

YCM—16VS MECHANICAL MANUAL

KNEE—TYPE MILLING MACHINE

OP16VSM02

R001

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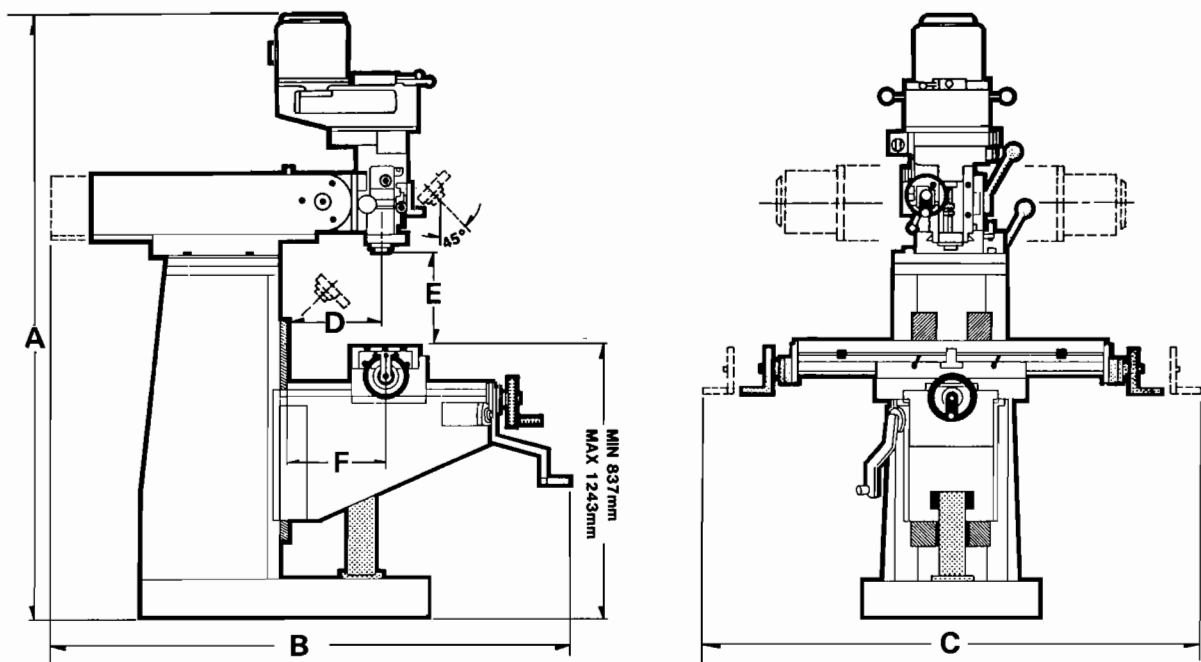
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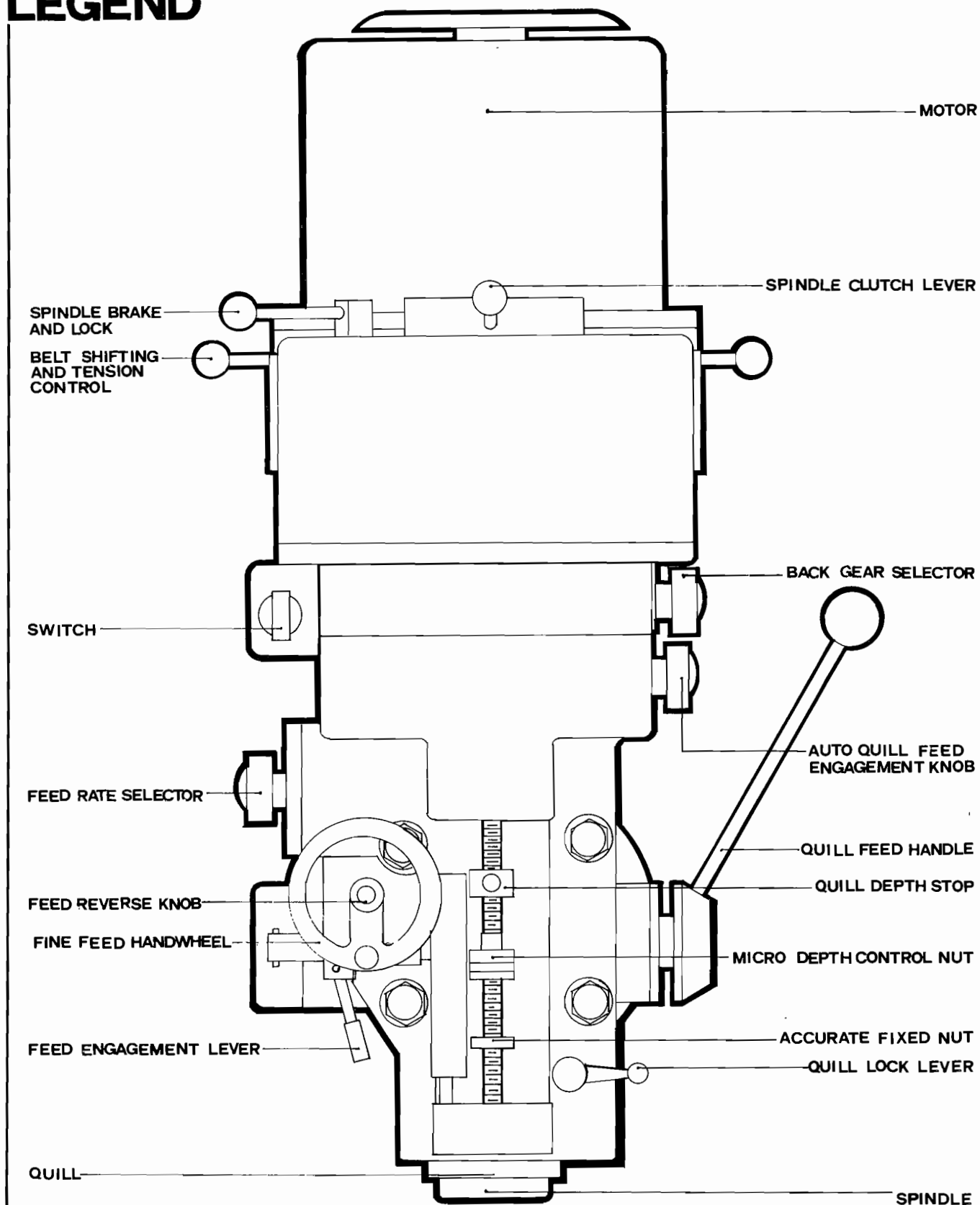
SPECIFICATIONS



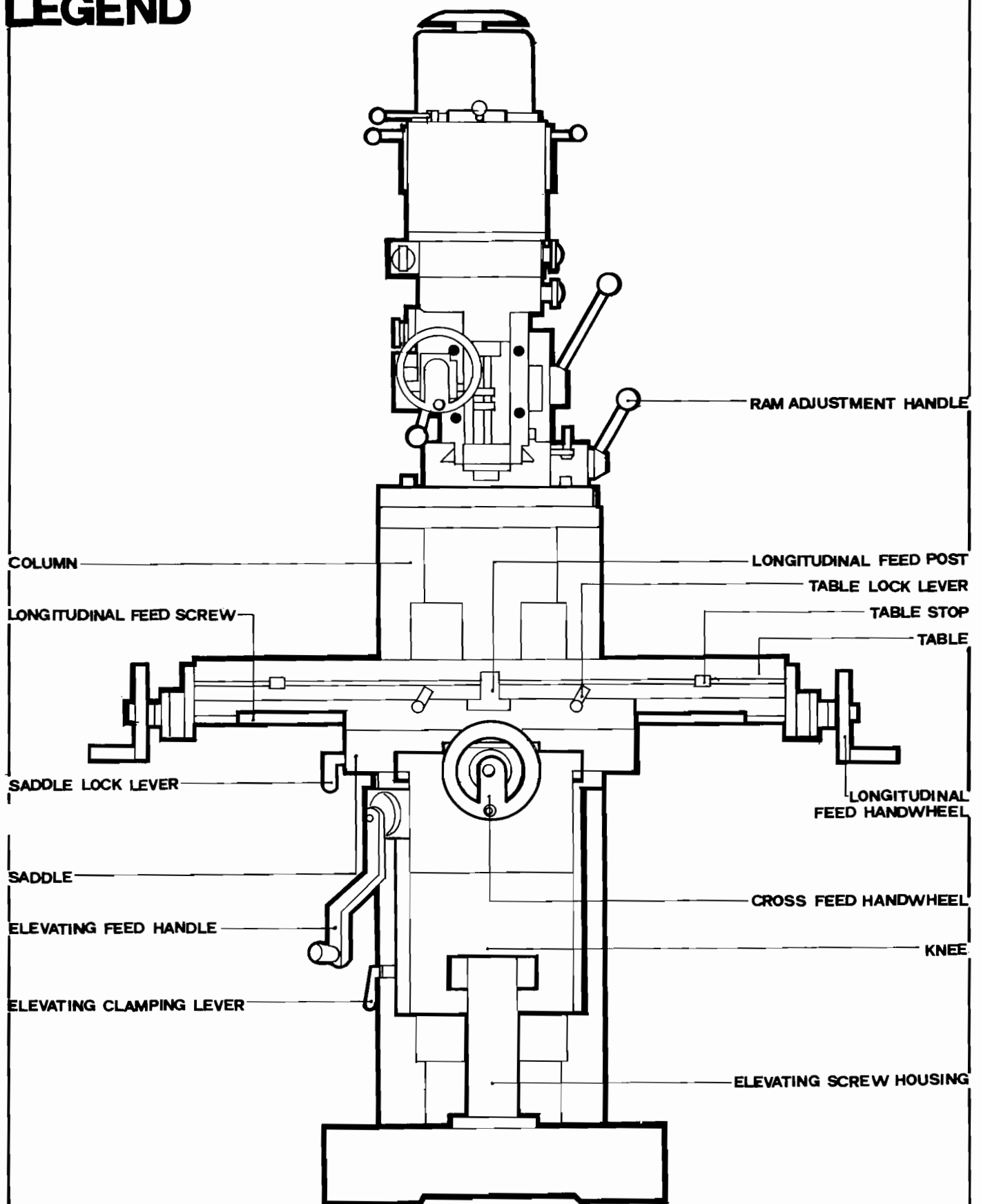
SPECIFICATIONS

SPINDLE MOTOR.....	AC 2 HP	
SPINDLE TAPER.....	R-8 or N.S.T. #30	
SPINDLE R.P.M.	80 135 210 325 660 1115 1750 2720	
POWER FEED PER REVOLUTION.....	0.0432mm, 0.0813mm, 0.1346mm	
T-SLOTS (width x number x distance).....	15.87mmx3x63.5mm	
MAX. LOADING CAPACITY	350kgs	
	STANDARD (42")	OPTIONS (49")
TABLE SIZE (width x length).....	230mmx1067mm	230mmx1245mm
LONGITUDINAL TRAVEL (X).....	787mm	940mm
LONGITUDINAL TRAVEL WITH POWER FEED (X).	692mm	850mm
CROSS TRAVEL (Y).....	406mm	
KNEE TRAVEL.....	406mm	
RAM TRAVEL	457mm	
QUILL TRAVEL.....	127mm	
A. OVERALL HEIGHT.....	2100mm	
B. OVERALL DEPTH	1870mm	
C. OVERALL WIDTH	2480mm	2700mm
D. SPINDLE CENTER TO COLUMN.....	163mm-620mm	
E. TABLE TO SPINDLE NOSE	0-483mm	
F. TABLE CENTER TO COLUMN.....	134mm-540mm	
MACHINE WEIGHTS.....	1000kgs	

LEGEND



LEGEND



INSTALLATION

UNCRATING

Be careful in removing protective crating, to avoid damaging the machine and parts. If the machine is damaged during transit, immediately contact your local distributor and the transportation company who delivered your machine.

CHECK FOR SHORTAGE

Be sure to check your machine against the packing list that is shipped with every machine. In case of shortages, immediately note items not received and contact your local distributor.

CLEANING

1. Remove rust preventative before moving any slideways.
2. The coating is best removed by using paraffin or light oil applied with a clean brush. When the coating has softened, remove with clean rags.

NOTE:

Do not use gasoline or any other flammable solution to clean the machine.

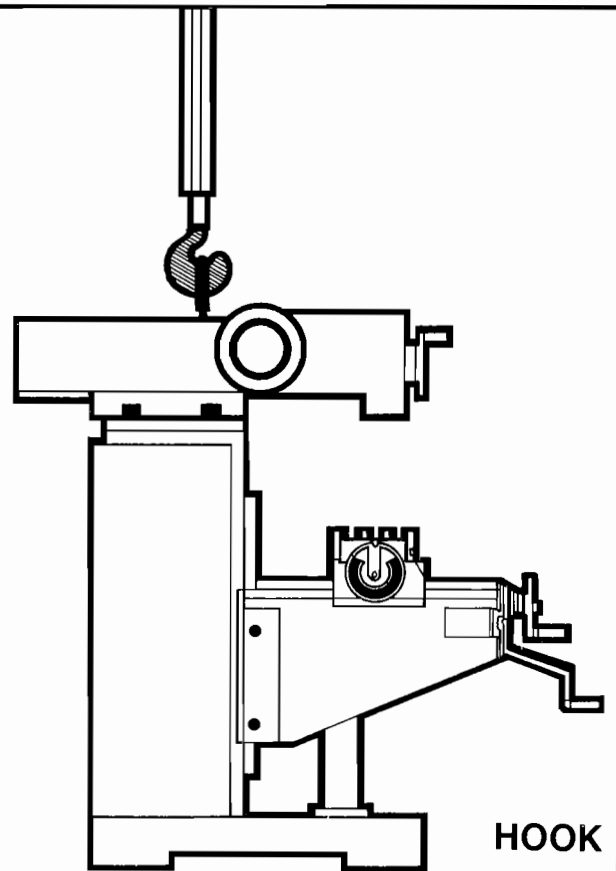
3. Oil or grease all lubrication points.

INSTALLATION

PROPER METHOD FOR LIFTING MACHINE

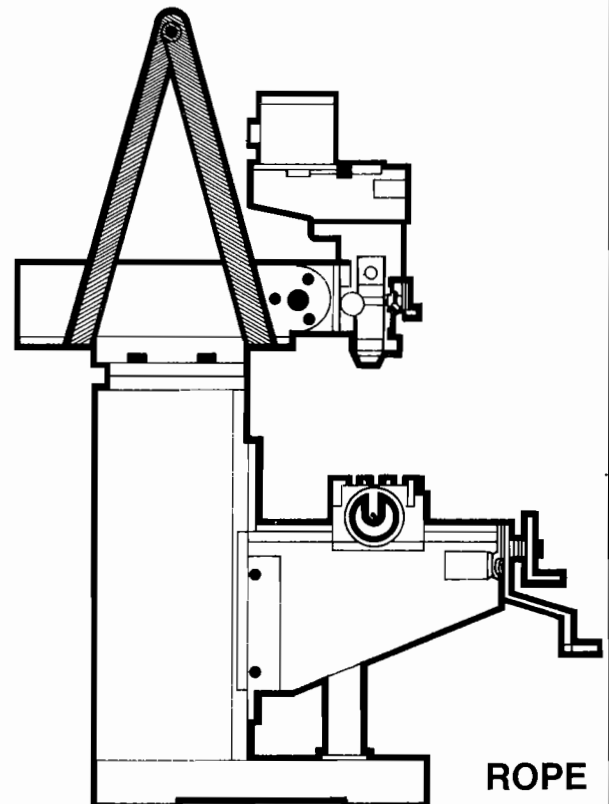
METHOD-1

Insert 5/8"-11 UNC Whitworth eye bolt in tapped hole. Ensure bolt is fully secured before lifting.



METHOD-2

Use rope sling as illustrated. Insert pads of soft cloth between rope and machined edges.



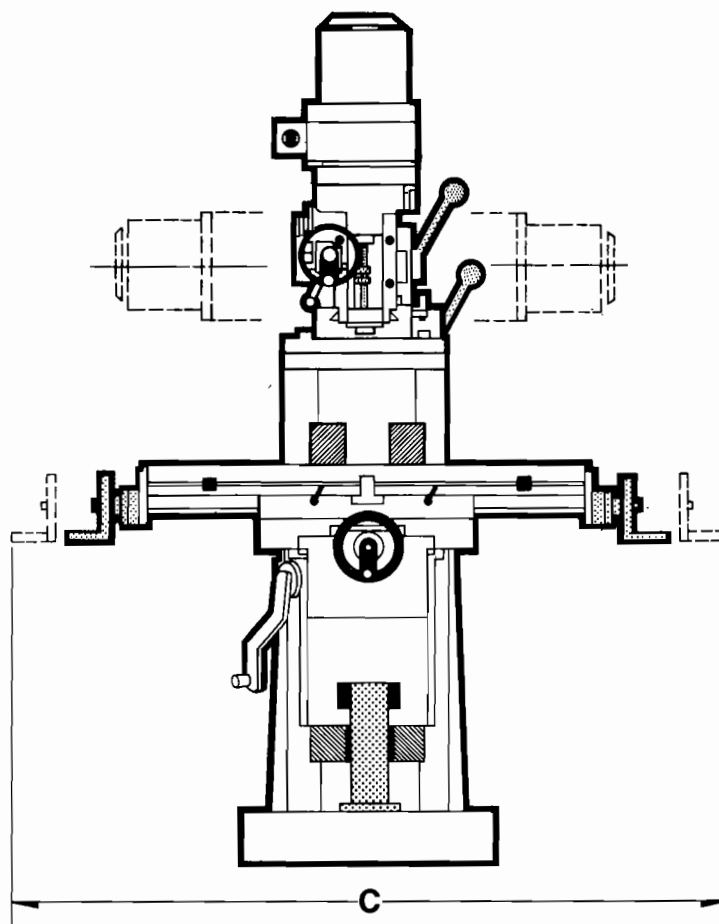
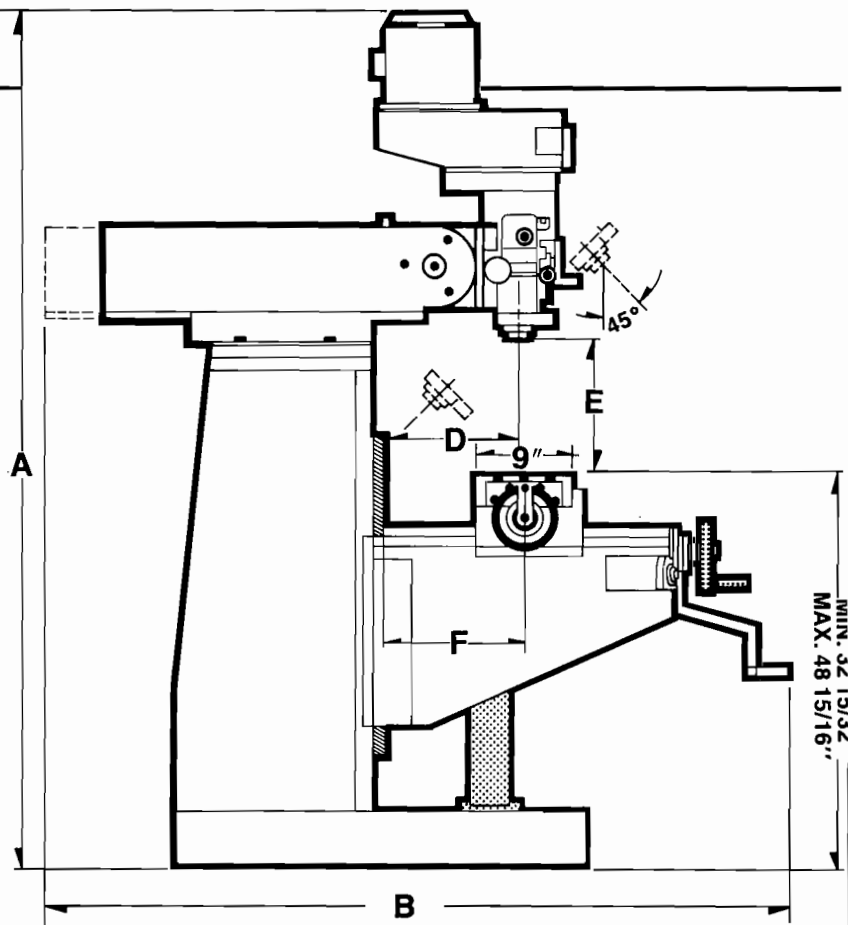
NOTE:

It is necessary to set the overarm and table at suitable position.

INSTALLATION

FLOOR PLAN

A. OVERALL HEIGHT	81"
B. OVERALL DEPTH	70 5/8"
FOR 16" CROSS	73 5/8"
C. OVERALL WIDTH	97 3/8"
FOR 49" TABLE	104 3/8"
D. SPINDLE CENTER TO COLUMN	5 7/16"
	23 7/16"
E. TABLE TO SPINDLE NOSE	0—19"
F. TABLE CENTER TO COLUMN	5 9/32"
	18 9/32"
FOR 16" CROSS	5 9/32"
	21 9/32"
MACHINE WEIGHTS (APPROX.)	2200 lbs



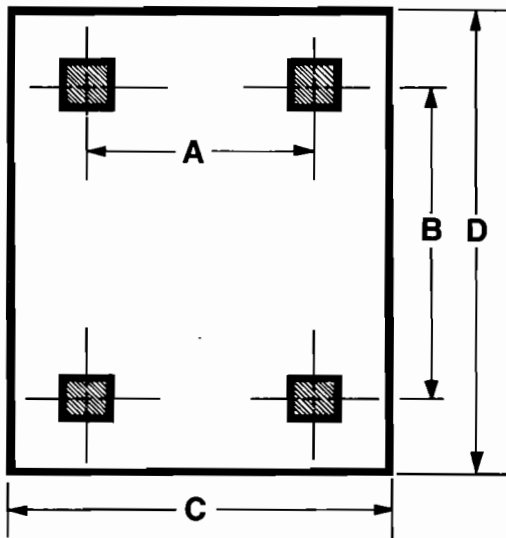
MIN. 36 13/32"
MAX. 48 15/16"

INSTALLATION

FOUNDATION

When setting machine on a concrete foundation, it is advisable to use a little grout to take care of unevenness in the concrete as well as to provide a solid foundation at all points.

FOUNDATION PLAN

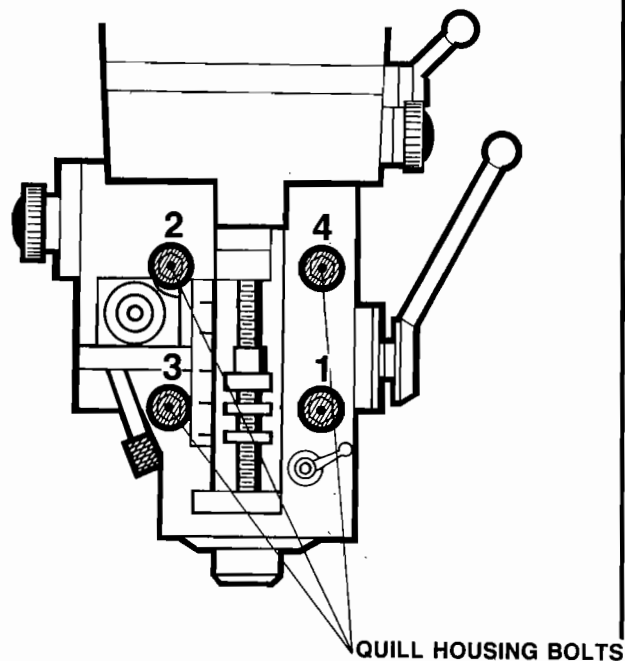


- A. 20 3/8" (518mm)
- B. 24 7/32" (742mm)
- C. 40 5/32" (1020mm)
- D. 48 7/8" (1242mm)

INSTALLATION

BRING HEAD TO UPRIGHT POSITION

Bring the milling head to the upright position by loosening the four quill housing bolts and rotating head to the upright position. Do not tighten quill housing locking bolts until the head has been properly aligned. To avoid quill distortion, tighten all quill housing locking bolts—according to the bolt rotation in Figure to exactly twenty-five ft.lbs., then repeat tightening according to rotation to exactly fifty ft.lbs.



POWER SUPPLY

1. Check motor voltages against supply.
2. Ensure that the supply is connected to comply with the local safety regulations.

NOTE:

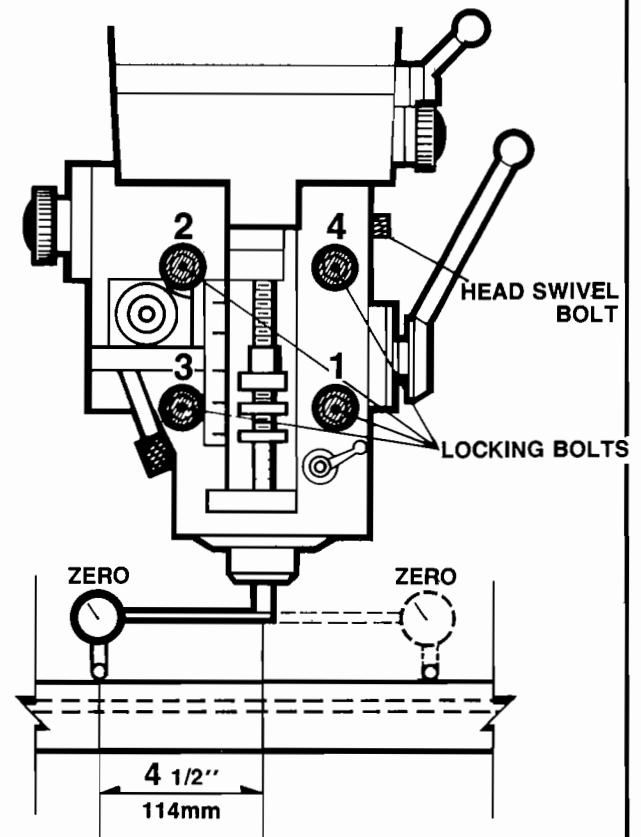
The head switch has no overload protection when a control panel is not fitted.

INITIAL SETTING

HEAD ALIGNMENT

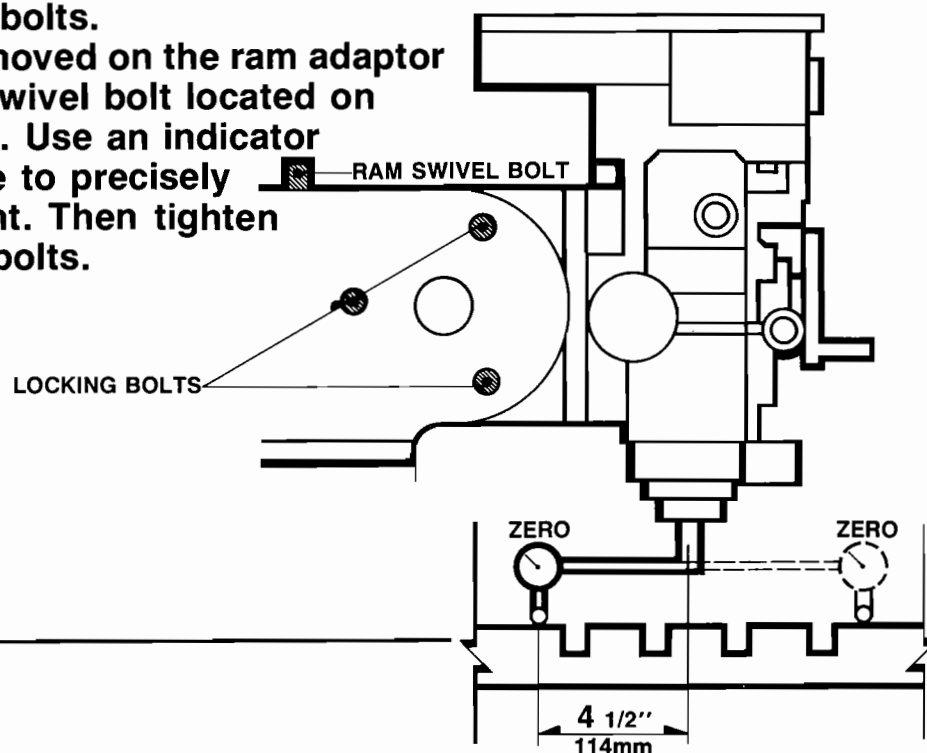
1. X AXIS

Loosen the four quill housing locking bolts. Be sure to leave a slight drag on these bolts. The head can now be moved from left to right by using the head swivel bolt that is located on the right side of the head. Use an indicator mounted in the spindle to indicate table alignment.



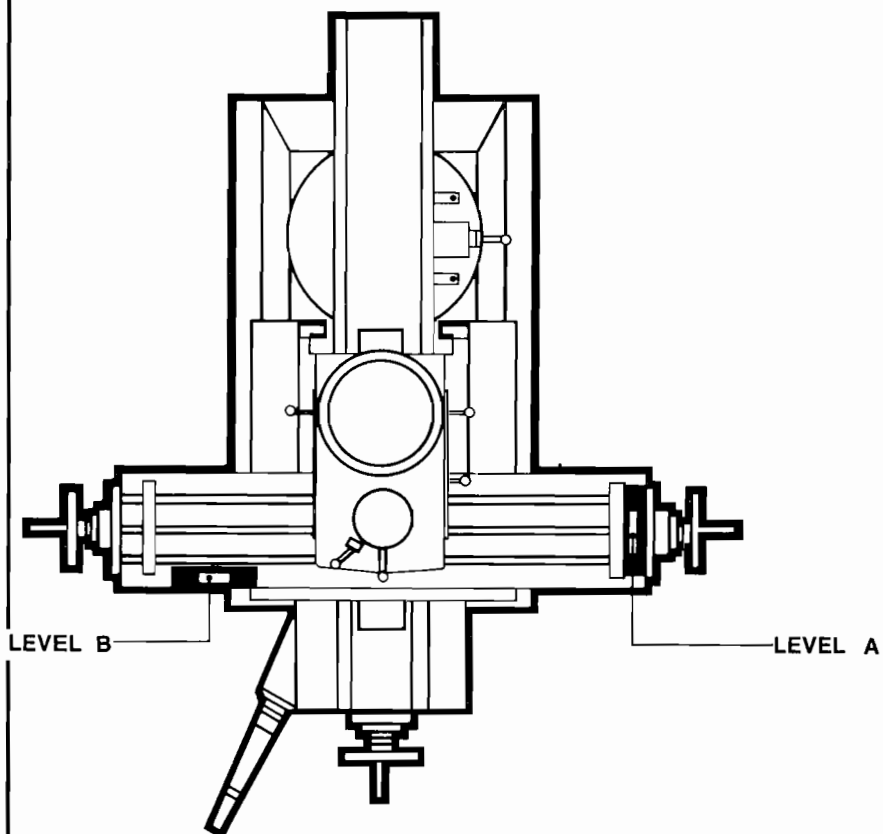
2. Y AXIS

Loosen the three ram locking bolts on the ram adaptor. Be sure to leave a slight drag on these bolts. The head can now be moved on the ram adaptor by using the adaptor swivel bolt located on top of the ram adaptor. Use an indicator mounted in the spindle to precisely indicate table alignment. Then tighten the three ram locking bolts.



LEVELING

1. Put levels on the table as illustrated.
2. Check the levels A and B. The allowance approximate 0.06mm/M.
3. Put the shims under the bed if necessary.



OPERATION

HEAD

SPINDLE SPEED

(STOP MOTOR BEFORE CHANGING SPEED)

80	135	210	325	BACK GEAR
660	1115	1750	2720	DIRECT

CHANGE SPEED

1. CHANGE SPEED WITHIN RANGE

- A. ISOLATE MACHINE
- B. SLACKEN TWO MOTOR LOCK LEVERS "A"
- C. SLIDE MOTOR FORWARD
- D. POSITION BELT ON APPROPRIATE PULLEYS
- E. SLIDE MOTOR TO THE REAR TO TENSION VEE BELT
- F. TIGHTEN TWO MOTOR LOCKING LEVERS

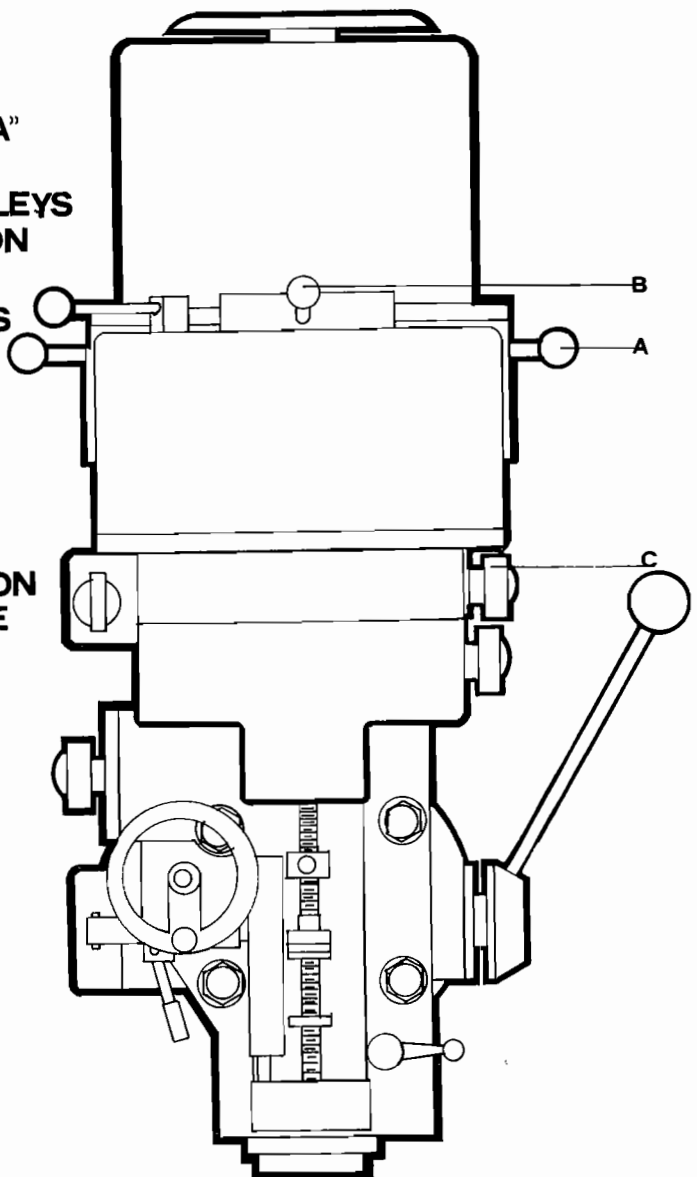
2. CHANGE RANGE

- A. FROM DIRECT TO BACK GEAR DRIVE
MOVE LEVER "B" TO THE RIGHT
MOVE KNOB "C" TO "IN" POSITION
- B. FROM BACK GEAR TO DIRECT DRIVE
MOVE LEVER "B" TO THE FRONT POSITION
ROTATE SPINDLE BY HAND UNTIL THE CLUTCH ARE FELT TO ENGAGE
MOVE KNOB "C" TO "OUT" POSITION

NOTE:

THE ACTION WILL REVERSE THE SPINDLE ROTATION.

MOVE MOTOR SWITCH TO REVERSE POSITION TO OBTAIN ORIGINAL DIRECTION OF SPINDLE ROTATION.



OPERATION

HEAD

AUTOMATIC FEED

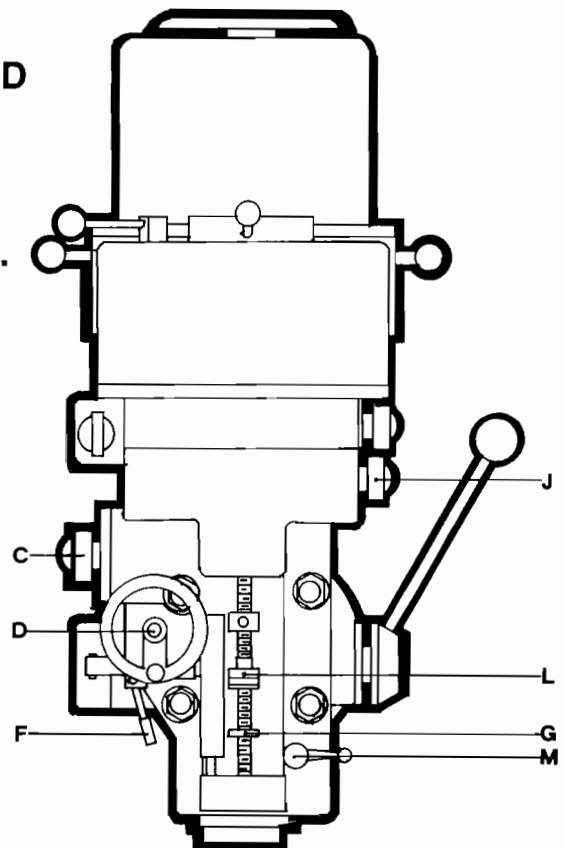
1. Loosen quill lock lever "M".
2. Engage auto quill feed "J".
3. Set micrometer dial "L" to required depth.
4. Select feed rate "C".
5. Engage the feed lever "F" to the left position.
6. The quill is now in automatic feed.

NOTE: A. Do not engage quill feed when spindle is over 3000 RPM.
B. Maximum loading 3/8" Dia. drill in steel.

HOW TO GET THE ACCURATE QUILL FEED DEPTH IN AUTOMATIC FEED

1. Locate "D" in the mid position.
2. Engage "F" to the left position.
3. Turn nut "G" to the bottom and lock it.
4. Adjust "L" to the required position.
5. Engage "D" in the required position.
6. When a series of clicks is heard, the required depth is reached. You should disengage "F" to the right position by hand.

* When this section is not in use, please loosen the nut "G".

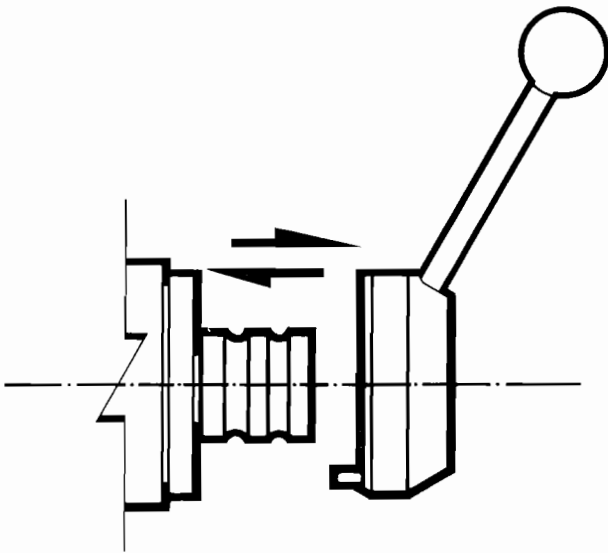


OPERATION

HEAD

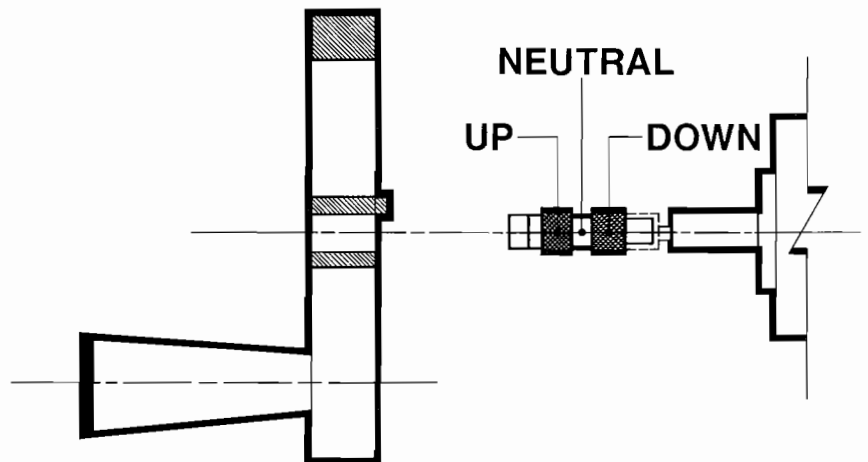
SENSITIVE HEAD FEED

1. Place the handle on the boss.
2. Select the most suitable position.
3. Push home until locating pin engages.



FINE HAND FEED

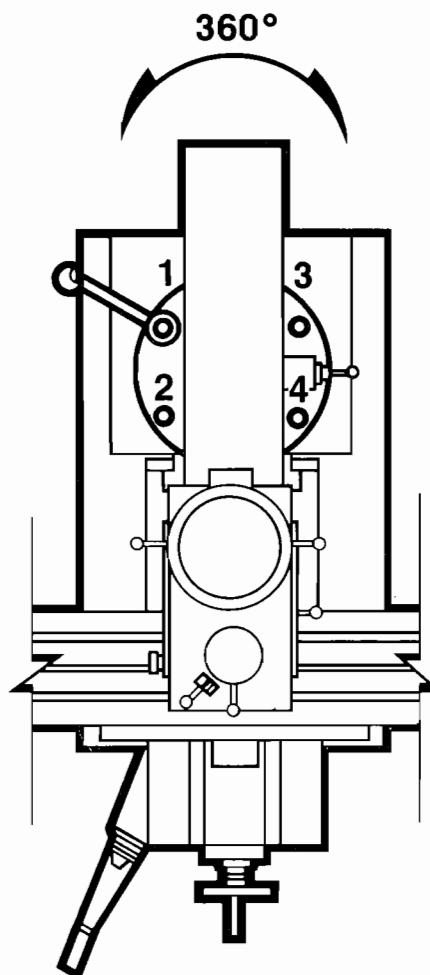
1. Disengage auto quill feed.
2. Locate feed select knob in the mid position.
3. Set feed engagement lever to the left position.
4. The quill is now under handwheel control.



