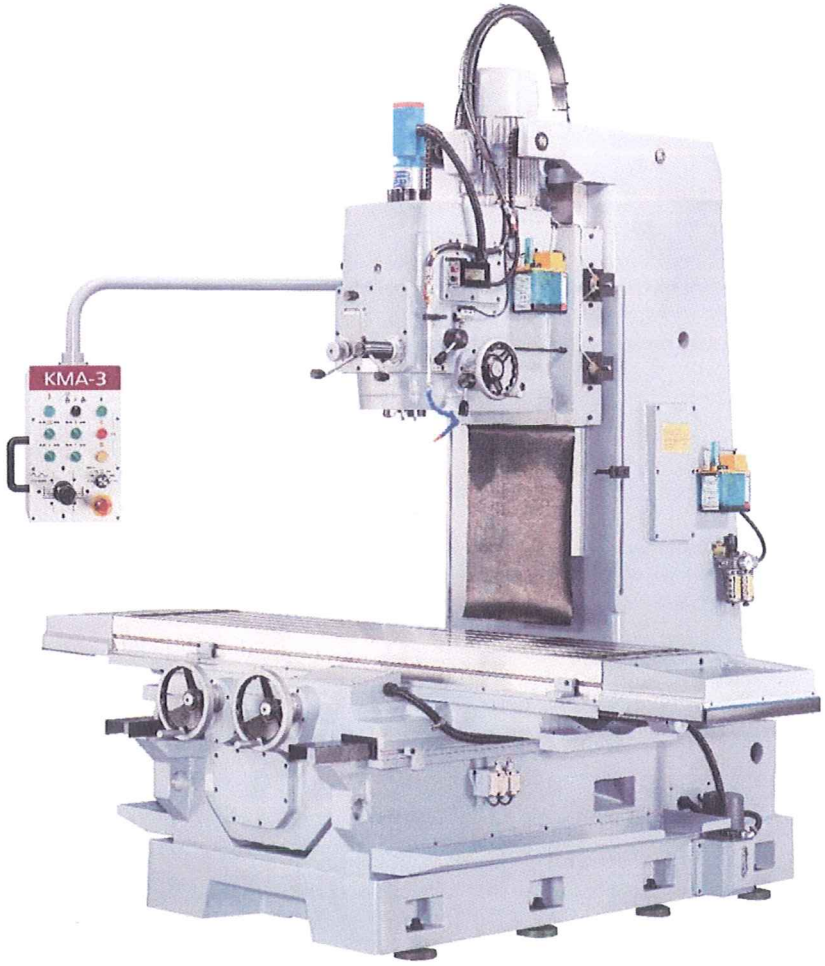
SHARP

VERTICAL BED TYPE MILLING & BORING MACHINE

KMA-1, KMA-2, KMA-3, KMA-3H

OPERATION MANUAL



MODEL KMA-3

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1. General instruction of machine

1-1 Specifications (KMA-2)

CAPACITY	
Table Travel (longitudinal)	1200mm(47-1/4 in)
Table Travel (cross)	450mm (17-11/16 inch)
Vertical spindle head travel(Vertical)	550mm (21-5/8 inch)
Vertical spindle nose to table top	100-650mm(3-15/16~25-5/8 inch)
Vertical spindle center to column front	450mm (17-11/16 inch)
TABLE	
Table working area	1900 x 450mm (74-13/16 x17-11/16 inch)
T slot (Wide x No. x Pitch)	18mm x 5 x 80mm (0.709 x5 x3-1/8 inch)
Table top to floor	800mm(33-1/2 inch)
SPINDLE HEAD	
Spindle Nose	ISO R297 No.50
Vertical Spindle speeds	45-1500RPM (60Hz) 35-1250RPM (50Hz)
No. of Vertical spindle speed	12 steps
Feeds (Vertical spindle)	0.05-0.2(0.002-0.008)mm/rev(ipr)
FEED	
Rapid traverse (longitudinal & cross)	2880mm/min (60Hz) 2400mm/min (50Hz)
Feed rates (longitudinal & cross)	28-875mm/min (60Hz)23-730m/min(50Hz)
Change of feed	12 steps
MOTORS	
Vertical spindle	AC7.5kW (10HP)-4P
Feed	AC1.5kw (2HP)-4P
Lubrication	AC3.5kw (1/4HP)-2P
Cutting fluid	AC0.15KW (1/6HP)-2P
MACHINE SIZE	
Machine height	2600(102-3/8)mm(in)
Floor space (longitudinal x cross)	3800x2210(149-5/8x87)mm(in)
Net weight (approx.)	5200(11,440)kgs(lbs)
Standard color	Gray

Standard accessories :

1. Cutting fluid device	1 unit
2. Tools and box	1 set
3. Leveling block	6 pcs
4. Leveling bolts & nuts	6 pcs
5. Draw bar	1 pc

Optional Accessories :

