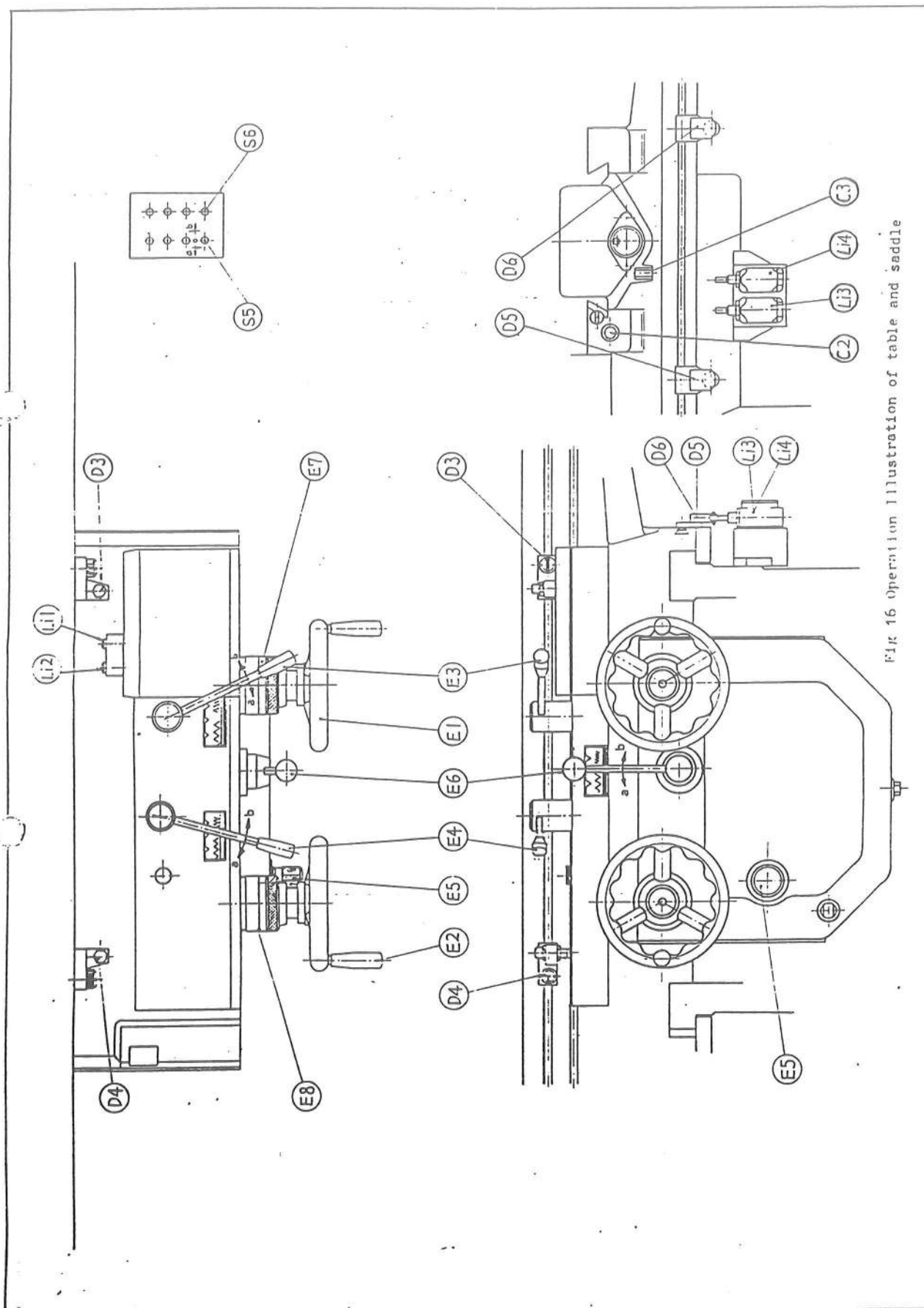


Fig 16 Operation illustration of table and saddle