OPERATION

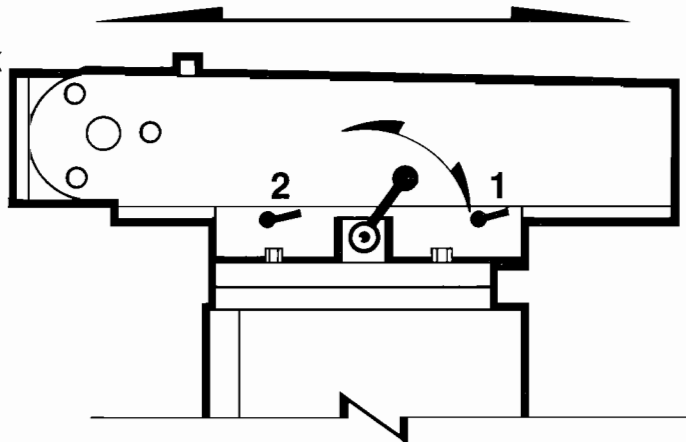
SWIVEL TURRET

1. Use wrench to unlock the four bolts.
2. Index to the required setting.
3. Lock the four bolts.



MOVE RAM SLIDE

1. Loosen two lock levers.
2. Turn the handle to move the slide to the desired position.
3. Tighten, tightening the rear lock lever first.



OPERATION

CLAMPING THE RAM, TABLE, SADDLE AND KNEE

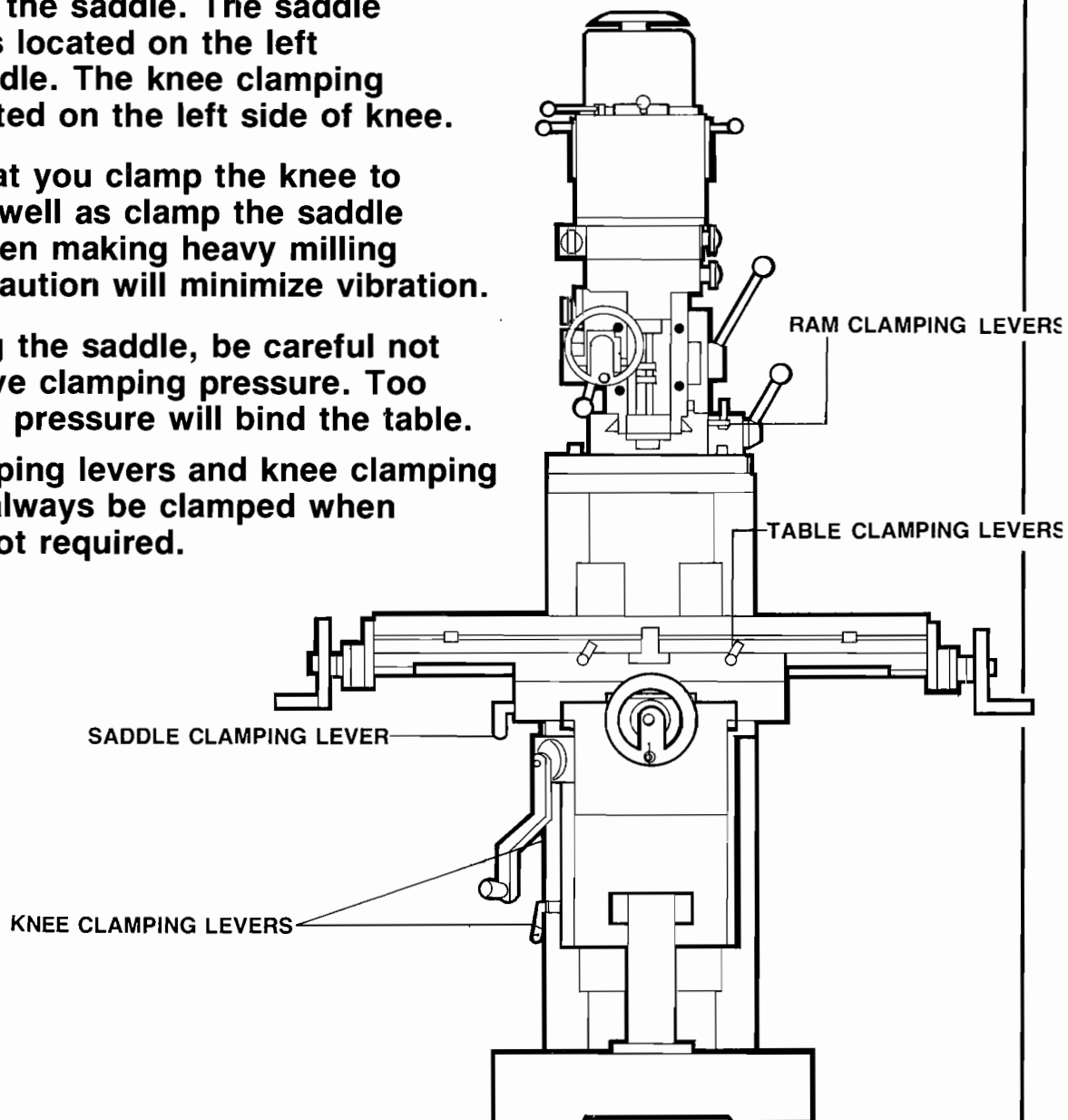
Two ram clamping levers are located on the right of ram. Both ram clamping levers should always be clamped.

Two table clamping levers are located on the front of the saddle. The saddle locking lever is located on the left side of the saddle. The knee clamping levers are located on the left side of knee.

We suggest that you clamp the knee to the column as well as clamp the saddle to the knee when making heavy milling cuts. This precaution will minimize vibration.

When clamping the saddle, be careful not to use excessive clamping pressure. Too much clamping pressure will bind the table.

The table clamping levers and knee clamping levers should always be clamped when movement is not required.



MAINTENANCE

MAY WE SUGGEST THAT

Before attempting any maintenance for safety you should isolate the machine electrically and for efficiency read the relevant section of this manual.

WHEN ORDERING REPLACEMENT PARTS

PLEASE QUOTE:

- * **THE MACHINE SERIAL NO.**
situated on the right hand side of the column.
- * **THE HEAD SERIAL NO.**
found on the right side of the belt housing.
- * **ITEM NUMBER.**
- * **PART NUMBER.**
- * **QUANTITY.**
- * **DESCRIPTION.**

PREVENTIVE MAINTENANCE

For securing the accuracy and life of the machine,
we offer the following suggestions.

DAILY:

- A. It is necessary to oil each lubrication point before operation.
- B. Check the level of the oil lubrication and fill if necessary.
- C. It is necessary to release the clamps, clean and lubricate the table after operation.

MONTHLY:

- A. Check all the gibs, and adjust if necessary.
- B. Check all the backlash between screws and nuts, and adjust if necessary.

QUARTERLY:

- A. Check and adjust the machine for accuracy.

TROUBLE-SHOOTING

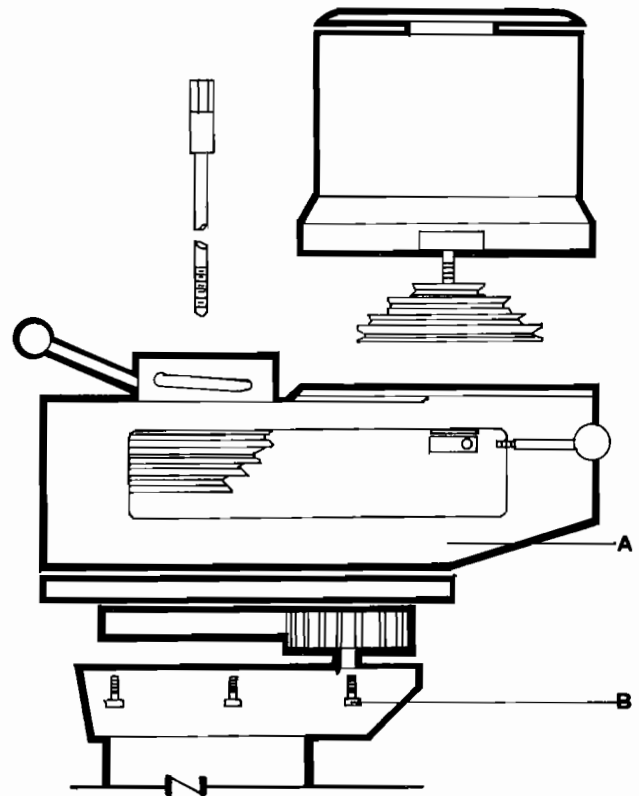
The following chart contains some typical probable troubles of operation, along with the possible causes and remedies for each.

TROUBLE	POSSIBLE CAUSE	REMEDY
SPINDLE FEED ABNORMAL	Quill clamp lever unrelease.	Release clamp lever.
SPINDLE BRAKE BRAKE-DOWN.	Brake shoe worn out	Replace.
POOR SPINDLE ROTATION	Poor contact on the switch,	Check the switch.
	Drive belt too slack.	Adjust or replace.
	Poor motor.	Repair or renew.
INCORRECT ROTATION	The switch knob indicated at wrong position.	Change to correct position.
3 AXES FEED UNSMOOTH	Gib strip too tight.	Release
	Unproper backlash between nuts and screws.	Adjust
	No lubrication at this point.	Check lubrication.
VIBRATES WHEN MACHINING	Machine unstable.	Reclamp
	unsuitable cutting condition.	Select proper cutting speed according to material and cutter.

MAINTENANCE

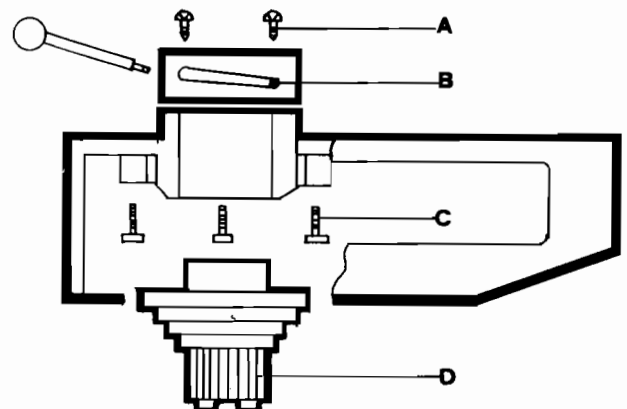
BELT REPLACEMENT

1. ISOLATE MACHINE
2. REMOVE DRAWBAR
3. REMOVE MOTOR
4. LOWER QUILL TO FULL EXTENSION
5. REMOVE SCREW "A"
6. REMOVE BELT HOUSING "B", TAP TO WITHDRAW FROM DOWELS
7. THE BELTS MAY NOW BE CHANGED



BRAKE SHOE REPLACEMENT

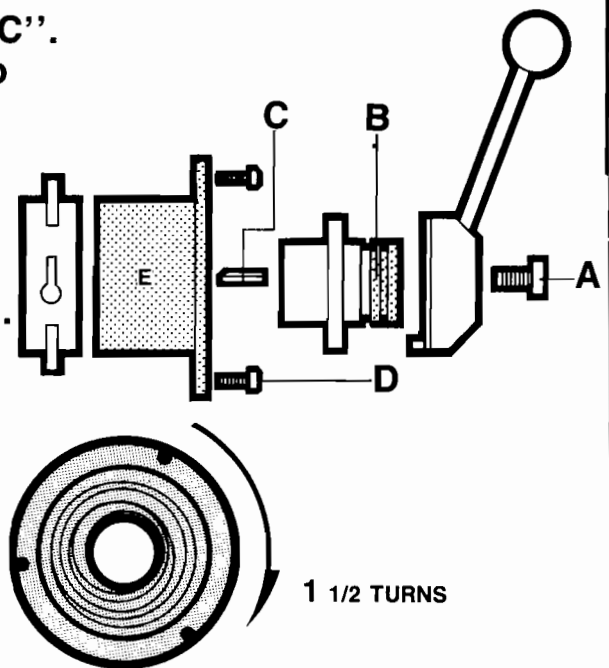
1. REMOVE FOUR SCREWS "A"
2. REMOVE TWO SCREWS "B"
3. PUSH BEARING HUB 'C' CLEAR OF HOUSING
4. REMOVE THREE SCREWS 'D'
5. REPLACE SHOE
6. ENSURE SCREW 'D' ARE FULLY TIGHTENED AND LOCKED WITH WASHERS AND NUTS



MAINTENANCE

BALANCE SPRING REPLACEMENT

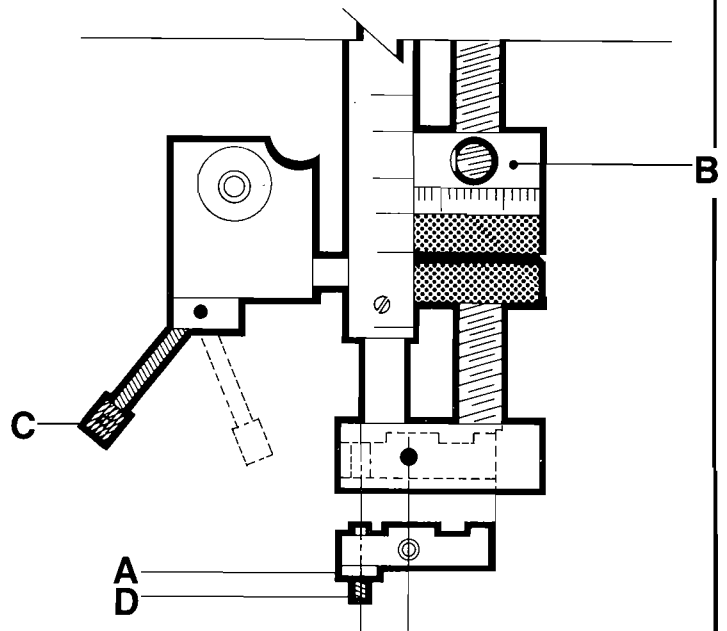
1. With quill at top of movement apply quill lock.
2. Remove screw "A", hub "B", and key "C".
3. Remove screws "D", allowing housing to rotate slowly releasing spring tension.
4. Lift end of spring from peg on the pinion shaft.
5. Rotate housing "E" counter-clockwise from head casting.
6. Remove spring from housing and replace.
7. Refit spring to main housing casting, turning housing clockwise until spring locates on peg in pinion shaft.



MAINTENANCE

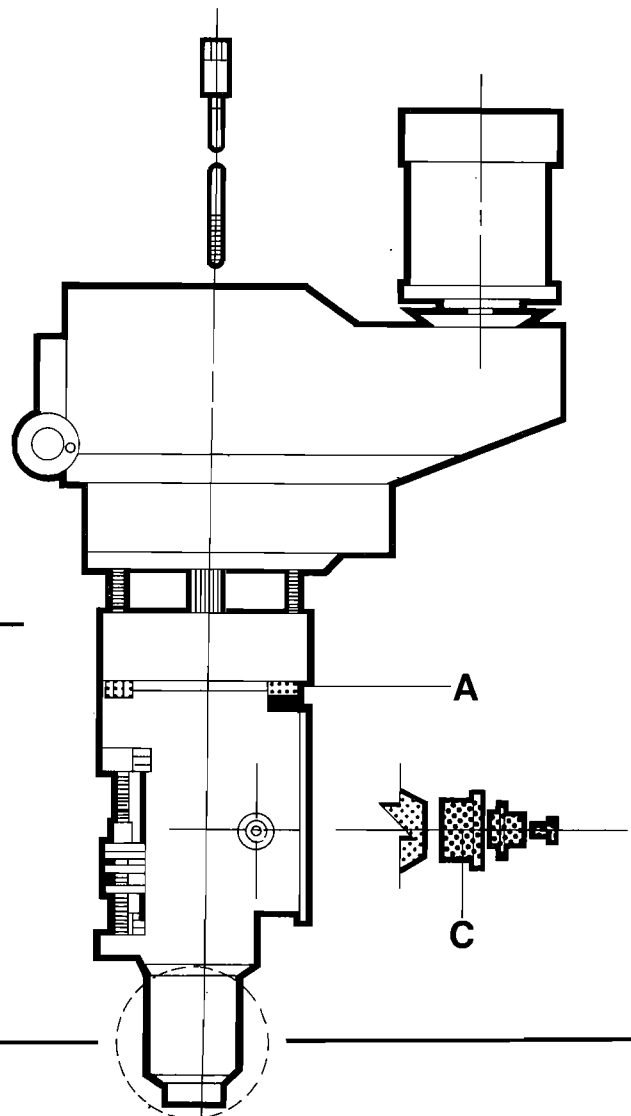
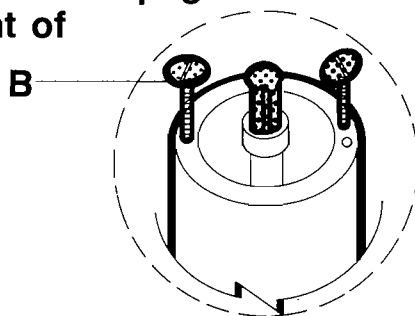
FEED TRIP ADJUSTMENT

1. Release lock nut "A".
2. Engage trip handle "C".
3. Adjust micro nuts against quill stop "B".
4. Slowly turn adjusting screw "D" until lever "C" trips.
5. At this point secure locknut "A".
6. Check that full trip action is obtained.



QUILL REMOVAL

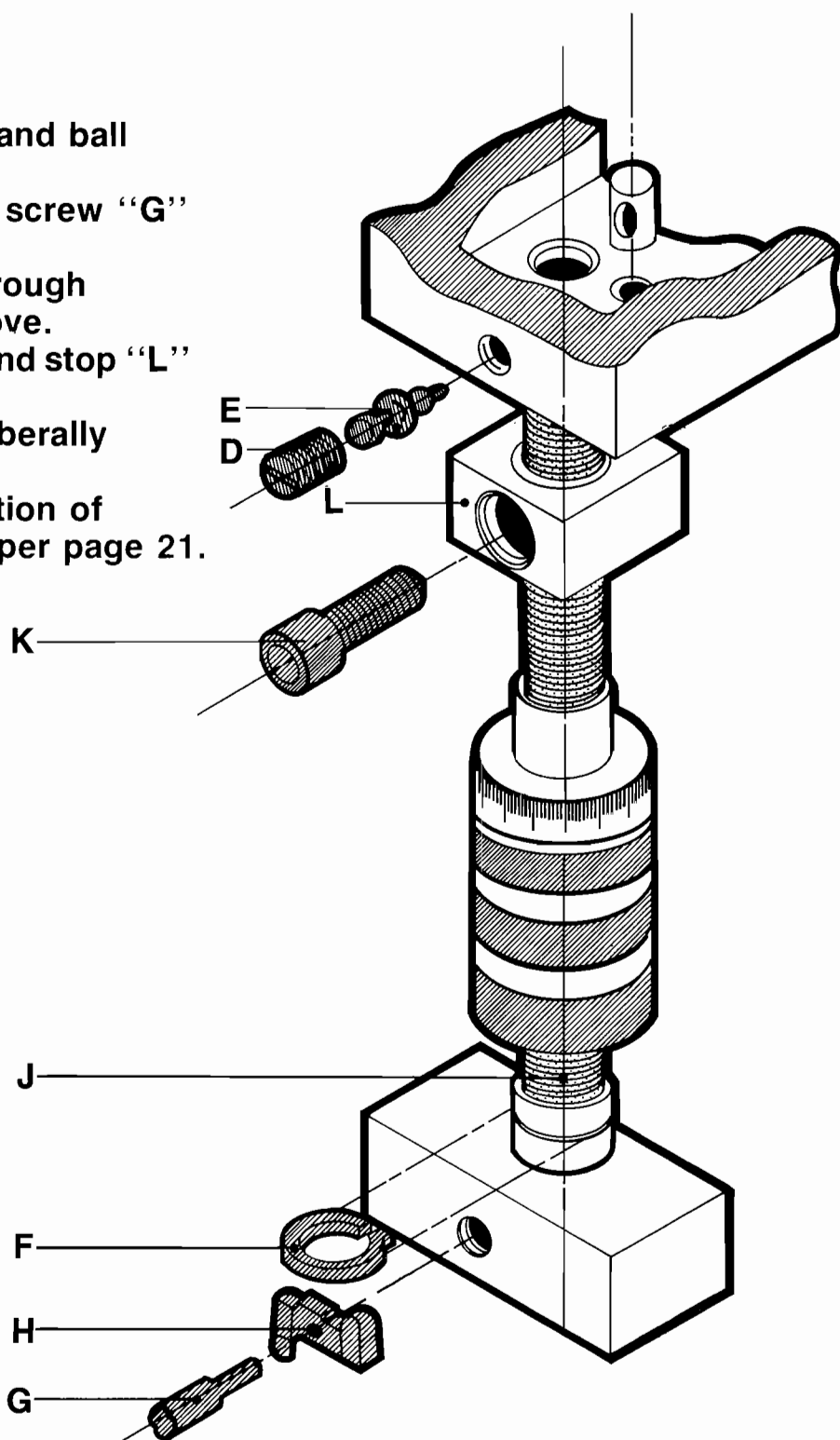
1. Disconnect electrical
2. Remove motor.
3. Remove drawbar.
4. Full extend quill fully.
5. Remove four nuts "A".
6. Remove top section completely.
7. Remove two screws "B" from top of quill.
8. Remove clock spring housing "C"—see instruction on page 20 for replacement of spring.



MAINTENANCE

QUILL REMOVAL

9. Remove screw "D" and ball reverse lever "E".
10. Remove circlip "F", screw "G" and arm "H".
11. Thread shaft "J" through micro nuts and remove.
12. Remove screw "K" and stop "L".
13. Remove quill.
14. Clean all areas, oil liberally and reassemble.
15. Check correct operation of feed trip linkage As per page 21.



MAINTENANCE

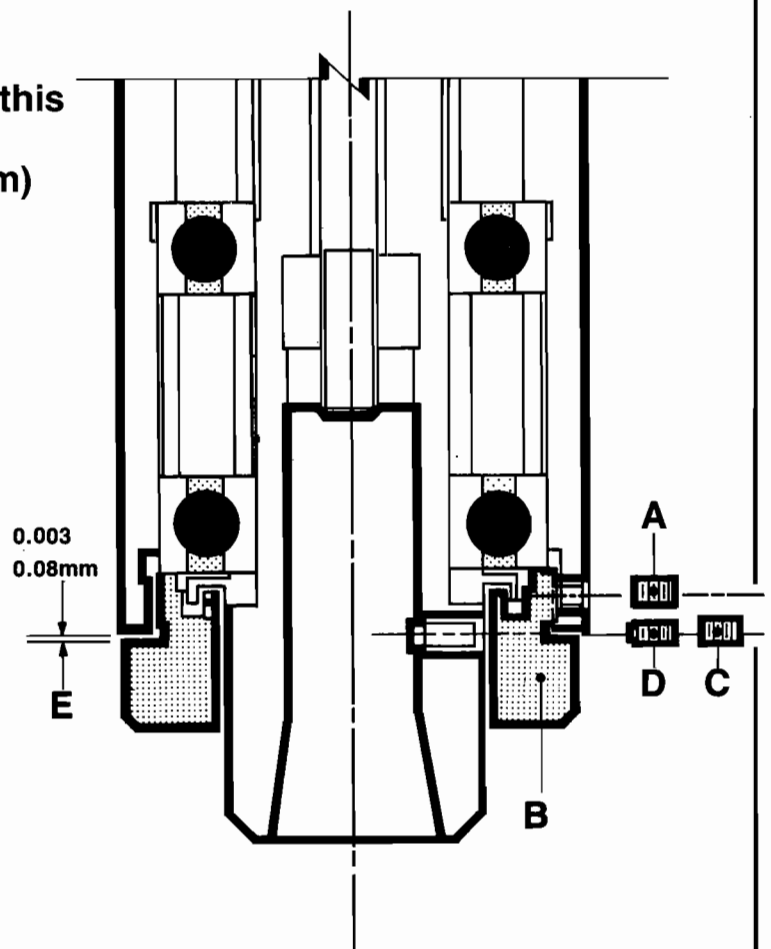
COLLET ALIGNING SCREW REPLACEMENT

1. Use felt pen to mark reference line on quill and nose cap "B".
2. Remove set screw "A".
3. Unscrew cap "B".
4. Remove lock screw "C" and screw "D".
5. Replace "D", insert R-8 collet and check that the dog on the end of the screw does not foul on the bottom of the guide slot.
6. Replace lock screw "C".
7. Replace nose cap "B", check felt pen markings for correct alignment.
8. Replace set screw "A".

CAUTION:

Do not overtighten as this will cause distortion.

9. Check gap "E". ($0.003'' = 0.08\text{mm}$)

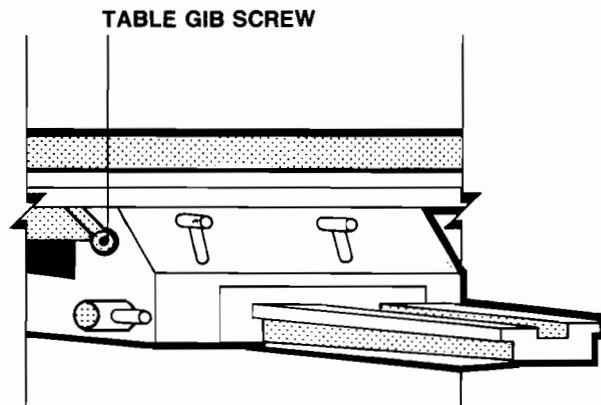


MAINTENANCE

GIB STRIP ADJUSTMENT

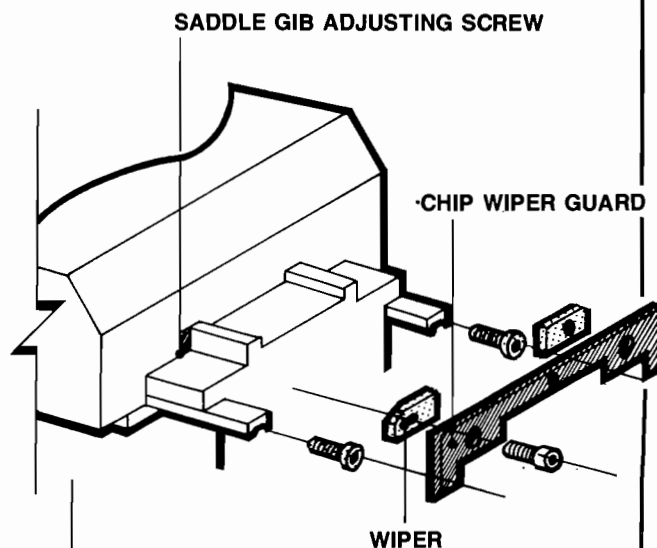
TABLE SADDLE WAYS

1. Remove all chips & foreign material from area.
2. Turn the table gib screw clockwise while moving the table until slight drag is felt.



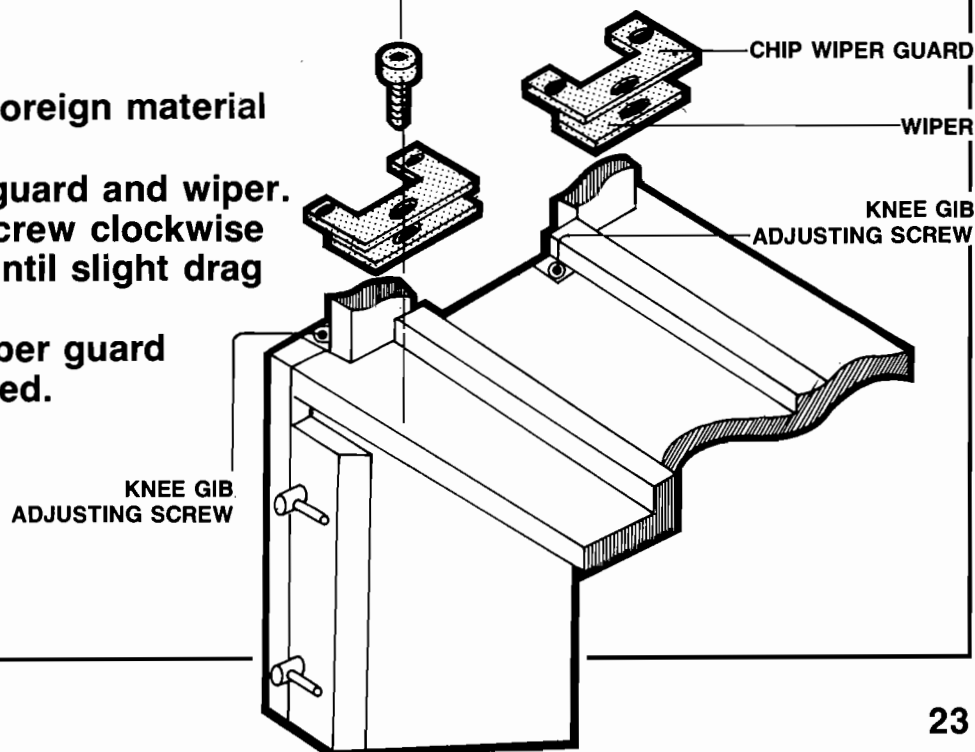
SADDLE KNEE WAYS

1. Remove all chips & foreign material from area.
2. Remove chip wiper guard and wiper.
3. Turn gib adjusting screw clockwise while moving the saddle until slight drag is felt.
4. Be sure that chip wiper guard and wiper are replaced.



KNEE COLUMN WAYS

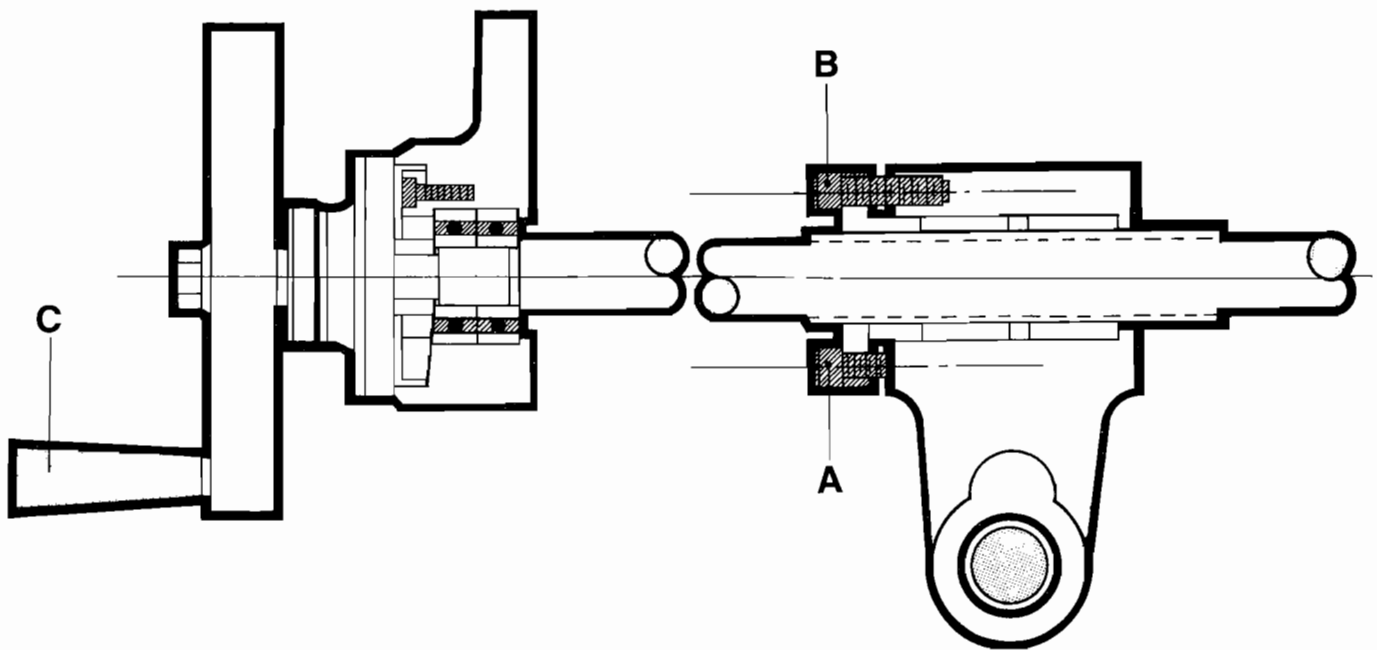
1. Remove all chips & foreign material from area.
2. Remove chip wiper guard and wiper.
3. Turn gib adjusting screw clockwise while moving knee until slight drag is felt.
4. Be sure that chip wiper guard and wiper are replaced.



MAINTENANCE

TABLE SCREW BACKLASH ADJUSTMENT

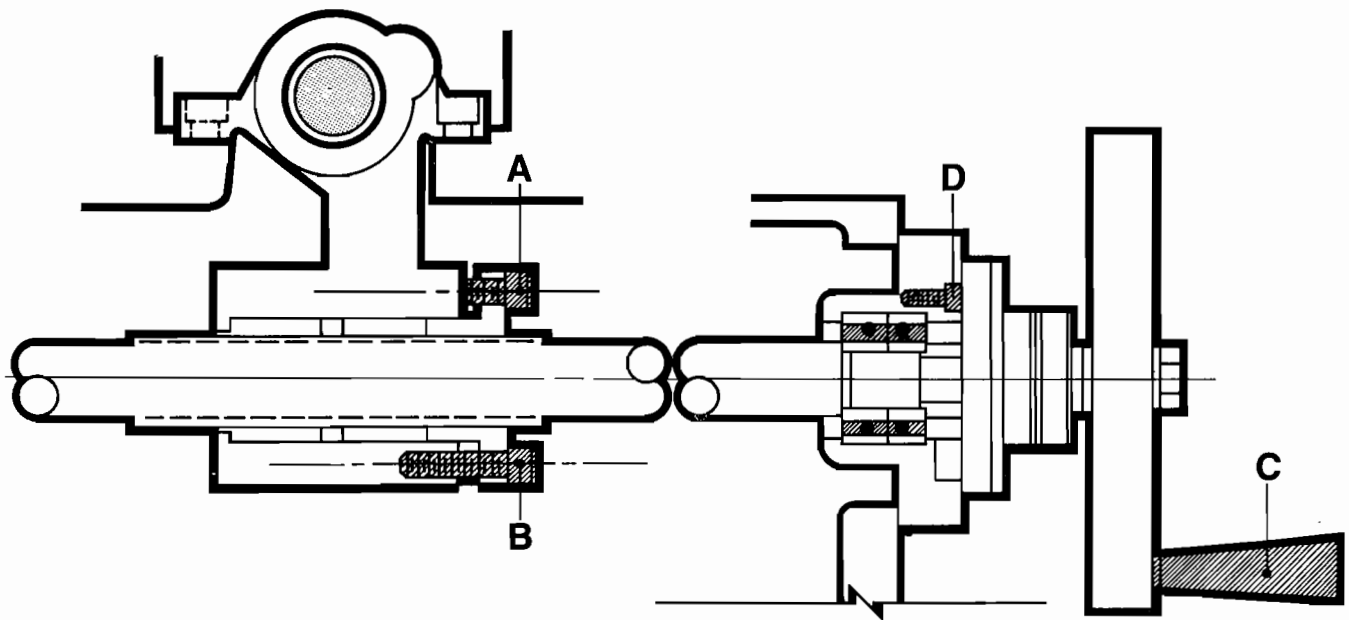
1. Crank the table to the left.
2. Remove the right side bearing support assembly.
3. Slowly turning handle "C", while tightening screws "B" until 0.004" or 0.005" backlash is obtained.
4. Lock screws "A".
5. Finally assemble the right side bearing support assembly.



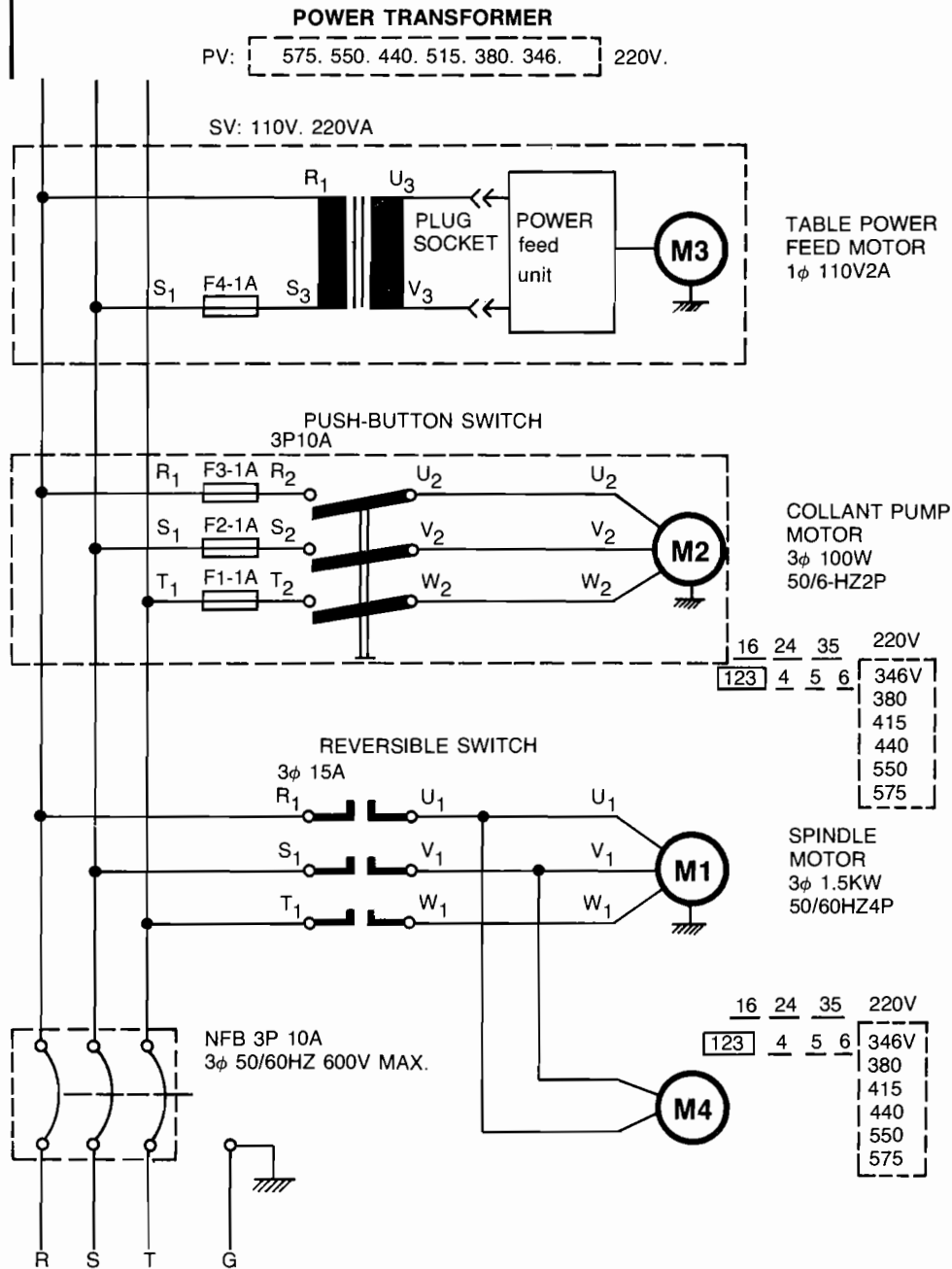
MAINTENANCE

CROSS SCREW BACKLASH ADJUSTMENT

1. Crank the saddle to mid position.
2. Withdraw four screws "D".
3. Pull the saddle forward to expose screws "A" and "B".
4. Slowly turning handle "C", tighten screws "B" until 0.004" or 0.005" backlash is obtained.
5. Lock screws "A".
6. Finally crank the saddle to the front of the knee and replace four screws "D".