1. Digital read out
2. Power draw bar

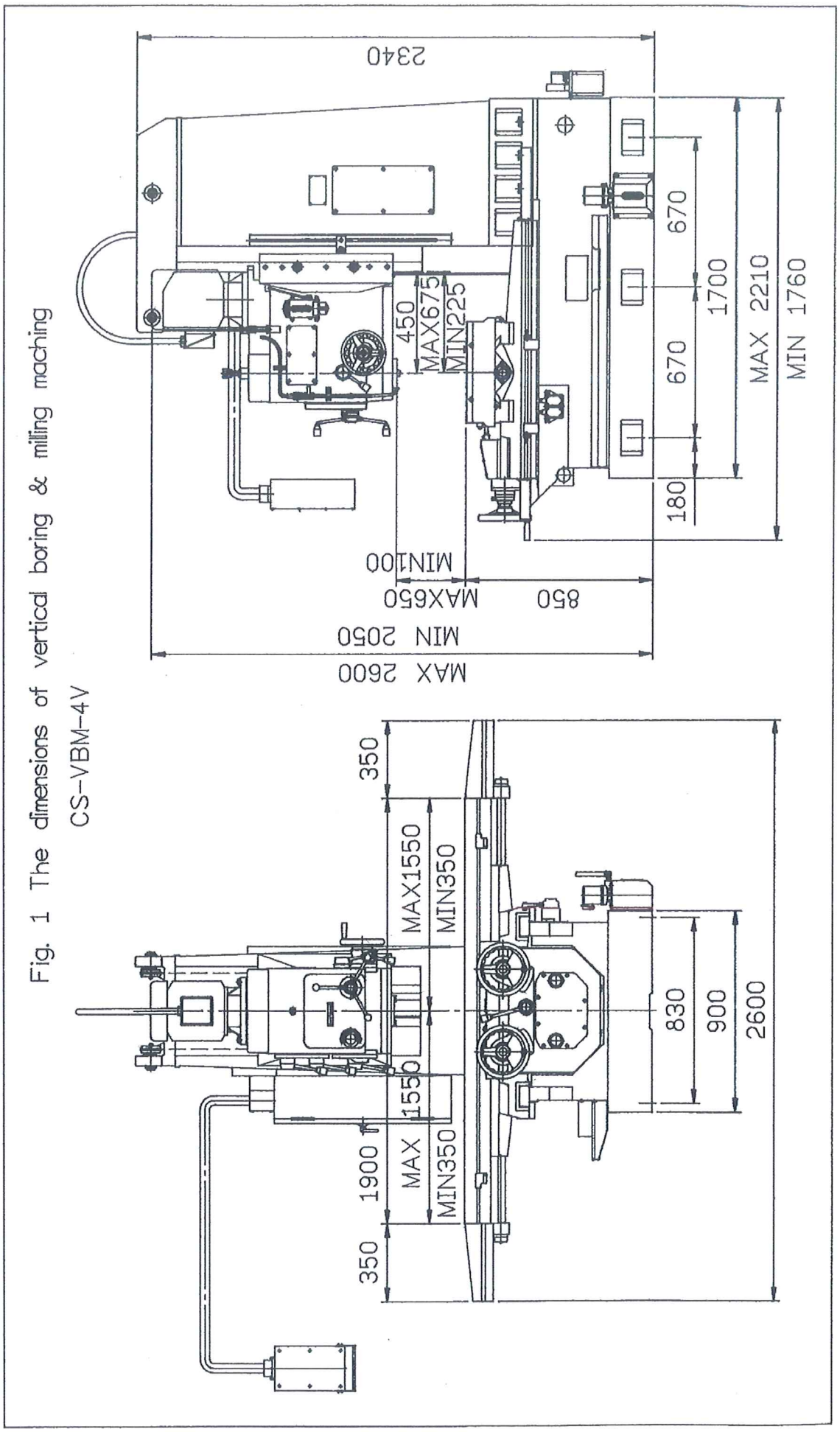


Fig. 1 The dimensions of vertical boring & milling maching CS-VBM-4V

Fig. 2 Dimension of table

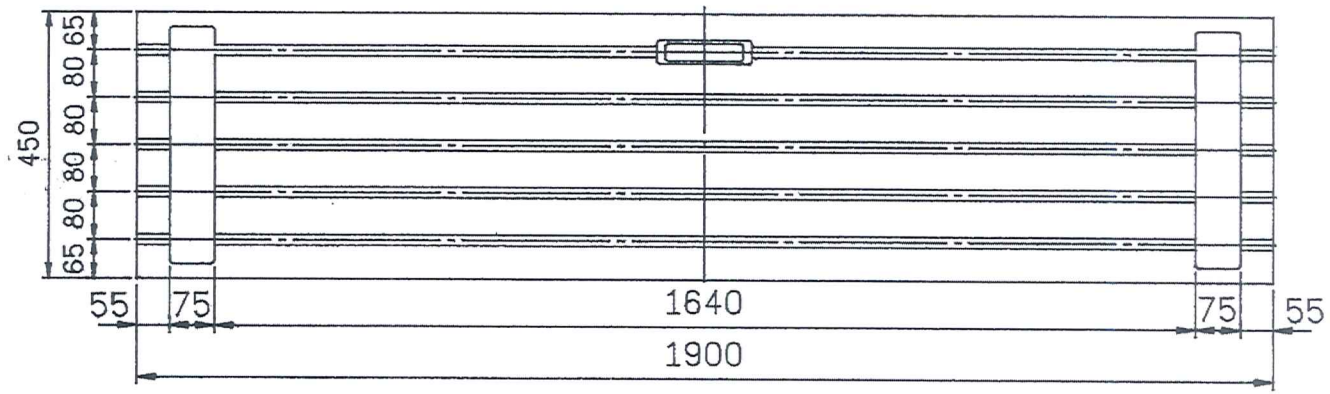


Fig. 3 Dimension of T-slot

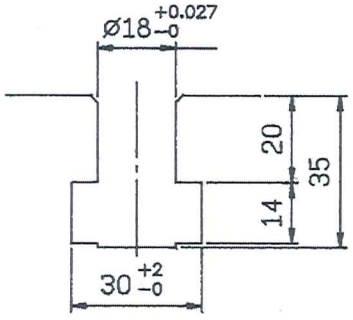
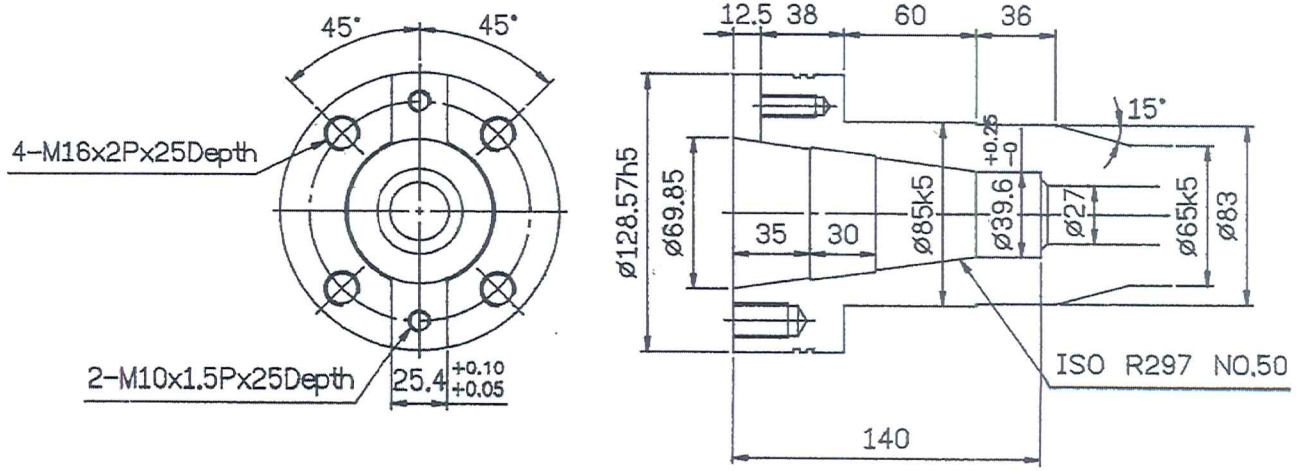


Fig. 4 Dimension of spindle nose



1-3 Name Of Main Parts (Fig. 5)

1. Upper cover of column
2. Column
3. Cover of main spindle
4. Spindle head
5. 2-step speed change lever formain spindle
6. Nameplate for feeding speed
7. High-low speed change lever for spindle head
8. Automatic feeding speed change knob for spindle head
9. 3-step speed change lever for spindle head
10. Operator's box
11. Starting switch of main spindle
12. Pilot lamp of power source
13. Switch for cutting fluid pump
14. Pilot lamp
15. Switch for motor in gearbox
16. Stop switch for main spindle
17. Inching switch for main spindle
18. Switch for emergency stop
19. Electrical wiring box
20. Chain
21. Motor for main spindle
22. Rapid feed hand wheel for spindle head
23. Micro feed speed change lever for spindle head
24. Micro feed hand wheel for spindle head
25. Automatic feed speed change lever for spindle head
26. Clamping bar of main spindle
27. Cutting fluid valve
28. Side cover of column
29. Side cover of table
30. Longitudinal feed lead screw bearing block
31. Lead screw of table feed
32. Working table
33. Clamping bar of working table
34. Speed change lever for rapid cutting feed
35. Saddle
36. Feeding hand wheel of saddle
37. Oil pump for table and saddle sliding surface
38. High and low speed change lever
39. Gear box
40. Speed change knob for 6-step automatic feed
41. Drainage plug for gear box
42. Bed
43. Feed hand wheel for working table
44. Limit switch for saddle feed stop
45. Cutting fluid pump
46. Cutting fluid pump fixed block
47. Lifting lever for operator's box
48. Oil feeding pump for sliding surface of spindle head
49. Rubber of block chip
50. Clamping lever for saddle table
51. Nameplate
52. Nameplate for manufacturing serial NO.

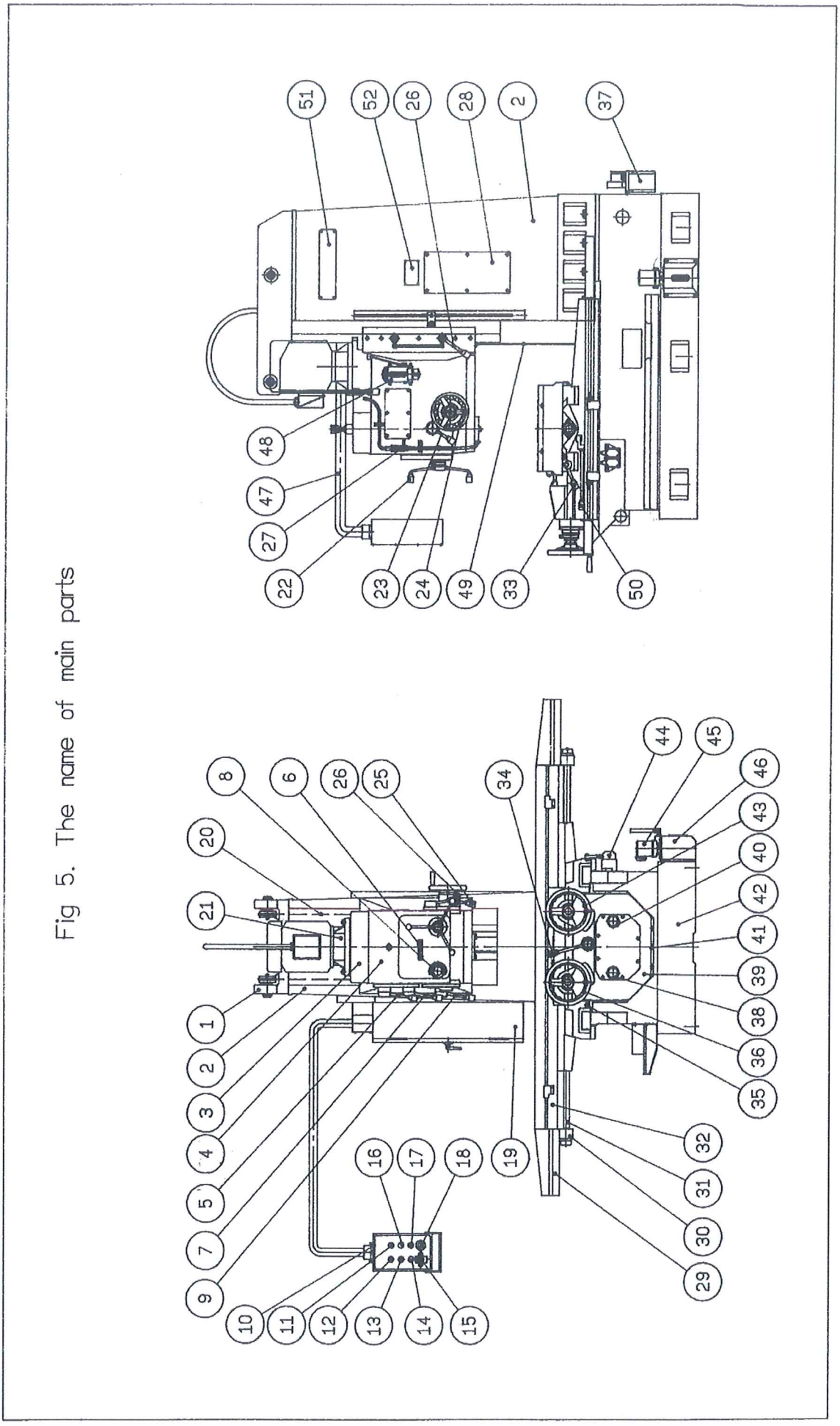
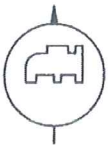
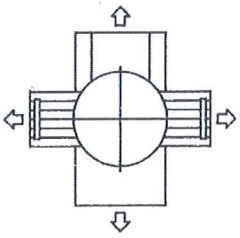
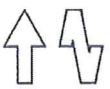
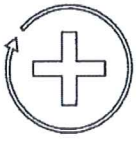
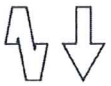
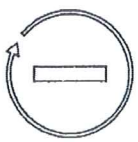
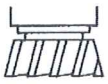
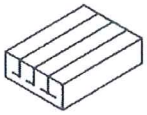


Fig 5. The name of main parts

1-4 Symbols

Table 2 Symbols

Symbols	Description	Symbols	Description
	Starting switch "on"		Cutting fluid pump
	The switch is "ON" while depressed		Lubricant pump
	Automatic longitudinal and transverse feed		
	Automatic longitudinal and transverse feed		Danger (Electrical device)
	Rapid feed		Automatic longitudinal and transverse feed
	Normal feed		
	Low speed feed		Automatic vertical feed
	Increase of spindle speed		
		 mm/○	Feed amount per rotation
	Decrease of spindle speed	 mm/min	Feed amount per minute
		 /min	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 weak parts 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 Leveling 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 0.02-0.05mm/1000mm) on the table to adjust the leveling of machine. After finishing the leveling. Pour the concrete into the anchor bolt holes , tighten the bolt after the concrete is completed rigid , check the machine leveling once move , clean the machine base (sands & scraps etc) 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 the entire used pad-bond coating agent and replace with new ones.