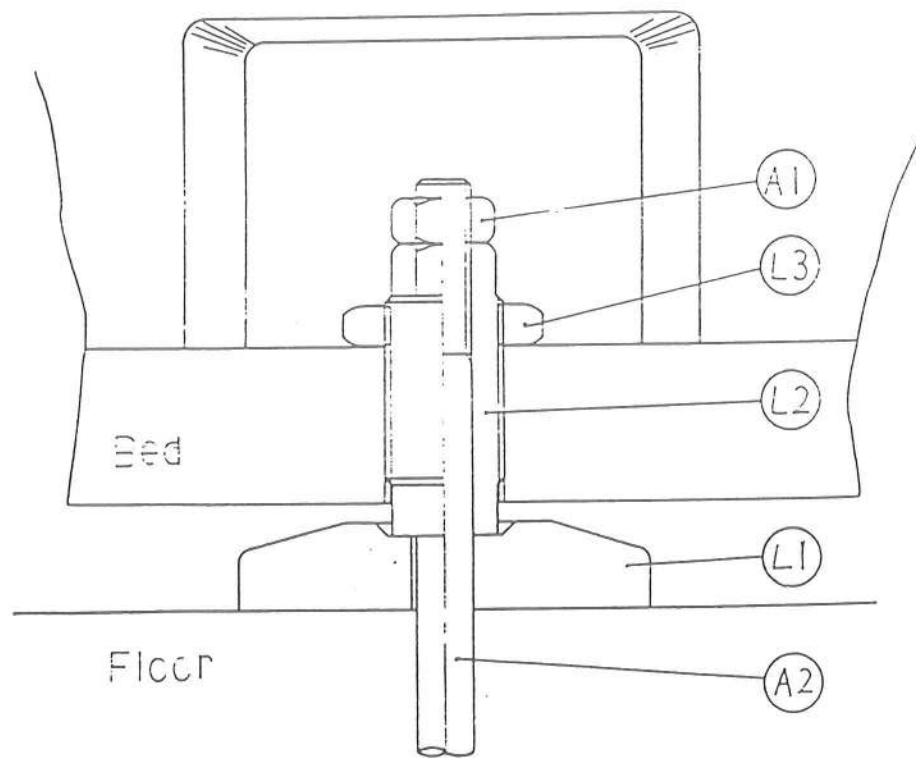


Fig 17 Adjusting machines level