ELECTRIC CIRCUIT DIAGRAM

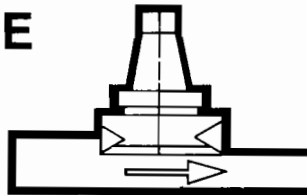


CUTTING DATA

MILLING DATA TABLE

CUTTING SPEEDS

Unit = m/min (IPM)



Material to be cut	High speed steel tools		Carbide-tipped tools	
	Rough mill	Finish mill	Rough mill	Finish mill
Cast iron HB 150–180	21 (826)	36 (1417)	80 (3150)	150 (5905)
Cast iron HB 180–220	16 (630)	27 (1063)	70 (2756)	120 (4724)
Cast iron HB 220–300	12 (472)	21 (827)	60 (2362)	90 (3543)
Carbon steel (Medium)	24 (945)	35 (1378)	75 (2953)	75 (2953)
Carbon steel (High)	12 (472)	24 (945)	60 (2362)	70 (2756)
Copper	38 (1496)	53 (2087)	180 (7086)	300 (11811)
Brass	76 (2992)	90 (3543)	240 (9449)	300 (11811)
Bronze	38 (1496)	50 (1968)	180 (7086)	300 (11811)
Aluminum	120 (4724)	210 (8267)	240 (9449)	300 (11811)

FEED PER TOOTH

Unit:mm/Tooth (INCH PER MIN.)

Material to be cut	Face mills	Helical mills	Aide mills	End mills	Form mill cutters	Circular saws
Cast iron HB 150–180	0.40 (0.015)	0.33 (0.013)	0.22 (0.009)	0.2 (0.008)	0.13 (0.005)	0.10 (0.004)
Cast iron HB 180–220	0.33 (0.013)	0.25 (0.01)	0.15 (0.006)	0.15 (0.006)	0.15 (0.006)	0.075 (0.003)
Cast iron HB 220–300	0.28 (0.011)	0.20 (0.008)	0.15 (0.006)	0.13 (0.005)	0.075 (0.003)	0.075 (0.003)
Carbon steel (Medium)	0.25 (0.01)	0.20 (0.008)	0.15 (0.006)	0.12 (0.0047)	0.075 (0.003)	0.075 (0.003)
Carbon steel (High)	0.15 (0.006)	0.13 (0.005)	0.10 (0.004)	0.075 (0.003)	0.05 (0.002)	0.05 (0.002)
Copper	0.30 (0.012)	0.25 (0.01)	0.17 (0.007)	0.15 (0.006)	0.10 (0.004)	0.75 (0.003)
Brass	0.35 (0.014)	0.28 (0.011)	0.20 (0.008)	0.18 (0.007)	0.10 (0.004)	0.75 (0.003)
Bronze	0.23 (0.009)	0.18 (0.007)	0.15 (0.006)	0.13 (0.005)	0.075 (0.003)	0.05 (0.002)
Aluminum	0.55 (0.022)	0.45 (0.018)	0.33 (0.013)	0.28 (0.011)	0.18 (0.007)	0.13 (0.005)

CUTTING DATA

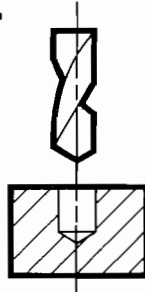
DRILLING DATA TABLE

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

V: Cutting speed, M/min.

D: Drill diameter, mm.

N: Revolutions per minute, rpm.



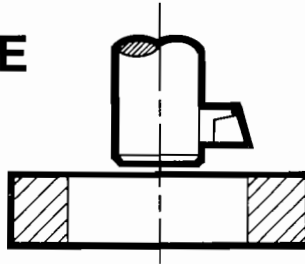
MATERIAL	HARDNESS Brinell	PERIPHERAL SPEED M/min (IN/min)	FEED mm/min (IN/min)	LUBRICANT
Cast iron, soft	126	42-45 (165-177)	Heavy	
Cast iron, medium	196	24-33 (95-130)	Medium	
Cast iron, hard	293-302	13-15 (50-59)	Light	Soluble oil
Steel, 40-50 carbon	170-196	24 (95)	Medium	Soluble oil
Mild steel, 20-30 carbon	170-202	33-36 (130-142)	Heavy	Soluble oil
Copper	80-85	21 (83)	Light	Soluble oil
Brass	129-202	61-76 (240-300)	Heavy	2/3 lard oil 1/3 kerosene
Bronze, common	166-183	61-76 (240-300)	Heavy	Soluble oil or dry
Aluminum	99-101	193-309 (760-1210)	0.127-0.88 (0.005-0.035)	2/3 lard oil 1/3 kerosene

KEY TO FEED REVOLUTION

DRILL MM (IN)	HEAVY FEED MM (IN)	MEDIUM FEED MM (IN)	LIGHT FEED MM (IN)
6 (0.236)	0.20 (0.008)	0.13 (0.005)	0.06 (0.0024)
12 (0.472)	0.25 (0.01)	0.19 (0.0075)	0.10 (0.004)
19 (0.748)	0.40 (0.016)	0.25 (0.01)	0.15 (0.006)
25 (1)	0.50 (0.02)	0.30 (0.012)	0.19 (0.0075)

CUTTING DATA

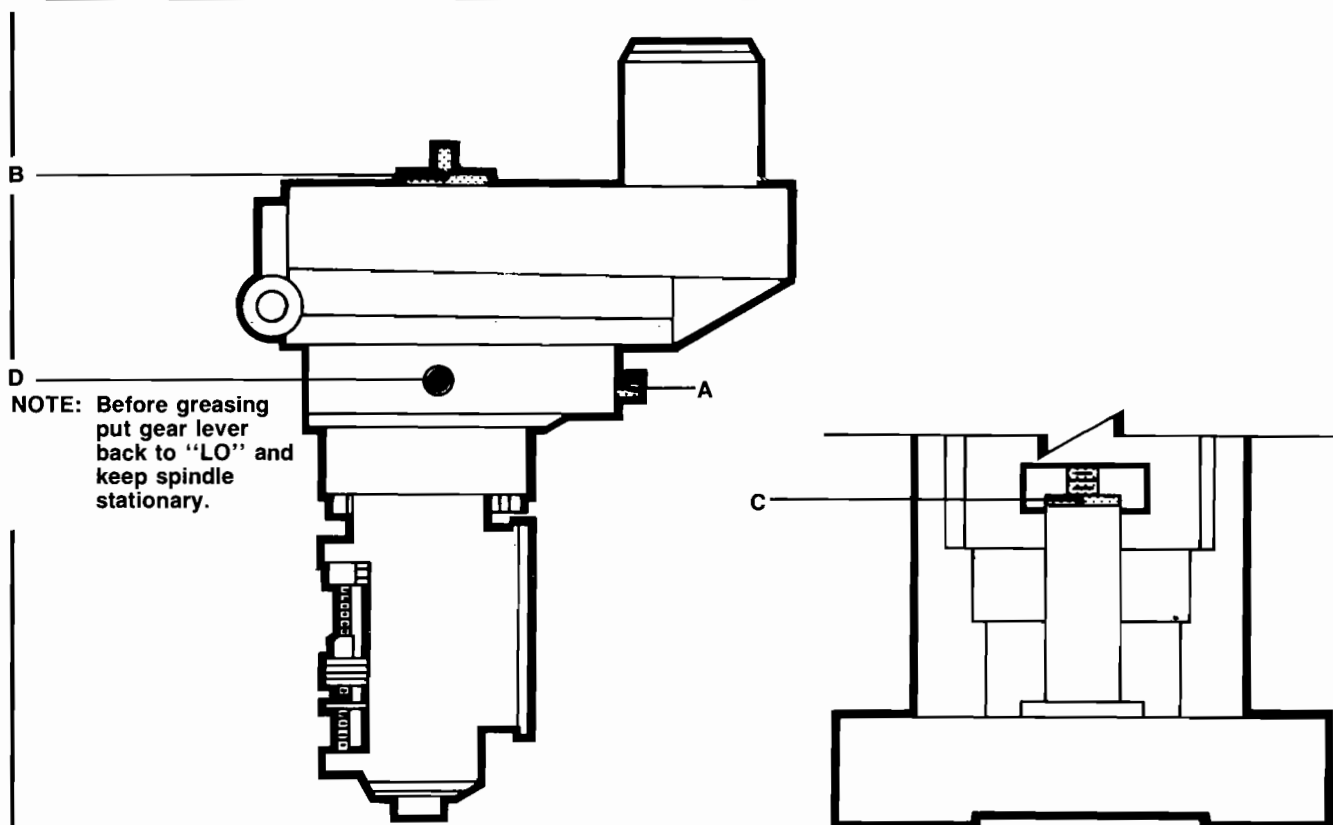
BORING DATA TABLE



Material	Cutting speeds		Lead	Depth of cut	Nose radius		Rake angles	
					Small bores	Large bores	Back rake	Side rake
	M/min. (IN/min)		mm/rev. (IN/rev.)	mm (IN)	mm (IN)	mm (IN)		
Cast iron	91 (358)		0.075 (0.003)	0.127 (0.005)	0.38 (0.015)	0.76 (0.03)		
	182 (716)		0.15 (0.006)	0.38 (0.015)	0.76 (0.03)	1.5 (0.06)		
Aluminum	280 (1100)		0.0025 (0.001)	0.127 (0.005)	0.38	0.38	0-15°	5-15°
	1800 (7080)		0.127	0.38		1.5		
Lead copper	91 (358)							
Lead red brass							0°	5°
Free cutting yellow brass								
Forging brass	1200 (4720)		0.025 (0.001)	0.05 (0.002)	0.38 (0.015)	0.76 (0.03)		
Red brass	150 (590)						0°	5°-10°
Yellow brass								
Naval brass	600 (2360)		0.127 (0.005)	0.38 (0.015)	0.76 (0.03)	1.5 (0.06)		
Copper	150 (590)						5°-10°	15°-20°
Chromium copper								
Commercial bronze								
Nickel-silver	300 (1180)							
High-carbon	80 (315)		Normally use 0.25 (0.01)				0°-6°	3°-8°
Alloy steels	100 (393)							
Interrupted cuts	180 (710)						5°-35°	11°-35°
and tough steels	210 (825)							
Low-carbon	300 (1180)						3°-10°	0°-15°
and free-cutting steels	350 (1380)							

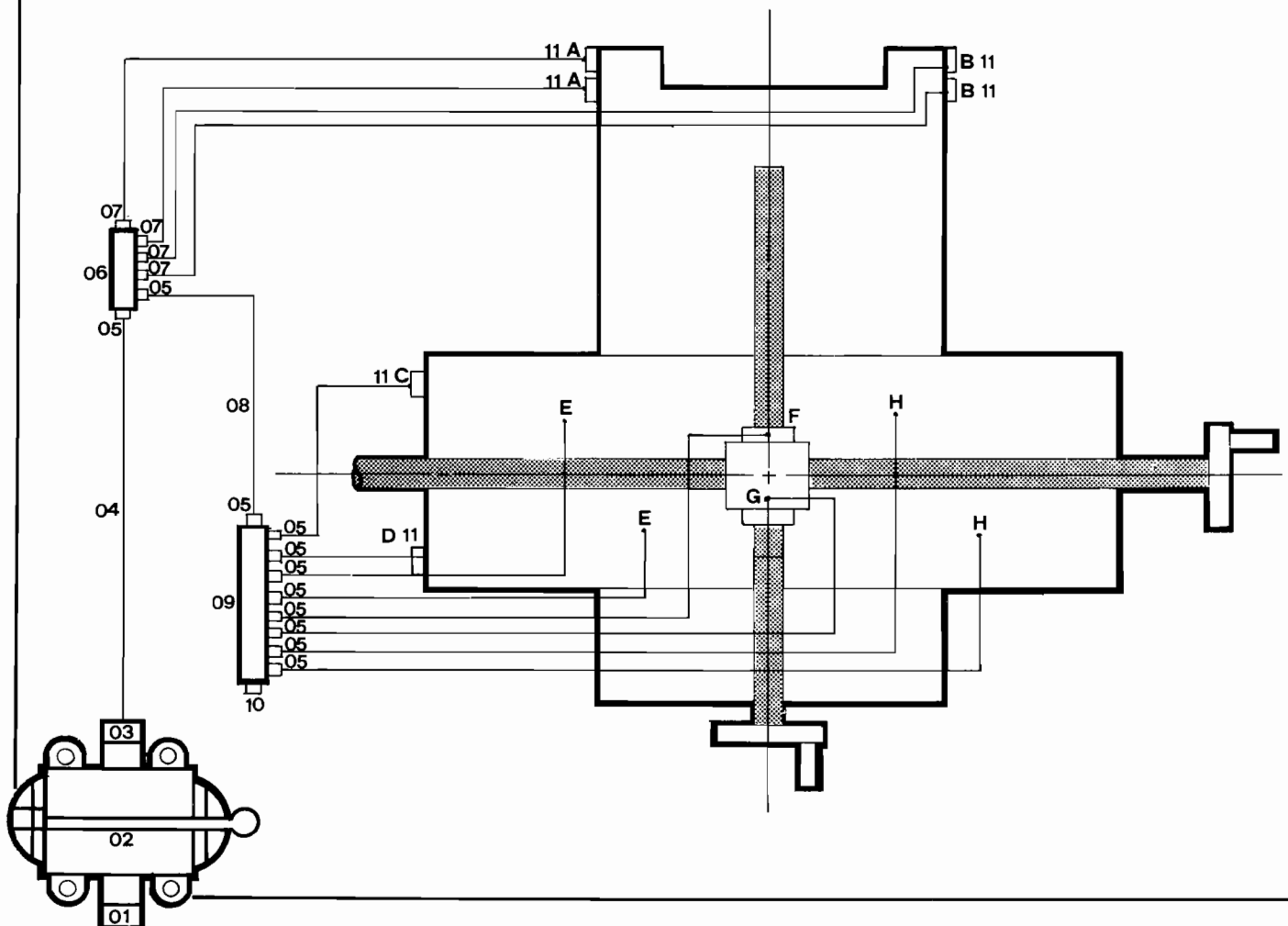
LUBRICATION

FREQUENCY	LUBRICATE	LUBRICANT	QUANTITY LUB.AT.	
Twice Daily (When feed is in use)	Spindle down feed	Vectra Heavy Medium S.A.E. 10 or 10W Light	Top-Up	A
Weekly	Drawbar splines (move quill down 2")	Ditto	5 drops	B
Twice Weekly	Elevating Screw	Shell Cornea Oil 41 MOBIL x 2 Socony Gargoyle Vectra No.2	5 Shots (Oil Gun)	C
Every 2 months (of normal use)	Back gear	Grease	Equivalent of one teaspoonful	D

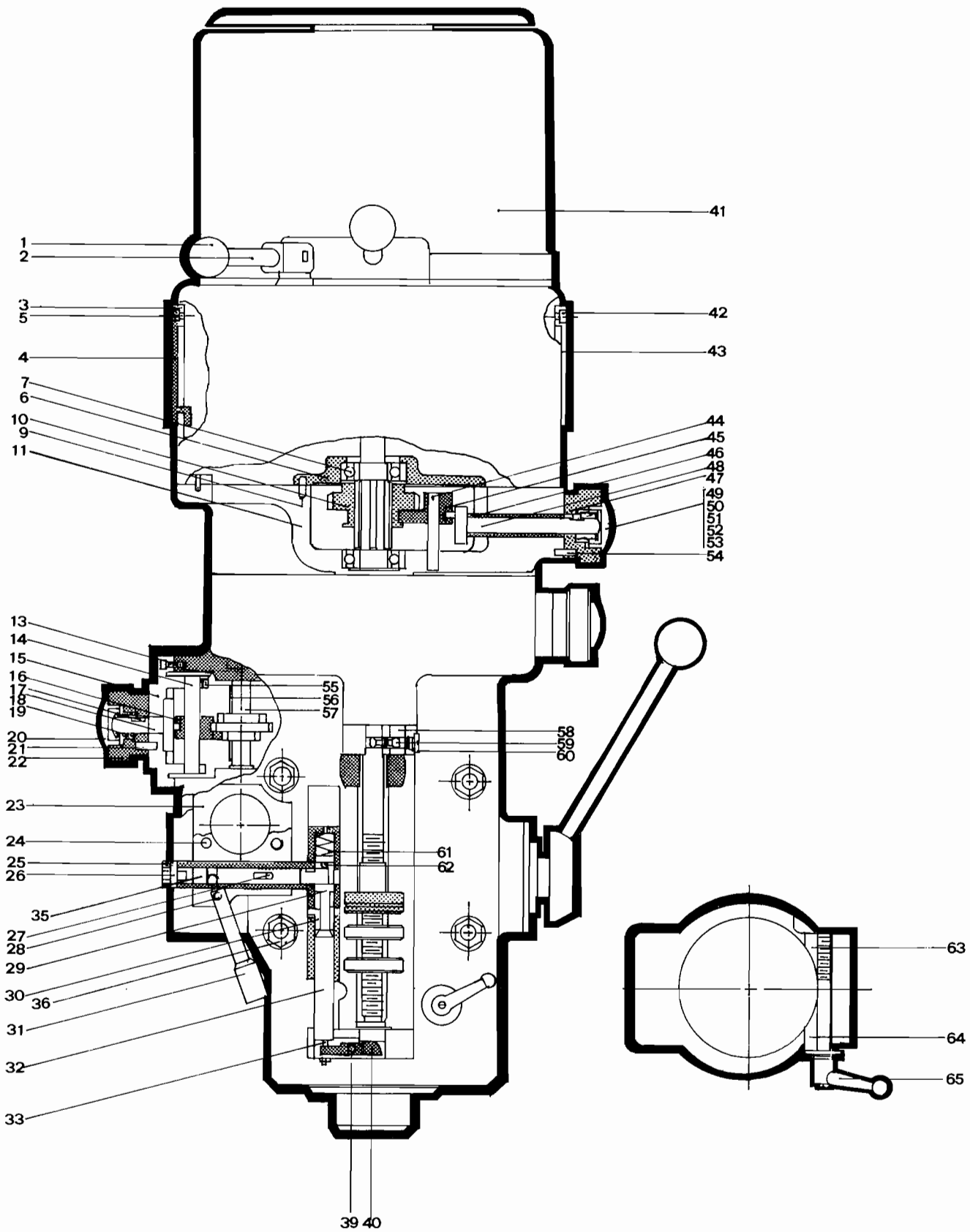


A. TO ELEVATING LEFT GUIDEWAY
 B. TO ELEVATING RIGHT GUIDEWAY
 C. TO TABLE AND SADDLE REAR GUIDEWAY
 D. TO TABLE AND SADDLE FRONT GUIDEWAY
 E. TO KNEE AND SADDLE LEFT GUIDEWAY
 F. TO CROSS SCREW
 G. TO LONGITUDINAL SCREW
 H. TO KNEE AND SADDLE RIGHT GUIDEWAY

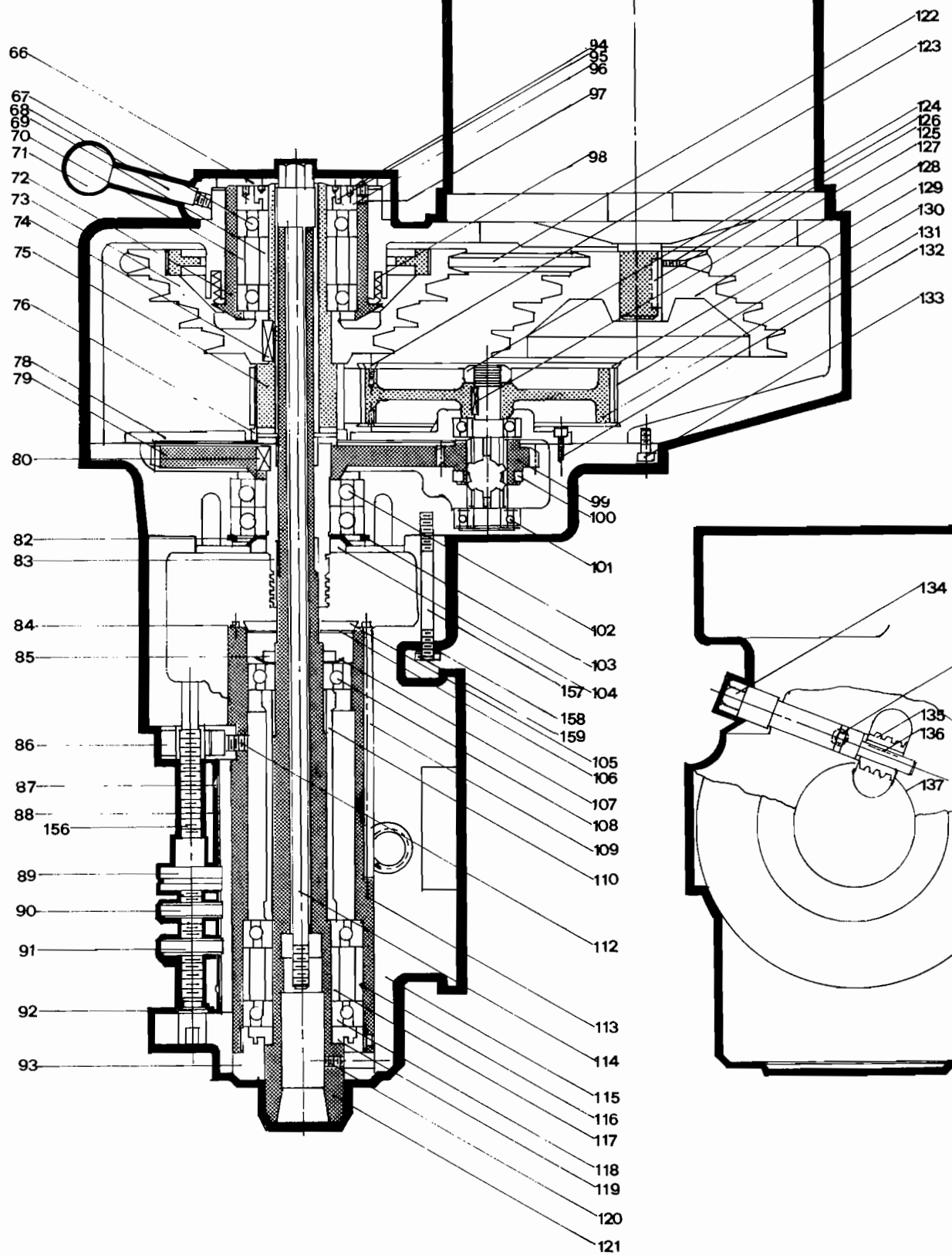
ITEM.NO.	COMP.NO.	DESCRIPTION	Q.T.
01	085008002	OIL PLUG	1
02	013008000	PLUNGER PUMP, (LT-8)	1
03	039040818	CHECK VALVE, (PDV-4)	1
	040004000	PIPE LOCK NUT (PA-4)	1
	050004000	PIPE JOINT (PB-4)	1
04	058008200	OIL PIPE 8MM×200	1
05	040004000	PIPE LOCK NUT (PA-4)	11
	050004000	PIPE JOINT (PB-4)	11
06	071060408	OIL DISTRIBUTOR (DB-6)	1
07	111001003	FLOW RECTIFIER (PSS-3)	4
	041004000	PIPE LOCK NUT (PAN-4)	4
	050004000	PIPE JOINT (PB-4)	4
08	058008330	OIL PIPE 8MM×330	1
09	0711004080	OIL DISTRIBUTOR (DB-10)	1
10	085000082	BRONZE PLUG	1
11	FE 031	COPPER CONNECTOR	6
	040004000	PIPE LOCK NUT (PA-4)	6
	050004000	PIPE JOINT (PB-4)	6



PARTS LIST

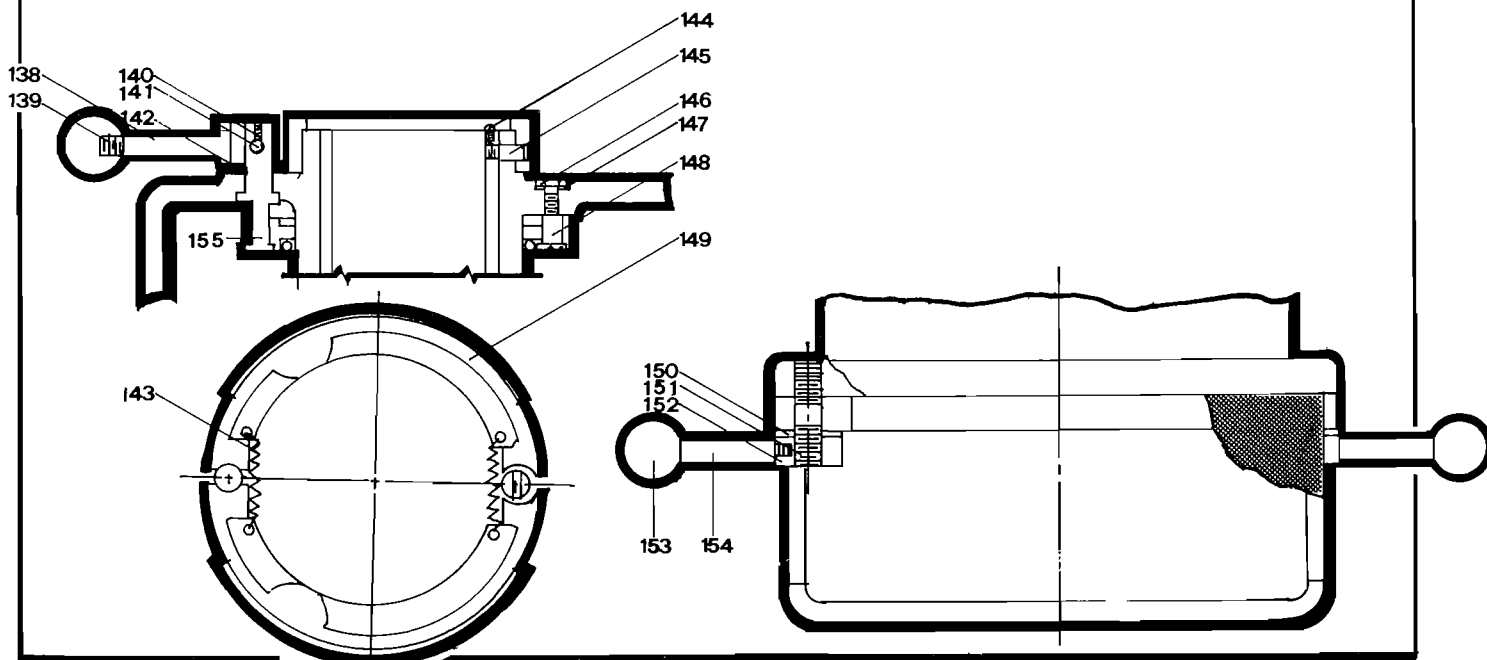


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
1	AA-039	BLACK PLASTIC BALL	1	42	600050150	M5X15 HEX-SOCKET	1
2	FA-314	BRAKE LEVER	1			HEAD CAP SCREW	
3	FA-303	BELT HOUSING	1	43	FA-336	BELT HOUSING RIGHT COVER	1
4	FA-335	BELT HOUSING LEFT	1	44	FA-339	DOWEL PIN	1
		COVER		45	FA-031	BACK GEAR SHIFTER FORK	1
5	600050150	M5 X15 HEX-SOCKET	1	46	FA-334	SLEEVE	1
		HEAD CAP SCREW		47	FA-323	BACK GEAR SELECT	1
6	FA-302	GEAR HOUSING COVER	1			HANDLE	
7	701062034	6203 2RS BEARING	2	48	FA-333	BACK GEAR SHIFT CRANK	1
9	622050020	Ø5X20 SPRING PINS	2	49	630030100	3X3X10 KEY	1
10	FA-025	COUNTER SHAFT GEAR	1	50	FA-326	SPRING	1
11	FA-301	GEAR HOUSING	1	51	FA-304	COVER	1
13	600050100	M5X10 HEX-SOCKET	4	52	FA-327	SPRING BASE	1
		HEAD CAP SCREW		53	665010000	A-10 OUTER RETAINING	2
14	FA-150	FEED SHIFT ROD	1			RINGS	
15	FA-337	CLUSTER GEAR COVER	1	54	622040012	Ø4X12 SPRING PIN	1
16	FA-149	FEED GEAR SHIFT FORK	1	55	604050100	M5X10 SET SCREW	1
17	630030100	3X3X10 KEY	1	56	630030460	3X3X46 CLUSTER	1
18	FA-311	CLUSTER GEAR SHAFT	1			GEAR KEY	
19	665010000	A-10 OUTER RETAINING	1	57	FA-143	CLUSTER GEAR SHAFT	1
		RING		58	FA-114	FEED REVERSE TRIP	1
20	FA-304	COVER	1			PLUNGER	
21	622040012	SPRING PIN	1	59	FA-113	REVERSE TRIP BALL LEVER	1
22	FA-323	HANDLE	1	60	FA-124	REVERSE TRIP BALL	1
23	FA-330	FEED TRIP BRACKET	1			LEVER SCREW	
24	600060200	M6X20 HEX-SOCKET	2	61	FA-094	COMPRESSION SPRING	1
		HEAD CAP SCREW		62	622030012	Ø3X12 SPRING PIN	1
25	FA-093	CAM ROD SLEEVE	1	63	FA-310	QUILL LOCK SLEEVE	1
		ASSEMBLY		64	FA-309	QUILL LOCK TAPED	1
26	FA-077	DOWEL PIN	1			SLEEVE	
27	622030008	Ø3X8 SPRING PIN	1	65	FA-088M	LOCK HANDLE	1
28	FA-077	DOWEL PIN	1	66	FA-073	CAM RING	1
29	FA-095	TRIP PLUNGER	1	67	701062072	BEARING 6207 2Z	2
30	FA-121	TRIP PLUNGER BUSHING	1	68	FA-315	SPINDLE CLUTCH LEVER	1
31	FA-328	TRIP HANDLE	1	69	FA-069	UPPER BEARING SPACER	1
32	FA-329	FEED TRIP PLUNGER	1	70	FA-068	UPPER BEARING SPACER	1
33	604040200	M4X20 SET SCREW	1	71	EB-047	HANDLE BALL	1
35	FA-091	CAM ROD	1	72	FA-066	BEARING SLEEVE	1
36	FA-040	HEAD FIXED NUTS	4	73	FA-065	SPINDLE PULLEY	1
39	FA-099	TRIP LEVER PIN	1	74	630060250	6X6X25 KEY	1
40	FA-098	FEED TRIP LEVER	1	75	FA-064	SPINDLE PULLEY HUB	1
41	413011010	MOTOR 2HP	1	76	FA-063	WASHER	1

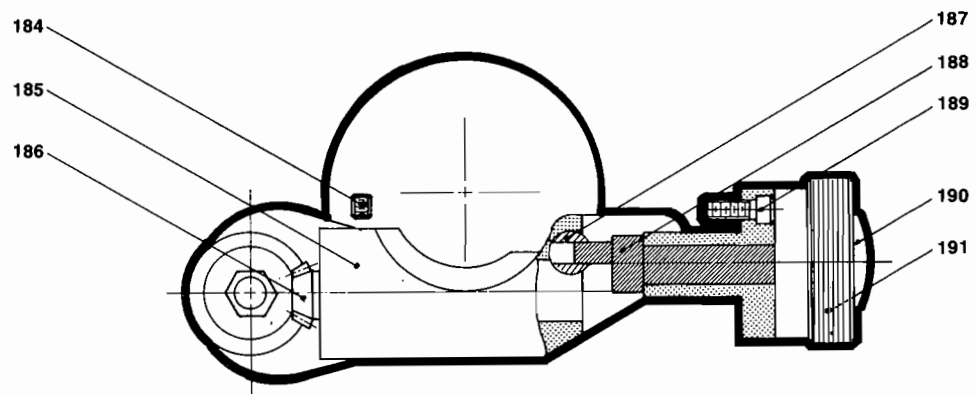


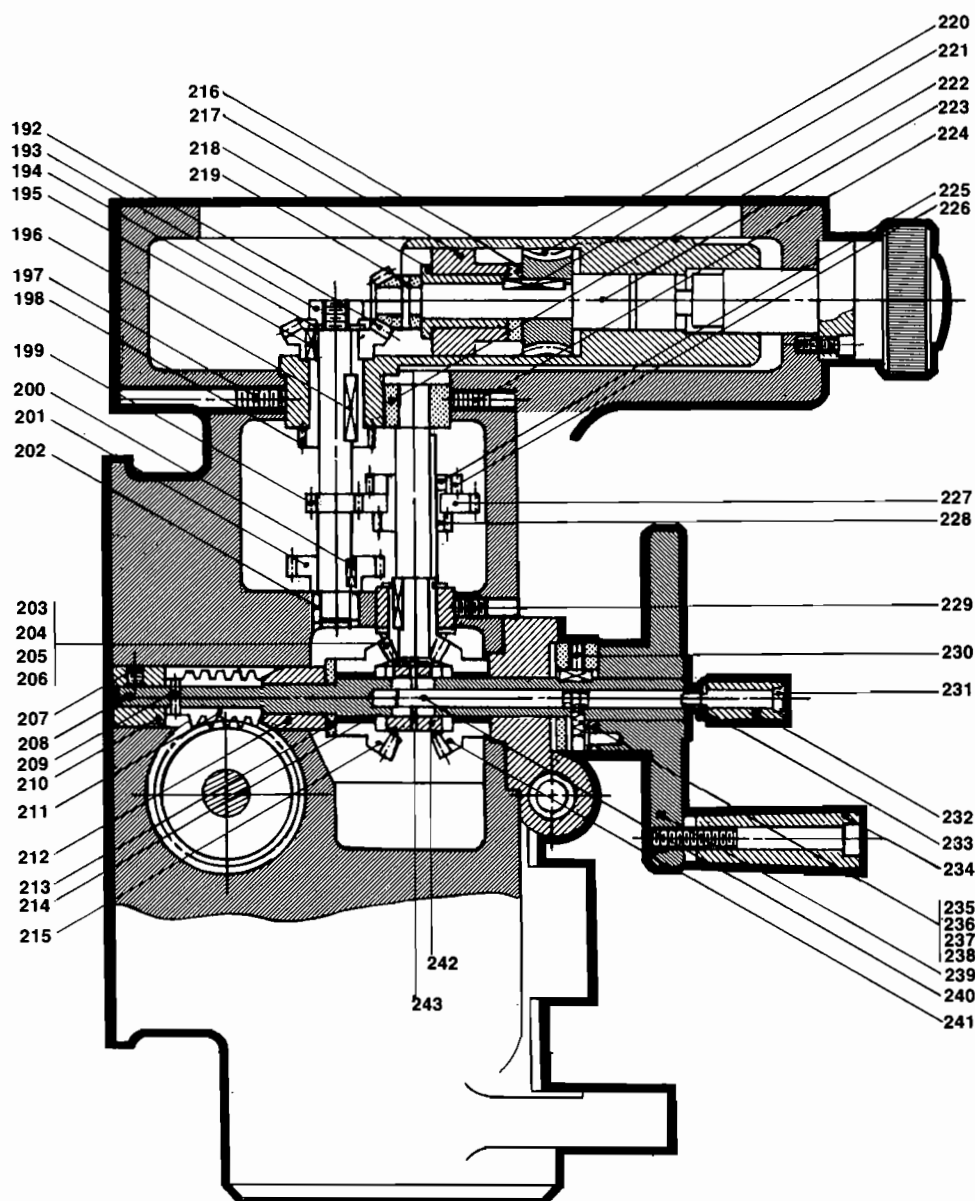
ITEM. NO.	COMP. NO.	DESCRIPTION	Q.T.Y.	ITEM. NO.	COMP. NO.	DESCRIPTION	Q.T.Y.
78	FA-302	GEAR HOUSING COVER	1	112	600100140	M10x14 HEX-SOCKET HEAD	1
79	FA-061	SPINDLE LOW SPEED	1			CAP SCREW	
		GEAR		113	FA-058	QUILL	1
80	635080140	8X8X14 KEY	1	114	FA-213C	DRAWBAR (NT 30, 1/2-12W	1
82	AB-003	LOCKNUT WASHER	1			STANDARD)	
83	FA-062	SPINDLE GEAR HUB	1		FA-213E	DRAWBAR (NT 30, 1/2-13UNC	1
84	606360041	W 3/16"X 1/4" PAN	2			OPTION)	
		HEAD SCREWS			FA-213D	DRAWBAR (NT 30, M12-175P	1
85	617030000	LOCKNUT	2			OPTION)	
86	FA-305	QUILL STOP KNOB	1		FA-213B	DRAWBAR, R8 7/16-20 UNF	1
87	606360041	W 3/16"X 1/4" PAN	2			OPTION	
		HEAD SCREW			FA-086A	DRAWBAR, NT30 FOR RT.	1
88	403011040	MICROMETER SCARE (MM)	1			ANGLE ATTACH	
	403011050	MICROMETER SCARE (IN)	1		FB-086B	DRAWBAR, R8 FOR RT.	1
89	FA-307A	MICRO METER NUT (MM)	1			ANGLE ATTACH	
	FA-307B	MICRO METER NUT (IN)	1	115	FA-300	QUILL HOUSING	1
90	FA-306A	MICRO-STOP NUT (MM)	1	116	FA-054	BEARING SPACER	1
	FA-306B	MICRO-STOP NUT (IN)	1	117	FA-053	BEARING SPACER	1
91	FA-332A	FIXED NUT (MM)	1	118	726002070	JM 207PP PRB DB BEARING	2
	FA-332B	FIXED NUT (IN)	1	119	FA-052	SPINDLE DIRT SHIELD	1
92	665016000	A-16 RETAINING RING	1	120	FA-172	SPECIAL SOCKET SET SCREW	1
93	FA-051A	NOSE-PIECE (N.T. 30)	1			FOR R8 ONLY	
	FA-051B	NOSE-PIECE (R8 TAPER)	1	121	FA-058	QUILL	1
94	605030080	M3X8 ROUND HEAD SCREW	1	122	065033001	"V" BELT, A-33	1
95	FA-071	UPPER BEARING LOCKNUT	1	123	606080381	1/8X3/8" FLAT HEAD SCREW	12
96	FA-070	BEARING SLEEVE LOCKNUT	1	124	FA-029	5/8-18 UNF NUT	1
97	604060060	M6X6 SET SCREW	2	125	630070250	7X7X25 KEY	1
98	FA-169	COMPRESSION SPRING	4	126	604060160	M6X10 SOCKET SET SCREW	1
99	FA-025	COUNTER SHAFT GEAR	1	127	630040180	4X4X18 KEY	1
100	FA-031	BACK GEAR SHIFTER FORK	1	128	FA-011	MOTOR PULLEY	1
101	701062034	BEARING 6203 2RS	2	129	FA-027	TIMING BELT PULLEY	2
102	701062080	BEARING 6208	2			FLANGE	
103	666080000	B-80 INNER RETAINING	1	130	066225125	TIMING BELT	1
		RING		131	FA-028	TIMING BELT	
104	FA-059	LOCKNUT	1	132	600050100	M5X10 HEX-SOCKET HEAD	5
105	FA-056	OIL STRAINER	1			CAP SCREW	
106	FA-057	OIL STRAINER COVER	1	133	600060160	M6X16 HEX-SOCKET HEAD	6
		FOR QUILL BEARING				CAP SCREW	
107	653030000	LOCKNUT WASHER	1	134	FA-017	ADJ. WORM SHAFT	1
108	726002060	BEARING M206 KDD	1	135	FA-018	WORM GEAR	1
109	FA-060	QUILL SKIRT	1	136	630040180	4X4X18 KEY	1
110	FA-055	SLEEVE	1	137	FD-001	WORM WHEEL GEAR	1