Fig 6. Method of lifting the machine

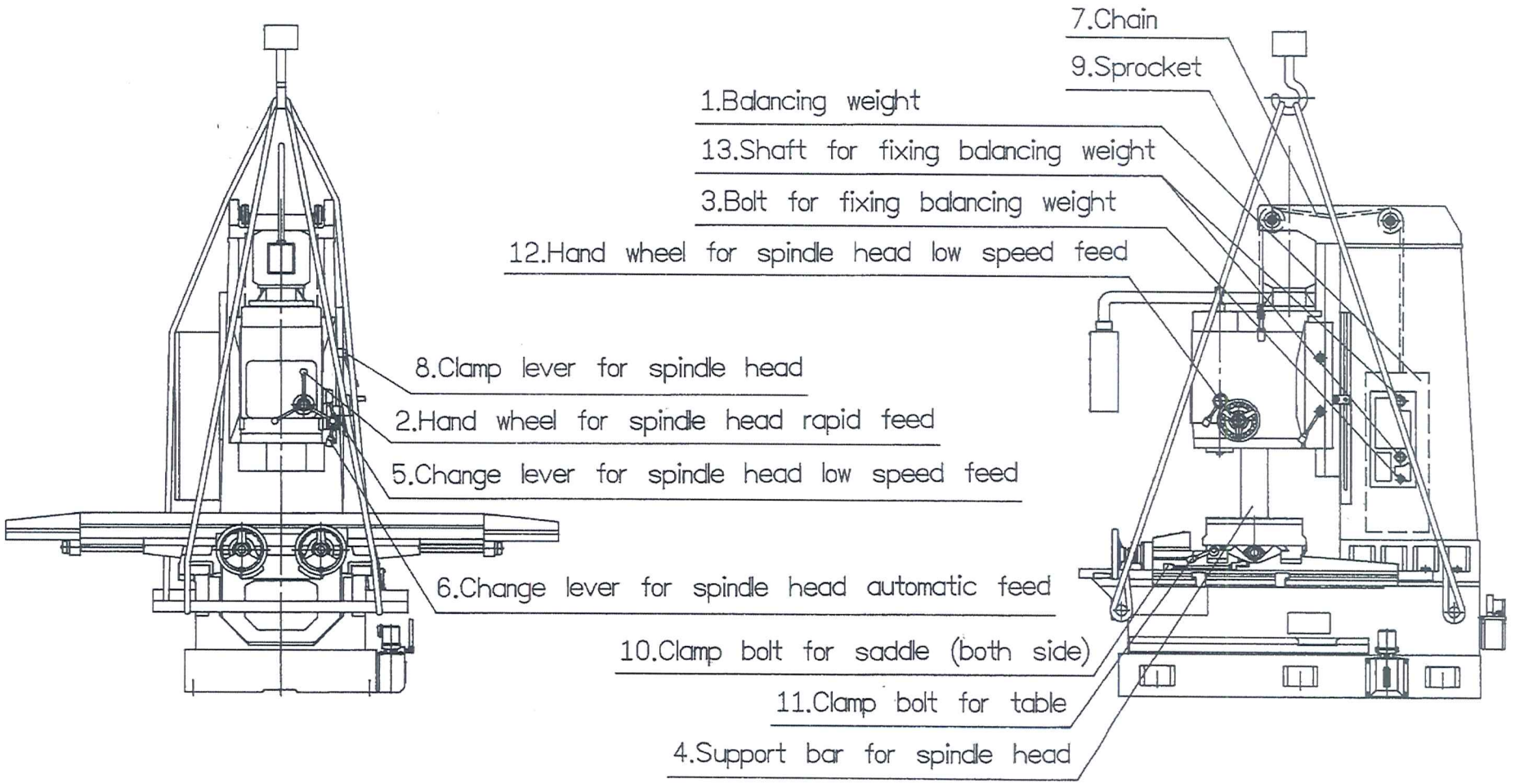
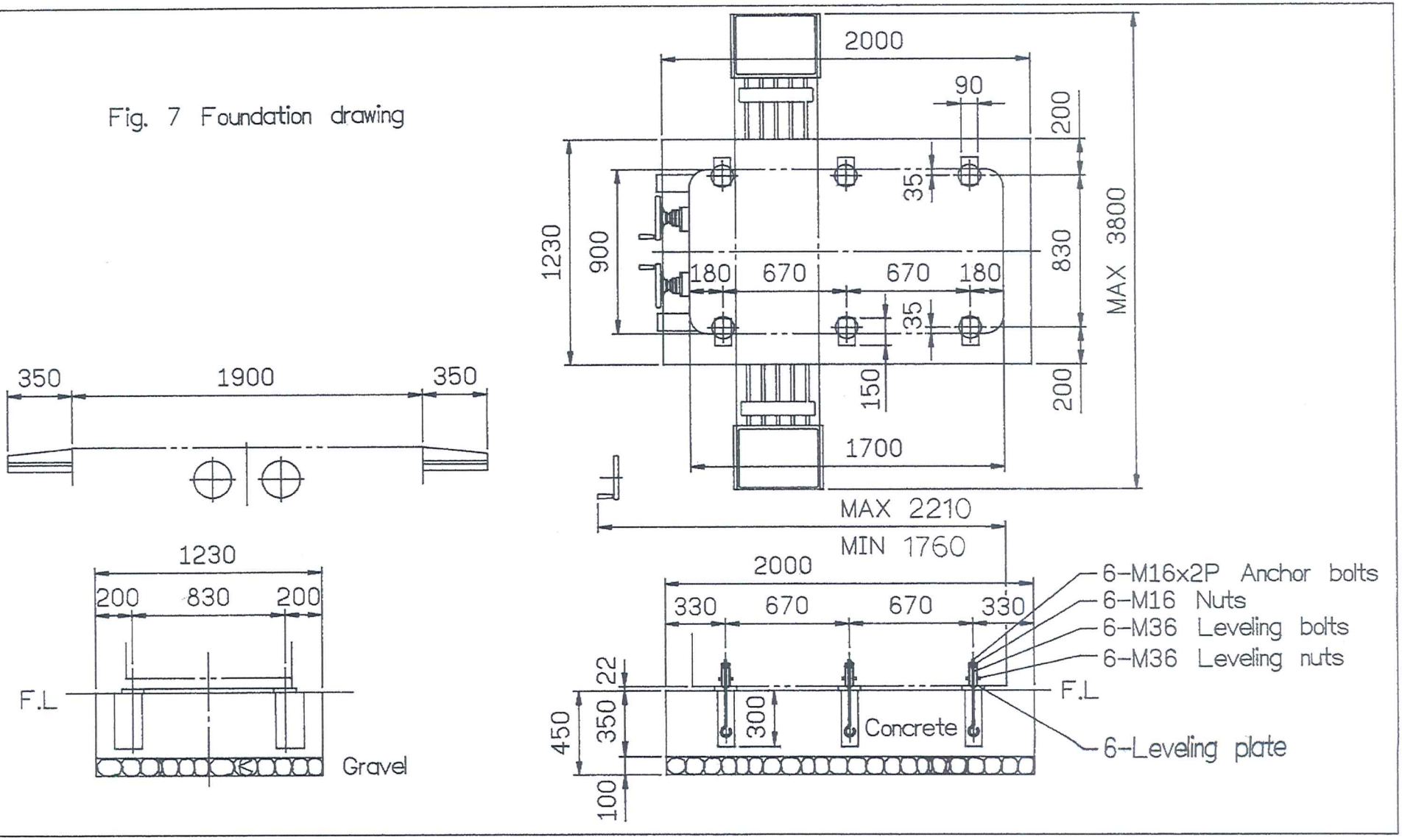


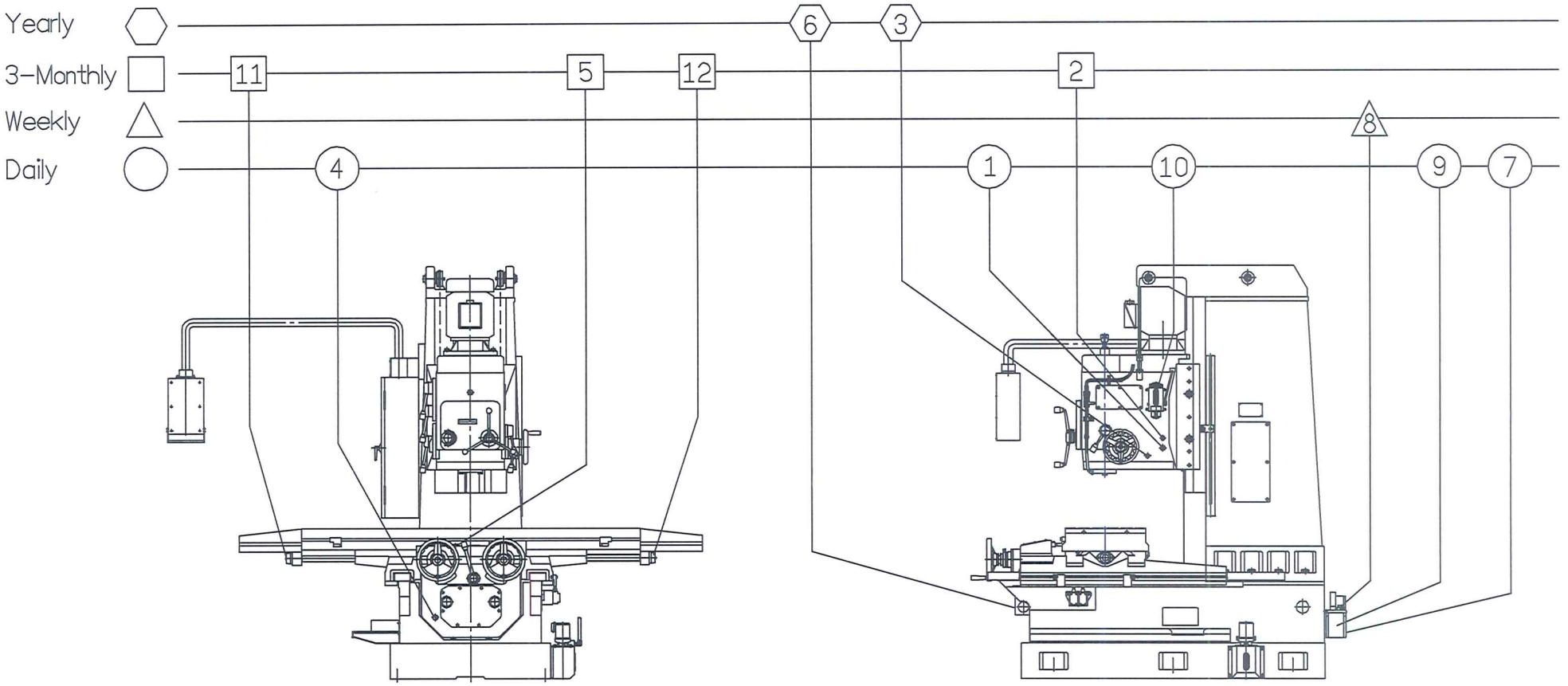
Fig. 7 Foundation drawing



3. Lubrication

3-1 Refer to (Fig. 8) , table 3 and table 4, 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.