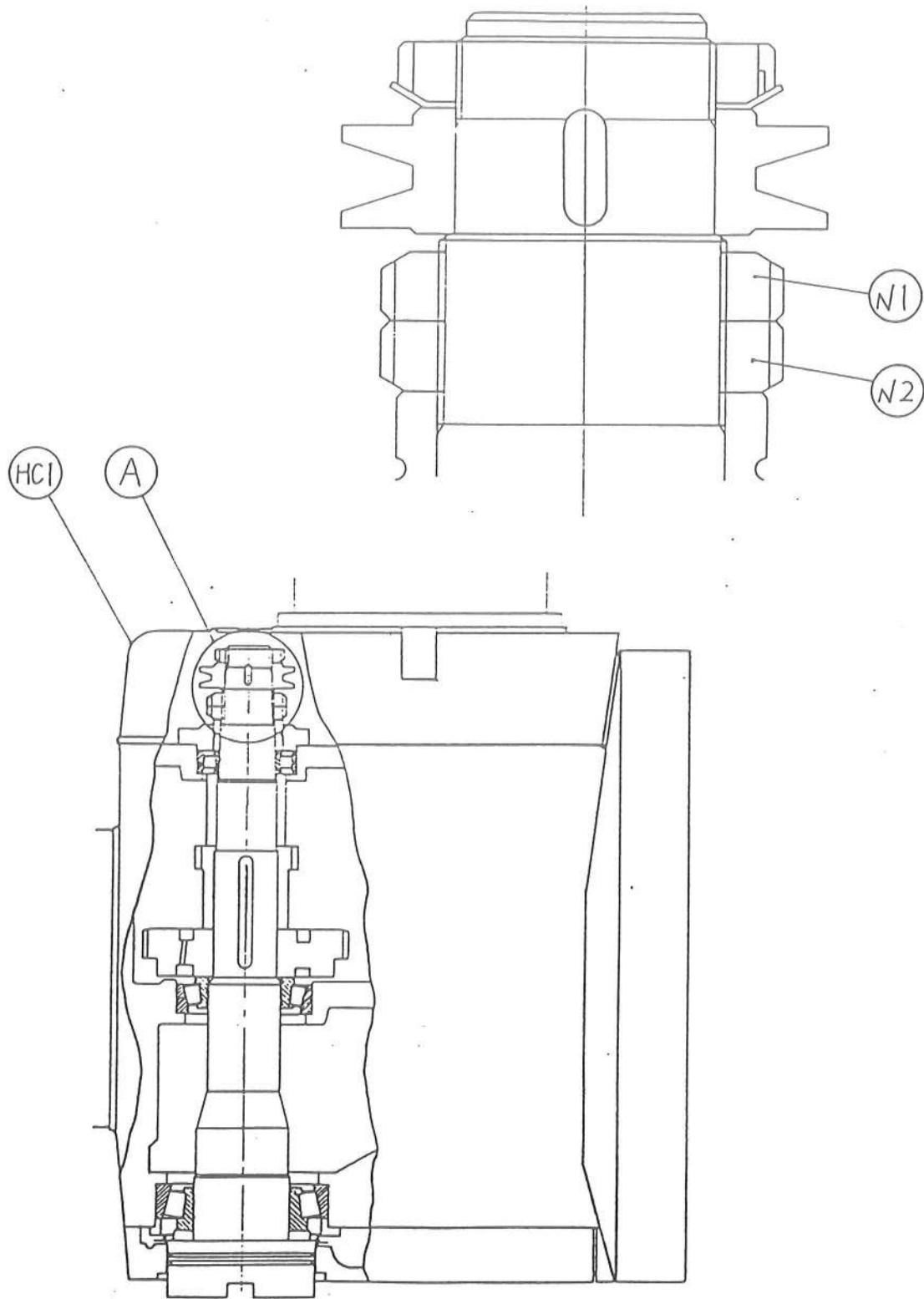
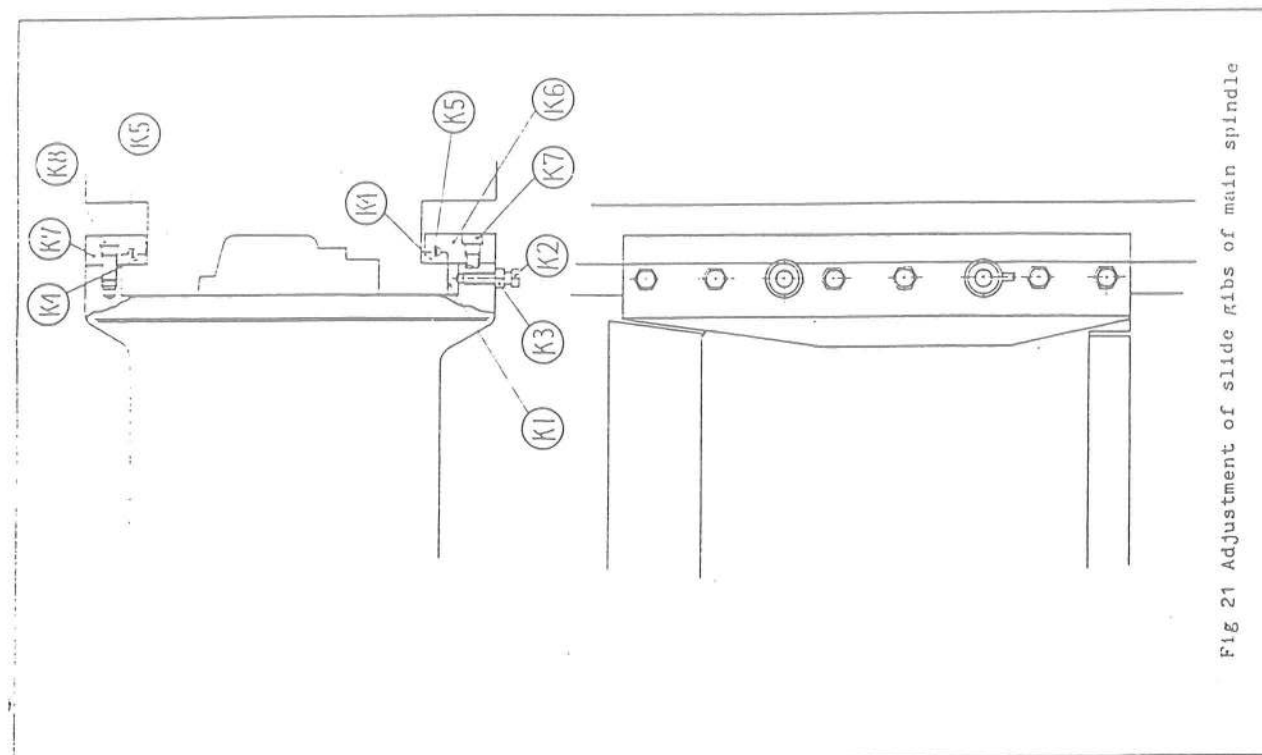