ITEM.NO.	COMP.NO.	DESCRIPTION	Q.T.Y.	ITEM.NO.	COMP.NO.	DESCRIPTION	Q.T.Y.
138	FA-314	BRAKE HANDLE	1	151	FA-012	MOTOR LOCK BOLTS	2
139	EB-047	HANDLE BALL	1	152	FA-007	MOTOR LOCKNUT	2
140	604040050	M4X5 SET SCREW	1	153	AA-039	HANDLE BALL	2
141	FA-038	PIN	1	154	FA-313	MOTOR LOCKNUT HANDLE	2
142	FA-047	WASHER	1	155	FA-037	BRAKE LOCK STUD	1
143	FA-036	EXTERNAL SPRING	2	156	403011040	QUILL MICRO (MM)	1
144	604030100	M3X10 SET SCREW	1		403011050	QUILL MICRO (IN)	1
145	FA-067	SPINDLE CLUTCH CAM	2	157	FB-077	STUD	4
		RING PIN		158	652038001	SPRING WASHER	1
146	615056001	5/16" NUT	3	159	615038001	NUT 3/8"	4
147	652056001	5/16" SPRING WASHER	3	160	FA-173	SOCKET SET SCREW	1
148	FA-034	BRAKE RING SCREW	3				
149	FA-035	BRAKE BLOCK	1				
150	FA-008	SPACER	2				



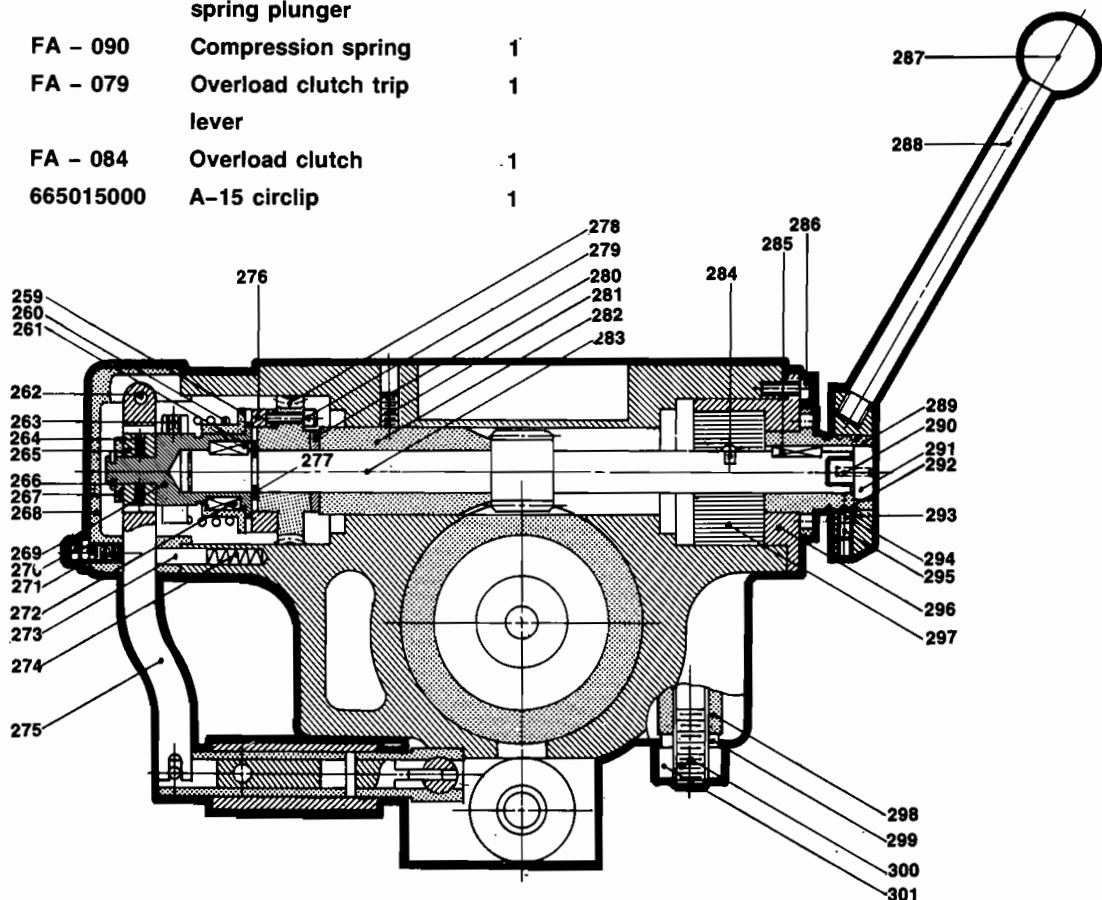
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
184	604060060	Set screw	1	205	FA - 142	Bevel gear bushing	1
185	FA - 320	Worm gear cradle	1	206	665016000	A-16 outer retaining ring	1
186	FA - 160	Feed bevel pinion	1		604060080	Set screw (M6 × 8)	1
187	FA - 324	Feed engage pin	1	207	604060080	Set screw	1
188	FA - 325	Worm gear cradle throw-out	1	208	FA - 133	Feed worm shaft	1
189	600050100	Hex-Socket head cap screws (M5 × 10)	3	209	622030012	Spring pin (3 × 12)	1
190	FA - 304	Cover	1	210	FA - 168	Bushing	1
191	FA - 323	Speed select handle	1	211	FA - 139	Worm	1
192	FA - 154	Feed reverse bevel gear	1	212	FA - 138	Feed worm shaft bushing	1
193	615056003	Nut (5/16")	1	213	FA - 137	Feed worm shaft thrust washer	1
194	FA - 153	Washer	1	214	FA - 134	Feed reverse bevel gear bushing	1
	652056001	Spring washer (5/16")	1	215	FA - 135	Feed reverse bevel gear	1
195	630030080	3 × 3 × 8 key	1	216	FA - 163	Worm gear spacer	1
196	630030200	3 × 3 × 20 key	1	217	FA - 162	Worm cradle bushing	1
197	FA - 171	Set screw	1	218	FA - 161	Feed worm gear shaft sleeve	1
198	FA - 155	Feed driving gear	1	219	622030016	Spring pin (3 × 16)	1
199	FA - 156	Cluster gear input shaft	1	220	FA - 164	Feed drive worm gear	1
200	630030100	Key 3 × 3 × 10	1	221	630030200	Key (3 × 3 × 20)	1
201	FA - 157	Feed drive gear	1	222	FA - 147	Cluster gear shaft upper bushing	1
202	735000660	IKO BA-66 needle bearing	1	223	FA - 165	Feed drive worm gear shaft	1
203	FA - 140	Feed reverse bevel pinion	1	224	604060140	Set screw (M6 × 14)	1
204	FA - 141	Bevel gear thrust spacer	1				



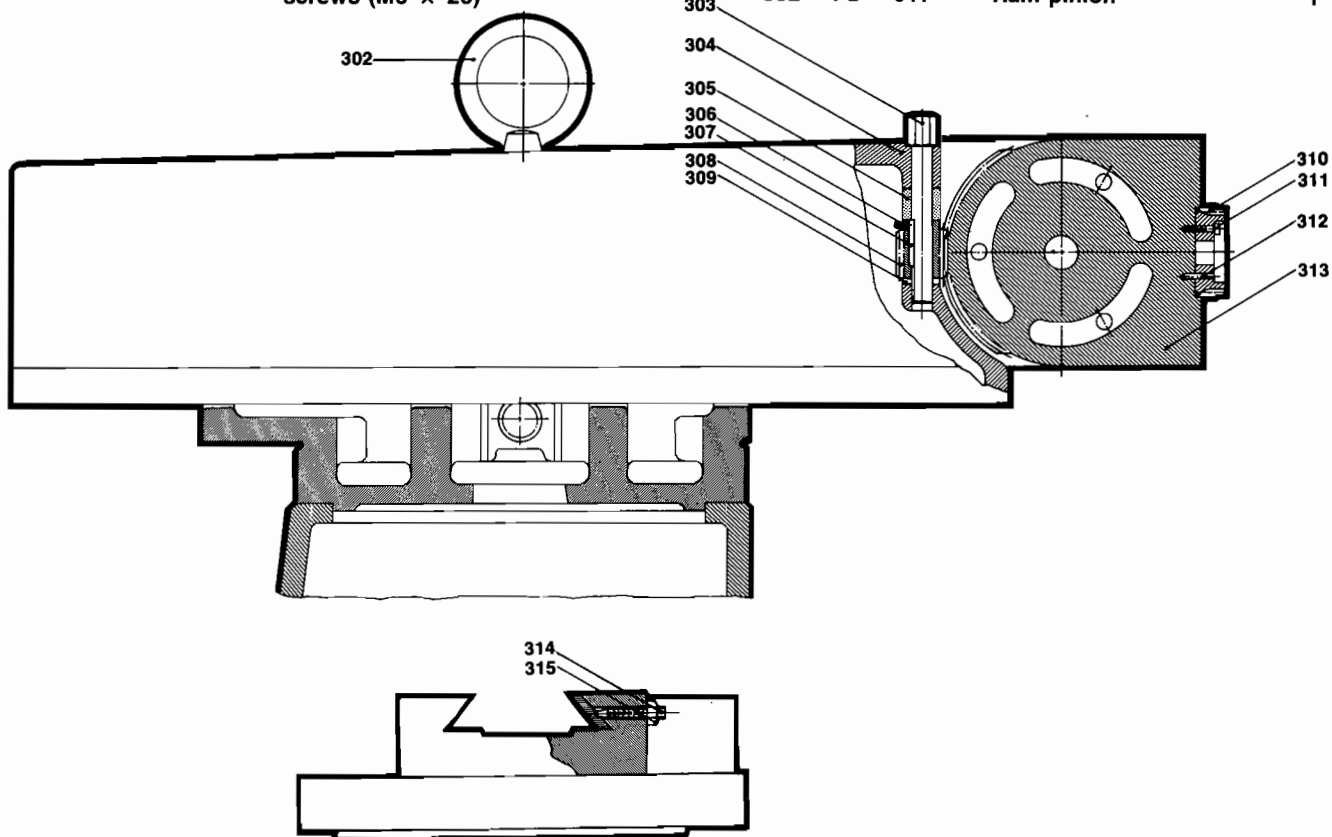


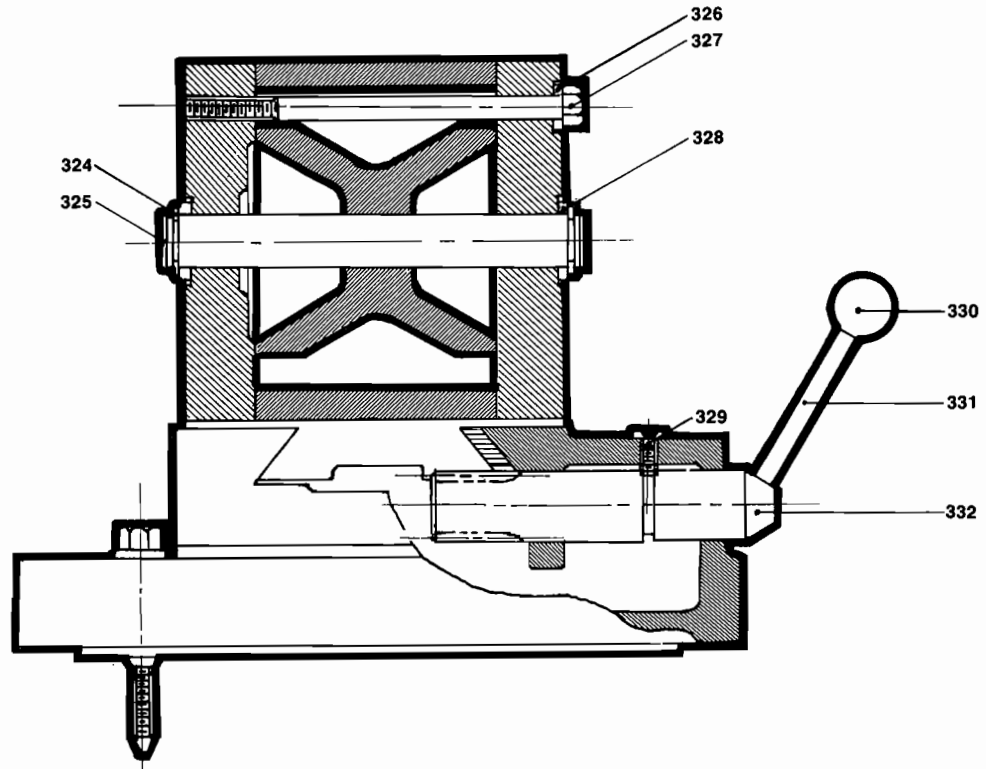
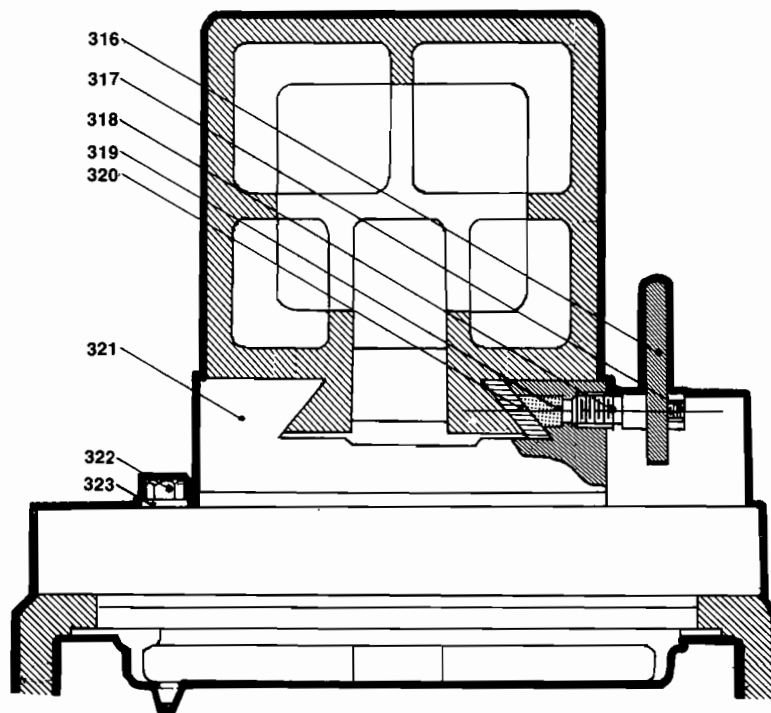
225	604040060	Set screw (M4 × 6)	1	235	FA - 129	Handwheel clutch	1
226	FA - 146	Cluster gear (upper)	1		FA - 129A	Handwheel clutch	1
227	FA - 145	Cluster gear (middle)	1			spring screw	
228	FA - 144	Cluster gear (low)	1		FA - 129B	Compression spring	1
229	604060120	Set screw (M6 × 12)	1	236	035036000	Ball (3/16")	1
230	604060100	Set screw (M6 × 10)	1	237	630030100	Key (3 × 3 × 10)	1
231	FA - 130	Feed reverse knob	1	238	FA - 128	Spring pin	1
		stud		239	FA - 321	Handwheel	1
232	FA - 131	Reverse knob	1	240	FA - 132	Reverse clutch rod	1
233	665005010	E-5 outer retaining	1	241	FA - 135	Bevel gear	1
		ring		242	FA - 136	Feed reverse clutch	1
234	FA - 312	Handwheel handle	1	243	622025020	Spring pin (2.5 × 20)	1

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
259	FA - 084	Overload clutch	1	278	FA - 087	Overload clutch worm gear	1
260	FA - 083	Safety clutch spring	1	279	600040160	Hex-Socket head cap screw (M4 x 16)	3
261	630050150	Key (5 x 5 x 15)	1	280	FA - 122	Pinion shaft worm gear spacer	1
262	FA - 077	Dowel pin	1	281	604060140	Set screw (M6 x 14)	1
263	FA - 082	Overload clutch locknut	1	282	FA - 123	Quill pinion shaft bushing	1
	604060080	Set screw (M6 x 8)	1	283	FA - 101	Quill pinion shaft	1
264	FA - 081	Clutch ring pins	2	284	FA - 101A	Pin	1
265	FA - 080	Clutch ring	1	285	630040180	Key (4 x 4 x 18)	1
266	665009000	A-9 circlip	1	286	600050100	Hex-Socket head cap screws (M5 x 10)	2
267	FA - 078	Overload clutch washer	1	287	FA - 106A	Handle ball	1
268	FA - 076	Clutch arm cover	1	288	FA - 106B	Pinion shaft hub handle	1
269	FA - 085A	Overload clutch sleeve	1	289	FA - 104	Pinion shaft hub sleeve	1
270	604060140	Set screw (M6 x 14)	1	290	622050025	Spring pin (5 x 25)	1
	600050350	Hex-Socket head cap screw (M5 x 35)	1	291	FA - 107	Screw	1
271	615006000	Nut (M6)	1				
272	630050150	Key (5 x 5 x 15)	1				
273	FA - 089	Overload clutch lever spring plunger	1				
274	FA - 090	Compression spring	1				
275	FA - 079	Overload clutch trip lever	1				
276	FA - 084	Overload clutch	1				
277	665015000	A-15 circlip	1				

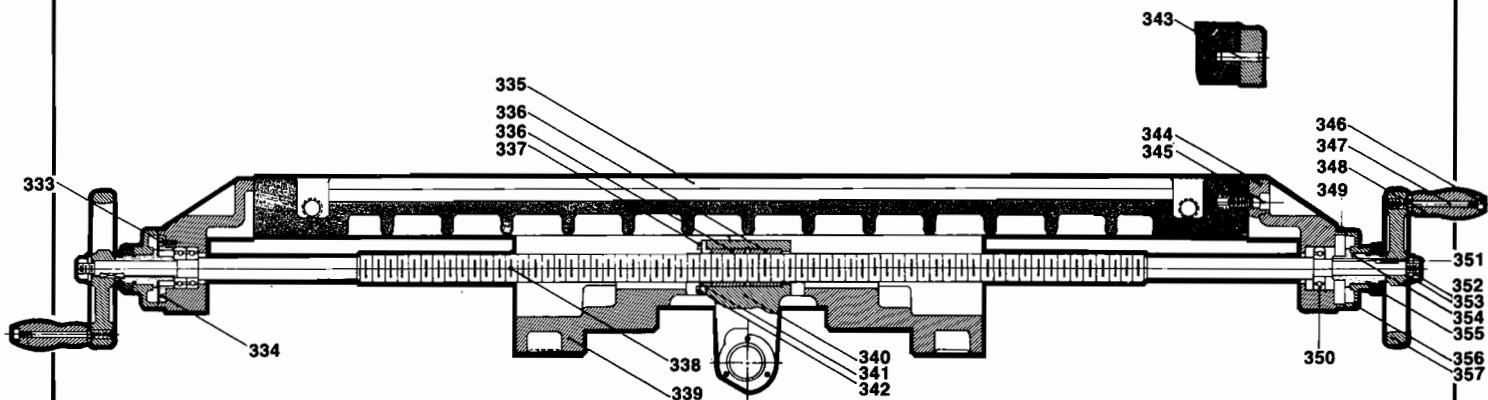


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
292	035040000	Ball	1	312	622060030	Spring pin	1
293	FA - 106	Back feed handle hub	1	313	FD - 303	Arm adaptor	1
294	FA - 105A	Compression spring	1	314	FD - 310	Screw	2
295	FA - 105B	Set screw	1	315	615010000	Nut (M10)	2
296	FA - 103	Spring cover	1	316	FD - 320	Ram clamp handle	2
297	FA - 102	Clock spring	1	317	604060060	Set screw (M6 × 6)	2
298	FA - 046	Clamping bolt spacer	4	318	FD - 309	Ram clamp bolt	2
299	FA - 042	Washer	4	319	FD - 309A	Ram clamp piece	2
300	FA - 306	Tee bolt	4	320	FD - 307	Gib	1
301	FA - 040	Head fixed nut	4	321	FD - 304	Turret	1
302	FD - 004B	Hook	1	322	FD - 308	Locking bolt	4
303	FD - 009	worm shaft	1	323	652002001	Spring washer (1/2")	4
304	FD - 301	Ram	1	324	665032000	A-32 retaining ring	2
305	FD - 010	Worm thrust washer	1	325	FD - 005	Adaptor pivot stud	1
306	604050060	Set screw (M5 × 6)	1	326	FD - 008	Washer	3
307	637050480	Parallel key (5 × 5 × 48)	1	327	FD - 007	Adaptor locking bolt	3
308	FD - 011	Adjust worm	1	328	FD - 006	Washer	2
309	FD - 012	Worm thrust washer	1	329	FD - 014	Ram pinion set screw	1
310	FD - 001	Worm wheel gear	1	330	FD - 015	Black plastic ball	1
311	600060250	Hex-Socket head cap screws (M6 × 25)	2	331	FD - 016	Ram pinion handle	1
				332	FD - 017	Ram pinion	1

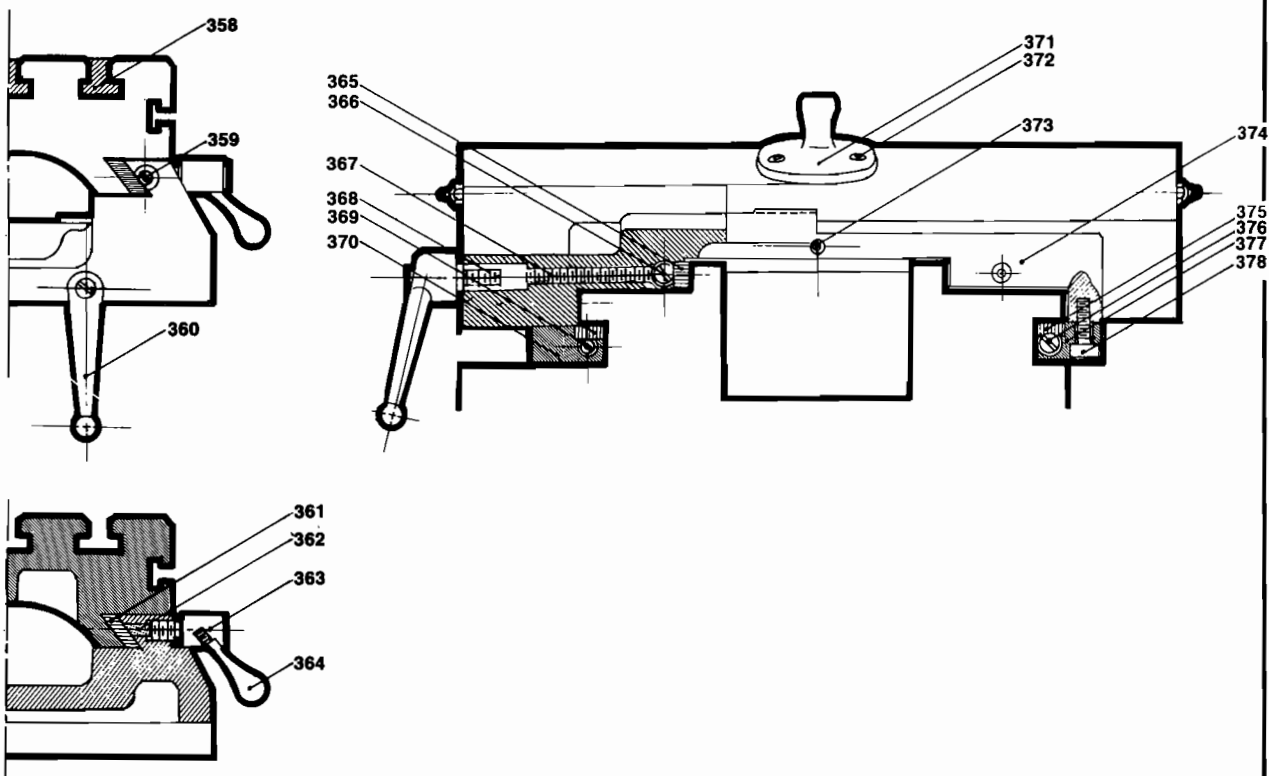




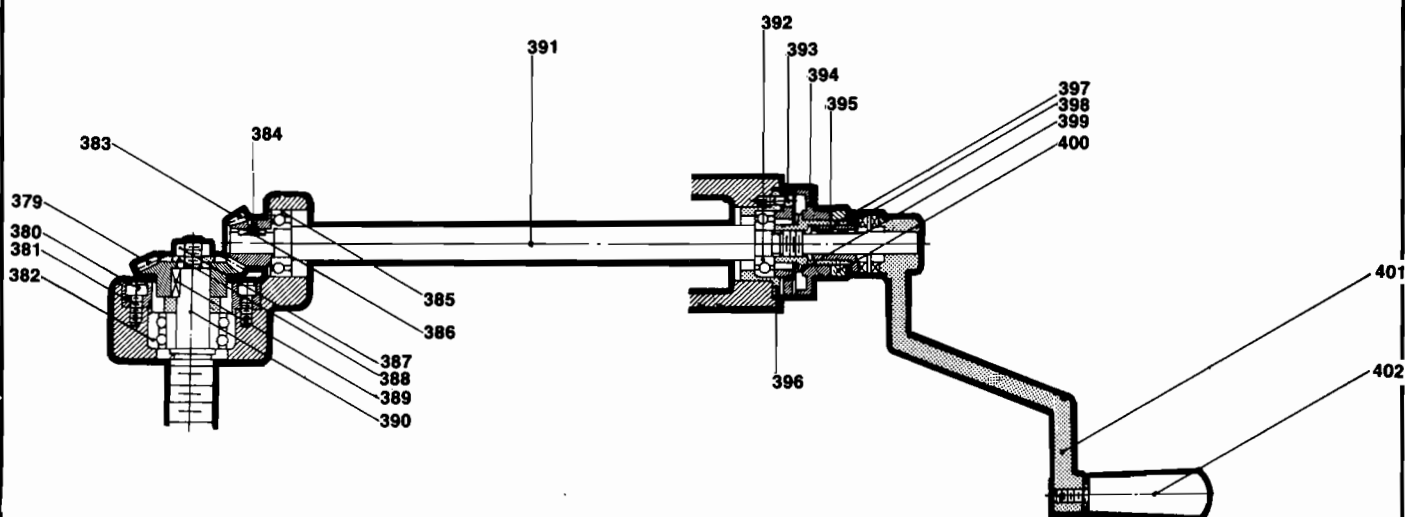
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
333	600060160	Hex-Socket head cap screws (M6 × 16)	6	343	622060040	Spring pin (6 × 40)	4
334	FC - 005	Bearing cover	1	344	FC - 300	Bearing brackets (L&R)	2
335	FC - 009	Table (42")	1	345	600100250	Hex-Socket head cap screws (M10 × 25)	8
	FC - 009B	Table (49")	1	346	AA - 029	Screws	2
336	FE - 323A	Table feed nuts (metric)	2	347	FC - 002A	Grip shafts	2
	FE - 323B	Table feed nuts (inch)	2	348	AC - 053	Grips	2
337	600060200	Hex-Socket head cap screws (M6 × 20)	3	349	FC - 313A	Indicator (metric)	1
					FC - 313B	Indicator (inch)	1
338	FC - 302A	Longitudinal feed screw (42" table metric)	1	350	701062040	Ball bearings (6204 2Z)	3
	FC - 302B	Longitudinal feed screw (42" table inch)	1	351	630040250	Parallel key (4 × 4 × 25)	2
	FC - 303A	Longitudinal feed screw (49" table metric)	1	352	615002003	Nut (1/2")	2
	FC - 303B	Longitudinal feed screw (49" table inch)	1	353	FC - 001D	Washers	2
339	FC - 304	Saddle	1	354	FC - 004	Dial holder	2
340	FE - 320	Feed nut bracket	1	355	FC - 002	Dial lock nut	2
341	FE - 322	Feed nut bracket ring	1	356	FC - 003A	Dial with 250 graduation (metric)	2
342	600050200	Hex-Socket head cap screws (M5 × 20)	3		FC - 003B	Dial with 200 graduation (inch)	2
				357	FC - 001B	Handwheel	2



ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
358	FC - 028	T-slot plugs	6	370	FC - 311	Saddle guide plate (left)	1
359	AC - 090	Screws	2	371	FC - 319	Table stop bracket	1
360	FC - 314	Saddle lock handle	1	372	600100200	Hex-Socket head cap screws (M10 × 20)	2
361	FC - 306	Table gib	1	373	600050100	Hex-Socket head cap screws (M5 × 10)	6
362	FC - 019	Table lock plungers	2	374	FC - 315	Saddle knee wiper plates	2
363	FC - 014A	Table lock bolts	2	375	FC - 305	Gib	1
364	FA - 125	Handle	2	376	AC - 090	Screws	2
365	FC - 307	Saddle gib	1	377	FC - 312	Saddle guide plate (right)	1
366	AC - 090	Screws	2	378	600120300	Hex-Socket head cap screws (M12 × 30)	6
367	FE - 315	Plunger	1				
368	FC - 305	Gib	1				
369	AC - 090	Screws	2				

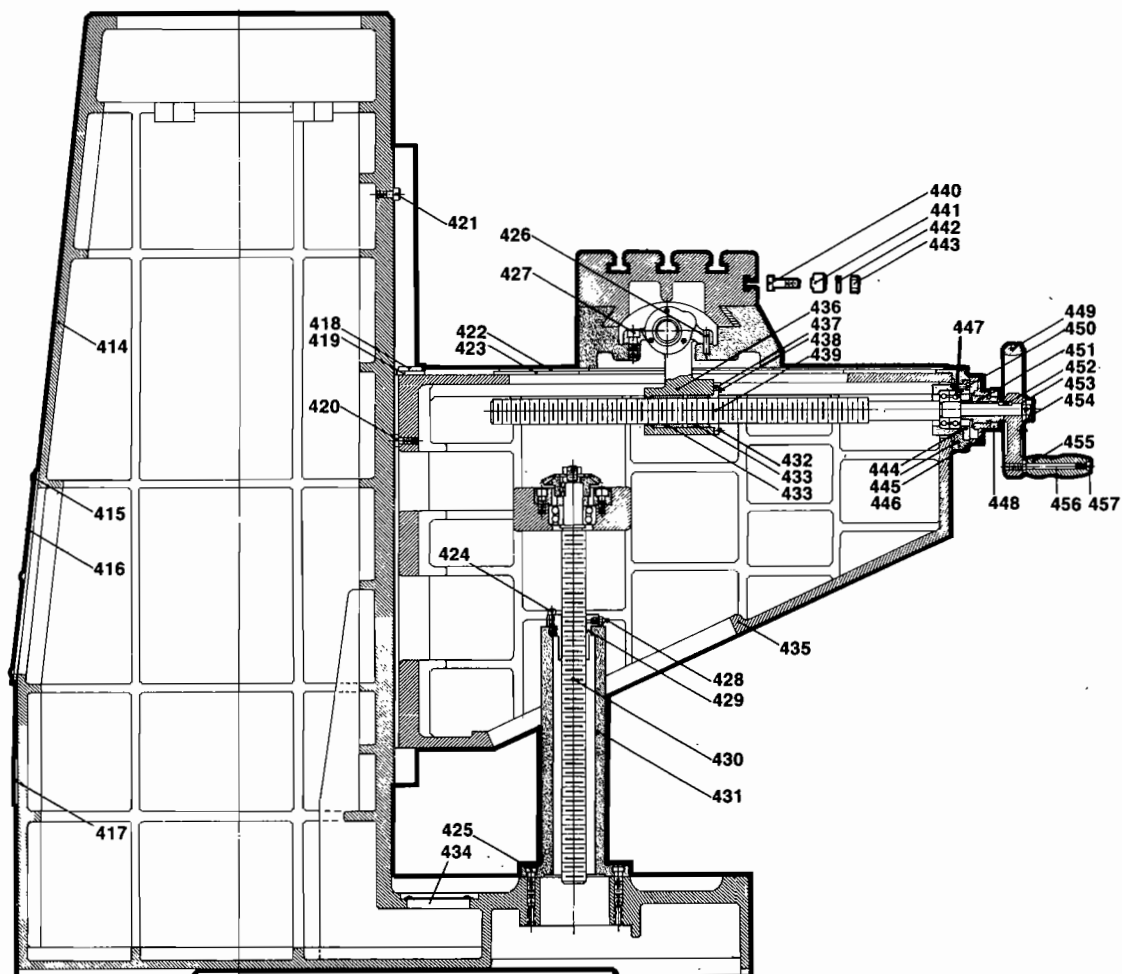
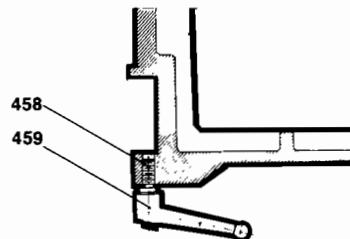
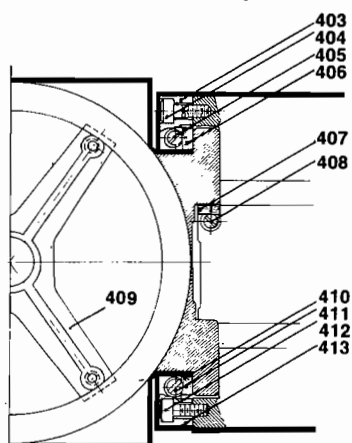


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
379	FE - 024	Bevel gear	1	392	701062040	Ball bearing (6204 2RS)	1
380	600100200	Hex-Socket head cap screws (M10 x 20)	3	393	600060160	Hex-Socket head cap screws (M6 x 16)	3
381	FE - 026	Bearing retainer ring	1	394	FE - 019A	Dial with 125 graduation	1
382	711033058	Bearings (#3305)	2		FE - 019B	Dial with 100 graduation	1
383	FE - 015	Bevel pinion	1	395	630040180	Key 4 x 4 x 18	1
384	604060060	Set screw (M6 x 6)	1	396	FE - 302	Bearing cap	1
385	701062040	Ball bearing (6204 2RS)	1	397	FE - 326	Dial holder	1
386	630040180	Key (4 x 4 x 18)	1	398	FE - 020	Gear shaft clutch insert	1
387	615002003	Nut (1/2"-20UNF)	1	399	FE - 303A	Bearing retainer ring (metric)	1
388	FE - 023	Washer	1		FE - 303B	Bearing retainer ring (inch)	1
389	630050200	Key (5 x 5 x 20)	1	400	FC - 002	Dial lock nut	1
390	FE - 027A	Elevating screw (metric)	1	401	FE - 310	Elevating crank	1
	FE - 027B	Elevating screw (inch)	1	402	FC - 316	Elevating crank handle	1
391	FE - 305A	Elevating shaft (13" knee)	1				
	FE - 305B	Elevating shaft (16" knee)	1				



ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
403	FD - 306	Guide plate (right)	1	428	076008000	Nipple	1
404	600140350	Hex-Socket head cap screws (M14 x 35)	5	429	FE - 028A	Elevating screw nut (metric)	1
405	AC - 090	Screws	2		FE - 208B	Elevating screw nut (inch)	1
406	FD - 302	Gib	1	430	FE - 027A	Elevating screw (metric)	1
407	FE - 307	Gib	1		FE - 027B	Elevating screw (inch)	1
408	AC - 090	Screws	2	431	FE - 301	Elevating screw housing	1
409	FD - 023	Spider	1	432	600060200	Hex-Socket head cap screws (M6 x 20)	3
410	FD - 302	Big	1	433	FE - 321A	Feed nut (metric)	2
411	AC - 090	Screws	2		FE - 321B	Feed nut (inch)	2
412	600140350	Hex-Socket head cap screws (M14 x 35)	5	434	FD - 325	Cover	2
413	FD - 305	Guide plate (oef t)	1	435	FE - 300A	13" knee	1
414	FD - 300B	Column	1		FE - 300B	16" knee	1
415	605050120	Round head screws (M5 x 12)	6	436	FE - 320	Feed nut bracket	1
416	FD - 311	Cover	1	437	FE - 322	Feed nut bracket	1
417	FD - 021	Cover	1	438	600050200	Hex-Socket head cap screws (M5 x 20)	3
418	FD - 312	Chip guard plate (left)	1	439	FE - 304A	Cross feed screw (metric)-13" knee	1
	FD - 312A	Chip guard plate (right)	1		FE - 304B	Cross feed screw (inch)-13" knee	1
419	FD - 318	Left wiper	1		FE - 314A	Cross feed screw (metric)-16" knee	1
	FD - 319	Right wiper	1		FE - 314B	Cross feed screw (inch)-16" knee	2
420	FE - 034	Cap screw	1	440	FC - 010	Stop piece T-bolts	2
421	FE - 034	Cap screw	1	441	FC - 011	Table stop pieces	2
422	FL-328	Chip Guard	1	442	FC - 011A	Washers	2
423		16" Knee		443	FC - 010A	Hexagon nuts (3/8"-16 UNC)	1
	FL-329	Chip Guard	1	444	FC - 005	Bearing retainer ring	1
		16" Knee		445	FE - 008	Cross feed bearing bracket	1
	FL-330	Chip Guard	1	446	FC - 003A	Dial with 250 graduation (metric)	1
		16" Knee			FC - 003B	Dial with 200 graduation (inch)	
	FL-331	Chip Guard	1	447	701062040	Ball bearings (6204 2RS)	2
		16" Knee		448	FC - 002	Dial lock nut	1
424	600060250	Hex-Socket head cap screws (M6 x 25)	3				
425	600100300	Hex-Socket head cap screws (M10 x 30)	2				
426	622050040	Spring pins (5 x 40)	2				
427	600100250	Hex-Socket head cap screws (M10 x 25)	4				

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
449	FC - 001B	Handwheel	1	454	615002003	Nut (1/2"-20UNF)	1
450	600060150	Hex-Socket head cap screws (M6 x 15)	3	455	AC - 053	Grip	1
451	FC - 004	Dial holder	1	456	FC - 002A	Grip shaft	1
452	630040250	Key (4 x 4 x 25)	1	457	AA - 029	Screw	1
453	FC - 001D	Washer	1	458	FC - 315A	Knee lock plungers	2
				459	FE - 311	Knee lock handles	2