Fig 8 Table of mechanical lubrication



Machine Component	Spindle Head Gears			Gears Box			Spindle Head & Slide Ways Screw & Slide Ways				Bearing & Screw	
Action Points	1	2	3	4	5	6	7	8	9	10	11	12
Symbol / Item												
Check	Daily			Daily			Daily					
Fill		3-M			3-M			Weekly	Daily	Daily	3-M	3-M
Clean & Replace			Yearly			Yearly						
Clean & Replace												
Lubricant		CB32			CB32			G68			XM2	
Quantity		6L	12L		1.2L	5L		0.5L	0.02L	0.02L	Drops	Drops
Remarks									Furnished Oil Auto			

TABLE 3 Instruction for correct lubricant

	Application Fields	Properties	Symbol and Viscosity Grade	Kinematic Viscosity CST(40°C)			REMARKS
				Mean.	min.	max.	
CEARS	Enclosed moderately loaded gear (spur gear,bevel gear)	Refined mineral oils with good oxidation stability	CB 32 CB 68 CB 150	32 68 150	28.8 61.2 135	35.2 74.8 165	Pinion speeds(motor output) 2000-5000 rpm(within 3.7kw) 1000-2000 rpm(within 7.5kw) -1000 rpm(within 15kw)
	Enclosed heavily loaded gears (worm and wheel)	Refined oils with good oxidation stability and with improved load-carrying ability	CC 150 CC 320 CC 460	150 320 460	135 288 414	165 352 506	Worm speeds 2000- rpm 1000-2000 rpm -1000 rpm
BEARINGS	Spindles bearings and associated clutches	Refined mineral oils with superior anticorrosion and anti-oxidation performnces.	FC 2 FC 10 FC 22	2.2 10 22	1.98 9.00 19.8	2.42 11.0 24.2	Shaft speeds(shaft dia) 10000- rpm(-30mm) 2000-10000 rpm(30-150mm) -2000 rpm(150- mm)
SLIDE WAYS	Slide ways	Refined mineral oils with improved lubricity and tackiness performance preventing stickslip	G 68 G 220	68 220	61.2 198	74.8 242	Slide way(surface pressure) Horizontal(under 4kgf/cm^2) Vertical(under 4kgf/cm^2)
HYDRAULIC SYSTEMS	Hydraulic systems	Refined mineral oils with superior anti-corrosion and anti-oxidation performance	HL 32 HL 68	32 68	28.8 61.2	35.2 74.8	Oil temperature(Rated pressure) 0-50°C(under35kgf/cm^2) 15-65°C(under35kgf/cm^2)
		Refined mineral oils with superior anti-corrosion, anti-oxidation and antiwear performances.	HM 32 HM 68	32 68	28.8 61.2	35.2 74.8	Oil temperature(Reted pressure) 0-50°C(under140kgf/cm^2) 15-65°C(under140kgf/cm^2)
	Hydraulic and Slide ways	Refined mineral oils of HM type with anti-stick-slip properties.	HG 32 HG 68	32 68	28.8 61.2	32.2 74.8	Oil temperature(Reted pressure) 0-50°C(under70kgf/cm^2) 15-65°c(under70kgf/cm^2)
GREASE		Premium qudity greases with superior anti-oxidation and anti-corrosion properties.	XM 1 XM 2	Viscosity (25°C) SSU 310 - 340 265 - 295			Centralized systems Cup or hand gun

TABLE 4 THE GENERAL LUBRICANTS FOR MACHINE TOOL						
	SYMBOL	CPC	ESSO/ESSON	SHELL	MOBIL	DAPHNE
Gears	CB32	R32	Teresso 32	Tulus Oil C32	DTE Oil Light	Mechanic Oil 32
	CB68	R68	Teresso 68	Tulus Oil C68	DTE Oil Heavy Medium	Mechanic Oil 68
	CB150	R150	Teresso 150	Tulus 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	Telus Oil C10	Velocite Oil NO.6	Mechanic Oil 10
	FC22	R22	Spinesso 22	Telus 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	Telus Oil C32	DTE Oil Light	Hydraulic Fluid 32
	HL68	R68	Teresso 68	Telus Oil C68	DTE Oil Heavy Medium	Hydraulic Fluid 68
	HM32	32AW	Nuto HP32	Telus Oil 32	DTE 24	Super Hydraulic Fluid 32
	HM68	68AW	Nuto HP68	Telus Oil 68	DTE 26	Super Hydraulic Fluid 68
	HG32		Powerex DP32	Tonna Oil T32	Vacuoline Oil 1405	Multiway 32
	HG68		Powerex DP68	Tonna Oil T68	Vacuoline Oil 1408	Multiway 68
Grease	XM1	Gulferown Grease E.P. NO.1	Listan 1	Alvania Grease 1	Mobilux EP1	Cornex Grease NO.1
	XM2	Gulforown Grease E.P. NO.2	Listan 2	Alvania Grease 2	Mobilux 2	Cornex Grease NO.2
C.P.C. China Petrolum Co. , Ltd.						

4. Cutting Fluid Pump Device (Fig 9)

Install the cutting fluid pump (P1) on the oil tank (P2) at right side of machine. Turn switch on the control box (P3) to left "a" direction to start with spindle together; turn switch to right "b" direction to start fluid pump only .Volume of the cutting fluid is 15L probably. Volume can be poured from pan (P4) until to reach the gauge (P5) level. The cutting fluid is replaced to loosen the plug (P5) .

Cutting fluid nozzle (P7) equipped at right side of spindle head and hold by nozzle clamper (P8). 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 (P9) . CCW turn for larger quantity and CW turn for smaller.

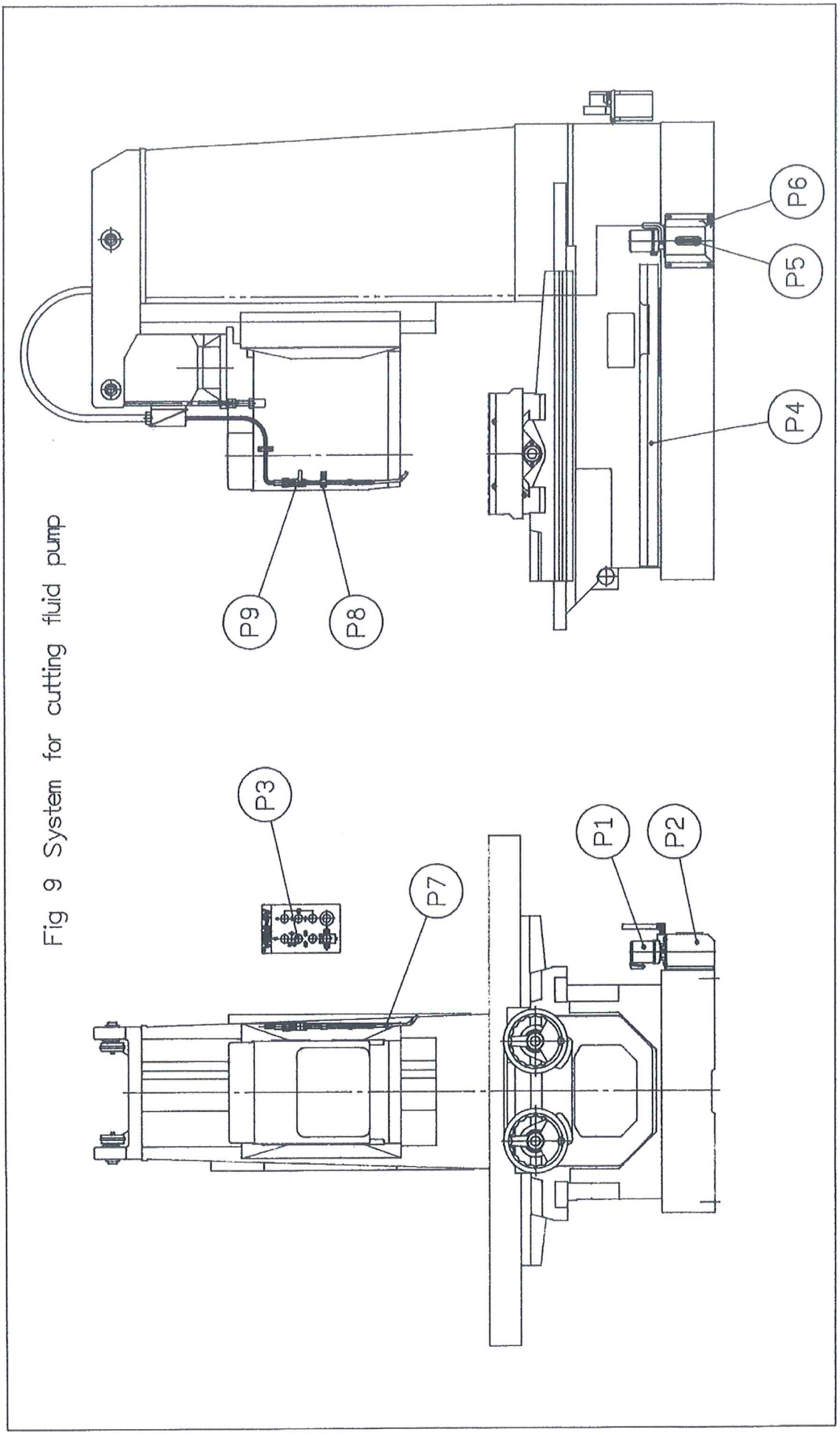


Fig 9 System for cutting fluid pump

5. Running Operation

5-1 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. 10).
   The power source (220V, 60Hz) may connect to the R.S.T. terminal board of electrical control box.
4. Push the no fuse breakers to "ON" position, the pilot lamp on control panel should be light .

5-2 Running Operation Of Spindle (Fig. 12 , 13 & 14)

Loosen the clamper of spindle head (C1) (Fig. 12) 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.
When the scale is calibrated to the zero point and fixed, then the reading, represents the displacement.

(B) Micro speed feed for spindle head
Micro feed change lever (H6) of spindle is engagement in down ward "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 3mm.

(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 rotation speed change of spindle will be controlled by three change lever (H1) , (H2) , and (H3) , (H1) with 3 steps of rotation speed , (H2) 2 steps of rotation speed , (H3) with High-Low 2 steps speed. Stop the motor of spindle before change the speed.

(E) Automatic Feed Of Spindle Head

The spindle head automatically feed can be operate by the feed direction change lever (H5) and spindle head manual or automatic feed change lever (H6).

Lever (H5) can select right direction downward or left direction (upward). Lever (H6) will set "A" direction for manual feed and push lever to "B" direction for automatic feed. The spindle head can automatically feed in spindle rotation, and can not move when the spindle is stopped.

(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. 13).