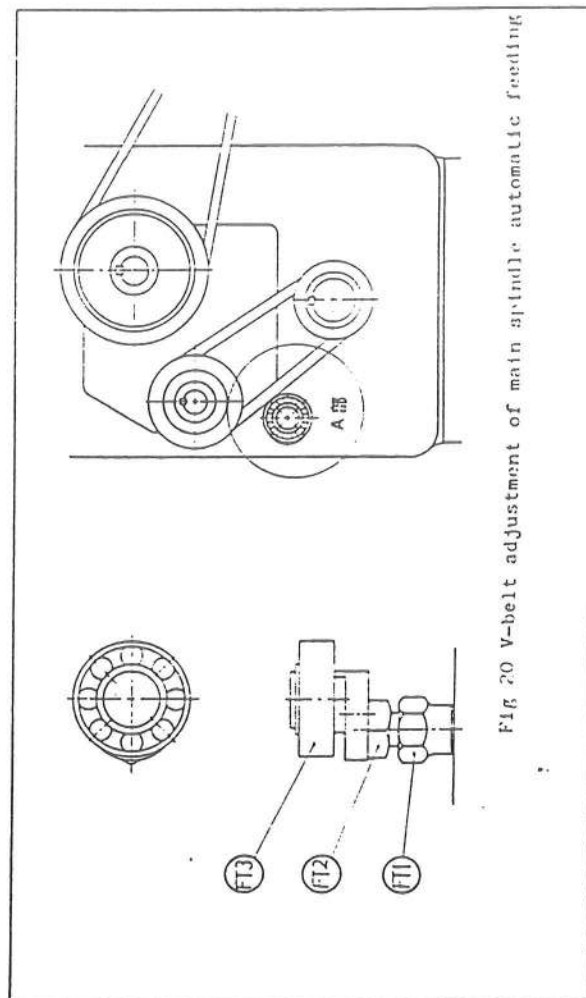
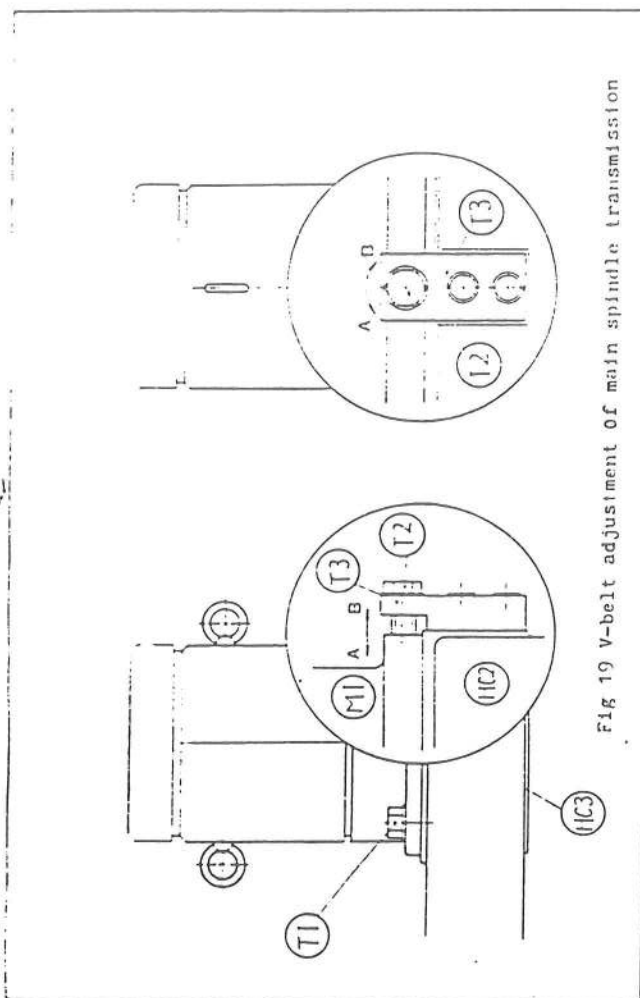