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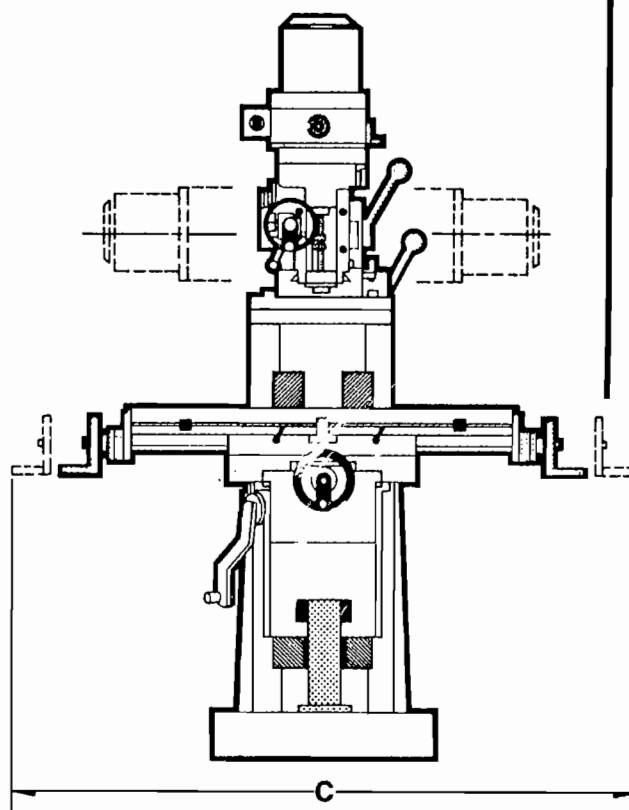
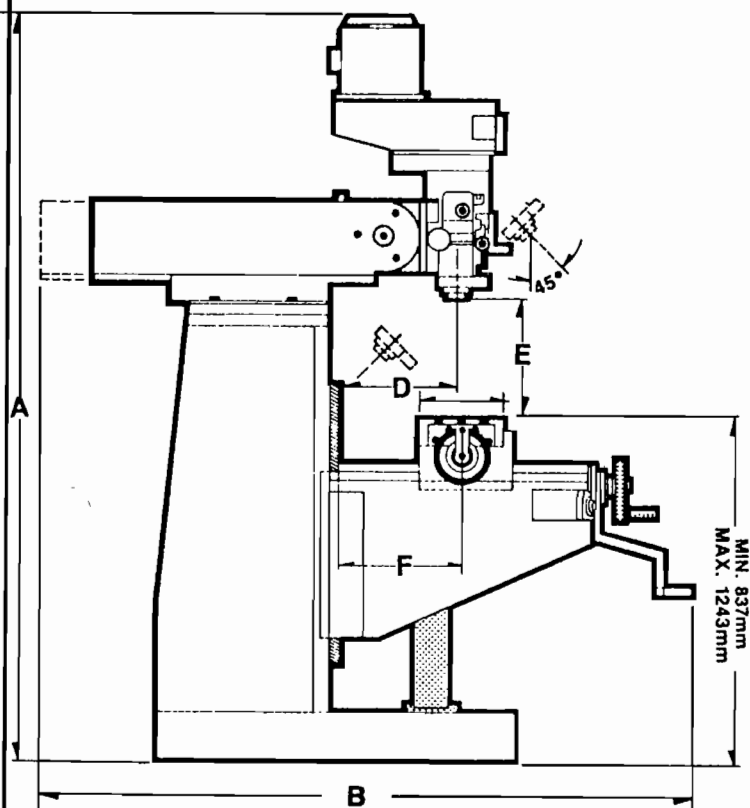
elevating46

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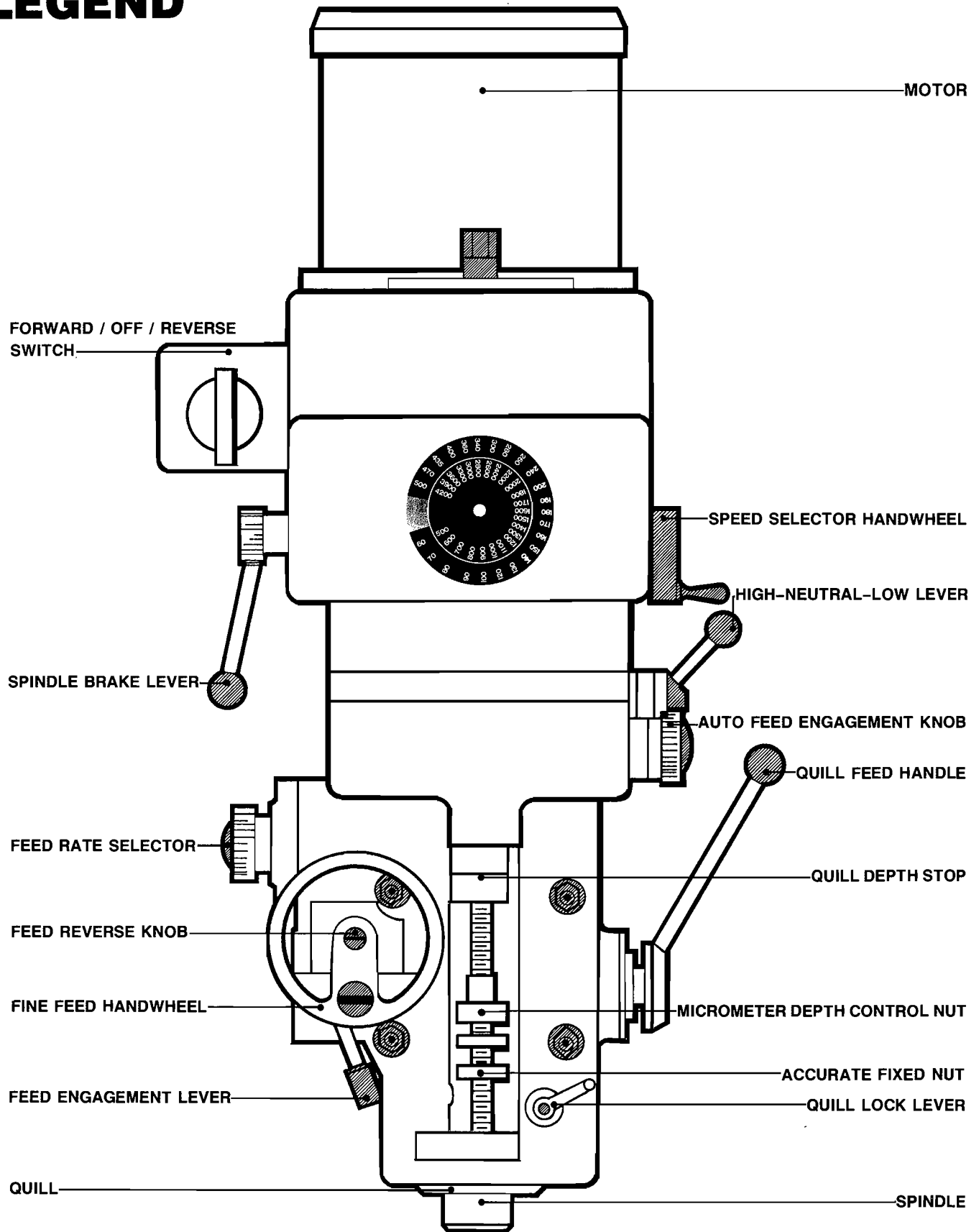
SPECIFICATIONS OF BASE

SPINDLE MOTOR.....	AC 3 HP
SPINDLE TAPER.....	R-8 or N.S.T. #30 (N.S.T. #40)
SPINDLE R.P.M.....	50 ~ 3500 (50Hz) 60 ~ 4200 (60Hz)
POWER FEED PER REVOLUTION.....	0.0432mm, 0.0813mm, 0.1346mm (0.047mm, 0.090mm, 0.149mm)
T-SLOTS (width × number × distance).....	15.87mm × 3 × 63.5mm
MAX. LOADING CAPACITY.....	350kgs

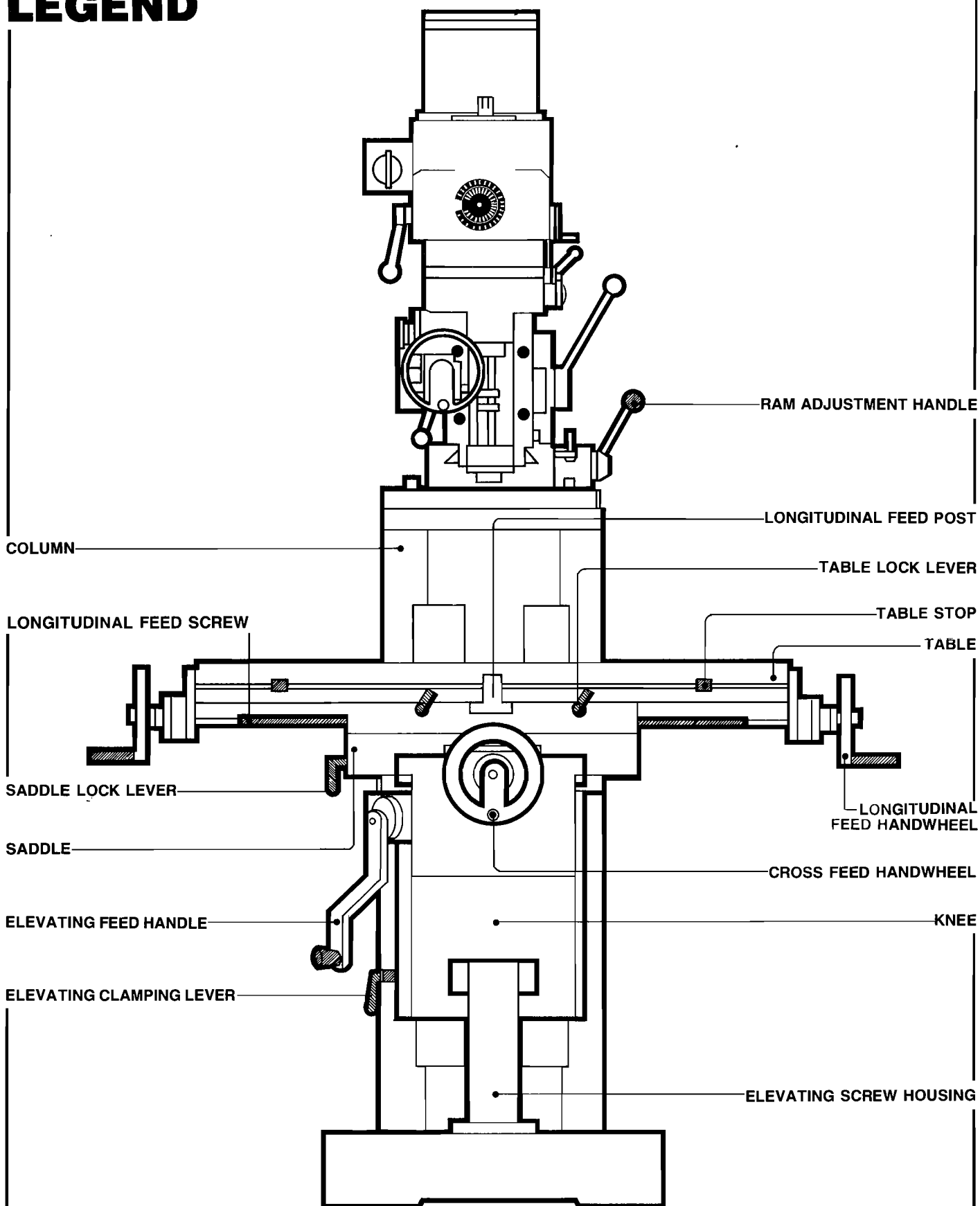
	STANDARD (42")	OPTIONS (49")
TABLE SIZE (width × length).....	230mm × 1067mm	230mm × 1245mm
LONGITUDINAL TRAVEL (X).....	787mm	940mm
LONGITUDINAL TRAVEL WITH POWER FEED (X).		
.....	692mm	850mm
CROSS TRAVEL (Y).....	406mm	
KNEE TRAVEL.....	406mm	
RAM TRAVEL.....	457mm	
QUILL TRAVEL.....	127mm	
A. OVERALL HEIGHT.....	2200mm	
B. OVERALL DEPTH.....	1870mm	
C. OVERALL WIDTH.....	2480mm	2700mm
D. SPINDLE CENTER TO COLUMN.....	135mm-595mm	
E. TABLE TO SPINDLE NOSE.....	0-483mm	
F. TABLE CENTER TO COLUMN.....	134mm-540mm	
MACHINE WEIGHTS.....	1090kgs	



LEGEND



LEGEND



INSTALLATION

UNCRATING

Be careful in removing protective crating, to avoid damaging the machine and parts. If the machine is damaged during transit, immediately contact your local distributor and the transportation company who delivered your machine.

CHECK FOR SHORTAGE

Be sure to check your machine against the packing list that is shipped with every machine. In case of shortages, immediately note items not received and contact your local distributor.

CLEANING

1. Remove rust preventative before moving any slideways.
2. The coating is best removed by using paraffin or light oil applied with a clean brush. When the coating has softened, remove with clean rags.

NOTE:

Do not use gasoline or any other flammable solution to clean the machine.

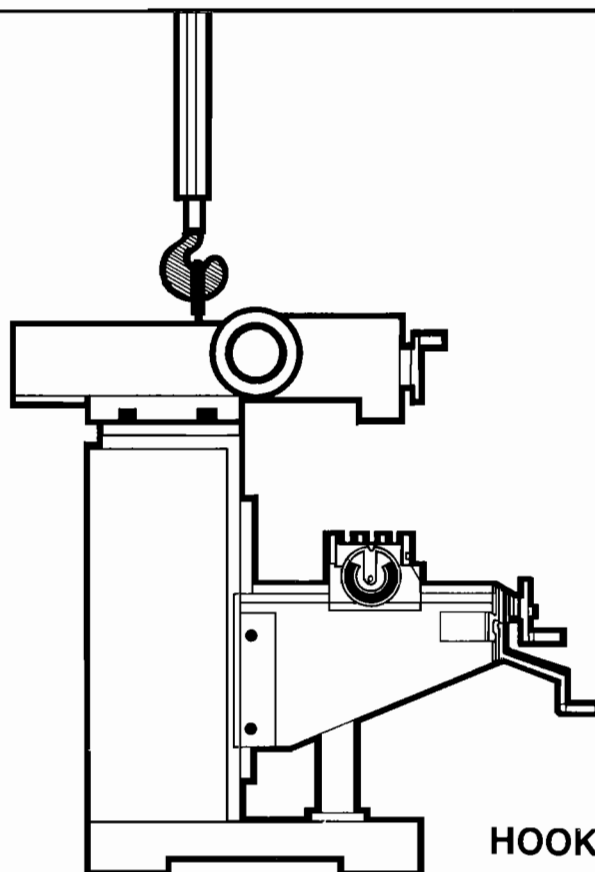
3. Oil or grease all lubrication points.

INSTALLATION

PROPER METHOD FOR LIFTING MACHINE

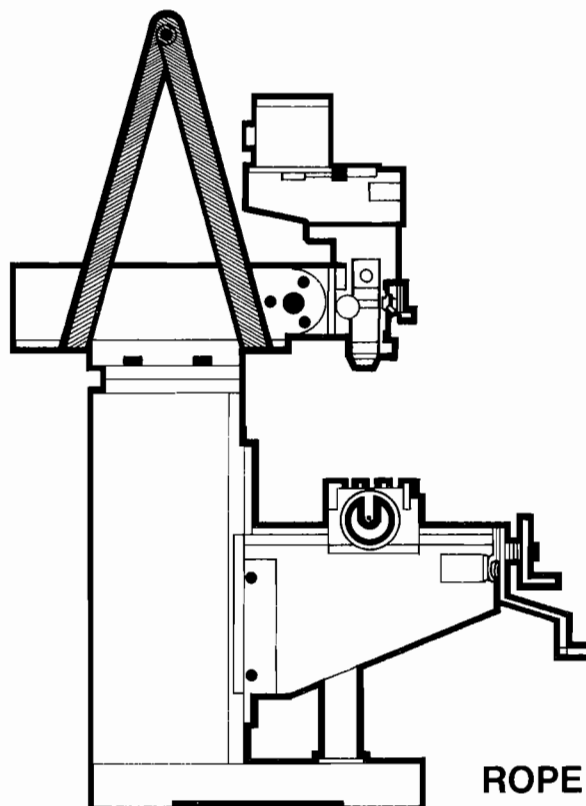
METHOD-1

Insert 5/8"-11 UNC eye bolt in tapped hole. Ensure bolt is fully secured before lifting.



METHOD-2

Use rope sling as illustrated. Insert pads of soft cloth between rope and machined edges.



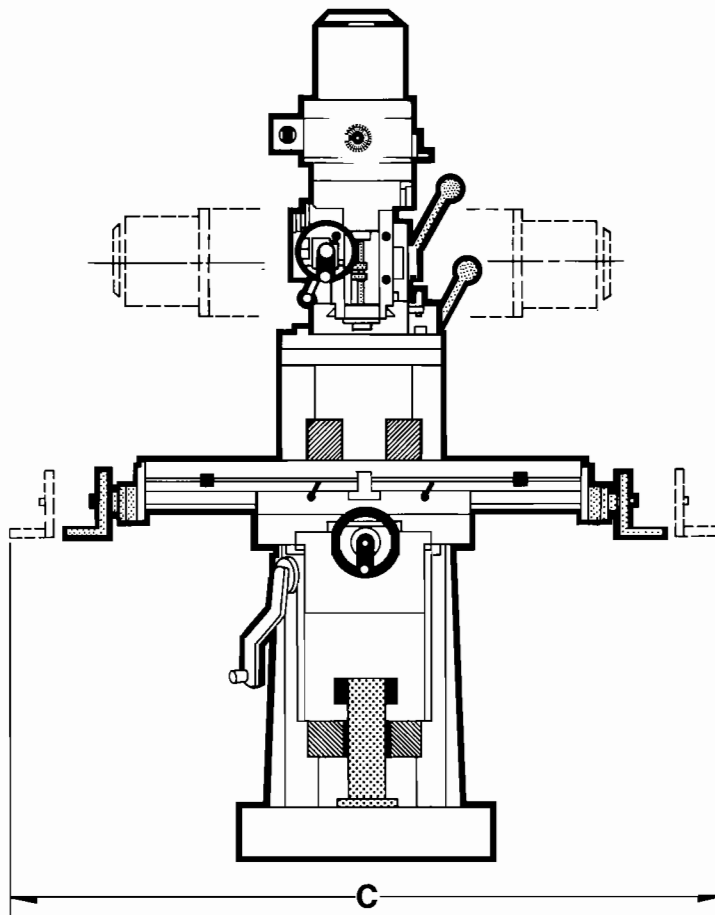
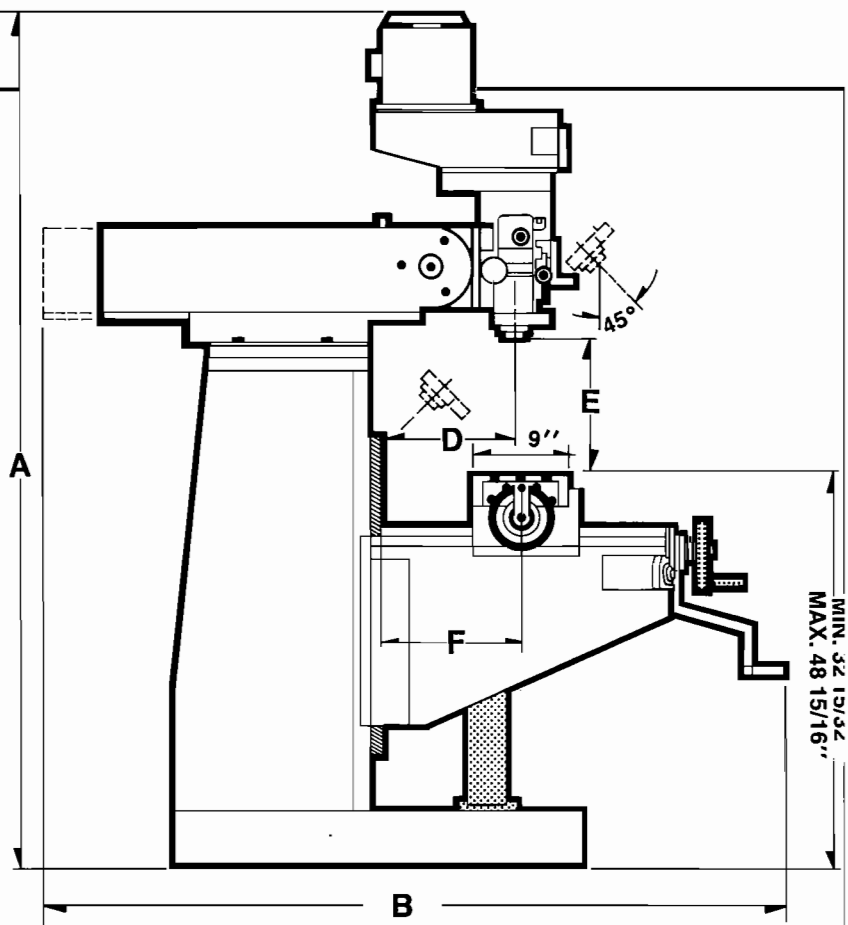
NOTE:

It is necessary to set the overarm and table at suitable position.

INSTALLATION

FLOOR PLAN

A. OVERALL HEIGHT	86 5/8"
B. OVERALL DEPTH	71 5/8"
FOR 16" CROSS	73 5/8"
C. OVERALL WIDTH	97 5/8"
FOR 49" TABLE	106 3/8"
D. SPINDLE CENTER TO COLUMN	5 5/16"
	23 7/16"
E. TABLE TO SPINDLE NOSE	0—19"
F. TABLE CENTER TO COLUMN	5 9/32"
	18 9/32"
FOR 16" CROSS	5 9/32"
	21 1/4 "
MACHINE WEIGHTS (APPROX.)	2402 lbs

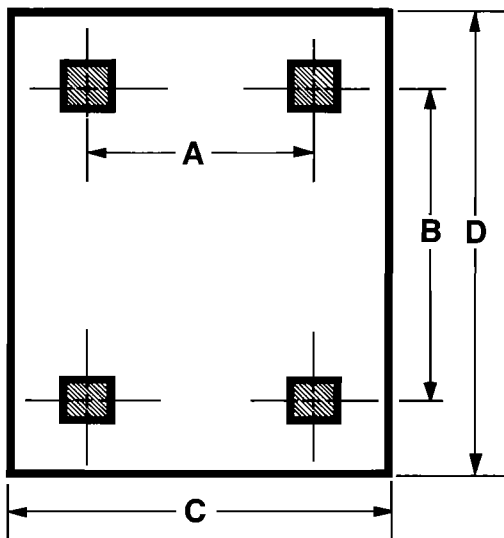


INSTALLATION

FOUNDATION

When setting machine on a concrete foundation, it is advisable to use a little grout to take care of unevenness in the concrete as well as to provide a solid foundation at all points.

FOUNDATION PLAN

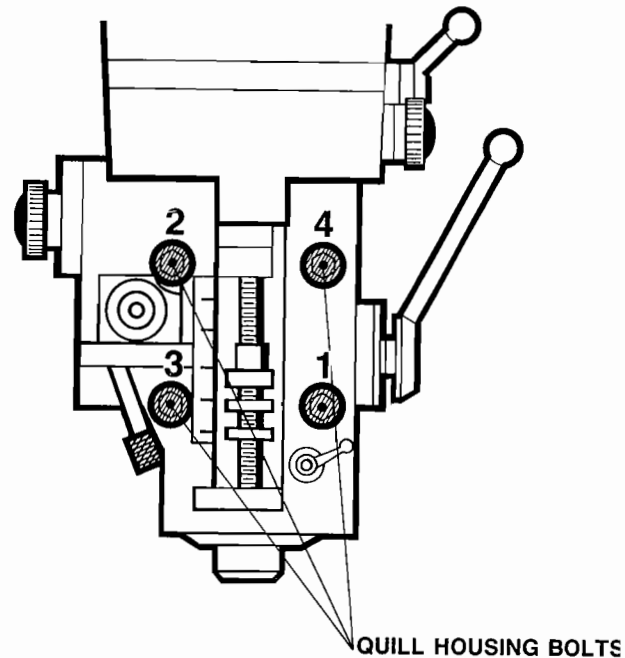


- A. 20 3/8" (518mm)
- B. 24 7/32" (742mm)
- C. 40 5/32" (1020mm)
- D. 48 7/8" (1242mm)

INSTALLATION

BRING HEAD TO UPRIGHT POSITION

Bring the milling head to the upright position by loosening the four quill housing bolts and rotating head to the upright position. Do not tighten quill housing locking bolts until the head has been properly aligned. To avoid quill distortion, tighten all quill housing locking bolts—according to the bolt rotation in Figure to exactly twenty-five ft.lbs., then repeat tightening according to rotation to exactly fifty ft.lbs.



POWER SUPPLY

1. Check motor voltages against supply.
2. Ensure that the supply is connected to comply with the local safety regulations.

NOTE:

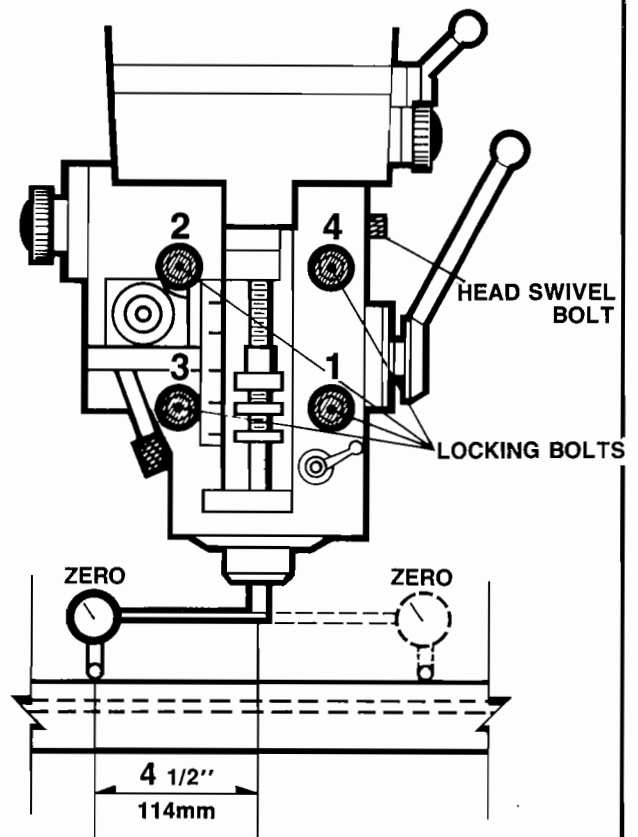
The head switch has no overload protection when a control panel is not fitted.

INITIAL SETTING

HEAD ALIGNMENT

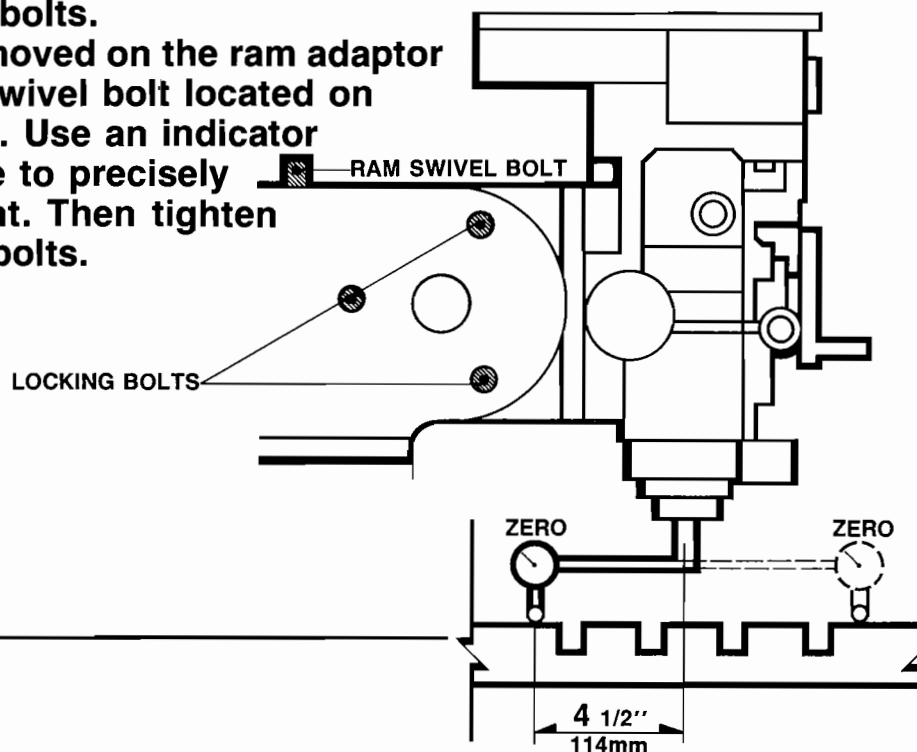
1. X AXIS

Loosen the four quill housing locking bolts. Be sure to leave a slight drag on these bolts. The head can now be moved from left to right by using the head swivel bolt that is located on the right side of the head. Use an indicator mounted in the spindle to indicate table alignment.



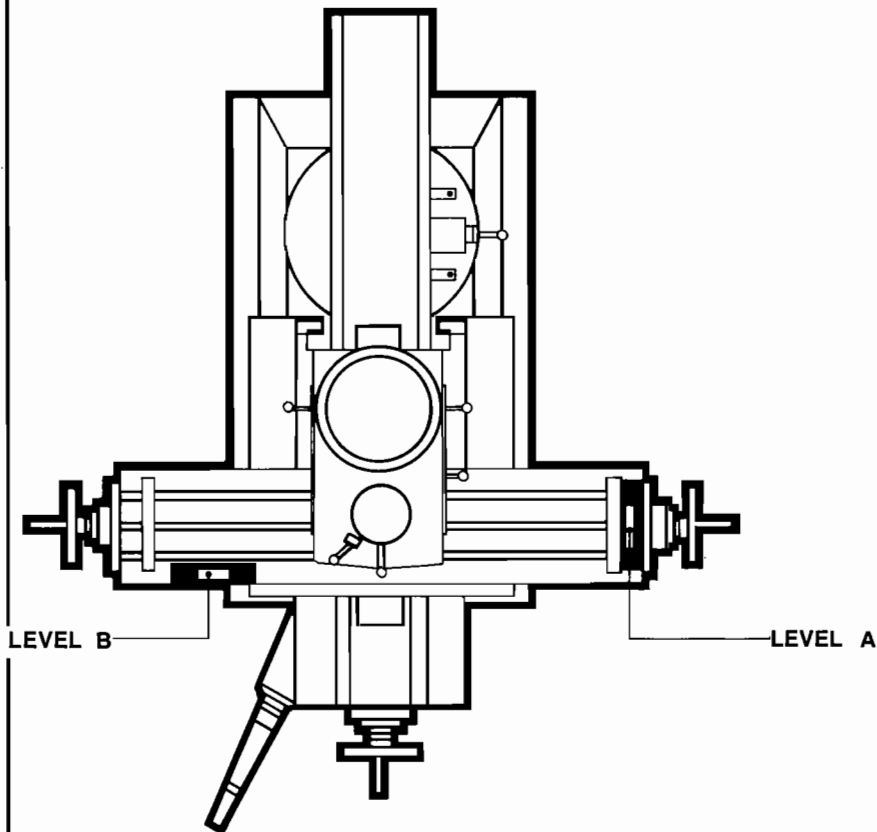
2. Y AXIS

Loosen the three ram locking bolts on the ram adaptor. Be sure to leave a slight drag on these bolts. The head can now be moved on the ram adaptor by using the adaptor swivel bolt located on top of the ram adaptor. Use an indicator mounted in the spindle to precisely indicate table alignment. Then tighten the three ram locking bolts.



LEVELING

1. Put levels on the table as illustrated.
2. Check the levels A and B. The allowance approximate 0.06mm/M.
3. Put the shims under the bed if necessary.



OPERATION

HEAD

SPINDLE SPEED

1. Start spindle.
2. Turn handwheel "H" to select required speed.

NOTE: Do not change speed while spindle is stopped.

HIGH-NEUTRAL-LOW LEVER

This lever "I" is to put the head into backgear or direct drive.

1. HIGH TO LOW

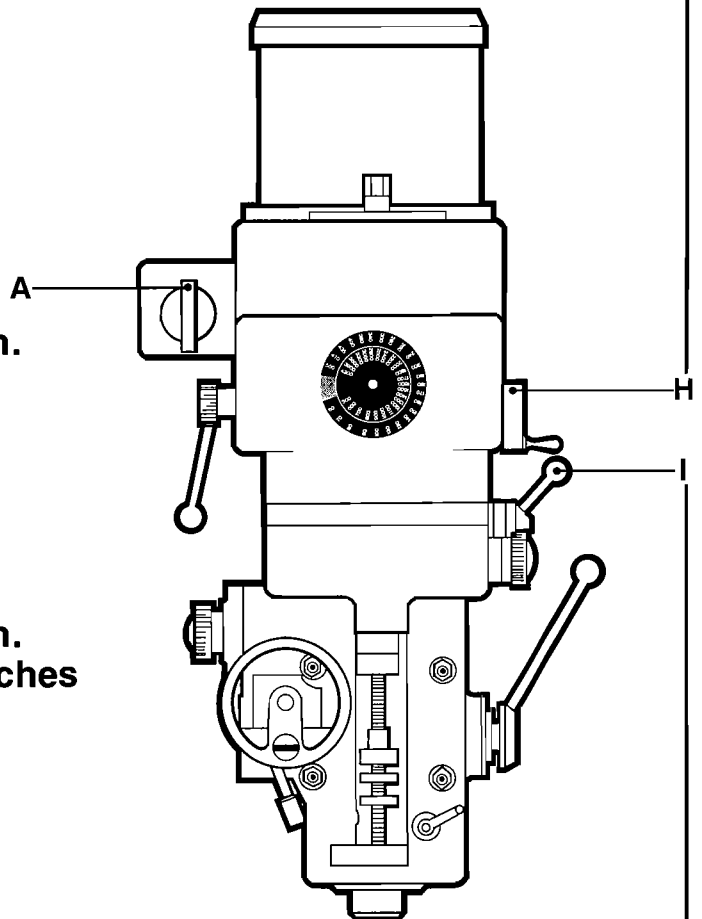
- A. Switch "A" to off.
- B. Move "I" through neutral to low.
This will reverse the spindle rotation.
- C. Switch "A" to the reverse position.

2. LOW TO HIGH

- A. Switch "A" to off.
- B. Move "I" through neutral to high.
This will reverse the spindle rotation.
- C. Rotate spindle by hand until the clutches are felt to engage.
- D. Switch "A" to the reverse position.

CAUTION:

DO not shift while the motor is running.



OPERATION

HEAD

AUTOMATIC FEED

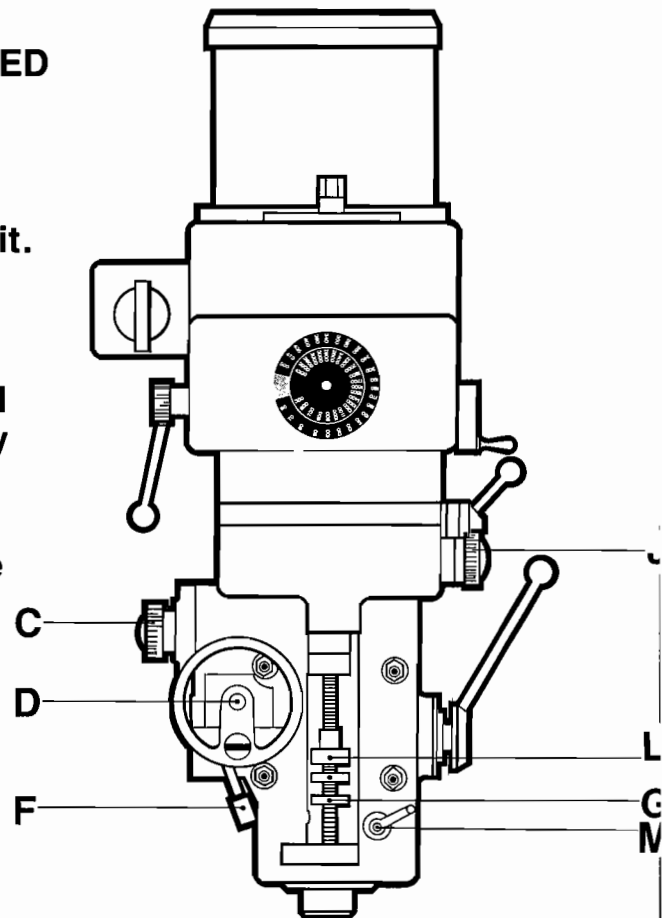
1. Loosen quill lock lever "M".
2. Engage auto quill feed "J".
3. Set micrometer dial "L" to required depth.
4. Select feed rate "C".
5. Engage the feed lever "F" to the left position.
6. The quill is now in automatic feed.

NOTE: A. Do not engage quill feed when spindle is over 3000 RPM.
B. Maximum loading 3/8" Dia. drill in steel.

HOW TO GET THE ACCURATE QUILL FEED DEPTH IN AUTOMATIC FEED

1. Locate "D" in the mid position.
2. Engage "F" to the left position.
3. Turn nut "G" to the bottom and lock it.
4. Adjust "L" to the required position.
5. Engage "D" in the required position.
6. When a series of clicks is heard, the required depth is reached. You should disengage "F" to the right position by hand.

* When this section is not in use, please loosen the nut "G".

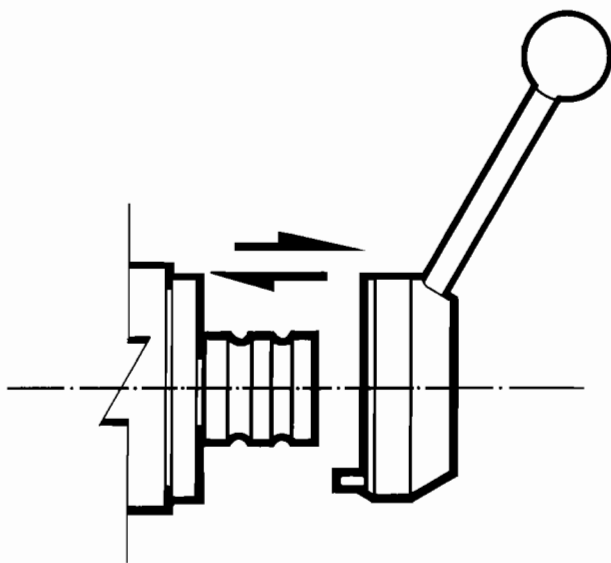


OPERATION

HEAD

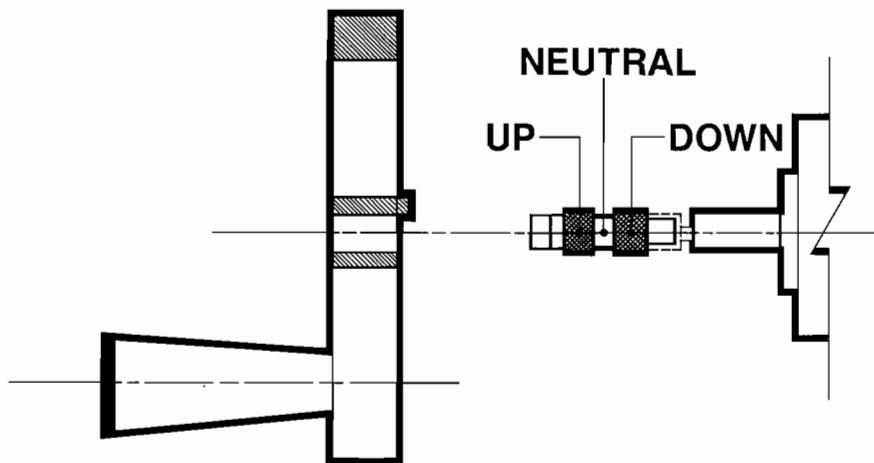
SENSITIVE HEAD FEED

1. Place the handle on the boss.
2. Select the most suitable position.
3. Push home until locating pin engages.



FINE HAND FEED

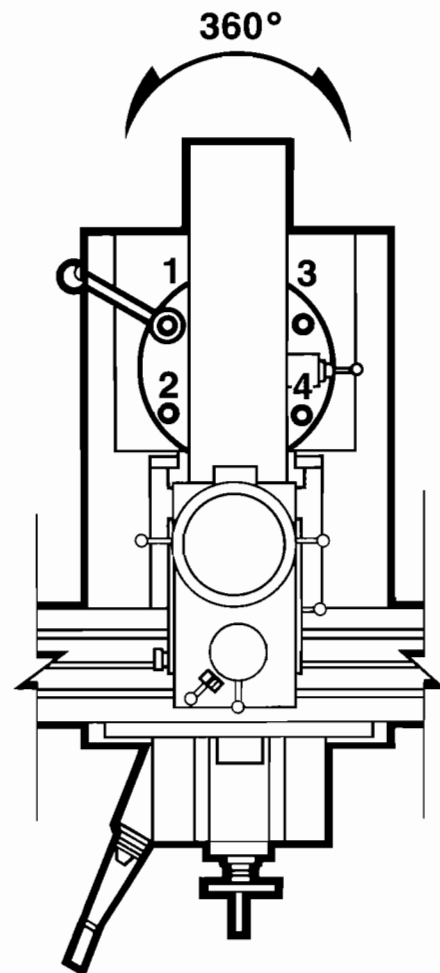
1. Disengage auto quill feed.
2. Locate feed select knob in the mid position.
3. Set feed engagement lever to the left position.
4. The quill is now under handwheel control.