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.

5-3 (A) Hand feed of table and saddle

Before operation, loosen the clamping lever (C2) of table and clamping bolts (C3) of 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 for-ward by turning hand wheel right, and backward by turning hand wheel left.

(3) Each revolution of hand wheel makes table or saddle to move 4mm distance.

(4) Every hand wheel with graduated scale 0.025mm on the graduation collar (E7) and (E8). The "O" position of graduation collar aim at the arrow head properly. The attached bolt fixes 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 control panel moving to the left "a" or right or "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 (S5) of table and saddle turns to "c" or "d" direction. The saddle will get the forward or backward movement , if lever turns to "a" or "b" direction the table will get the left or right movement.

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.

(D) Cutting speed change of table

Put the different position of lever (E4) 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 12 step speed change can be carried on during operation of the machine.

During rapid movement of saddle and table. The position of cutting feed change lever (E4) , (E5) have no relation with them and keep original speed going on.

(E) How to stop the automatic feed

E-1 How to stop (Li1) 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 withdrawer immediately.

E-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 "a" position the direction of motor rotation is reverse. The table will be withdrawer immediately.

E-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 stops moving at once. If you intend to withdraw the saddle the switch (S5) of motor turns from upward "c" position to downward "d" position, the direction of motor rotation is reverse. The saddle will be backward suddenly.

E-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 stops moving at once. If you are willing to withdraw the saddle, the switch of motor turns from downward "d" position to upward "c" position. The direction of motor rotation will be reverse the saddle will be backward suddenly.

(F) 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 and make the elbow block and limit switch separate. Then motor switch (S5) can be recovered to start.

6. Clamping devices

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

6-1 Spindle head clamping (Fig. 12)

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).

6-2 Table clamping (Fig. 15)

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).

6-3 Saddle clamping (Fig. 15)

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).

7. 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).

7-1 The level adjustment of the machine (Fig. 16)

(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 (A1).

(7) Recheck the airbubbles displacement on the level , if no move-ment that is right , or should be readjusted.

7-2 Adjustment of spindle (Fig. 17)

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 bolts (B1).
(3) Screwing the adjustable nuts (N1) not so loose , not so tight (because of temperature rise of bearing).
(4) Screwing the fixed bolts (B1) , (preventing the adjusted nuts (N1) from loose).
(5) Reassembling the spindle head cover

7-3 Adjustment of automatic feed V-Belts of spindle head. (Fig. 17 & Fig. 18)

(1) Take the cover (HC2) of spindle head apart.
(2) Loosen the tension strength of support locking nuts (FT1).
(3) One hand use the wrench to screw the tension deport (FT2) and make the belt tension to moderate condition. Other hand, tighten the support looking nuts (FT1).

7-4 Adjustment of all feed lead screws (Fig. 20 , Fig. 22)

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

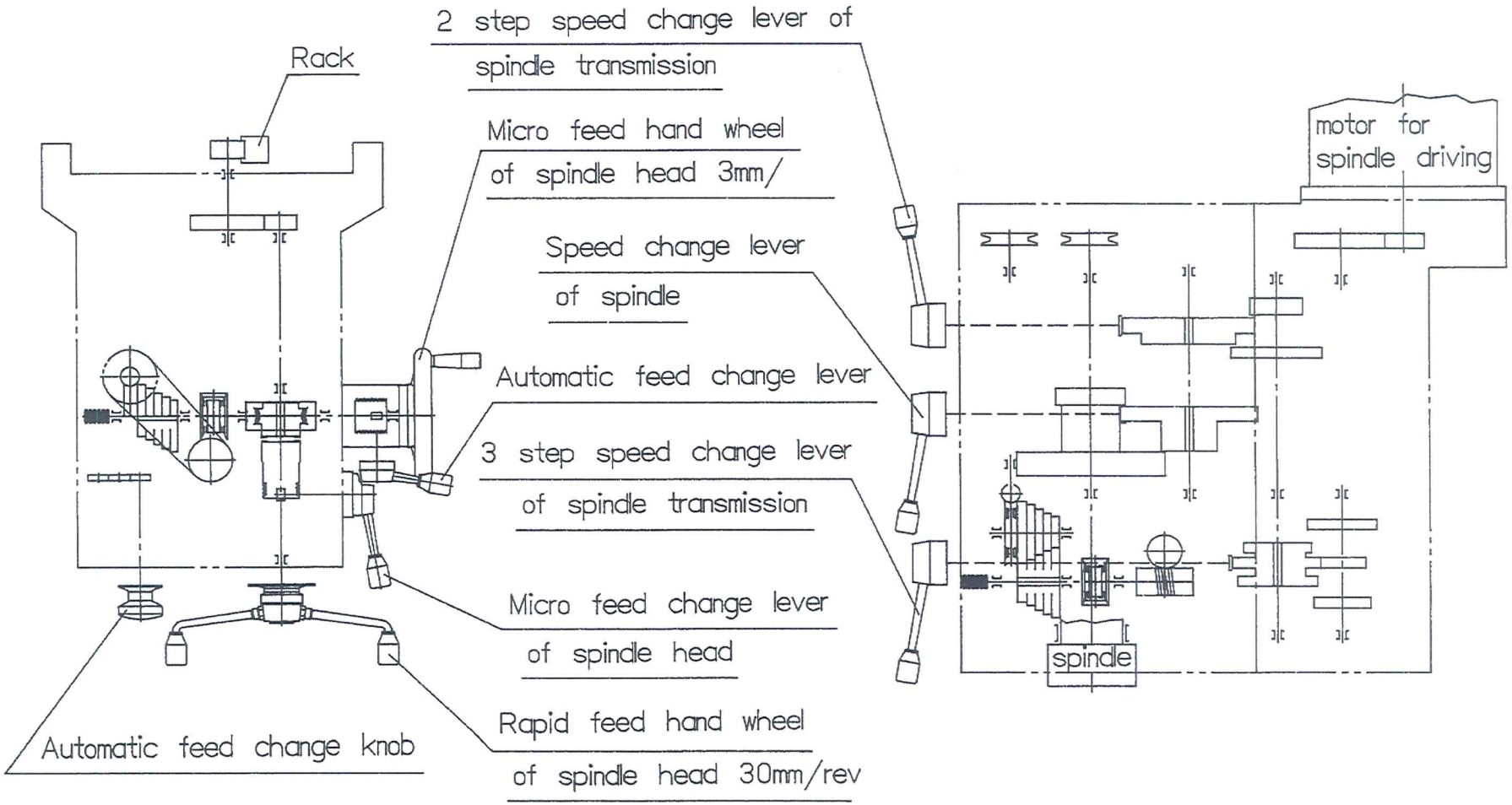
7-5-1 Adjustment of feed lead screw of table (Fig. 22)

(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. 22).
(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.

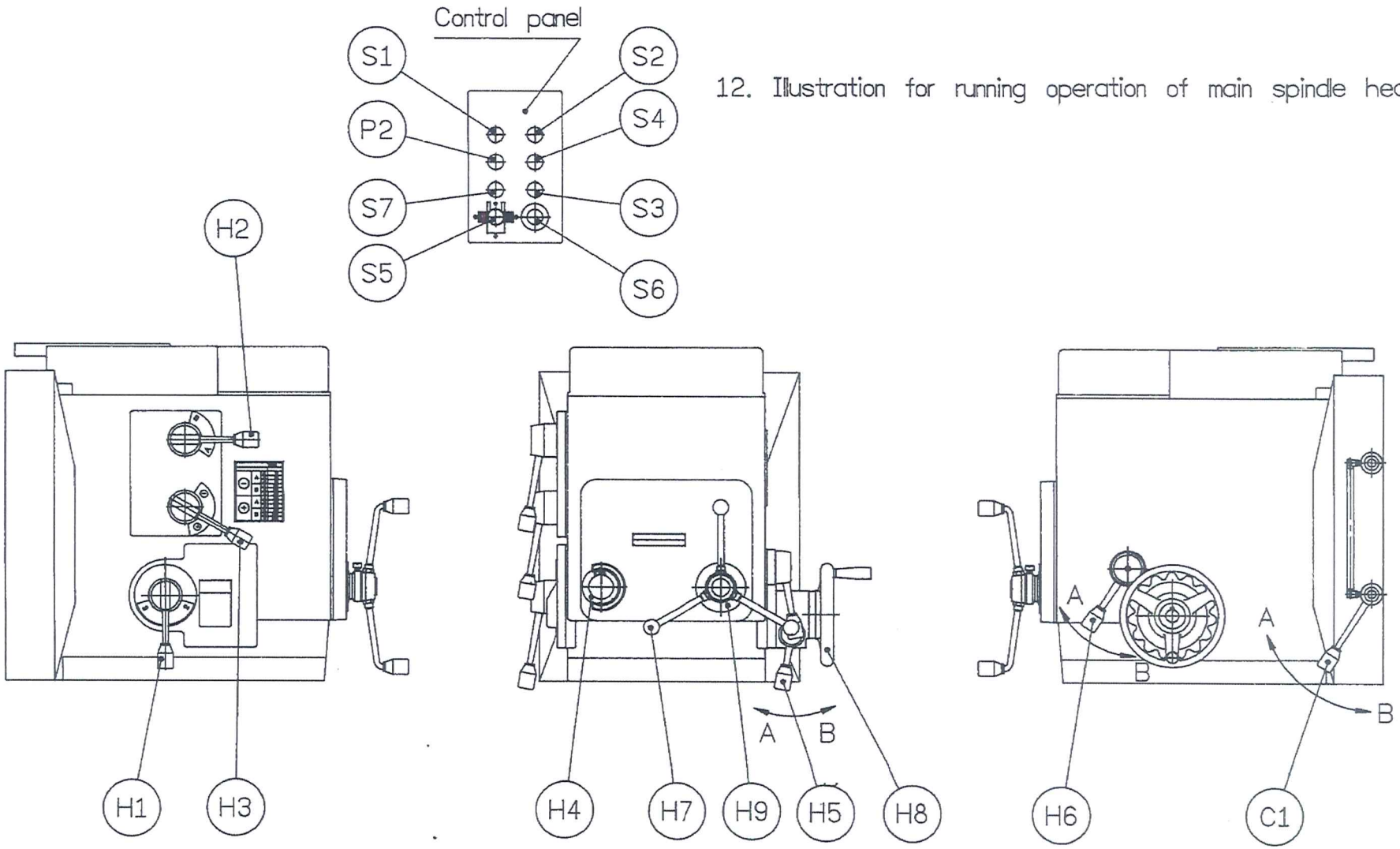
7-5-2 Adjustment of feed lead screw of saddle (Fig. 20)