Fig 18 Adjustment of main spindle.



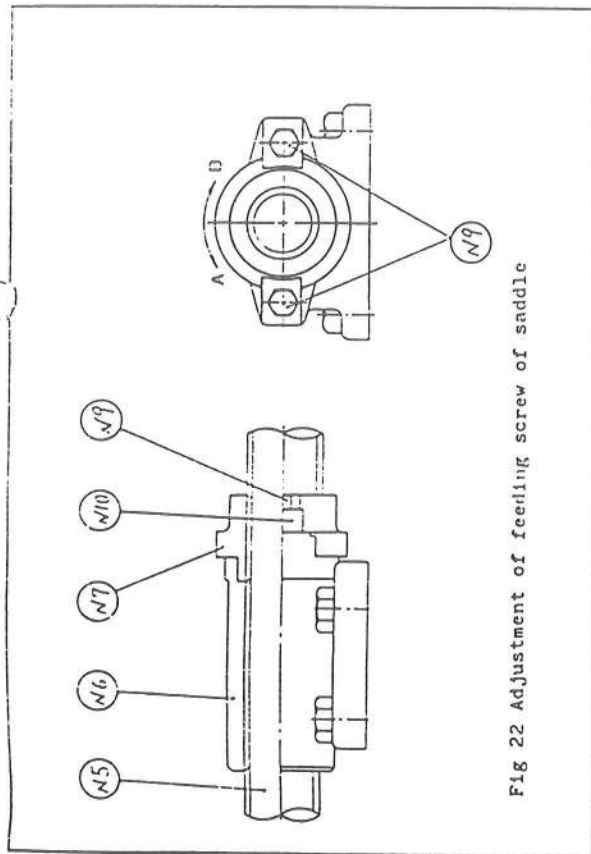


Fig 22 Adjustment of feeding screw of saddle

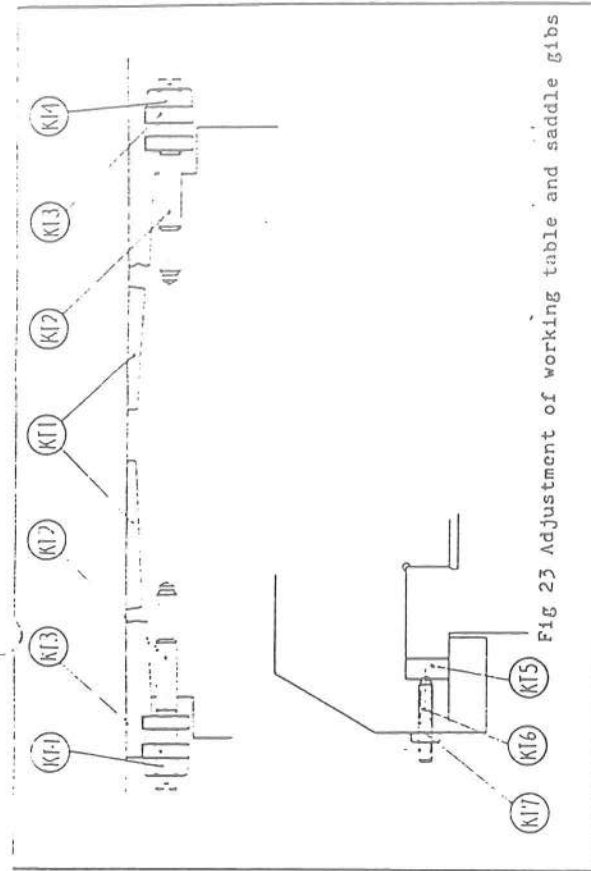


Fig 23 Adjustment of working table and saddle gibs

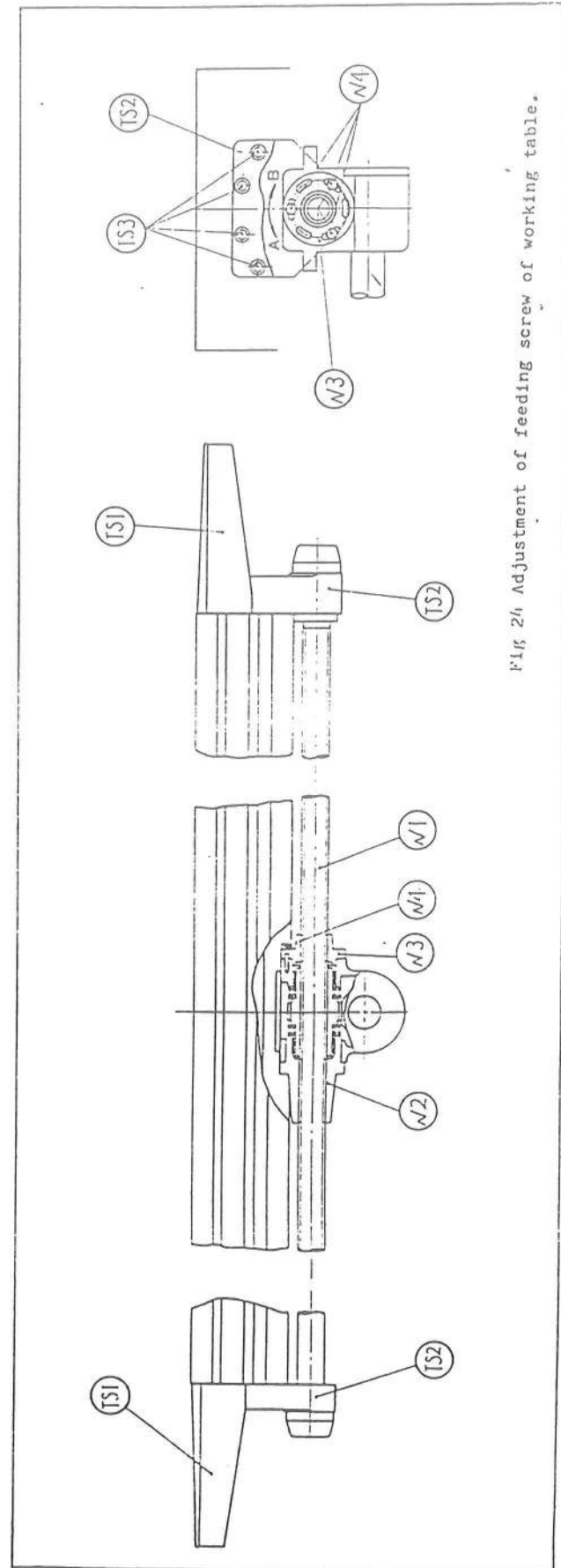


Fig 24 Adjustment of feeding screw of working table.

9. REFERENCE FOR MACHINING

9-1 CUTTING SPEED

The cutting speed of milling cutter can be found as follows:

$$V = \frac{\pi DN}{1000}$$

V= CUTTING SPEED (M/MIN)

D= DIAMETER OF CUTTER (MM)

N= REVOLUTION OF CUTTER PER MINUTE. (R.P.M.)

The cutting speed is accorded to metal of workpiece, metal of cutter and some condition of machining. The followings are the considerations for machining:

1. For longer life time of the milling cutter, using the lower cutting speed.
2. For rough cutting surface using lower cutting speed and higher feed; For fine cutting surface using higher cutting speed and lower feed.
3. When some special workpiece to be cut, it is better to use medium cutting speed at first, then increase the speed. Gradually up to adapting condition.

The suitable cutting speed is shown in table 6.