OPERATION

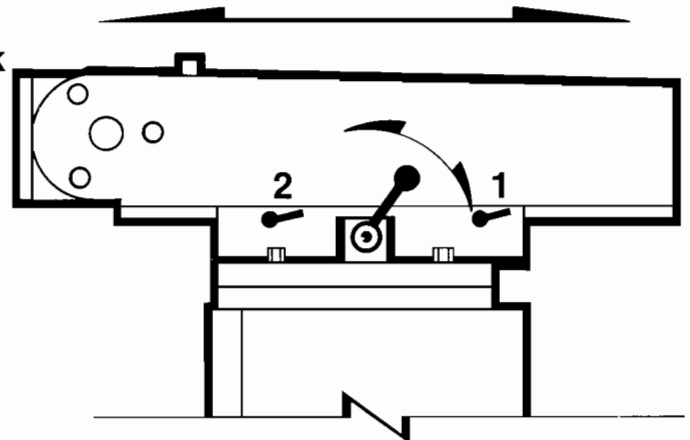
SWIVEL TURRET

1. Use wrench to unlock the four bolts.
2. Index to the required setting.
3. Lock the four bolts.



MOVE RAM SLIDE

1. Loosen two lock levers.
2. Turn the handle to move the slide to the desired position.
3. Tighten, tightening the rear lock lever first.



OPERATION

CLAMPING THE RAM, TABLE, SADDLE AND KNEE

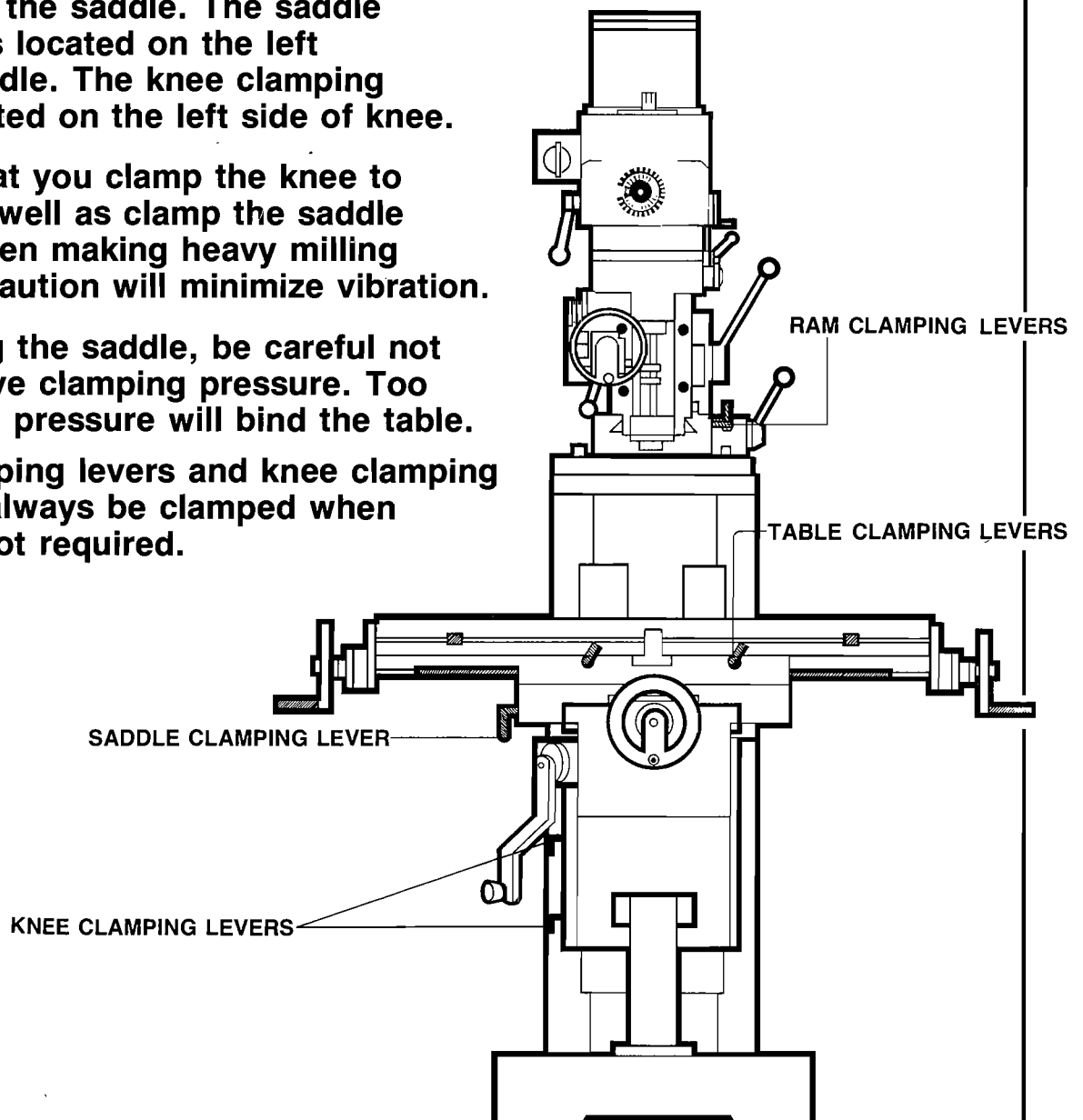
Two ram clamping levers are located on the right of ram. Both ram clamping levers should always be clamped.

Two table clamping levers are located on the front of the saddle. The saddle locking lever is located on the left side of the saddle. The knee clamping levers are located on the left side of knee.

We suggest that you clamp the knee to the column as well as clamp the saddle to the knee when making heavy milling cuts. This precaution will minimize vibration.

When clamping the saddle, be careful not to use excessive clamping pressure. Too much clamping pressure will bind the table.

The table clamping levers and knee clamping levers should always be clamped when movement is not required.



MAINTENANCE

MAY WE SUGGEST THAT

Before attempting any maintenance for safety you should isolate the machine electrically and for efficiency read the relevant section of this manual.

WHEN ORDERING REPLACEMENT PARTS

PLEASE QUOTE:

- * **THE MACHINE SERIAL NO.**
situated on the right hand side of the column.
- * **THE HEAD SERIAL NO.**
found on the right side of the belt housing.
- * **ITEM NUMBER.**
- * **PART NUMBER.**
- * **QUANTITY.**
- * **DESCRIPTION.**

PREVENTIVE MAINTENANCE

For securing the accuracy and life of the machine,
we offer the following suggestions.

DAILY:

- A. It is necessary to oil each lubrication point before operation.
- B. Check the level of the oil lubrication and fill if necessary.
- C. It is necessary to release the clamps, clean and lubricate the table after operation.

MONTHLY:

- A. Check all the gibs, and adjust if necessary.
- B. Check all the backlash between screws and nuts, and adjust if necessary.

QUARTERLY:

- A. Check and adjust the machine for accuracy.

TROUBLE-SHOOTING

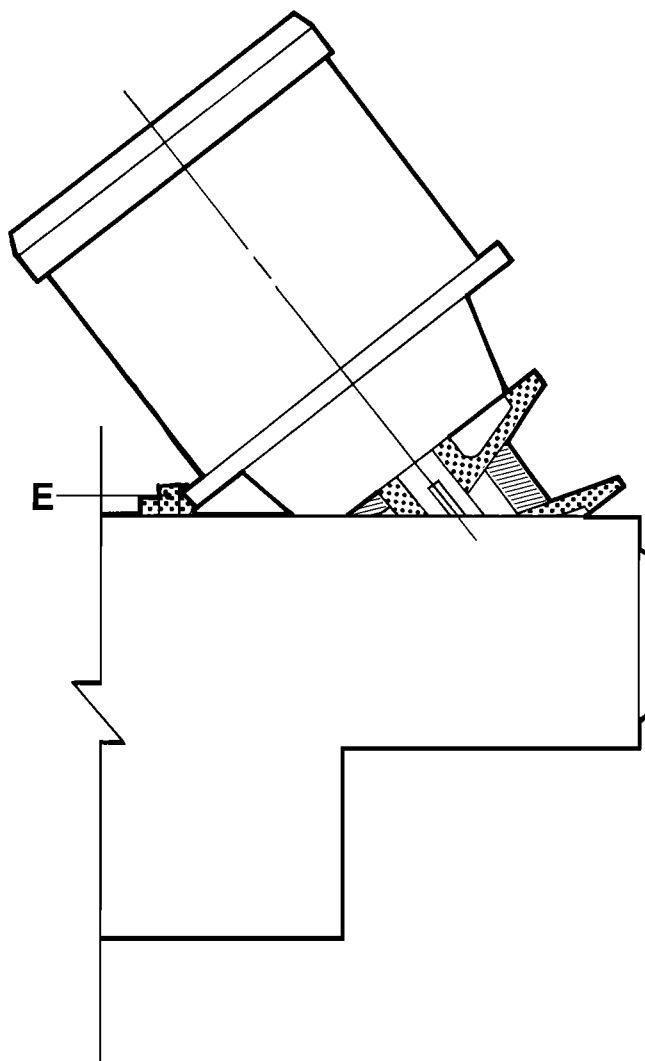
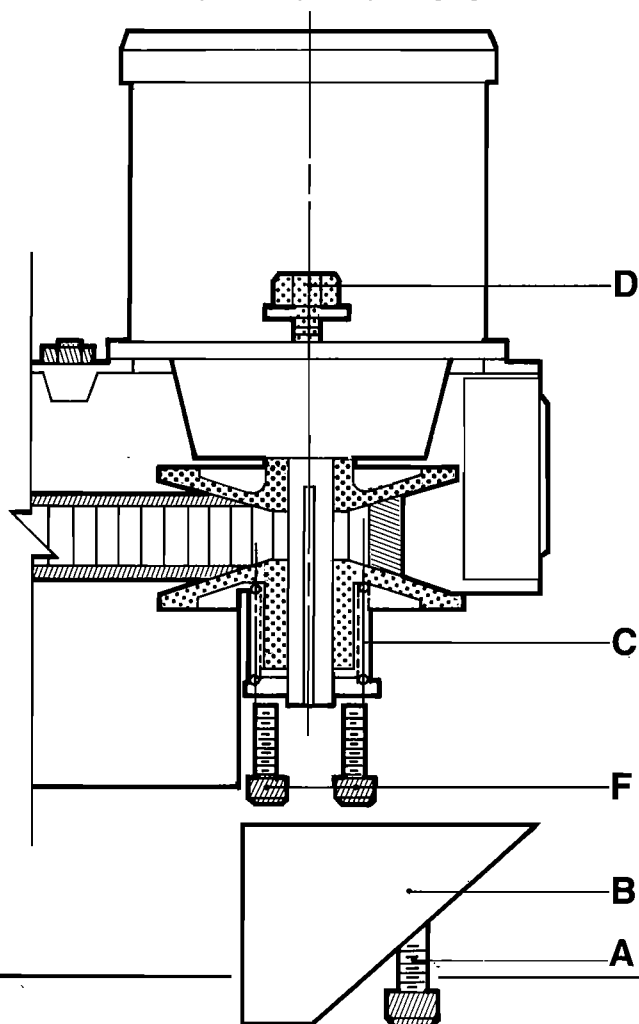
The following chart contains some typical probable troubles of operation, along with the possible causes and remedies for each.

TROUBLE	POSSIBLE CAUSE	REMEDY
SPINDLE FEED ABNORMAL	Quill clamp lever unrelease.	Release clamp lever.
SPINDLE BRAKE BRAKE-DOWN.	Brake shoe worn out	Replace.
POOR SPINDLE ROTATION	Poor contact on the switch,	Check the switch.
	Drive belt too slack.	Adjust or replace.
	Poor motor.	Repair or renew.
INCORRECT ROTATION	The switch knob indicated at wrong position.	Change to correct position.
3 AXES FEED UNSMOOTH	Gib strip too tight.	Release
	Unproper backlash between nuts and screws.	Adjust
	No lubrication at this point.	Check lubrication.
VIBRATES WHEN MACHINING	Machine unstable.	Reclamp
	unsuitable cutting condition.	Select proper cutting speed according to material and cutter.

MAINTENANCE

MOTOR REMOVAL

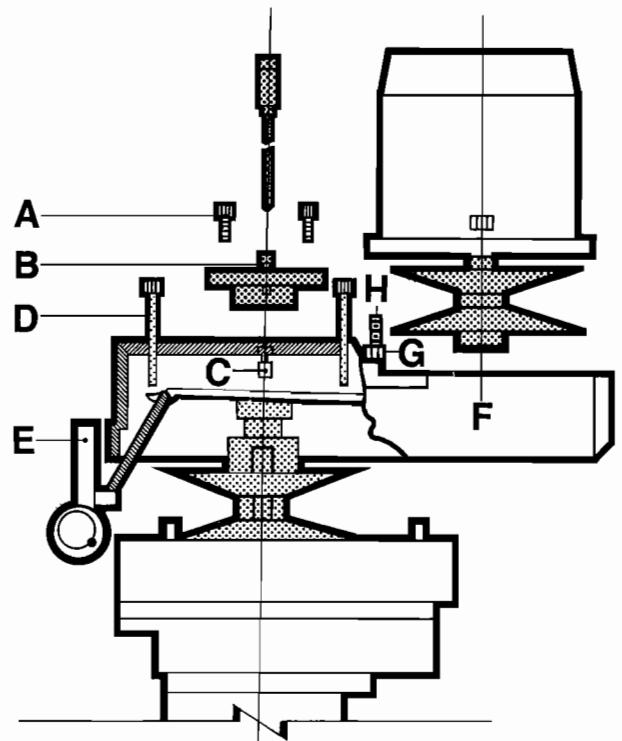
1. Run head to adjust to the lowest speed.
2. Disconnect form power source.
3. Remove two screws "A" and remove cover "B".
4. Using two M5—0.8P screws "F", compress spring "C".
5. Rotate the speed changer to the highest speed.
6. Remove the reversing switch from the belt housing.
7. Remove the two bolts "D".
8. Lift the motor and rest the case on stud "E".
9. Ease the belt over the lower drive disc and remove the motor.



MAINTENANCE

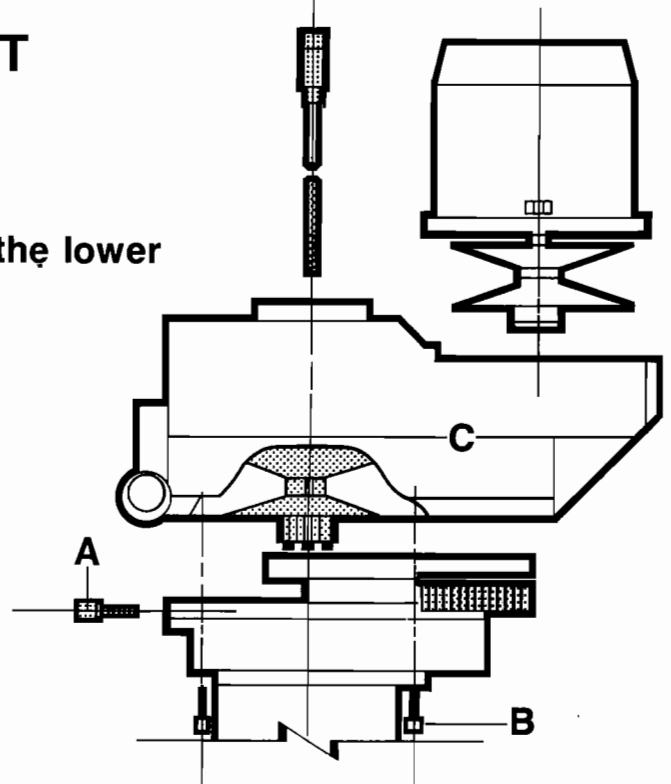
DRIVE BELT REPLACEMENT

1. Remove the motor.
2. Remove the three screws "A", insert into the adjacent tapped holes and withdraw bearing housing "B".
3. Remove four screws "D".
4. Remove screws "E".
5. Remove lock nut "G" and turn speed change plate pivot stud "H" clockwise to remove.
6. Remove top housing "F", tap to clear the dowels.
7. Replace the belt.



TIMING BELT REPLACEMENT

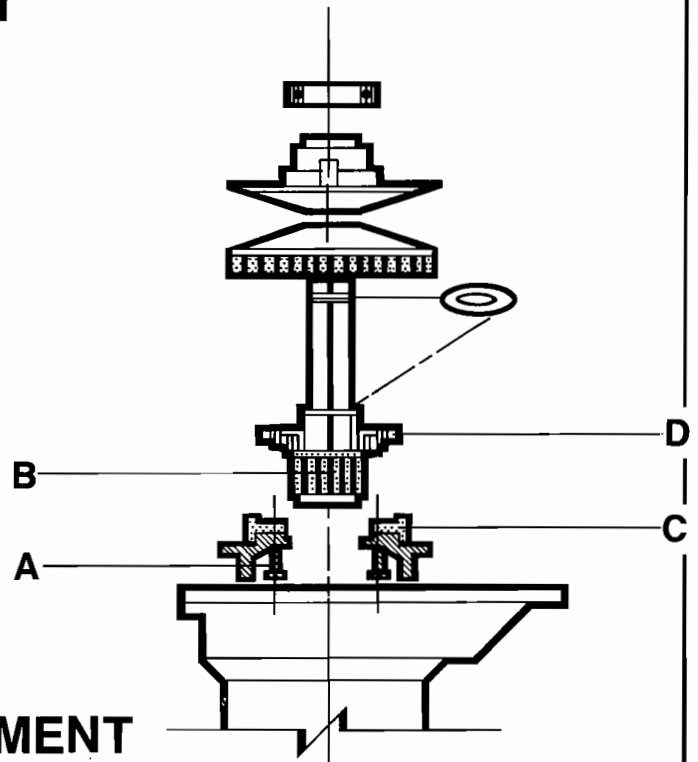
1. Remove the motor.
2. Lower the quill to full extent.
3. Remove the two screws "A" from the lower speed changer housing.
4. Remove the four screws "B".
5. Remove the top assembly "C" and tap to clear dowels.
6. Replace the belt.



MAINTENANCE

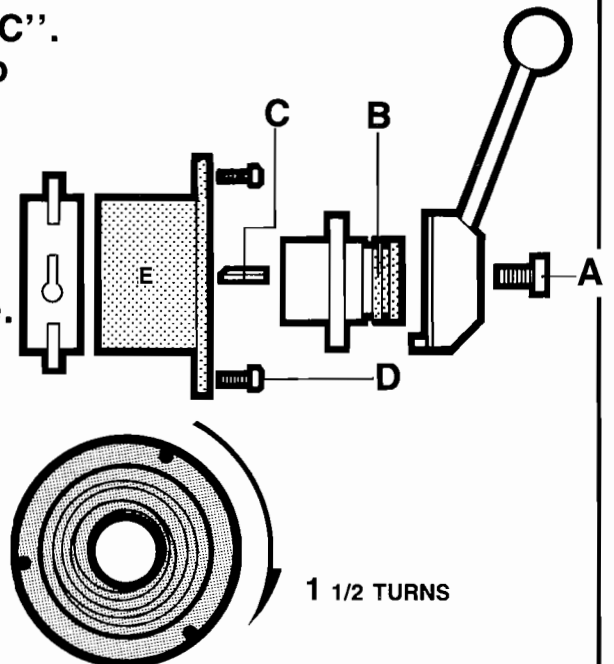
BRAKE SHOE REPLACEMENT

1. Remove the top section.
2. Remove the two screws "A".
3. Remove the clutch hub assembly "B" and "D".
4. Replace the brake shoes "C".



BALANCE SPRING REPLACEMENT

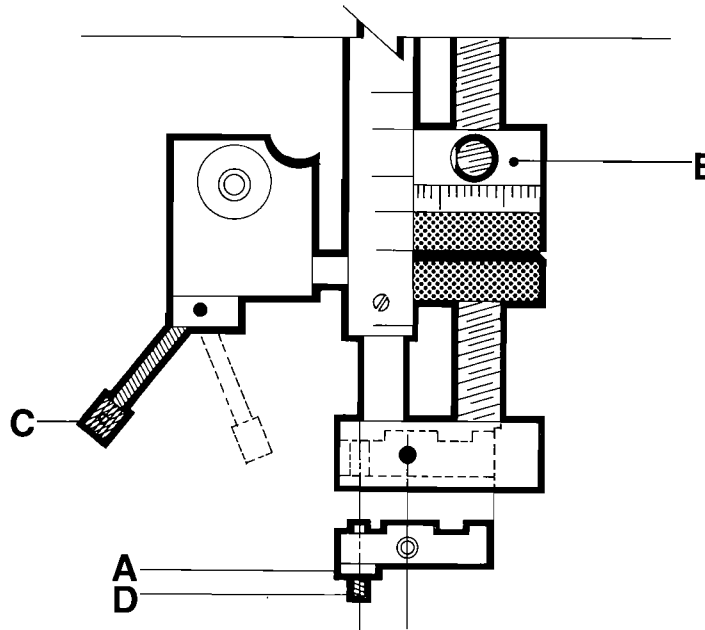
1. With quill at top of movement apply quill lock.
2. Remove screw "A", hub "B", and key "C".
3. Remove screws "D", allowing housing to rotate slowly releasing spring tension.
4. Lift end of spring from peg on the pinion shaft.
5. Rotate housing "E" counter-clockwise from head casting.
6. Remove spring from housing and replace.
7. Refit spring to main housing casting, turning housing clockwise until spring locates on peg in pinion shaft.



MAINTENANCE

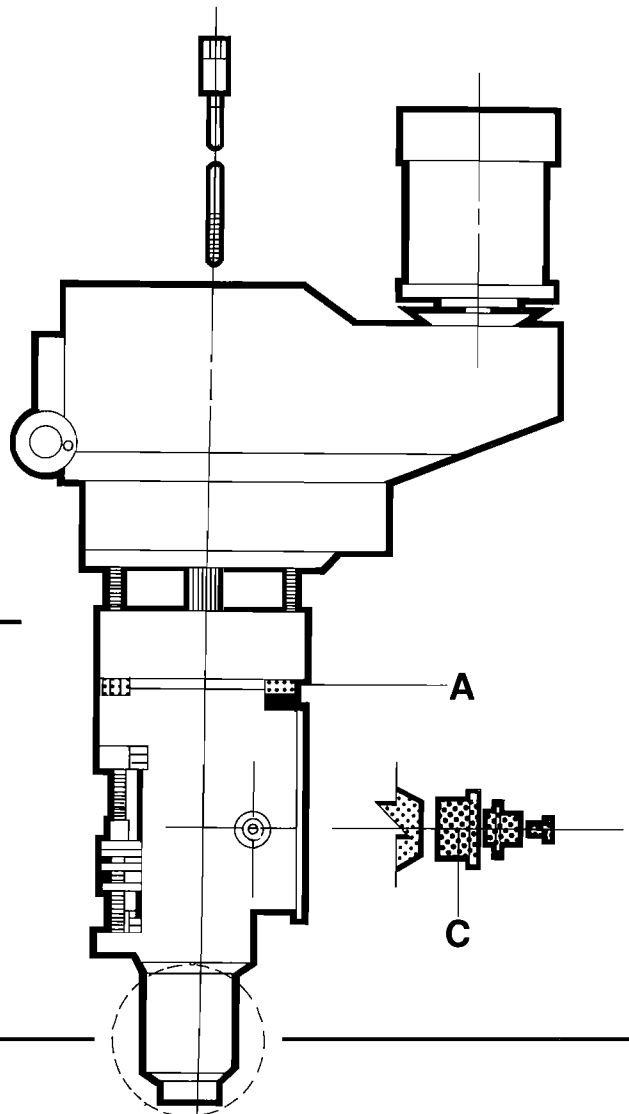
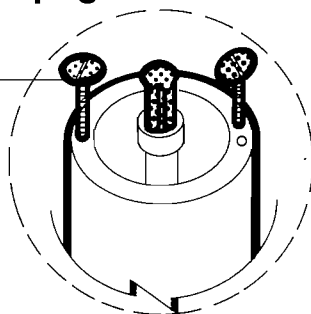
FEED TRIP ADJUSTMENT

1. Release lock nut "A".
2. Engage trip handle "C".
3. Adjust micro nuts against quill stop "B".
4. Slowly turn adjusting screw "D" until lever "C" trips.
5. At this point secure locknut "A".
6. Check that full trip action is obtained.



QUILL REMOVAL

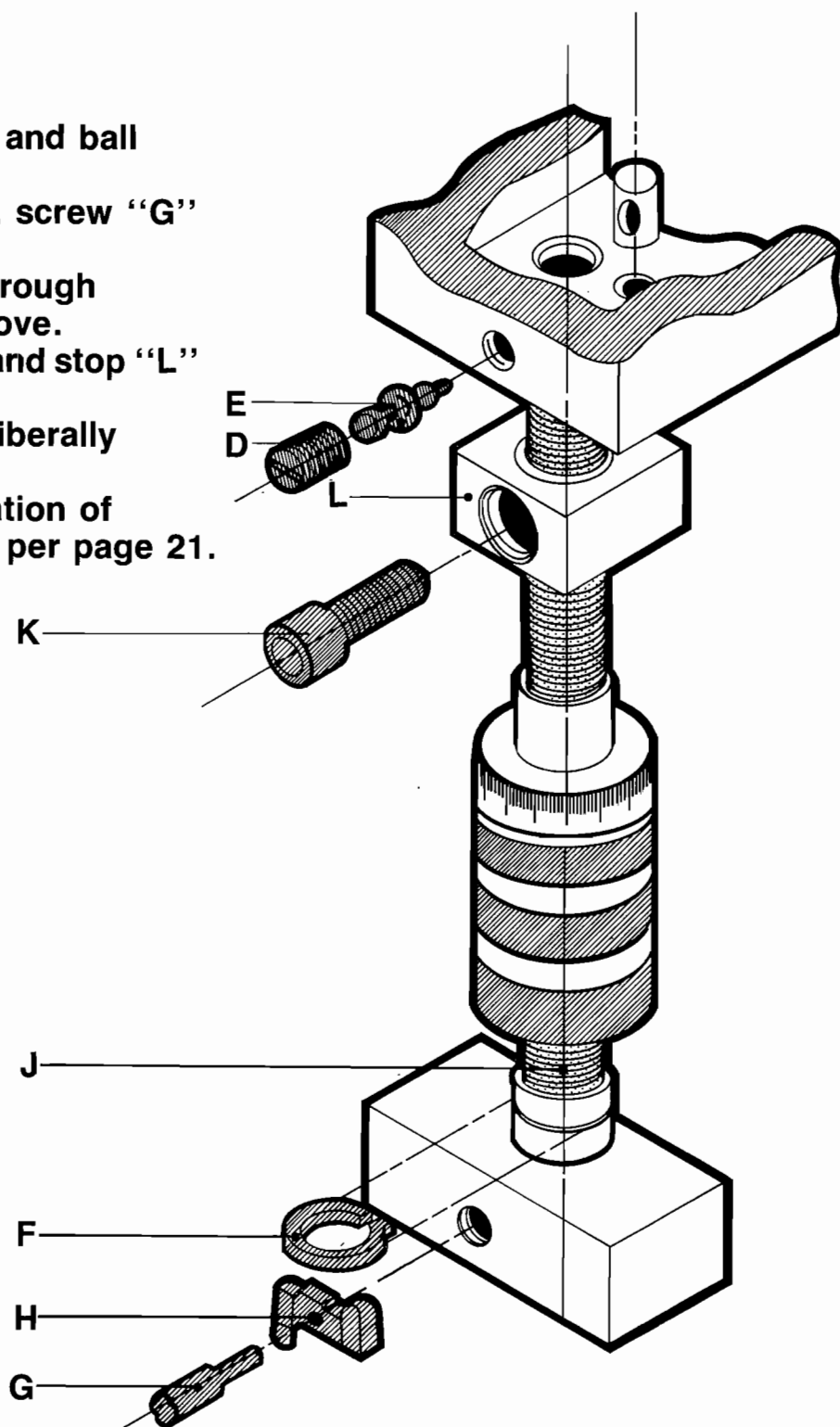
1. Disconnect electrical
2. Remove motor.
3. Remove drawbar.
4. Full extend quill fully.
5. Remove four nuts "A".
6. Remove top section completely.
7. Remove two screws "B" from top of quill.
8. Remove clock spring housing "C" — see instruction on page 20 for replacement of spring. B



MAINTENANCE

QUILL REMOVAL

9. Remove screw "D" and ball reverse lever "E".
10. Remove circlip "F", screw "G" and arm "H".
11. Thread shaft "J" through micro nuts and remove.
12. Remove screw "K" and stop "L".
13. Remove quill.
14. Clean all areas, oil liberally and reassemble.
15. Check correct operation of feed trip linkage As per page 21.



MAINTENANCE

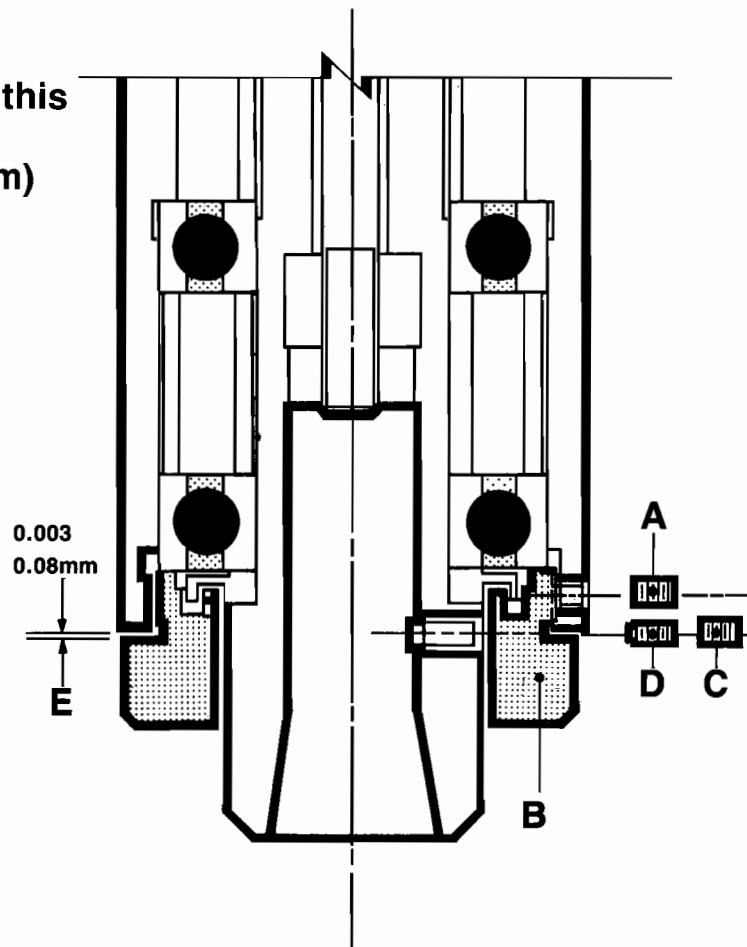
COLLET ALIGNING SCREW REPLACEMENT

1. Use felt pen to mark reference line on quill and nose cap "B".
2. Remove set screw "A".
3. Unscrew cap "B".
4. Remove lock screw "C" and screw "D".
5. Replace "D", insert R-8 collet and check that the dog on the end of the screw does not foul on the bottom of the guide slot.
6. Replace lock screw "C".
7. Replace nose cap "B", check felt pen markings for correct alignment.
8. Replace set screw "A".

CAUTION:

Do not overtighten as this will cause distortion.

9. Check gap "E". ($0.003'' = 0.08\text{mm}$)

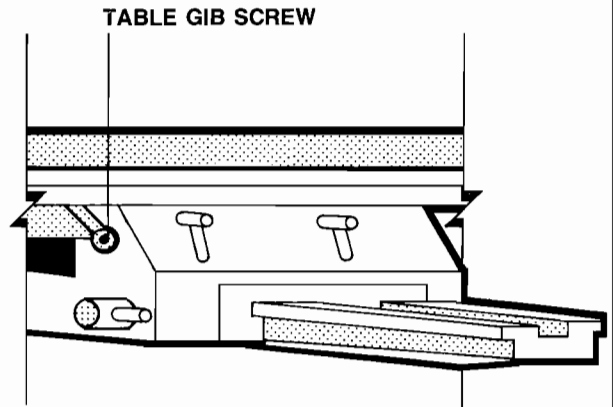


MAINTENANCE

GIB STRIP ADJUSTMENT

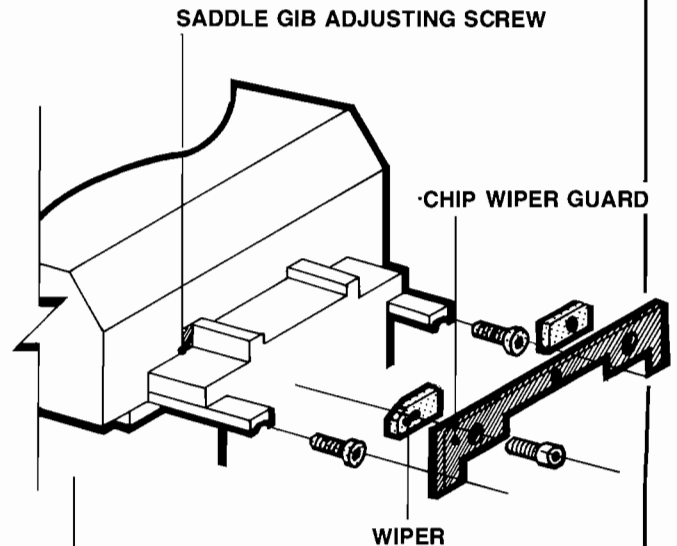
TABLE SADDLE WAYS

1. Remove all chips & foreign material from area.
2. Turn the table gib screw clockwise while moving the table until slight drag is felt.



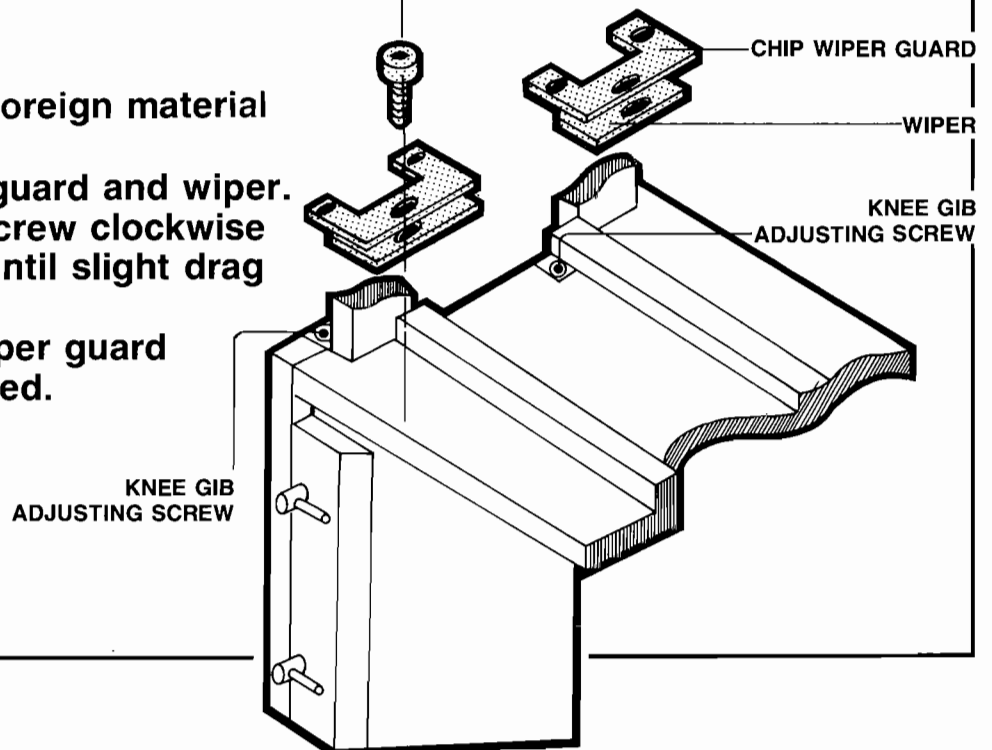
SADDLE KNEE WAYS

1. Remove all chips & foreign material from area.
2. Remove chip wiper guard and wiper.
3. Turn gib adjusting screw clockwise while moving the saddle until slight drag is felt.
4. Be sure that chip wiper guard and wiper are replaced.



KNEE COLUMN WAYS

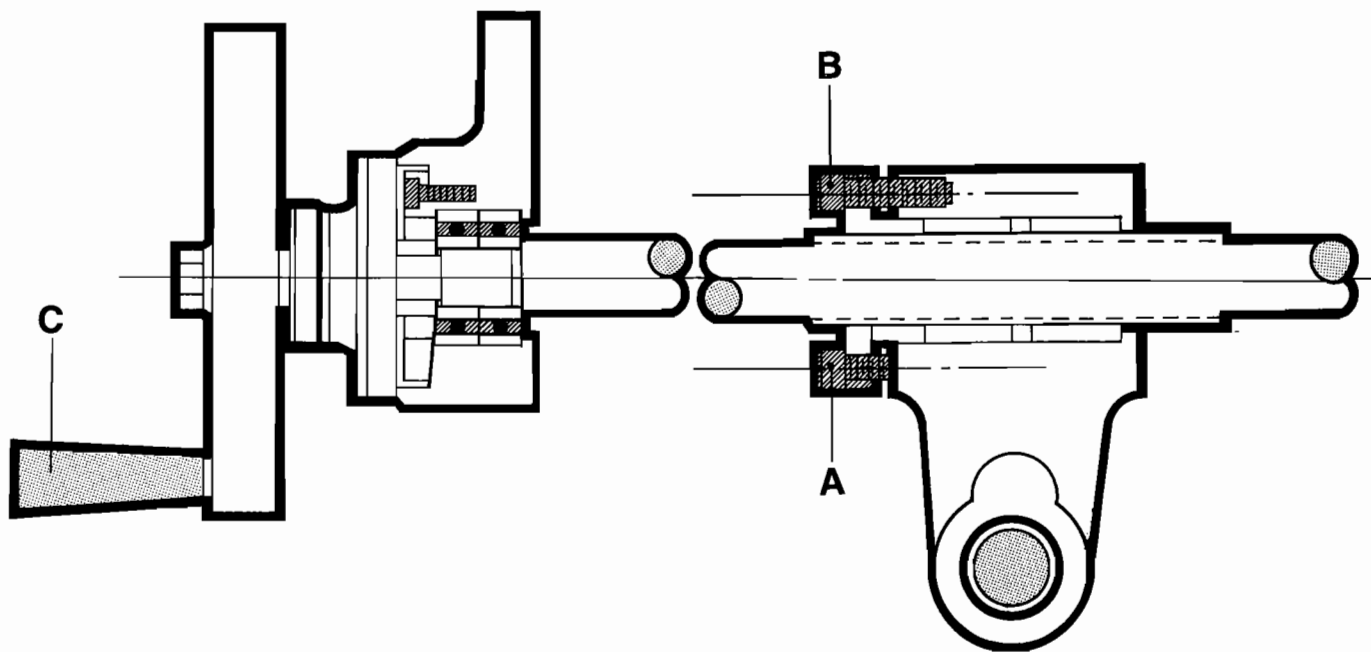
1. Remove all chips & foreign material from area.
2. Remove chip wiper guard and wiper.
3. Turn gib adjusting screw clockwise while moving knee until slight drag is felt.
4. Be sure that chip wiper guard and wiper are replaced.