(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 φ 5 mm diameter of steel bar (200 mm long) to insert the outsidehole 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 11. Spindle head driving



12. Illustration for running operation of main spindle head



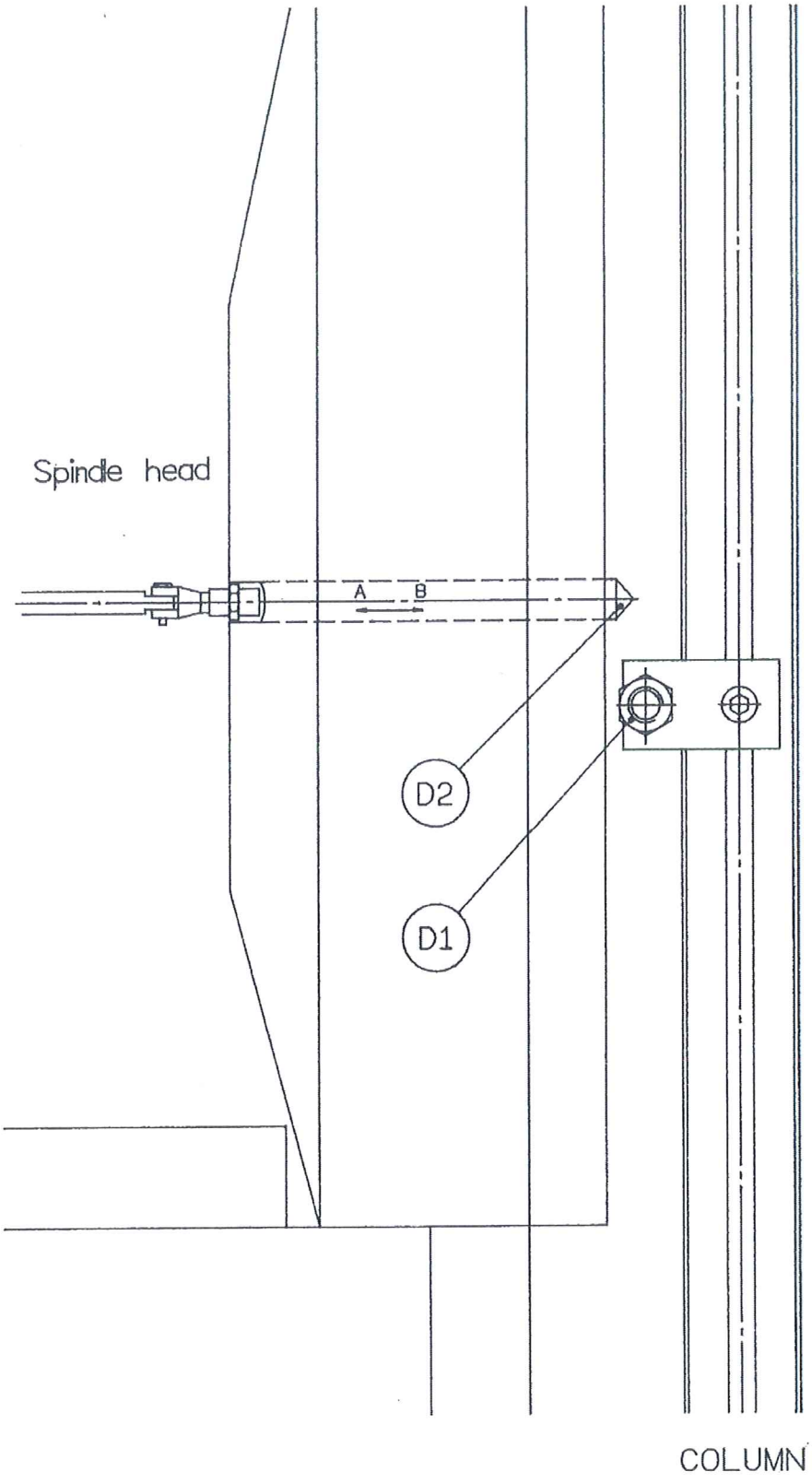


Fig 13. Setting relation of spindle head

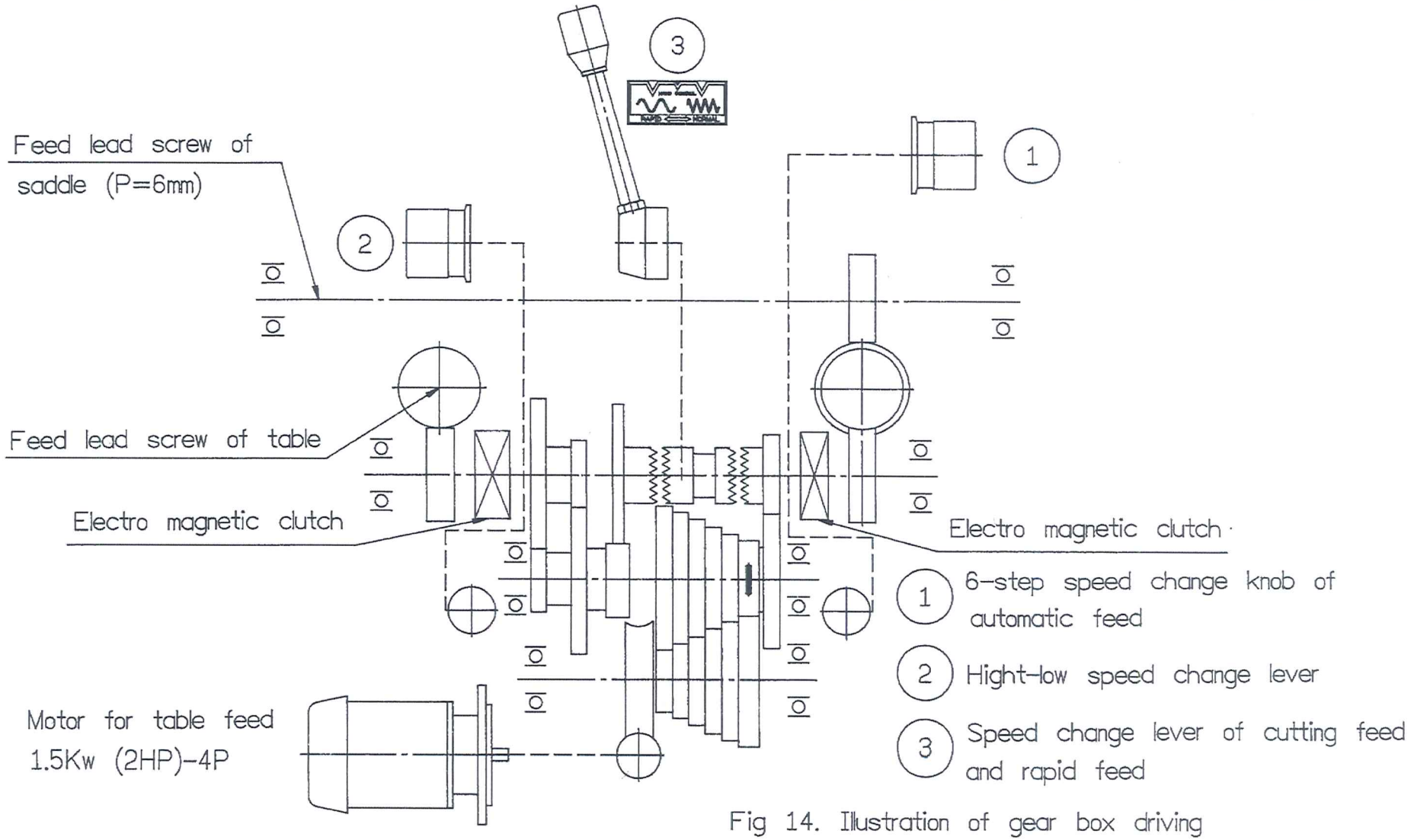
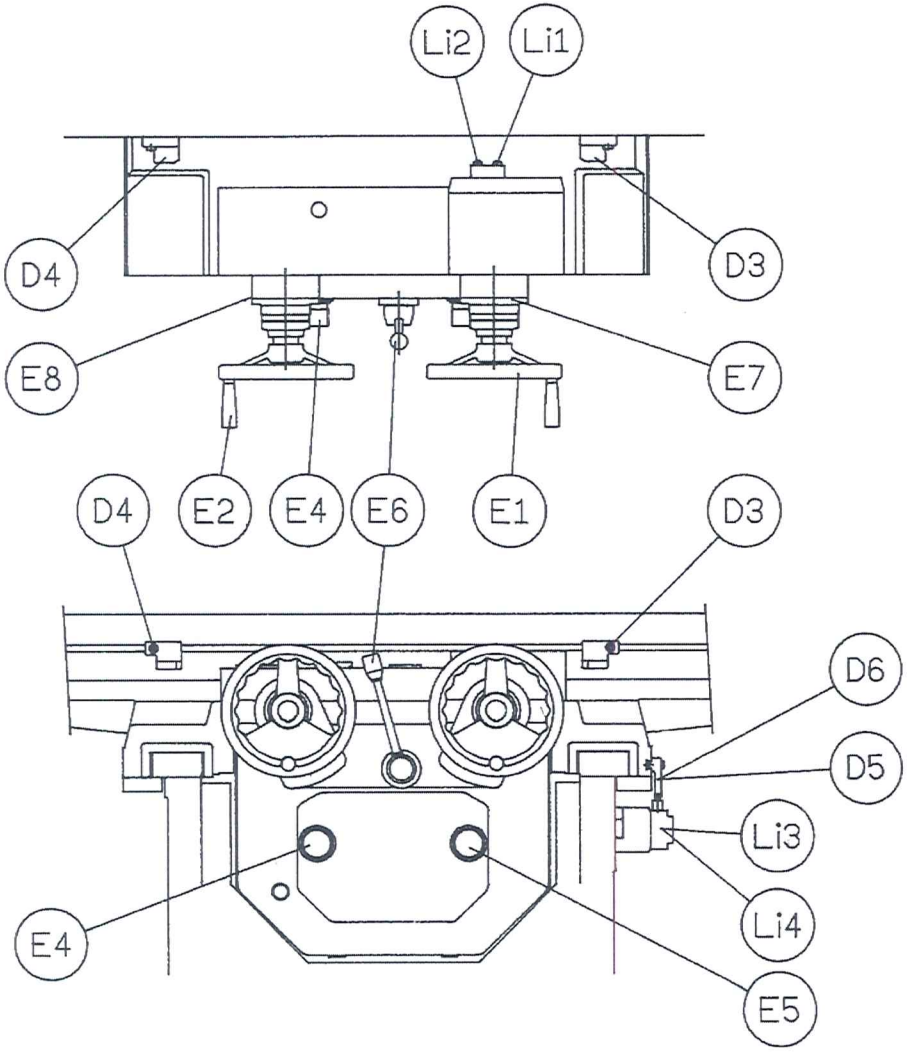