9-2 FEED

The table feed is based on the revolution of cutter per minute, number of teeth in cutter and feed per cutting edge. It can be found as follows:

$$S = N \times S_x \times Z$$

S= FEED PER MINUTE (MM/MIN)

N= REVOLUTION OF CUTTER (R.P.M)

Z= NUMBER OF TEETH. (EDGE)

S= FEED PER CUTTING EDGE. (MM/TOOTH- R)

The feed of per cutting edge is used usually to account the table feed.

The suitable feed per cutting edge for high speed steel, and tungstencarbide steel is shown in chart 7.

9-3 DEPTH OF CUTTING

The depth of cutting varies with different kinds of cutting surfaces which is shown probably in table 8.

TABLE 8 DEPTH OF CUTTING

KIND OF CUTTING SURFACE	DEPTH OF CUTTING
FINE CUTTING SURFACE	0.3-0.5
GENERAL CUTTING SURFACE	0.5-1.5
ROUGH CUTTING SURFACE	1.5-5

Table 6

Work			Cutting speed			
Material		Brinell hard- ness HB	High-speed steel cutter		Super-hard alloy cutter	
			m/min		m/min	
Special steel	Hard	300 400	13	15	30	50
	Tough	220 300	15	23	50	75
	Annealed	180 220	23	35	75	108
Low- carbon steel	Malleable	152 197	28	46	90	130
	Cuts well	150 180	35	46	108	130
Cast iron	Hard	220 300	15	23	50	75
	Medium hard	180 220	23	33	75	108
	Soft	150 180	35	46	108	130
Brass and Bronze	Hard	150 250	21	46	63	130
	Medium hard	100 150	46	83	130	200
	Cuts well	80 100	83	116	200	330
Magnesium and its alloys			116	500		
Aluminum and its alloys			66	500		
Plastic			66	500		

Note: The above table should be regarded as a general criterion. Attention must be paid to the following when operating the machine.

Table 7-1

Milling cutter	Work		Feed amount per tooth mm.					
	Quality of materials	Brinell hardness HB	Face milling cutter	Plane milling cutter with helical teeth	Slotting saw and side milling cutter	End mill	Formed cutter	Saw blade milling cutter
High-speed steel milling cutters	Special steel	Hard Tough Annealed	300 400 220 300 180 220	0.1 0.13 0.2	0.075 0.125 0.175	0.075 0.1 0.125	0.05 0.075 0.1	0.025 0.05 0.05
	Low-carbon steel	Malleable Cuts well	152 197 150 180	0.25 0.3	0.2 0.25	0.13 0.175	0.125 0.13	0.075 0.035
	Cast iron	Hard Medium hard Soft	220 300 150 250 150 180	0.27 0.325 0.4	0.2 0.25 0.325	0.13 0.175 0.225	0.13 0.175 0.2	0.075 0.0075 0.1
	Brass and bronze	Hard Medium hard Cuts well	150 250 100 150 80 100	0.225 0.35 0.55	0.225 0.35 0.55	0.13 0.2 0.325	0.125 0.175 0.27	0.05 0.075 0.125
	Magnesium and its alloys			0.55	0.45	0.325	0.27	0.125
	Aluminum and its alloys			0.55	0.45	0.325	0.27	0.125
	Plastic			0.375	0.3	0.225	0.175	0.1

Table 7-2 (continue)

Milling cutter	Work		Feed amount per tooth mm.					
	Quality of materials	Brinell hardness (HB)	Face milling cutter	Plane milling cutter with helical teeth	Slotting saw and side milling cutter	End mill	Formed cutter	Saw blade milling cutter
Super-hard alloy milling cutter	Special steel	Hard	0.25	0.2	0.13	0.125	0.075	0.075
		Tough	0.3	0.25	0.175	0.13	0.1	0.075
		Annealed	0.35	0.27	0.2	0.175	0.1	0.1
	Low-carbon steel	Malleable	0.35	0.27	0.2	0.175	0.1	0.1
		Cuts well	0.4	0.325	0.225	0.2	0.125	0.1
	Cast iron	Hard	0.3	0.25	0.175	0.13	0.1	0.075
		Medium hard	0.4	0.325	0.25	0.2	0.125	0.1
		Soft	0.5	0.4	0.3	0.25	0.13	0.125
	Brass and bronze	Hard	0.25	0.2	0.13	0.125	0.075	0.075
		Medium hard	0.3	0.25	0.175	0.13	0.1	0.075
		Cuts well	0.5	0.4	0.3	0.25	0.13	0.125
	Magnesium and its alloys		0.5	0.4	0.3	0.25	0.13	0.125
Aluminum and its alloys		0.5	0.4	0.3	0.25	0.13	0.125	
Plastic		0.573	0.3	0.225	0.175	0.125	0.1	