MAINTENANCE

TABLE SCREW BACKLASH ADJUSTMENT

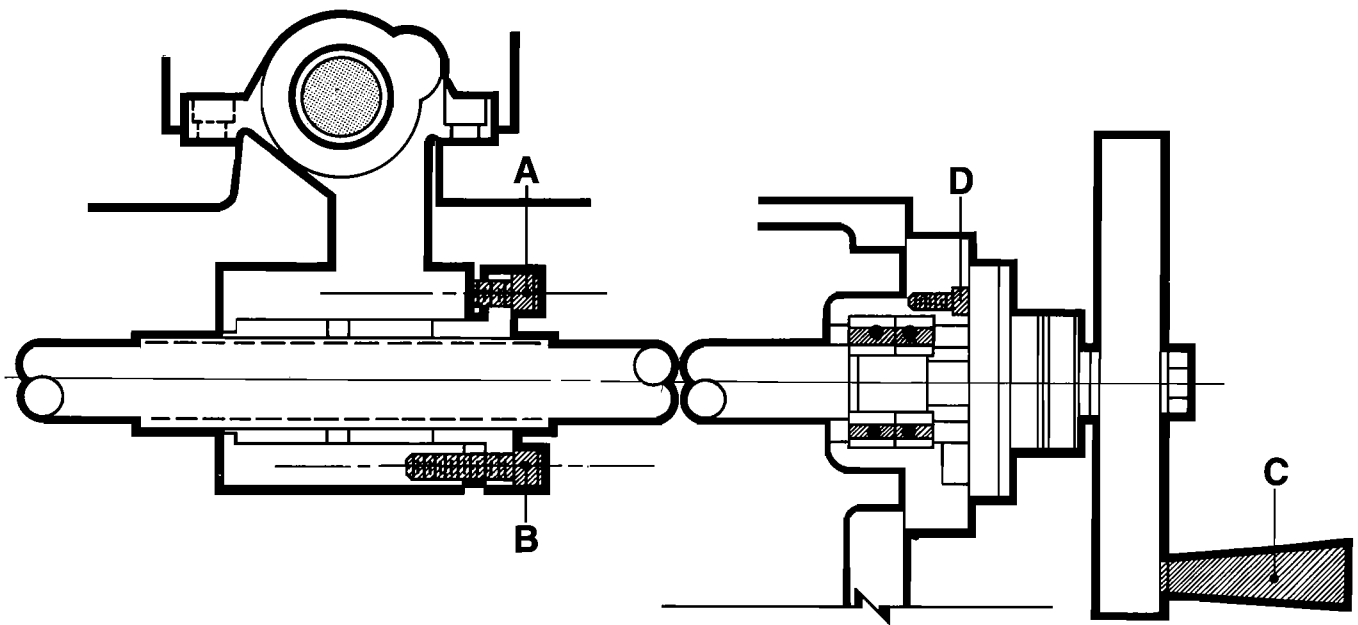
1. Crank the table to the left.
2. Remove the right side bearing support assembly.
3. Slowly turning handle "C", while tightening screws "B" until 0.004" or 0.005" backlash is obtained.
4. Lock screws "A".
5. Finally assemble the right side bearing support assembly.



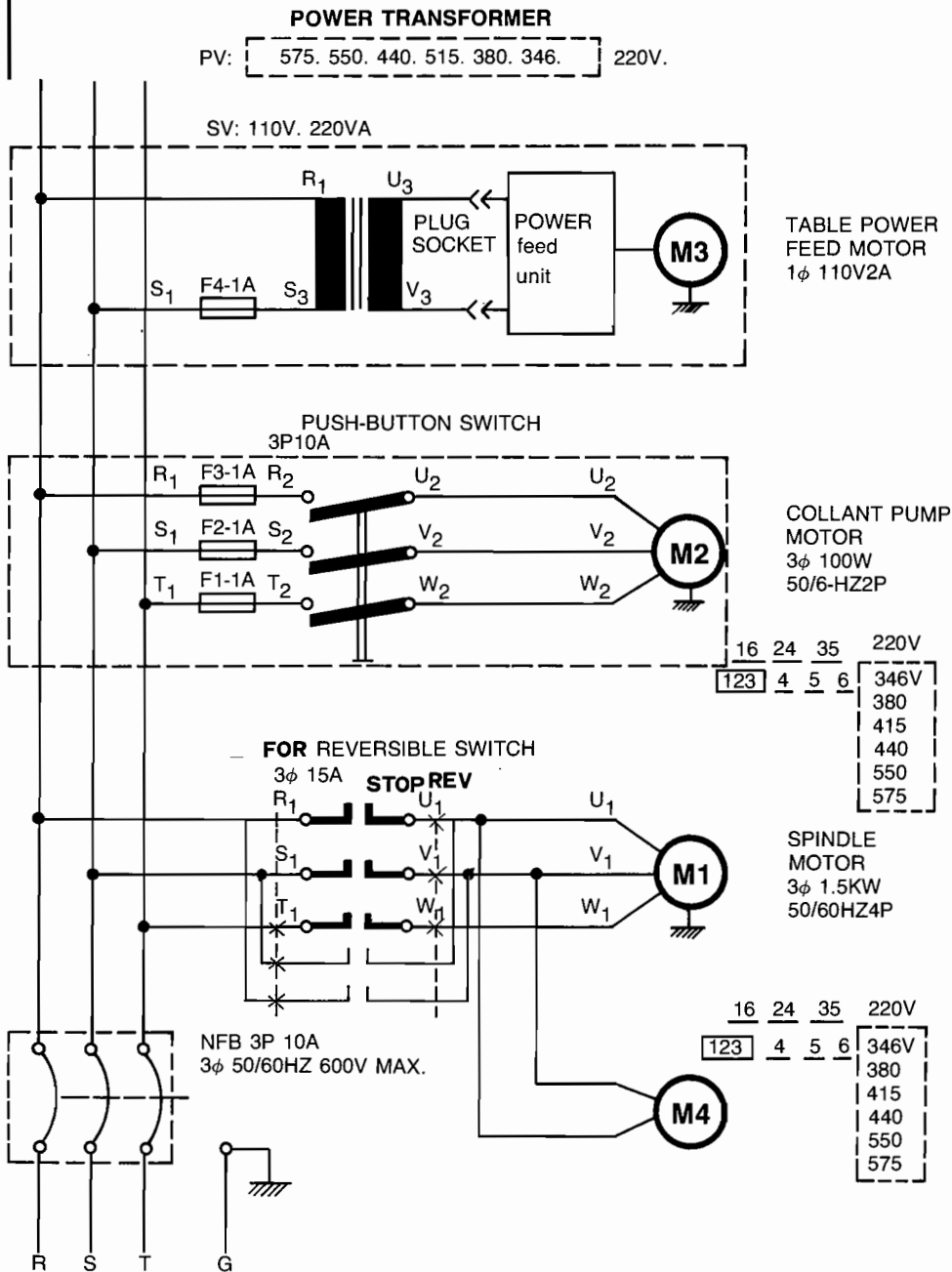
MAINTENANCE

CROSS SCREW BACKLASH ADJUSTMENT

1. Crank the saddle to mid position.
2. Withdraw four screws "D".
3. Pull the saddle forward to expose screws "A" and "B".
4. Slowly turning handle "C", tighten screws "B" until 0.004" or 0.005" backlash is obtained.
5. Lock screws "A".
6. Finally crank the saddle to the front of the knee and replace four screws "D".

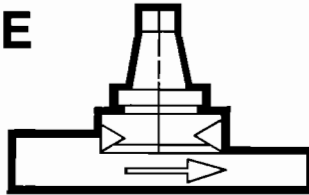


ELECTRIC CIRCUIT DIAGRAM



CUTTING DATA

MILLING DATA TABLE



CUTTING SPEEDS

Unit = m/min (IPM)

Material to be cut	High speed steel tools		Carbide-tipped tools	
	Rough mill	Finish mill	Rough mill	Finish mill
Cast iron HB 150-180	21 (826)	36 (1417)	80 (3150)	150 (5905)
Cast iron HB 180-220	16 (630)	27 (1063)	70 (2756)	120 (4724)
Cast iron HB 220-300	12 (472)	21 (827)	60 (2362)	90 (3543)
Carbon steel (Medium)	24 (945)	35 (1378)	75 (2953)	75 (2953)
Carbon steel (High)	12 (472)	24 (945)	60 (2362)	70 (2756)
Copper	38 (1496)	53 (2087)	180 (7086)	300 (11811)
Brass	76 (2992)	90 (3543)	240 (9449)	300 (11811)
Bronze	38 (1496)	50 (1968)	180 (7086)	300 (11811)
Aluminum	120 (4724)	210 (8267)	240 (9448)	300 (11811)

FEED PER TOOTH

Unit = mm/Tooth (INCH PER MIN)

Material to be cut	Face mills	Helical mills	Adie mills	End mills	Form mill cutters	Circular saws
Cast iron HB-150-180	0.40(0.0157)	0.33(0.013)	0.22(0.009)	0.2 (0.008)	0.13 (0.005)	0.10 (0.004)
Cast iron HB 180-220	0.33(0.013)	0.25(0.01)	0.15(0.006)	0.15 (0.006)	0.15 (0.006)	0.075(0.003)
Cast iron HB 220-300	0.28(0.011)	0.20(0.008)	0.15(0.006)	0.13 (0.005)	0.075(0.003)	0.075(0.003)
Carbon steel (Medium)	0.25(0.01)	0.20(0.008)	0.15(0.006)	0.12 (0.0047)	0.075(0.003)	0.075(0.003)
Carbon steel (High)	0.15(0.006)	0.13(0.005)	0.10(0.004)	0.075(0.003)	0.05 (0.002)	0.05 (0.002)
Copper	0.30(0.012)	0.25(0.01)	0.17(0.007)	0.15 (0.006)	0.10 (0.004)	0.75 (0.003)
Brass	0.35(0.014)	0.28(0.011)	0.20(0.008)	0.18 (0.007)	0.10 (0.004)	0.75 (0.003)
Bronze	0.23(0.009)	0.18(0.007)	0.15(0.006)	0.13 (0.005)	0.075(0.003)	0.05 (0.002)
Aluminum	0.55(0.022)	0.45(0.018)	0.33(0.013)	0.28 (0.011)	0.18 (0.007)	0.13 (0.005)

CUTTING DATA

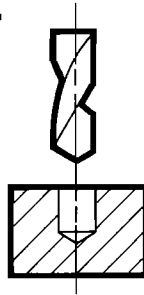
DRILLING DATA TABLE

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

V: Cutting speed, M/min.

D: Drill diameter, mm.

N: Revolutions per minute, rpm.



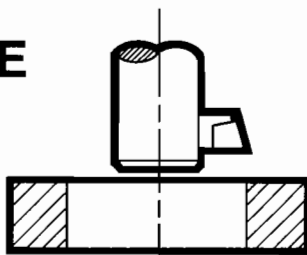
MATERIAL	HARDNESS Brinell	PERIPHERAL SPEED M/min (IN/min)	FEED mm/min (IN/min)	LUBRICANT
Cast iron, soft	126	42 – 45 (165 – 177)	Heavy	
Cast iron, medium	196	24 – 33 (95 – 130)	Medium	
Cast iron, hard	293 – 302	13 – 15 (50 – 59)	Light	Soluble oil
Steel, 40-50 carbon	170 – 196	24 (95)	Medium	Soluble oil
Mild steel, 20-30 carbon	170 – 202	33 – 36 (130 – 142)	Heavy	Soluble oil
Copper	80 – 85	21 (83)	Light	Soluble oil
Brass	129 – 202	61 – 76 (240 – 300)	Heavy	2/3 lard oil 1/3 kerosene
Bronze, common	166 – 183	61 – 76 (240 – 300)	Heavy	Soluble oil or dry
Aluminum	99 – 101	193 – 309 (760 – 1210)	0.127 – 0.88 (0.005 – 0.035)	2/3 lard oil 1/3 kerosene

KEY TO FEED REVOLUTION

DRILL MM (IN)	HEAVY FEED MM (IN)	MEDIUM FEED MM (IN)	LIGHT FEED MM (IN)
6 (0.236)	0.20 (0.008)	0.13 (0.005)	0.06 (0.0024)
12 (0.472)	0.25 (0.01)	0.19 (0.0075)	0.10 (0.004)
19 (0.748)	0.40 (0.016)	0.25 (0.01)	0.15 (0.006)
25 (1)	0.50 (0.02)	0.30 (0.012)	0.19 (0.0075)

CUTTING DATA

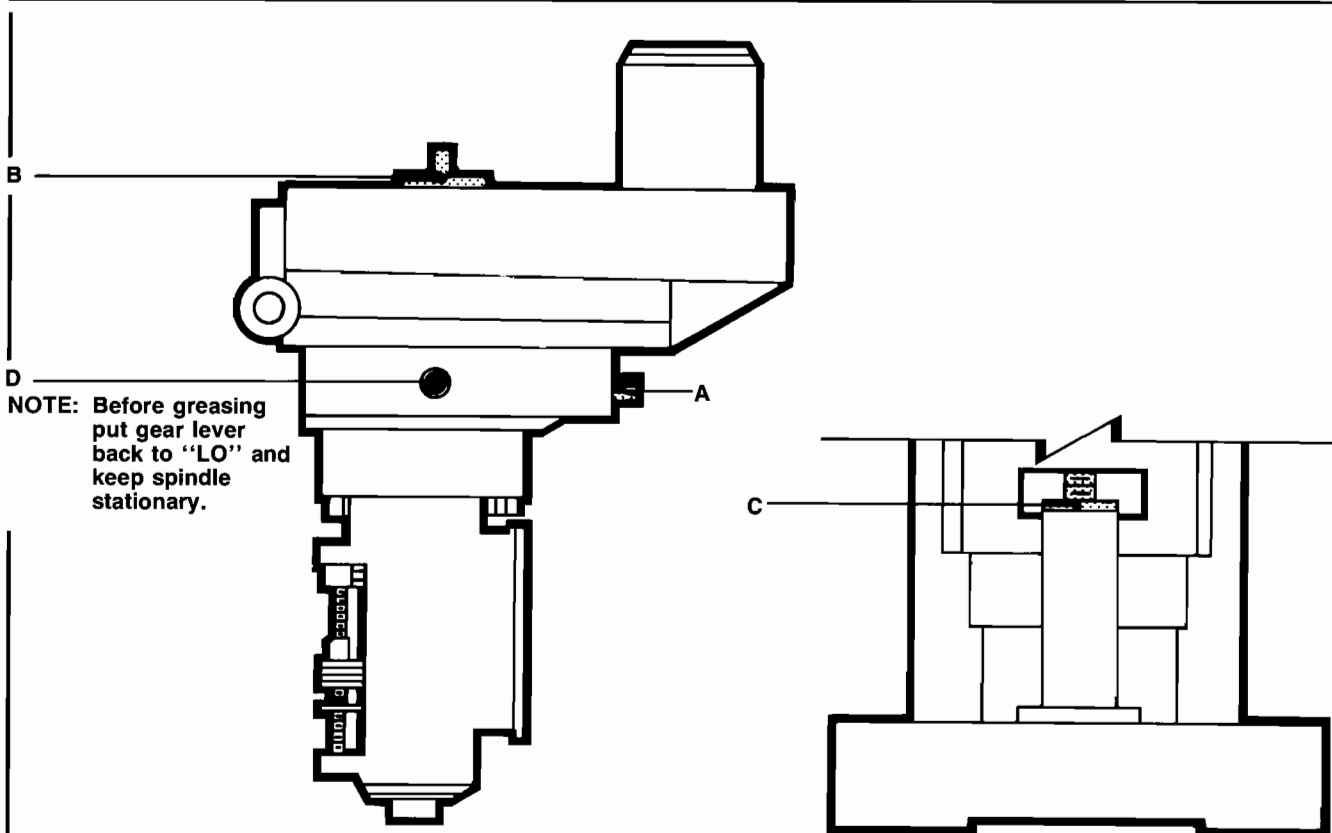
BORING DATA TABLE



Material	Cutting speeds	Lead	Depth of cut	Nose radius		Rake angles	
	M/min. (IN/min.)			mm/rev. (IN/rev)	mm (IN)	Small bores mm (IN)	Large bores mm (IN)
Cast iron	91 (358) 182 (716)	0.075 (0.003) 0.15 (0.006)	0.127 (0.005) 0.38 (0.015)	0.38 (0.015) 0.76 (0.03)	0.76 (0.03) 1.5 (0.06)		
Aluminum	280 (1100) 1800 (7080)	0.025 (0.001) 0.127 (0.005)	0.127 (0.005) 0.38 (0.015)	0.38 (0.015) 1.5 (0.06)	0.38 (0.015) 1.5 (0.06)	0-15°	5-15°
Lead copper Lead red brass Free cutting yellow brass Forging brass	91 (358) 1200 (4720)	0.025 (0.001) 0.127 (0.005)	0.05 (0.002) 0.38 (0.015)	0.38 (0.015) 0.76 (0.03)	0.76 (0.03) 1.5 (0.00)	0°	5°
Red brass Yellow brass Naval brass	150 (590) 600 (2360)					0°	5°-10°
Copper Chromium copper Commercial bronze Nickel-silver	150 (590) 300 (1180)					5°-10°	15°-20°
High-carbon Alloy steels	80 (315) 100 (393)	Normally use 0.25 (0.01)				0°-6°	3°-8°
Interrupted cuts and tough steels	180 (710) 210 (825)					5°-35°	11°-35°
Low-carbon and free-cutting steels	300 (1180) 350 (1380)					3°-10°	0°-15°

LUBRICATION

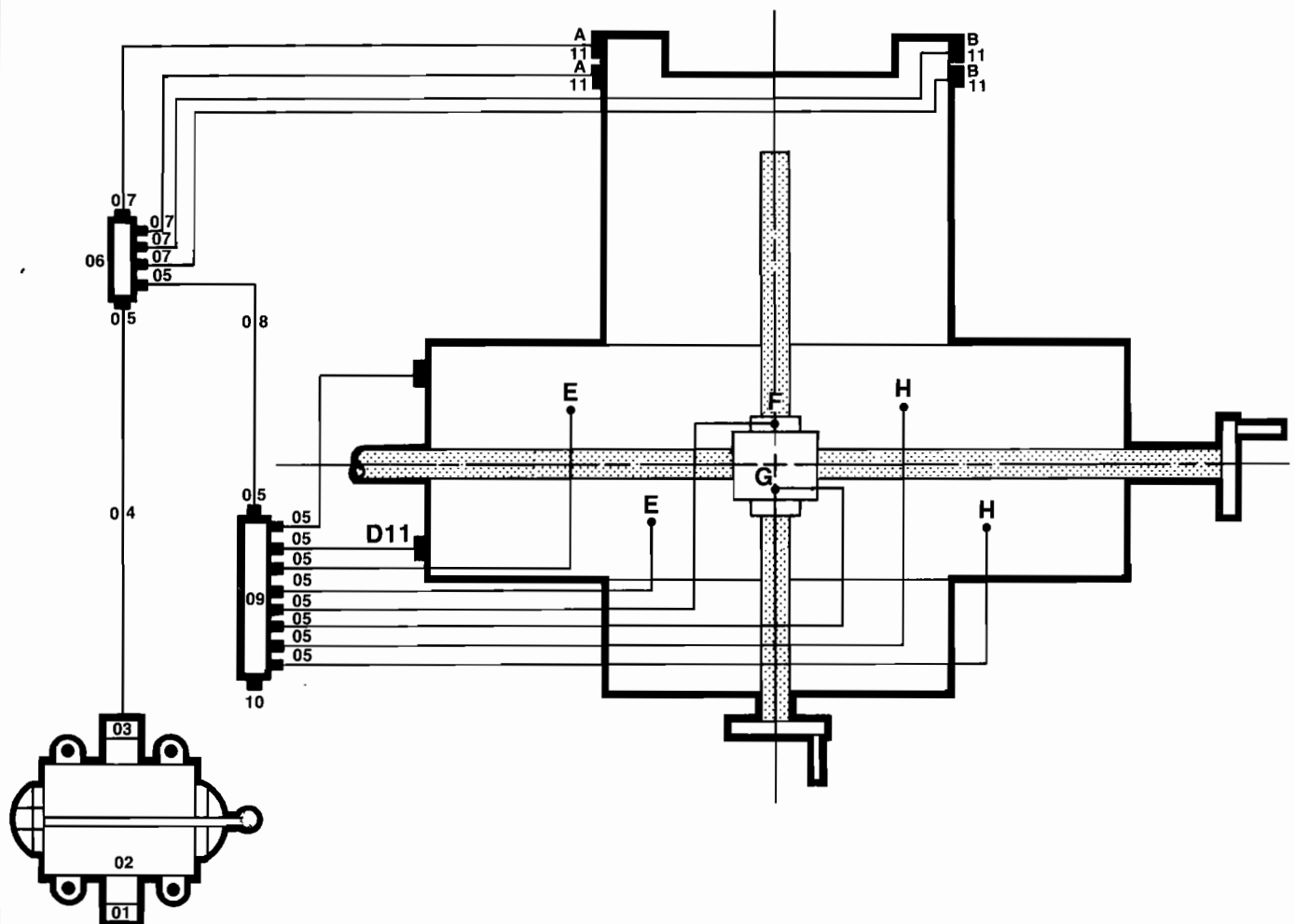
FREQUENCY	LUBRICATE	LUBRICANT	QUANTITY LUB.AT.	
Twice Daily (When feed is in use)	Spindle down feed	Vectra Heavy Medium S.A.E. 10 or 10W Light	Top-Up	A
Weekly	Drawbar splines (move quill down 2")	Ditto	5 drops	B
Twice Weekly	Elevating Screw	Shell Cornea Oil 41 MOBIL x 2 Socony Gargoyle Vectra No.2	5 Shots (Oil Gun)	C
Every 2 months (of normal use)	Back gear	Grease	Equivalent of one teaspoonful	D



LUBRICATION

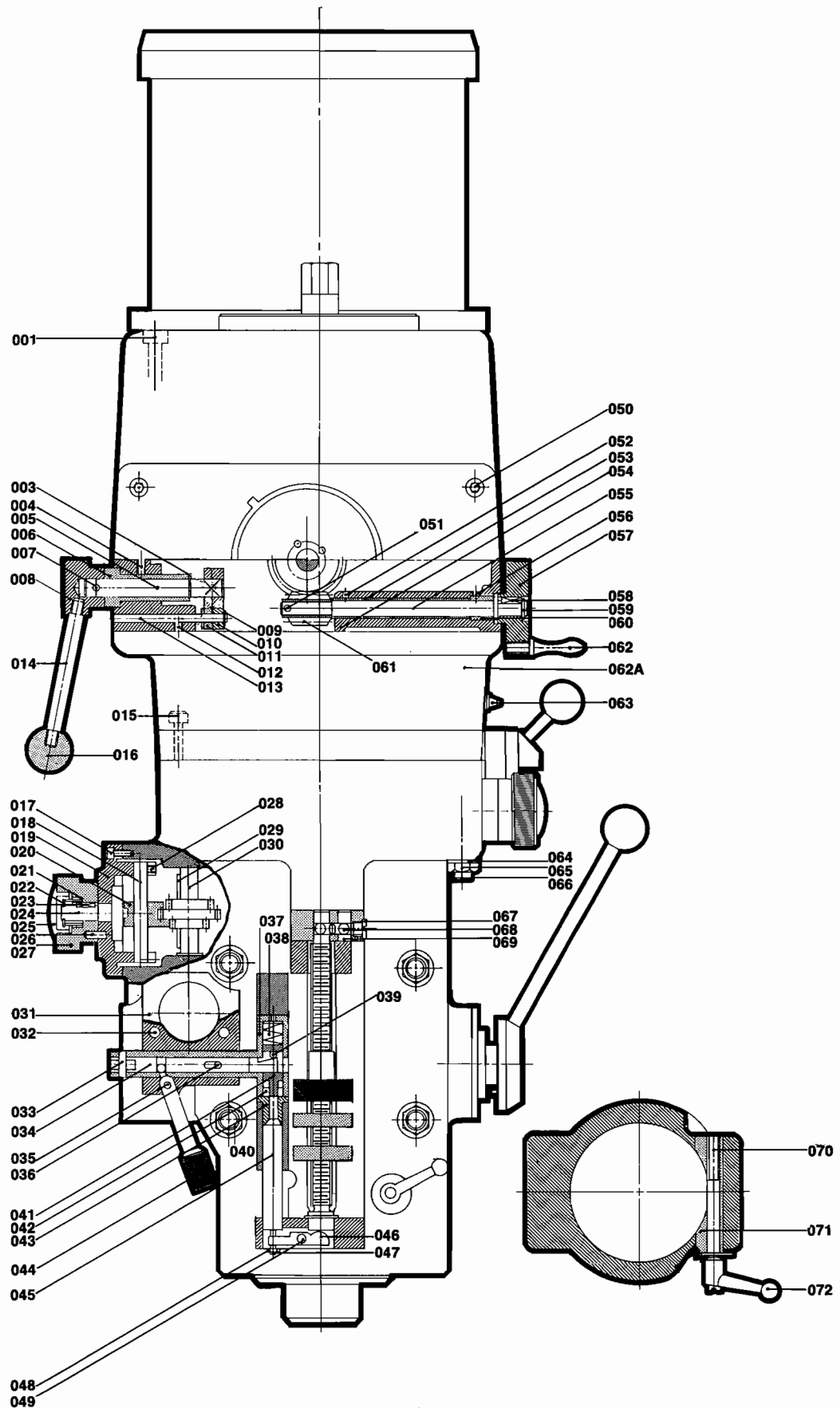
- A. To elevating left guideway.
- B. To elevating right guideway.
- C. To table and saddle rear guideway.
- D. To table and saddle front guideway.
- E. To knee and saddle left guideway.
- F. To cross screw.
- G. To longitudinal screw.
- H. To knee and saddle right guideway.

ITEM NO.	PART NO.	PART NAME	Q.T.Y:
01	085008002	Oil plug	1
02	013008000	Plunger pump (LT-8)	1
03	039040818	Check valve (PDV-4)	1
	040004000	Pipe lock nut (PA-4)	1
	050004000	Pipe joint (PB-4)	1
04	062040200	Aluminum pipe (Φ4x200)	1
05	040004000	Pipe lock nut (PA-4)	11
	050004000	Pipe joint (PB-4)	11
06	071060408	Oil distributor (DB-6)	1
07	111001003	Flow rectifier (PSS-3)	4
	041004000	Pipe lock nut (PAN-4)	4
	050004000	Pipe joint (PB-4)	4
08	062040330	Aluminum pipe (Φ4x330)	1
09	071100408	Oil distributor (DB-10)	1
10	085000082	Bronze plug (PG-8,M8xP10)	1
11	FE-031	Copper connector	6
	040004000	Pipe lock nut (PA-4)	6
	050004000	Pipe joint (PB-4)	6



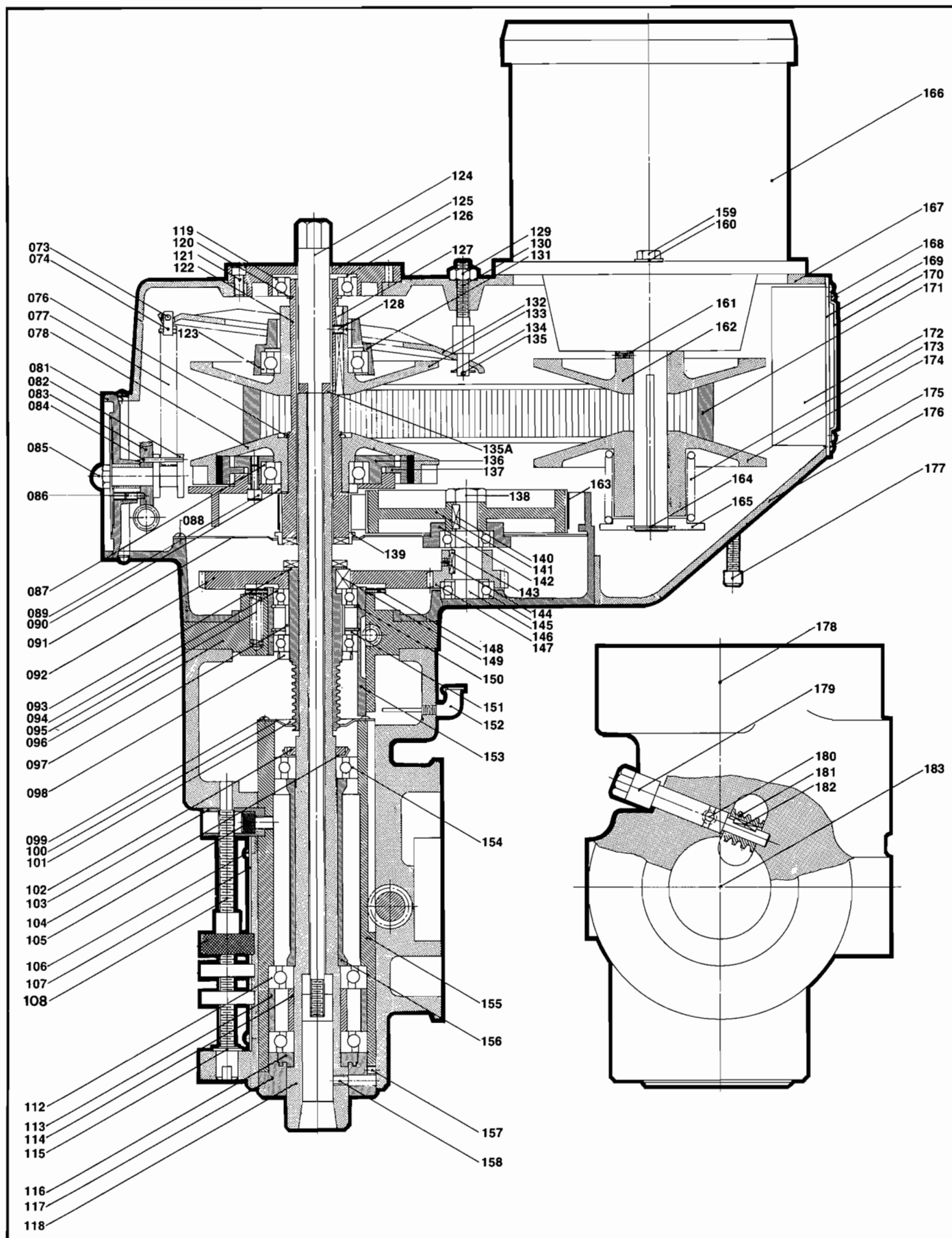
PARTS LIST

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
001	600081500	Hex-Socket cap(M8×150)	4	037	FA - 093	Cam rod sleeve	1
		screws		038	FA - 094	Compression spring	1
003	665012000	Outer retaining (A-12)	1	039	622030012	Spring pin (φ3× 12)	1
004	604060060	Set screw (M6 × 6)	1	040	FA - 040	Head fixed nuts	4
005	FB - 313A	Brake lock shaft	1	041	FA - 095	Trip plunger	1
006	FB - 065	Sleeve for brake lock shaft	1	042	FA - 096	Pad	1
				043	FA - 121	Trip plunger bushing	1
007	622040024	Spring pin (φ4×24)	1	044	FA - 328	Trip handle	1
008	FB - 319	Brake handwheel	1	045	FA - 097	Feed trip plunger	1
009	665006000	Outer retaining (A-6)	1	046	FA - 098	Feed trip lever	1
010	FB - 067A	Brake finger pivot stud	1	047	604040200	Set screw (M4 × 20)	1
011	FB - 067A	Brake finger pivot stud	1	048	615004000	Nut (M4)	1
012	604060060	Set screw (M6 × 6)	1	049	FA - 099	Trip lever pin	1
013	FB - 068	Brake operating finger	1	050	600060300	Hex-Socket head cap screws (M6 × 30)	4
014	FA - 074	Brake handle	1	051	622030012	Spring pin (φ3× 12)	1
015	600080200	Hex-Socket head cap screws (M8 × 20)	4	052	604060060	Set screw (M6 × 6)	1
016	AA - 039	Black plastic ball	1	053	FB - 322	Bushing	1
017	600050100	Hex-Socket head cap screws (M5 × 10)	4	054	FB - 301	Flange sleeve	1
018	FA - 150	Feed shift rod	1	055	FB - 309	Speed control shaft	1
019	FA - 337	Cluster gear cover	1	056	604060060	Set screw (M6 × 6)	1
020	FA - 149	Feed gear shift fork	1	057	FB - 308	Speed change handw heel	1
021	FA - 326	Spring	1	058	630030120	3 × 3 × 12 key	1
022	665010000	A-10 outer retaining ring	2	059	665010000	A-10 outer retaining ring	1
023	630030100	3 × 3 × 10 key	2	060	FB - 316	Flange sleeve	1
024	FA - 311	Cluster gear shaft	1	061	FA - 139	Worm	1
025	FA - 304	Cover	2	062	FB - 053	Speed change handw-heel knob	1
026	622040012	Spring pin (φ4×12)	1	062A	FB - 302	Gear housing	1
027	FA - 323	Handwheel	1	063	076008000	1/8"-28 PT nipple	1
028	604050100	Set screw (M5 × 10)	1	064	652038001	Spring washer (3/8")	4
029	630030460	Parallel key (3×3×46)	1	065	615038001	Nut (3/8")	4
030	FA - 143	Cluster gear shaft	1	066	FB - 077	Studs	4
031	FA - 330	Feed trip bracket	1	067	FA - 124	Reverse trip ball lever screw	1
032	600060200	Hex-Socket head cap screws (M6 × 20)	2	068	FA - 113	Reverse trip ball lever	1
033	FA - 077	Dowel pin	1	069	FA - 114	Feed reverse trip plunger	1
034	FA - 091	Cam rod	1	070	FA - 110	Quill lock sleeve tapped	1
035	FA - 077	Dowel pin	1	071	FA - 111	Quill lock sleeve	1
036	622030008	Spring pin (φ3 × 8)	1	072	FA - 088M	Handle assembly	1

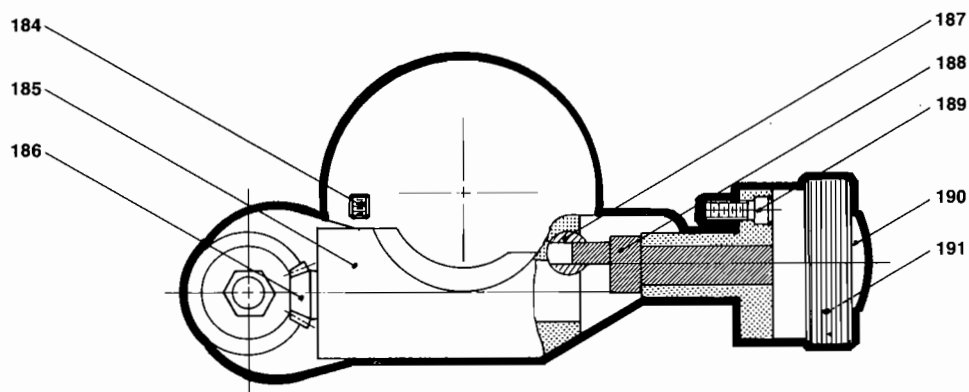


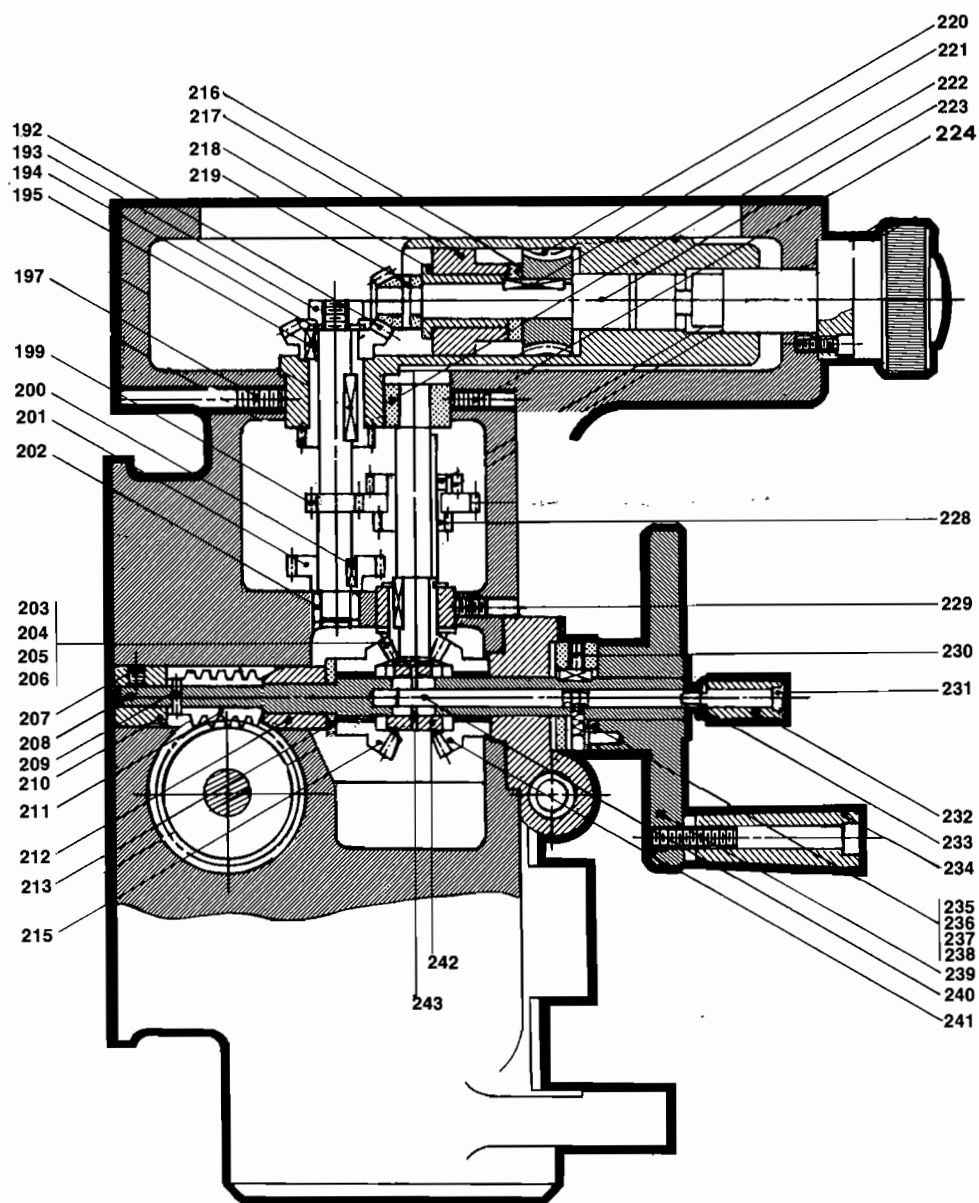
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
073	622040030	Spring pin	1	105	600100140	Hex-Socket head cap screw (M10 x 14)	1
074	FB - 059	Speed change chain stud	1	106	625020006	Rivet (Φ2x6)	2
			1				
076	665040000	A-40 retaining ring	1	107	403092040	Micrometer scale (Metre)	1
077	FB - 315	Roller chain	1		403092050	Micrometer scale (Inch)	1
078	FB - 012	Stationary driven varidisc	1	108	FA - 331AM	Quill stop micro screw (Metre)	1
081	FB - 303	Speed changer housing	1		FA - 331BM	Quill stop micro screw (Inch)	1
082	FB - 311	Speed changer chain drum	1		FA - 307A	Micrometer nut (Metre)	1
083	FB - 310	Speed changer gear	1		FA - 307B	Micrometer nut (Inch)	1
084	622030030	Spring pin (Φ3x 30)	1		FA - 306A	Quill micro stop nut (Metre)	1
085	FB - 056	Hexagon cap screw	1		FA - 306B	Quill micro stop nut (Inch)	1
086	FB - 085	Full dog	1				
087	701060104	Bearing (6010 2RS)	1	111	FA - 332A	Fixed nut (Metre)	1
088	606360381	Pan head screw (3/16"x3/8")	3		FA - 332B	Fixed nut (Inch)	1
089	600060150	Hex-Socket head cap screws (M6 x 15)	2	112	714072075	Bearing (7207C/P4 DB)	2
090	FB - 016	Spindle pulley spacer	1				
091	FB - 325	Gear housing plate	1	113	FA - 054	Bearing spacer	1
092	FB - 021A	Spindle bull gear	1	114	FA - 053	Bearing spacer	1
093	FB - 018	Spindle gear hub	1	115	665016000	A-16 retaining ring	1
094	701069084	Bearing (6908 2RS)	2	116	FA - 052	Spindle dirt shield	1
095	FB - 024	Compression springs	3	117	FA - 051A	Nose-piece (For N.T. #30)	1
096	FB - 304	Fixed clutch bracket	1		FA - 051B	Nose-piece (For R8 taper)	1
097	FB - 027	Bull gear bearing spacer	1				
098	FB - 019	Bearing locknut	1	118	FA - 050A	Spindle (N.T. #30)	1
099	601050100	Round head screws (M5 x 10)	2		FA - 050B	Spindle (R8 taper)	1
0100	FA - 057	Oil strainer for quill bearing	1	119	701060072	Bearing (6007 2Z)	1
0101	FA - 056	Felt	1	120	665035000	A-35 retaining ring	1
0102	617030000	Lock nut (M30 x 1.5P)	2	121	600060200	Hex-Socket head cap screws (M6 x 20)	3
0103	FA - 305	Quill stop knob	1	122	FB - 015	Spindle pulley hub	1
0104	653030000	AW-06 washer	1	123	701060104	Bearing (6010 2RS)	1
				124	FA - 213C	Drawbar (N.T. #30, 1/2-12W: standard)	1
					FA - 213E	Drawbar (N.T. #30,	1