Fig 14. Illustration of gear box driving



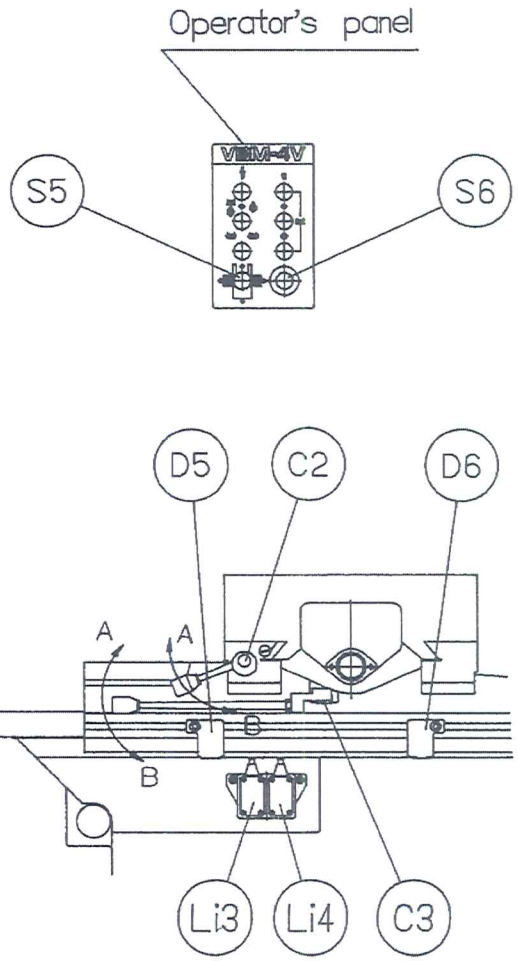


Fig 15. Illustration of working table and saddle

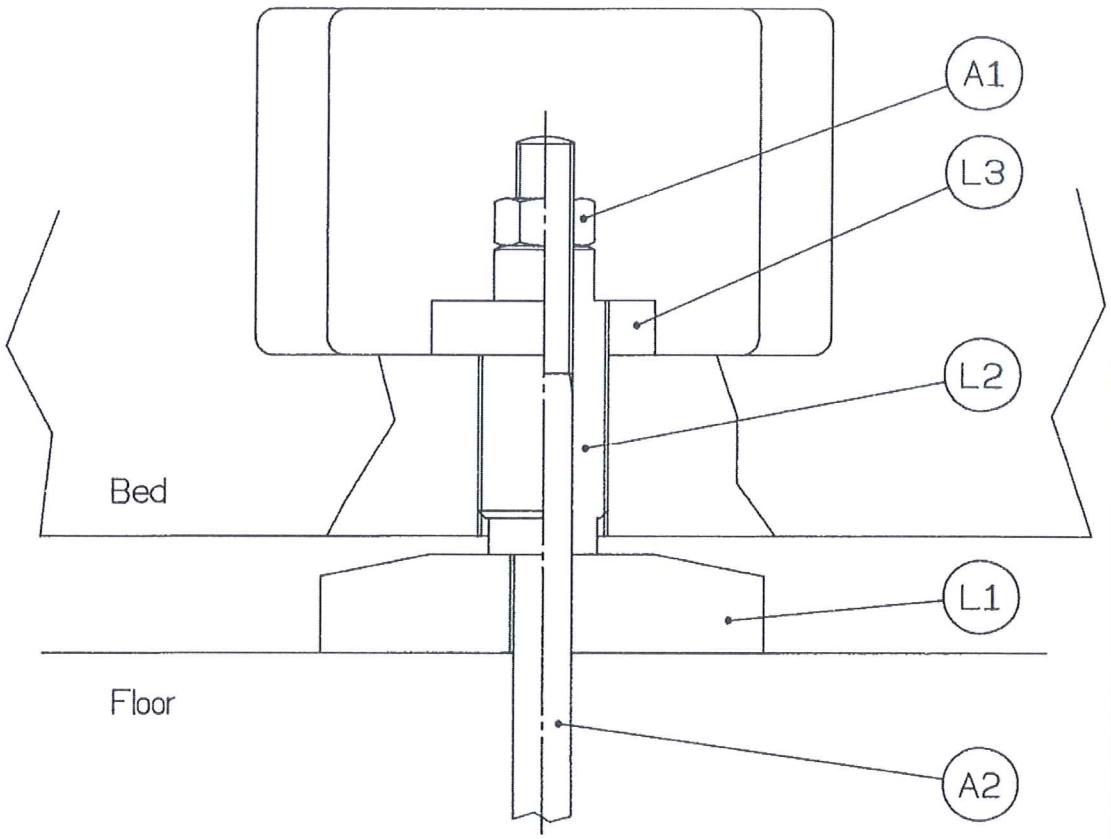


Fig 16. Adjusting machines level

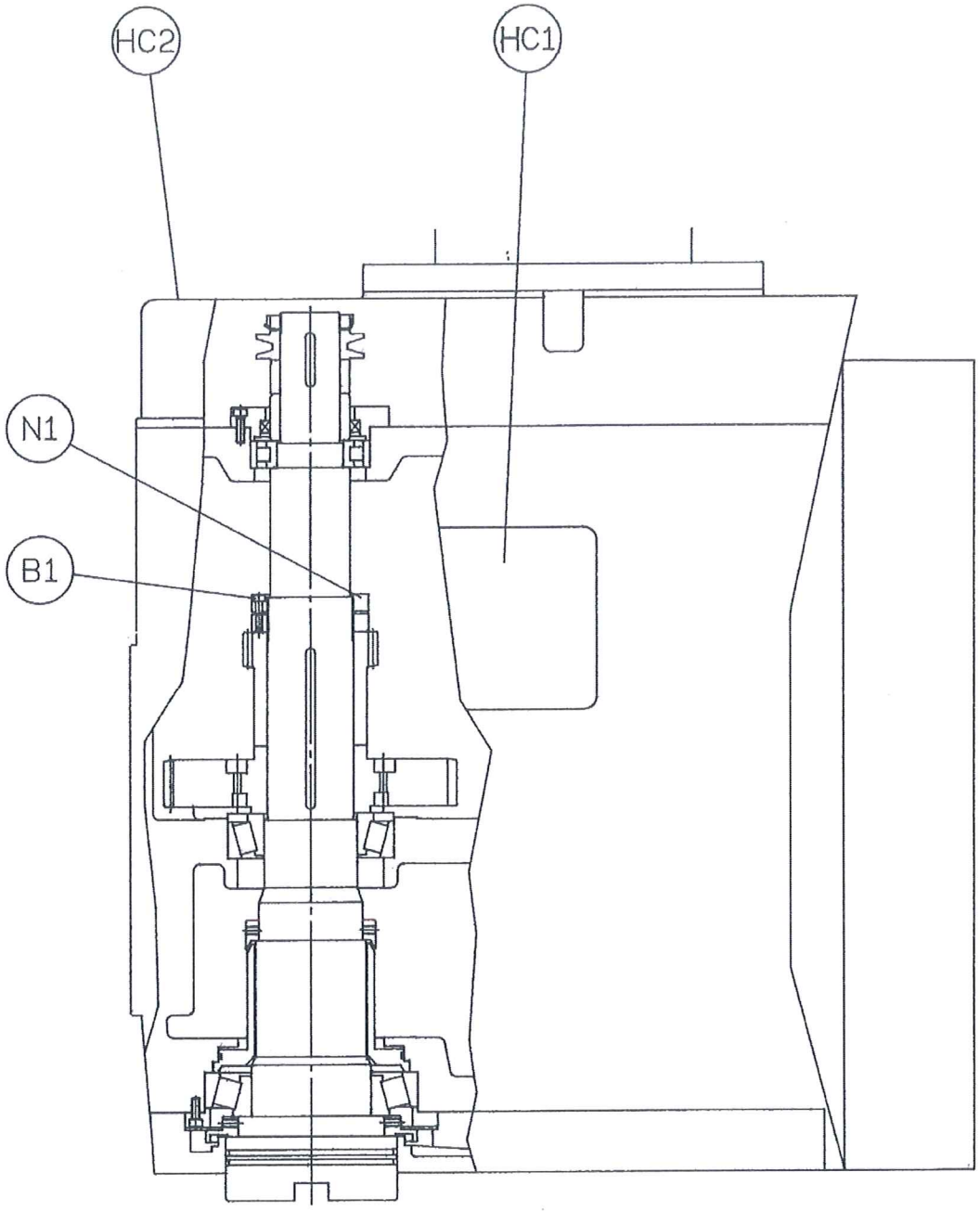


Fig 17. Adjustment of main spindle

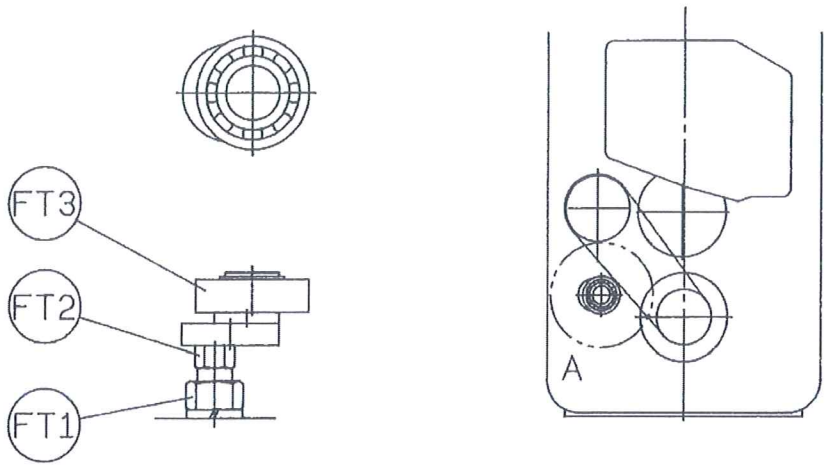


Fig 18. V-belt adjustment of main spindle automatic feeding

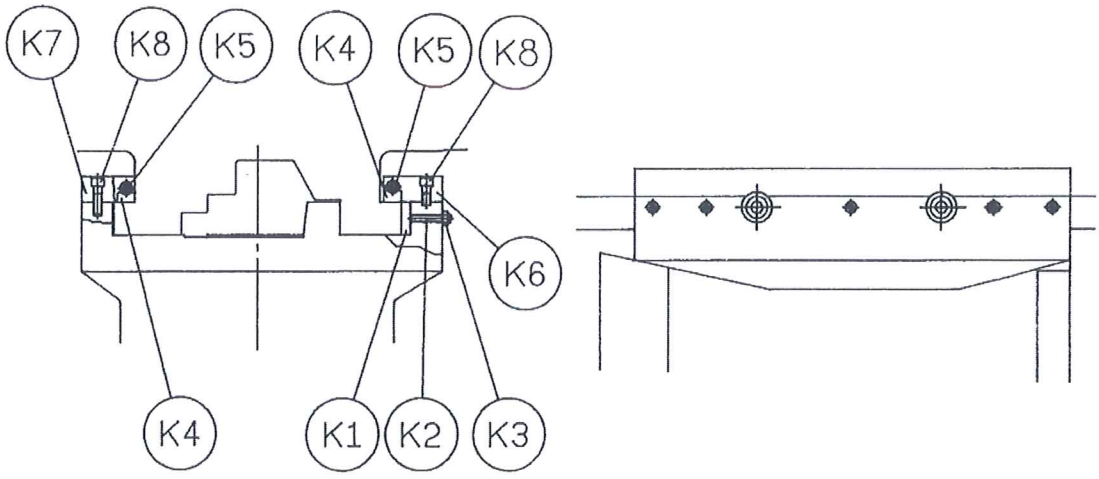
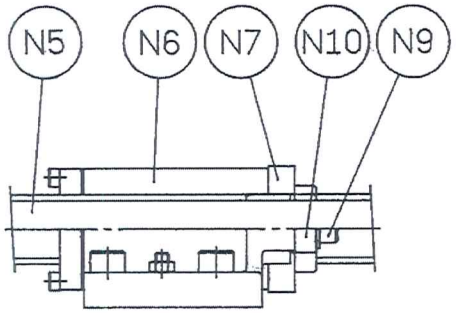


Fig 19. Adjustment of slide gibs of main spindle



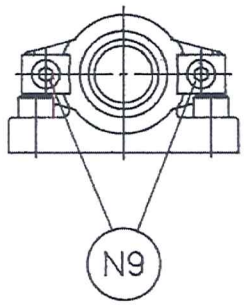


Fig 20. Adjustment of feeding screw of saddle

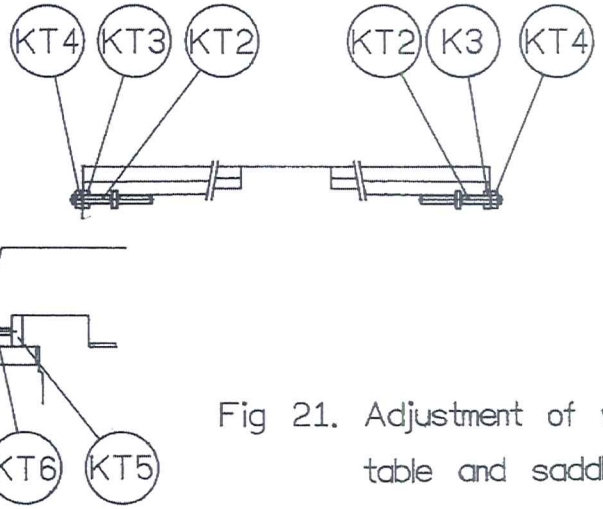
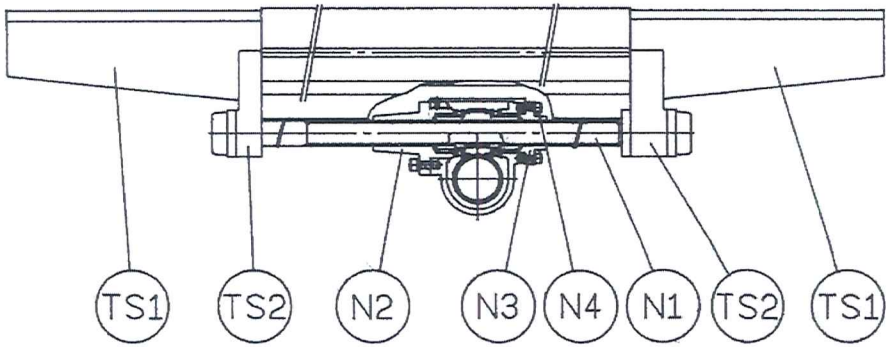
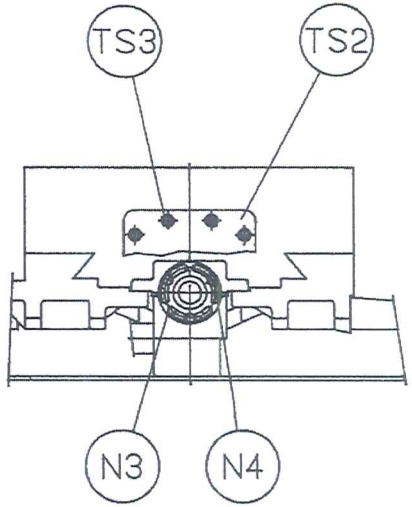


Fig 21. Adjustment of working table and saddle gibs

Fig 22. Adjustment of feeding screw of working table





8. REFERENCE FOR MACHINING

8-1 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 .

8-2 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 :

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

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 tungsten carbide steel is shown in table 7 .

8-3 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		Brine 11 hardness HB	High-speed steel cutter	Supper-hard alloy cutter
			m/min	m/min
Special steel	Hard Tough	300 400	13 15	30 50
	Annealed	220 300	15 23	50 75
		180 220	23 35	75 108
Low-carbon steel	Malleable Cuts well	152 197	28 46	90 130
		150 180	35 46	108 130
Cast iron	Hard Medium hard	220 330	15 23	50 75
	soft	180 220	23 33	75 108
		150 180	35 46	108 130
Brass and Bronze	Hard Medium hard	150 250	21 46	63 130
	cuts well	100 150	46 83	130 200
		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 hard-ness 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	300 400	0.1	0.075	0.075	0.05	0.05	0.025
		Tough	220 300	0.13	0.125	0.1	0.075	0.05	0.05
		Annealed	180 220	0.2	0.175	0.125	0.1	0.025	0.05
	Low - carbon steel	Malleable	152 197	0.25	0.2	0.13	0.125	0.075	0.075
		Cuts well	150 180	0.3	0.25	0.175	0.13	0.1	0.035
	Cast iron	Hard	220 300	0.27	0.2	0.13	0.13	0.1	0.075
		Medium hard	150 250	0.325	0.25	0.175	0.175	0.1	0.0075
		Soft	150 180	0.4	0.325	0.225	0.2	0.125	0.1
	Brass and bronze	Hard	150 250	0.225	0.225	0.13	0.125	0.075	0.05
		Medium hard	100 150	0.35	0.35	0.2	0.175	0.1	0.075
		Cuts well	80 100	0.55	0.55	0.325	0.27	0.175	0.125
	Magnesium and its alloys			0.55	0.45	0.325	0.27	0.175	0.125