10. TROVELE SHIOTING

Trouble	Possible causes	Correction
1. Running out of cutter	1. Not accurate for cutter edges 2. Not accurate for cutters' holder 3. Dirty inside the spindle hole	1. Regrinding the cutter edges. 2. Replace new one 3. Clean it.
2. Chatter	1. Tool shank too long or too fine 2. Lack of rigidity in the machine, fixture, or work-piece. 3. Spindle bearing too loose or worn 4. Feed rate too high 5. Dull of cutter 6. Cutting angles of cutter not proper 7. Back-lash of feed screw too loose 8. Grit of table too loose	1. Replace suitable one 2. Improve rigidity. 3. Adjust or change it. 4. Reduce feed rate 5. Resharpen it 6. Regrind it 7. Adjust by the adjustable nut. 8. Adjust by the adjustable screws.
3. Poor surface finish	1. Feed too high 2. Dull tool 3. Speed too low 4. Insufficient number of cutter teeth	1. Reduce feed or increase cutting speed 2. Resharpen it 3. Increase surface speed of cutter 4. Adding more teeth for cutter
4. Vibration	1. Loose of levelling screws 2. Torn or mismatch of V-belt 3. Motor out of balance 4. Unbalance of pulley	1. Tighten it 2. Replace with new set. 3. Replace it 4. Replace it.
5. Cutter burns	1. Insufficient lubricants 2. Speed too high	1. Add more sulfur base oil 2. Reduce speed
6. Teeth Bearing	1. Feed too high 2. Lack of rigidity of workpiece	1. Reduce feed 2. Improve design of workpiece or fixture
7. Out of dimension of workpiece after taking off from fixture	1. Not suitable of fixture 2. Some residual stress in the inside of workpiece 3. Rough surface	1. Improve design of fixture 2. Improve heat treatment. 3. Refinishing.
8. Stepped machining surface	Center line of spindle not in perpendicular to table or slide way of carriage or bed.	Readjust it correctly

11. MAINTENANCE SCHEDULE

ITEM	POSITION	FREQUENCY			
		DAILY	WEEKLY	MONTHLY	YEARLY
1. LUBRICATION	ACCORDING TO TABLE 3	1	1-2		
2. ACCURACY	ACCORDING TO ACCURACY INSPECTION CHART				1
3. CLEANING AND CORROSION PROTECTION	ALL SLIDING SURFACES, TABLE SURFACE, T-SLOTS, SPINDLE NOSE, SPINDLE HOLE, ALL EXPOSED FINISHING SURFACES.				
4. ADJUSTING OF GIBS	TABLE, SADDLE, SPINDLE HEAD			2	
5. ADJUSTMENT OF FEEDING SCREWS	TABLE, SADDLE, SPINDLE HEAD			1	
6. ADJUSTING OF FIXED MECHANISM	TABLE, SADDLE, SPINDLE HEAD			2	
7. LEVELLING AND TIGHTEN	FOUNDATION BOLT & SETTING SCREWS				2
8. TEMPERATURE OF BEARINGS CHECK UP	SPINDLE, GEAR BOX, BEARINGS MOTORS AND HYDRAULIC SYSTEM			1	
9. VIBRATION AND SOME ABNORMAL MOVEMENT CHECK UP	MOTORS, HYDRAULIC SYSTEM, GEARS AND OTHER TRANSMISSION		1		
10. ELECTRIC CIRCUIT CHECK UP	MOTORS, SWITCHES CONNECTING POINTS OF WIRE, PUSH BUTTONS			1	

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