	Aluminum and its alloys			0.55	0.45	0.325	0.27	0.175	0.125
	Plastic			0.375	0.3	0.225	0.175	0.125	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
Sper-hard alloy milling cutter	Special steel	Hard	300 400	0.25	0.2	0.13	0.125	0.075	0.075
		Tough	220 300	0.3	0.25	0.175	0.13	0.1	0.075
		Annealed	180 220	0.35	0.27	0.2	0.175	0.1	0.1
	Low - carbon steel	Malleable	152 197	0.35	0.27	0.2	0.175	0.1	0.1
		Cuts well	150 180	0.4	0.325	0.225	0.2	0.125	0.1
	Cast iron	Hard	220 300	0.3	0.25	0.175	0.13	0.1	0.075
		Medium hard	180 220	0.4	0.325	0.25	0.2	0.125	0.1
		Soft	150 180	0.5	0.4	0.3	0.25	0.13	0.125
	Brass and bronze	Hard	140 250	0.25	0.2	0.13	0.125	0.075	0.075
		Medium hard	100 150	0.3	0.25	0.175	0.13	0.1	0.075
		Cuts well	80 100	0.5	0.4	0.3	0.25	0.13	0.125
	Magnesium and its alloys			0.4	0.45	0.3	0.25	0.13	0.125
	Aluminum and its alloys			0.4	0.45	0.3	0.25	0.13	0.125
	Plastic			0.3	0.3	0.225	0.175	0.125	0.1

10. TROUBLE SHOOTING

Table 9

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.Regringing the cutter edges 2.Replace new one 3.Clean it
2.Chatter	1.Tool shank too long or too fine 2.Laek of rigidity in the machine , fixture , or workpiece 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.Gib of table too loose	1.Replace suitable one 2.Improve rigidity 3.Adjust or change it 4.Reduce feed rate 5.Resharpen it 6.Regring it 7.Adjust by the adjustable nut 8.Adjut 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 pully	1.Tighten it 2.Replace with new set 3.Replace it 4.Replace it
5.Cutter burns	1.Insufficient lubicants 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 machinning surface	Center line of spindle not in perpendicular to table or slide way of carriage or bed	Readjust it correctly

11. MAINTENANCE SCHEDULE

Table 10

ITEM	POSITION	FREQUENCY			
		DAILY	WEEKLY	MONTHLY	YEARLY
1.LUBRICATION	ACCORDING TO TABLE 3	1	1-2		
2.ACCURACY	ACCORDING TO ACCUR A-INSPECTION CHART				1
3.CLEANING AND CORROSION PROTECTION	ALL SLIDDING SURFACES, TABLE SURFACE, T-SLOTS, SPINDLE NOSE, SPINDLE HOLE, ALL EXPOSED FI-NISHING SURFACES	1			
4.ADJUSTING OF GIBS	TABLE , SADDLE , SPINDLE , HEAD			2	
5.ADJUSTMENT OF FEEDING SCREWS	TABLE , SADDLE , SPIN-DLE , HEAD			1	
6.ADJUSTING OF FTXED MECHAN-ISM	TABLE , SADDLE , SPINDLE HEAD			2	
7.LEVELLING AND TIGHTEN	FOUNDTION 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	MOYORS , SWITCHSCON-NECTING POINTS OF WIRE , PUSH BUTTONS			1	

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