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
		1/2-13UNC: option)		151	FB - 028	Wave spring	1
	FA - 213D	Drawbar (N.T. #30,	1	152	075008000	Oil cup (1/8"-28PT)	1
		M12-1.75P: option)		152-1	062060000	Pipe (Φ6×100)	1
	FA - 213B	Drawbar (R8,7/16-20	1	153	FB - 306	Bearing sleeve	1
		UNF: option)		154	701062060	Bearing (6206)	1
	FB - 086A	Drawbar (N.T. #30 for	1	155	FA - 058	Quill	1
		RT. angle attach)		156	FA - 055B	Sleeve	1
	FB - 086B	Drawbar (R8 for RT.	1	157	604050060	Set screw (M5 × 6)	1
		angle attach)		158	FA - 172	Special socket set screw (for R8 only)	1
125	FB - 006	Top bearing cap	1	159	602381041	Hexagon head bolts	2
126	FB - 028	Wave spring	1	160	652038001	Spring washers (3/8")	2
127	FB - 010A	Key	1	161	604060100	Set screw (M6 × 10)	1
128	606040060	Pan head screw (M4×6)	1	162	FB - 030	Stationary motor varidisc	1
129	615038001	Nut (3/8")	1	163	066225110	Belt (225L, 110)	1
130	FB - 318	Speed change plate	1	164	665024000	A-24 retaining ring	1
		pivot stud		165	FB - 036	Adjust varidisc spring	1
131	FB - 014	Spindle pulley bearing	1			collar	
		sliding housing		166	413062156	Motor (3HP220/440 60cycle)	1
132	FB - 057	Speed change plate	1	167	FB - 300	Belt housing	1
133	FB - 008M	Varidisc	1	168	605080581	Round head screws	4
134	FB - 084	Washer	1			(1/8" × 5/8")	
135	633061001	Cotter pin (1/16"×1")	1	169	FB - 091	Plate	1
135A	FA - 212	Washer (for R8)	1	170	FB - 088	Iron wire	1
	FA - 212A	Washer (for N.T.#30)	1	171	FB - 082	Belt (383032B-13)	1
136	FB - 007	Brake bearing cap	1	172	FB - 089	Fan	1
137	FB - 307	Brake shoes	1	173	FB - 035	Compression spring	1
138	615058001	Nut (5/8")	1	174	FB - 029	Adjustable motor varidisc	1
139	FB - 017	Timing belt clutch sleeve	1	175	605050100	Round head screws	4
140	630050180	Parallel key (5 × 5 × 18)	1			(M5 × 10)	
141	FB - 041	Timing belt pulley	1	176	FB - 305	Motor pulley cover	1
142	FB - 031	Pinion bearing cap	1	177	600080650	Hex-Socket head cap	2
143	630050180	Parallel key (5 × 5 × 18)	1			screws (M8 × 65)	
144	604060080	Set screw (M6 × 8)	1	178	FA - 300A	Head	1
145	701062034	Bearing (6203 2RS)	2	179	FA - 017	Adj. worm shaft	1
146	FB - 039	Pinion shaft	1	180	FA - 173	Socket set screw	1
147	FB - 040A	Pinion	1	181	FA - 018	Worm gear	1
148	FB - 025	Washer	1	182	630040180	Parallel key (4 × 4 × 18)	1
149	635080140	Parallel key (8 × 8 × 14)	1	C 183	FD - 001	Worm wheel gear	1
150	666062000	B-62 retaining ring	1				



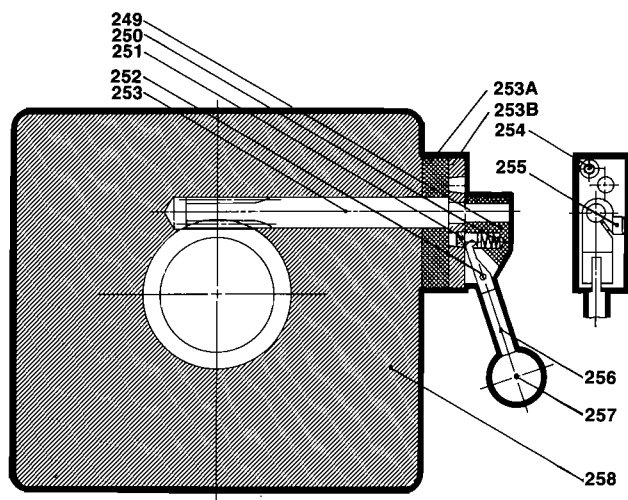
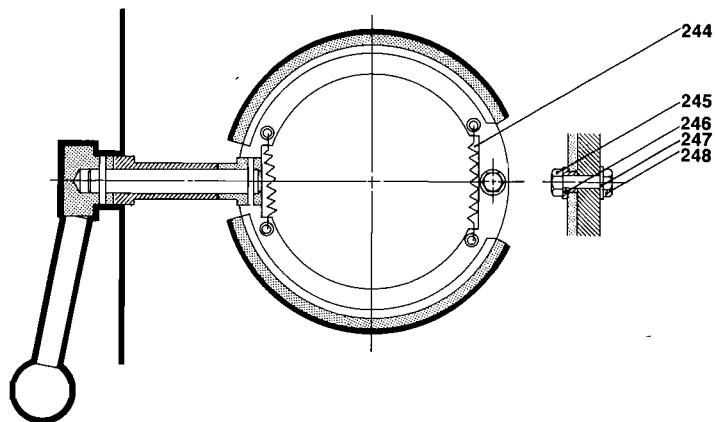
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
184	604060060	Set screw	1	205	FA - 142	Bevel gear bushing	1
185	FA - 320	Worm gear cradle	1	206	665016000	A-16 outer retaining ring	1
186	FA - 160	Feed bevel pinion	1		604060120	Set screw (M6 x12)	1
187	FA - 167	Feed engage pin	1	207	604060120	Set screw	1
188	FA - 325	Worm gear cradle throw-out	1	208	FA - 133	Feed worm shaft	1
189	600040100	Hex-Socket head cap screws (M4 x 10)	3	209	622030018	Spring pin (ø3x 18)	1
190	FA - 304	Cover	1	210	FA - 168	Bushing	1
191	FA - 323	Speed select handle	1	211	FA - 139	Worm	1
192	FA - 154	Feed reverse bevel gear	1	212	FA - 138	Feed worm shaft bushing	1
193	600080160	Hex stock cap screw (M8x16)	1	213	FA - 137	Feed worm shaft thrust washer	1
194	FA - 153	Washer	1				
	650008000	Spring washer (M 8)	1				
195	630030080	3 x 3 x 8 key	1	215	FA - 135M	Feed reverse bevel gear	1
197	FA - 171	Set screw	1	216	FA - 163	Worm gear spacer	1
199	FA - 156A	Cluster gear input shaft	1	217	FA - 162	Worm cradle bushing	1
200	630030100	Key 3 x 3 x 10	1	218	FA - 161	Feed worm gear shaft sleeve	1
201	FA - 157	Feed drive gear	1	219	622030016	Spring pin (3 x 16)	1
202	735000660	IKO BA-66 needle bearing	1	220	FA - 164	Feed drive worm gear	1
203	FA - 140A	Feed reverse bevel pinion	1	221	630030200	Key (3 x 3 x 20)	1
204	FA - 141	Bevel gear thrust spacer	1	222	FA - 147	Cluster gear shaft upper bushing	1
				223	FA - 165	Feed drive worm gear shaft	1
				224	604060120	Set screw (M6 x 12)	1



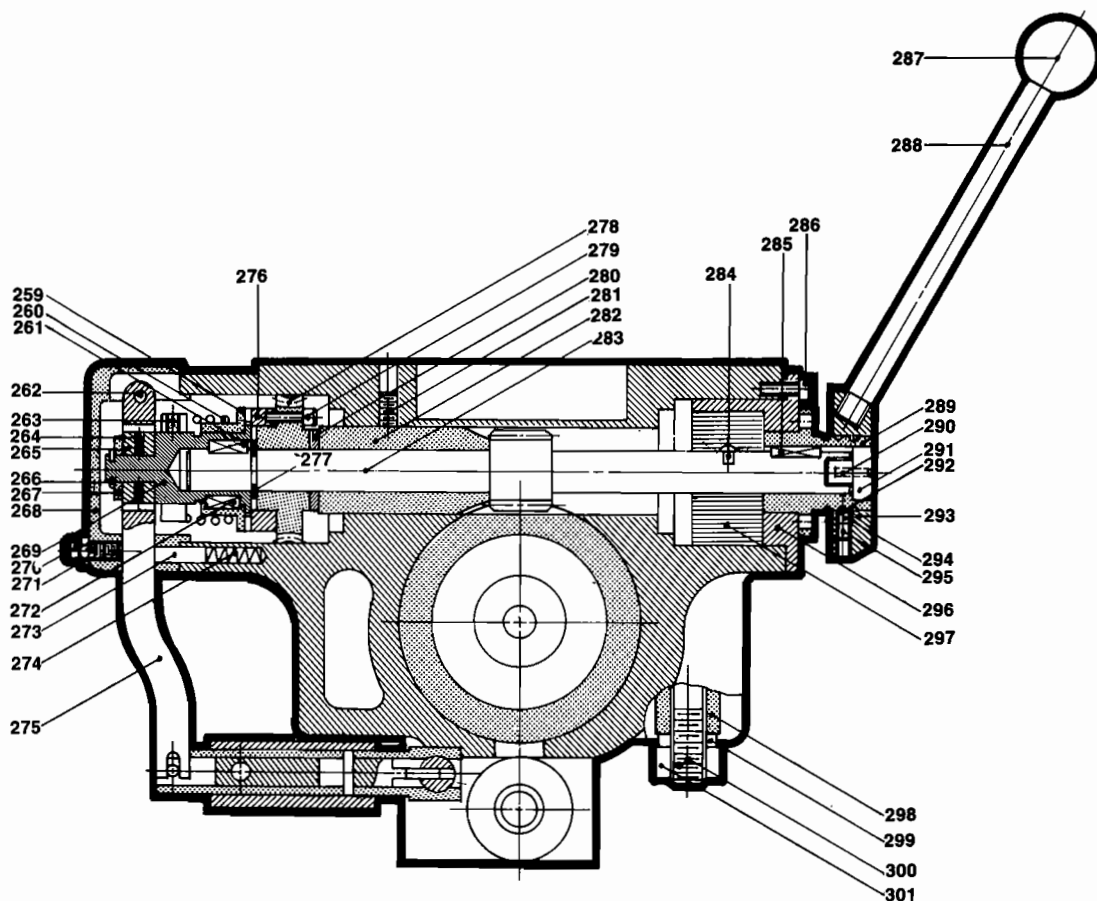


	EA-018	Straight pin	2	235	FA - 129	Handwheel clutch	1
	FA - 146	Cluster gear (upper)	1		FA - 129A	Handwheel clutch	1
	FA - 145	Cluster gear (middle)	1			spring screw	
228	FA - 144M	Cluster gear (low)	1		FA - 129B	Compression spring	1
229	604060120	Set screw (M6 × 12)	1	236	035036000	Ball (3/16'')	1
230	604060100	Set screw (M6 × 10)	1	237	630030100	Key (3 × 3 × 10)	1
231	FA - 130	Feed reverse knob	1	238	FA - 128	Spring pin	1
		stud		239	FA - 321	Handwheel	1
232	FA - 131	Reverse knob	1	240	FA - 132	Reverse clutch rod	1
233	665005010	E-5 outer retaining	1	241	FA - 135M	Bevel gear	1
		ring		242	FA - 136	Feed reverse clutch	1
234	FA - 312	Handwheel handle	1	243	622025020	Spring pin (2.5 × 20)	1

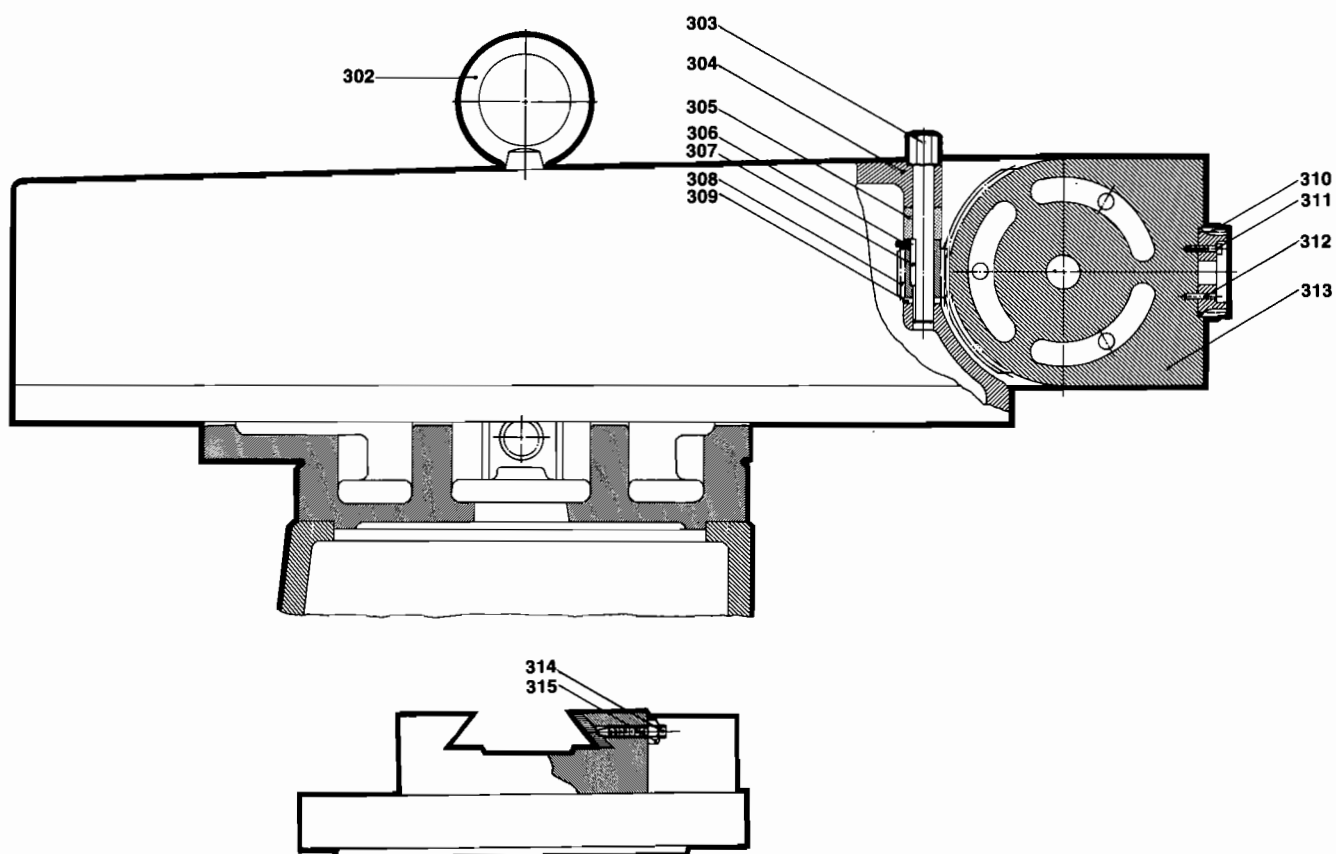
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
244	FB - 063	Brake springs	2
245	602041001	Hexagon head bolt (1/4" x 1")	1
246	FB - 069	Brake shoe pivot sleeve	1
247	652004001	Spring washer (1/4")	1
248	618004001	Tighten nut (1/4")	1
249	FB - 075	HI-LOW pinion block	1
250	FB - 072	Spring	1
251	FB - 073B	HI-LOW detent plunger	1
252	622030015	Spring pin (3 x 15)	1
253	FB - 314	Bull gear shift pinion	1
253A	FB - 324B	HI-LOW detent plate block	1
253B	FB - 073A	HI-LOW detent plate	1
254	600050350	Hex-Socket head cap screws (M5 x 35)	2
255	600040140	Hex-Socket head cap screws (M4 x 14)	2
256	FB - 070	HI-LOW shift crank	1
257	FA - 006	Black plastic ball	1
258	FB - 304	Fixed clutch bracket	1
259	FA - 084	Overload clutch	1
260	FA - 083	Safety clutch spring	1
261	FA - 085A	Key (5 x 5 x 15)	1
262	FA - 077	Dowel pin	1
263	FA - 082	Overload clutch locknut	1
	FA - 081	Clutch ring pins	1
264	FA - 081	Clutch ring pins	2
265	FA - 080	Clutch ring	1
266	665009000	A-9 circlip	1
267	FA - 078	Overload clutch washer	1
268	FA - 076	Clutch arm cover	1
269	FA - 085	Overload clutch sleeve	1
270	604060140	Set screw (M6 x 14)	1
	600050350	Hex-Socket head cap screw (M5 x 35)	1
271	615006000	Nut (M6)	1
272	FA - 085A	Key (5 x 5 x 15)	1

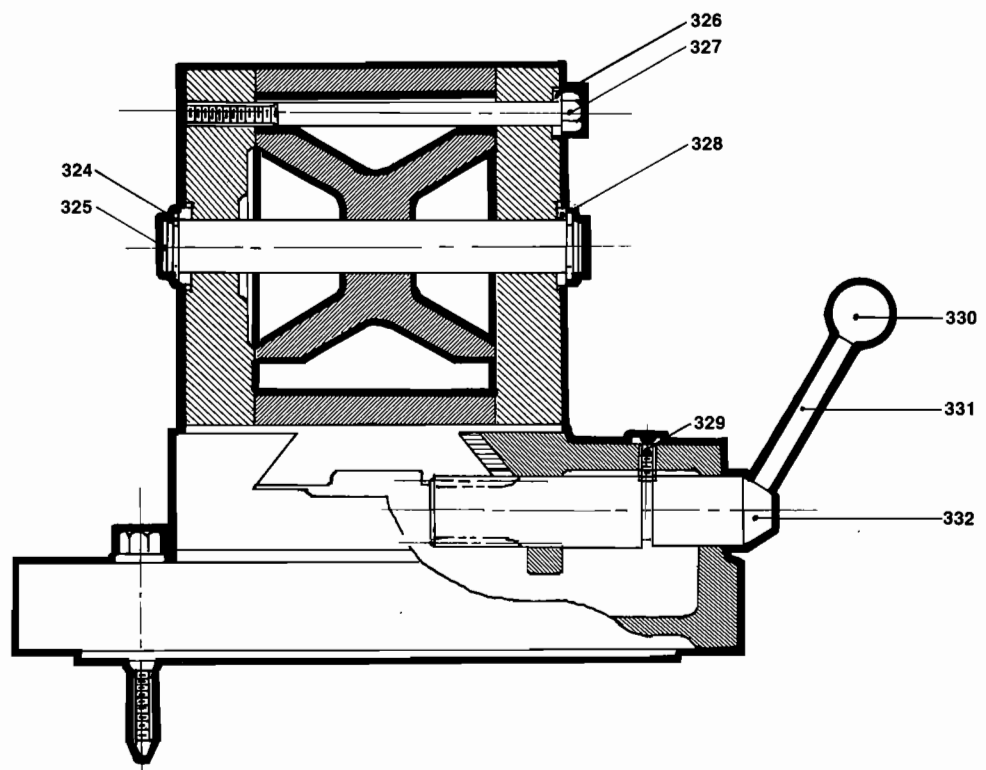
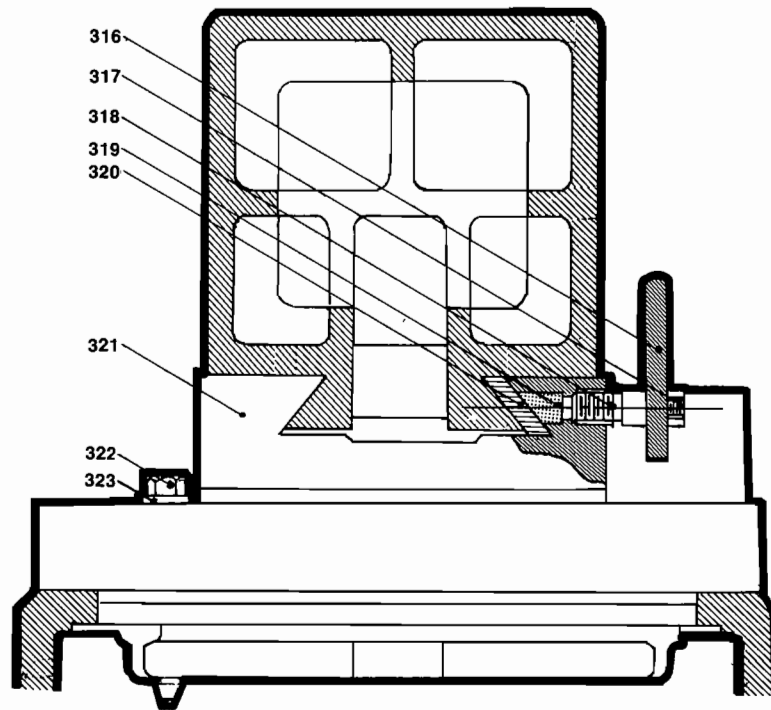


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
273	FA - 089	Overload clutch lever spring plunger	1	285	630040180	Key (4 × 4 × 18)	1
274	FA - 090	Compression spring	1	286	600050120	Hex-Socket head cap screws (M5 × 12)	2
275	FA - 079	Overload clutch trip lever	1	287	FA - 106A	Handle ball	1
276	FA - 084	Overload clutch	1	288	FA - 106B	Pinion shaft hub handle	1
277	665015000	A-15 circlip	1	289	FA - 104	Pinion shaft hub sleeve	1
278	FA - 087	Overload clutch worm gear	1	290	622050025	Spring pin (5 × 25)	1
279	600040160	Hex-Socket head cap screw (M4 × 16)	3	291	FA - 107	Screw	1
280	FA - 122	Pinion shaft worm gear spacer	1	292	035040000	Ball(φ4)	1
281	604060120	Set screw (M6 × 12)	1	293	FA - 106	Back feed handle hub	1
282	FA - 123	Quill pinion shaft bushing	1	294	FA - 105A	Compression spring	1
283	FA - 101	Quill pinion shaft	1	295	FA - 105B	Set screw	1
284	FA - 101A	Pin	1	296	FA - 103	Spring cover	1
				297	FA - 102	Clock spring	1
				298	FA - 046	Clamping bolt spacer	4
				299	FA - 042	Washer	4
				300	FA - 043	Tee bolt	4
				301	FA - 040	Head fixed nut	4

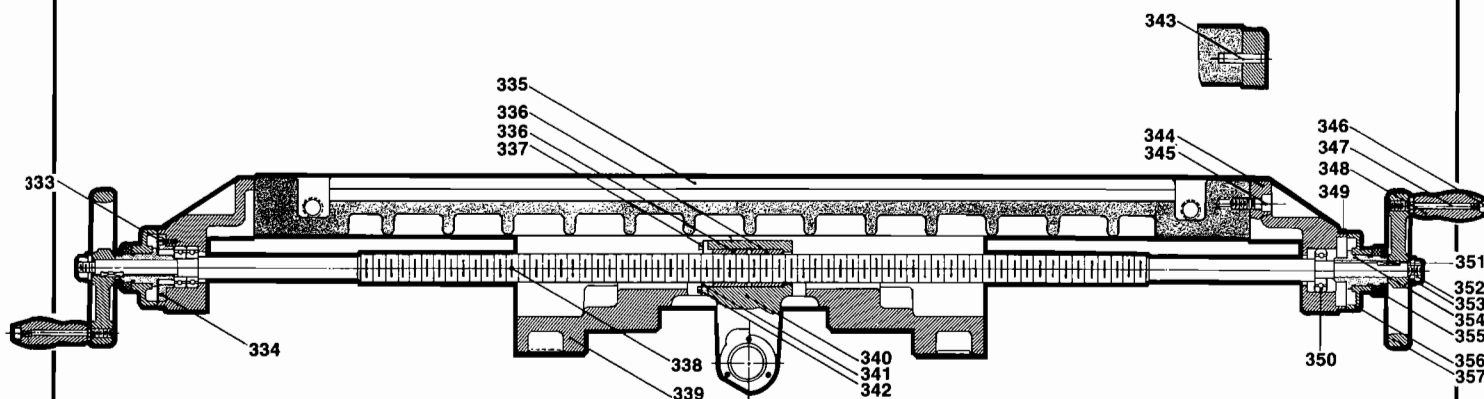


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
302	FD - 004B	Hook	1	317	604060060	Set screw (M6 x 6)	2
303	FD - 009	worm shaft	1	318	FD - 309	Ram clamp bolt	2
304	FD - 301C	Ram	1	319	FD - 309M	Ram clamp piece	2
305	FD - 010	Worm thrust washer	1	320	FD - 307	Gib	1
306	604050060	Set screw (M5 x 6)	1	321	FD - 304	Turret	1
307	637050480	Parallel key (5 x 5 x 48)	1	322	FD - 022	Locking bolt	4
308	FD - 011	Adjust worm	1	323	652002001	Spring washer (1/2")	4
309	FD - 012	Worm thrust washer	1	324	665032000	A-32 retaining ring	2
310	FD - 001	Worm wheel gear	1	325	FD - 005	Adaptor pivot stud	1
311	600060250	Hex-Socket head cap screws (M6 x 25)	2	326	FD - 008	Washer	3
312	622060030	Spring pin	1	327	FD - 007	Adaptor locking bolt	3
313	FD - 303A	Ram adaptor	1	328	FD - 006	Washer	2
314	FD - 310	Screw	2	329	FD - 014	Ram pinion set screw	1
315	615010000	Nut (M10)	2	330	FD - 015	Black plastic ball	1
316				331	FD - 016	Ram pinion handle	1
				332	FD - 017	Ram pinion	1

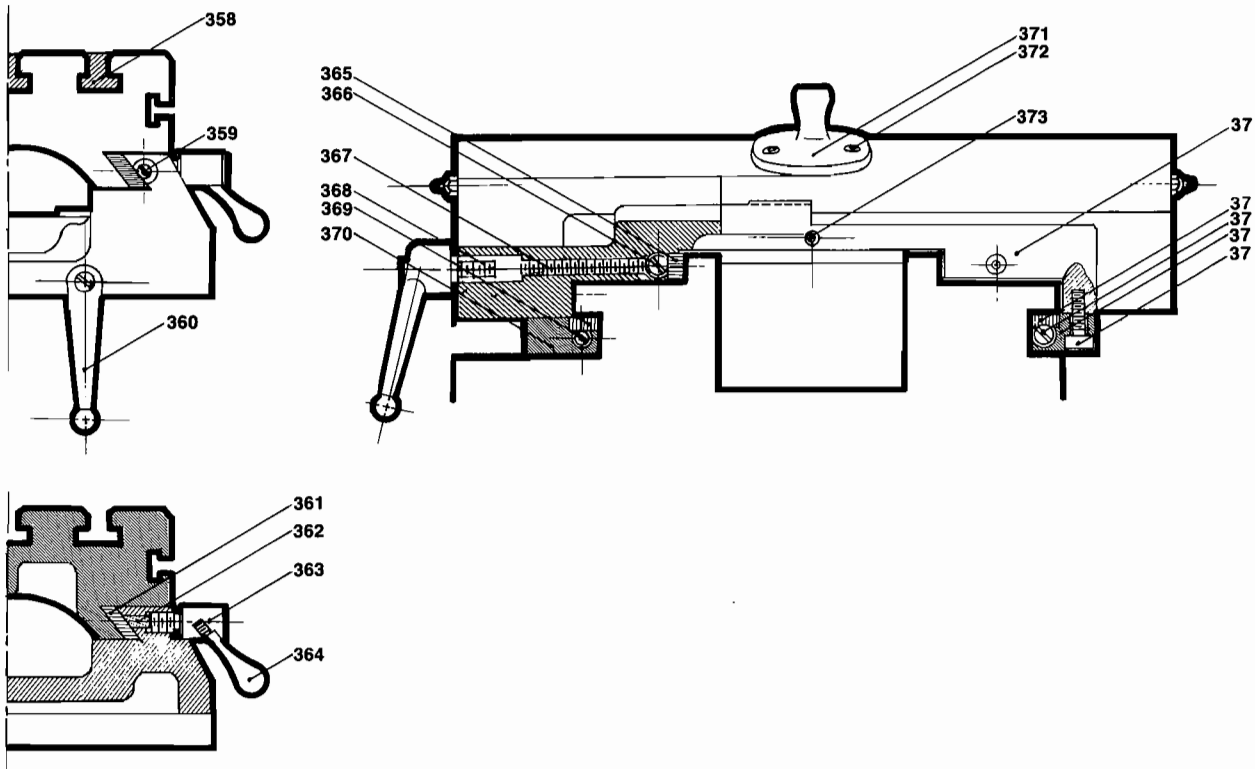




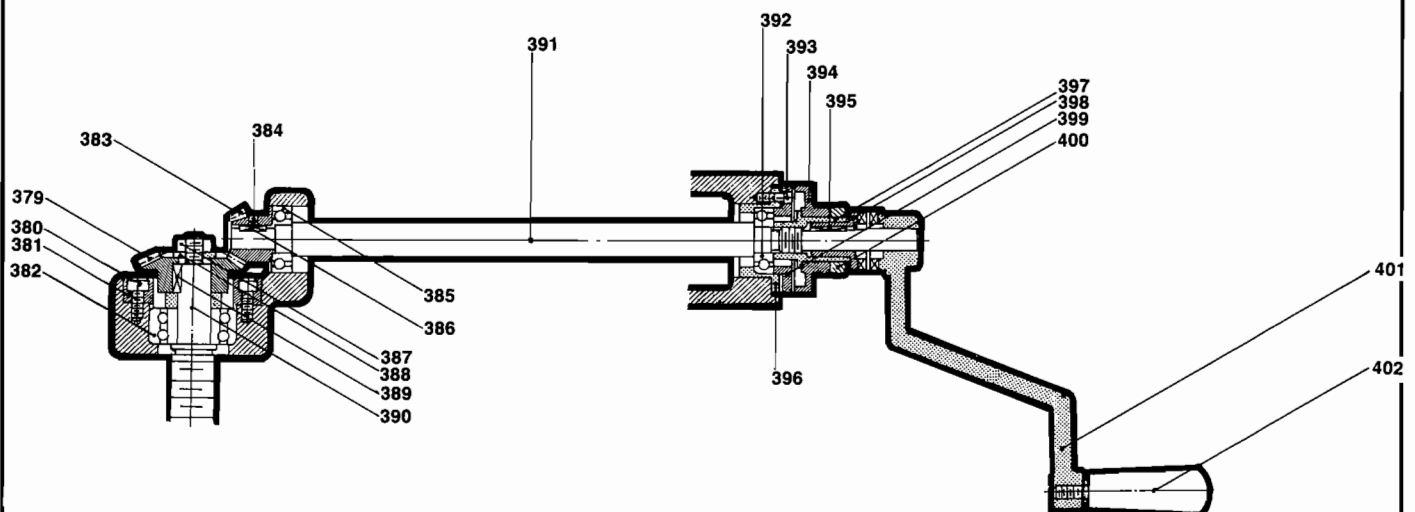
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
333	600060160	Hex-Socket head cap screws (M6 × 16)	6	343	622060040	Spring pin (6 × 40)	4
334	FC - 005	Bearing cover	1	344	FC - 300 ^A _B	Bearing brackets (L&R)	1 1
335	FC - 009	Table (42'')	1	345	600100250	Hex-Socket head cap screws (M10 × 25)	8
	FC - 009B	Table (49'')	1	346	AA - 029	Screws	2
336	FC - 321A	Table feed nuts (metric)	1	347	FC - 002A	Grip shafts	2
	FC - 321B	Table feed nuts (inch)	1	348	AC - 053	Grips	2
337	600050200	Hex-Socket head cap screws (M5 × 20)	3	349	FC - 313A	Indicator (metric)	1
					FC - 313B	Indicator (inch)	1
338	FC - 302A	Longitudinal feed screw (42'' table metric)	1	350	701062042	Ball bearings (6204 2Z)	3
	FC - 302B	Longitudinal feed screw (42'' table inch)	1	351	630040250	Parallel key (4 × 4 × 25)	2
	FC - 303A	Longitudinal feed screw (49'' table metric)	1	352	615002003	Nut (1/2'')	2
	FC - 303B	Longitudinal feed screw (49'' table inch)	1	353	FC - 001D	Washers	2
339	FC - 304	Saddle	1	354	FC - 004	Dial holder	2
340	FE - 320	Feed nut bracket	1	355	FC - 002	Dial lock nut	2
341	FE - 322	Feed nut bracket ring	1	356	FC - 003A	Dial with 250 graduation (metric)	2
341-1	FE-322A	Feed nut bracket ring	1		FC - 003B	Dial with 200 graduation (inch)	2
342	600050200	Hex-Socket head cap screws (M5 × 20)	3	357	FC - 001B	Handwheel	2



ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
358	FC - 028	T-slot plugs	6	370	FC - 311	Saddle guide plate (left)	1
359	AC - 090	Screws	2	371	FC - 319	Table stop bracket	1
360	FE - 311	Saddle lock handle	1	372	600100200	Hex-Socket head cap screws (M10 × 20)	2
361	FC - 306	Table gib	1	373	600050100	Hex-Socket head cap screws (M5 × 10)	6
362	FC - 019	Table lock plungers	2	374	FC - 315 ^A _B	Saddle knee wiper plates	1
363	FC - 014A	Table lock bolts	2	375	FC - 305	Gib	1
364	FA - 014CM	Handle	2	376	AC - 090	Screws	2
365	FC - 307	Saddle gib	1	377	FC - 312	Saddle guide plate (right)	1
366	AC - 090	Screws	2	378	600120300	Hex-Socket head cap screws (M12 × 30)	6
367	FE - 315A	Plunger (Short)	1				
	FE - 315B	Plunger (Long)	1				
368	FC - 305	Gib	1				
369	AC - 090	Screws	2				

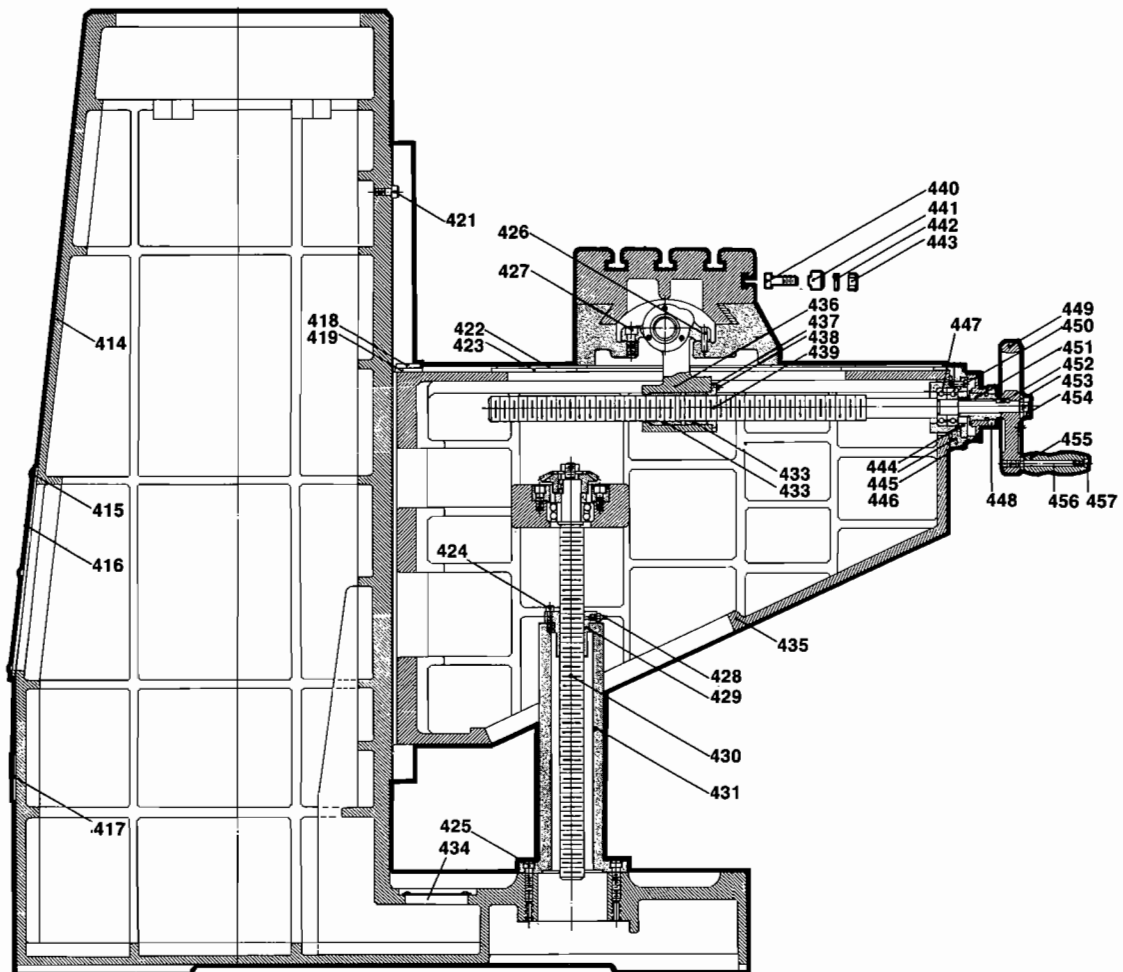
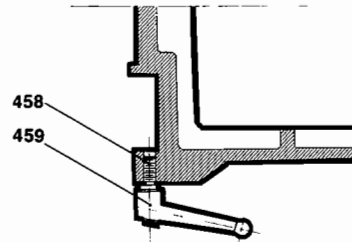
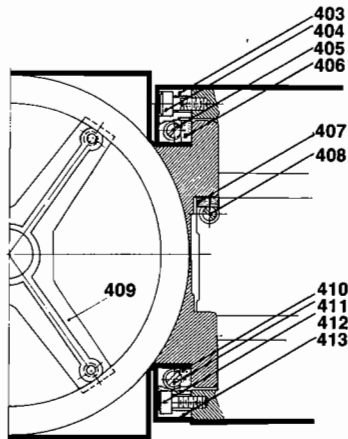


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
379	FE - 024	Bevel gear	1	392	701062042	Ball bearing (6204 2Z)	1
380	600100250	Hex-Socket head cap screws (M10 x 25)	4	393	600060160	Hex-Socket head cap screws (M6 x 16)	3
381	FE - 026	Bearing retainer ring	1	394	FE - 019A	Dial with 125 graduation	1
382	711033058	Bearings (#3305)	2		FE - 019B	Dial with 100 graduation	1
383	FE - 015	Bevel pinion	1	395	630040160	Key 4 x 4 x 16	1
384	604060060	Set screw (M6 x 6)	1	396	FE - 302	Bearing cap	1
385	650160000	Retaining ring (A-16)	1	397	FE - 326	Dial holder	1
386	630040180	Key (4 x 4 x 18)	1	398	FE - 020	Gear shaft clutch insert	1
387	615002003	Nut (1/2"-20UNF)	1	399	FE - 303A	Bearing retainer ring (metric)	1
388	FE - 023	Washer	1		FE - 303B	Bearing retainer ring (inch)	1
389	630050200	Key (5 x 5 x 20)	1				
390	FE - 027A	Elevating screw (metric)	1	400	FC - 002	Dial lock nut	1
	FE - 027B	Elevating screw (inch)	1	401	FE - 310	Elevating crank	1
391	FE - 305A	Elevating shaft (13" knee)	1	402	FC - 316	Elevating crank handle	1
	FE - 305B	Elevating shaft (16" knee)	1				

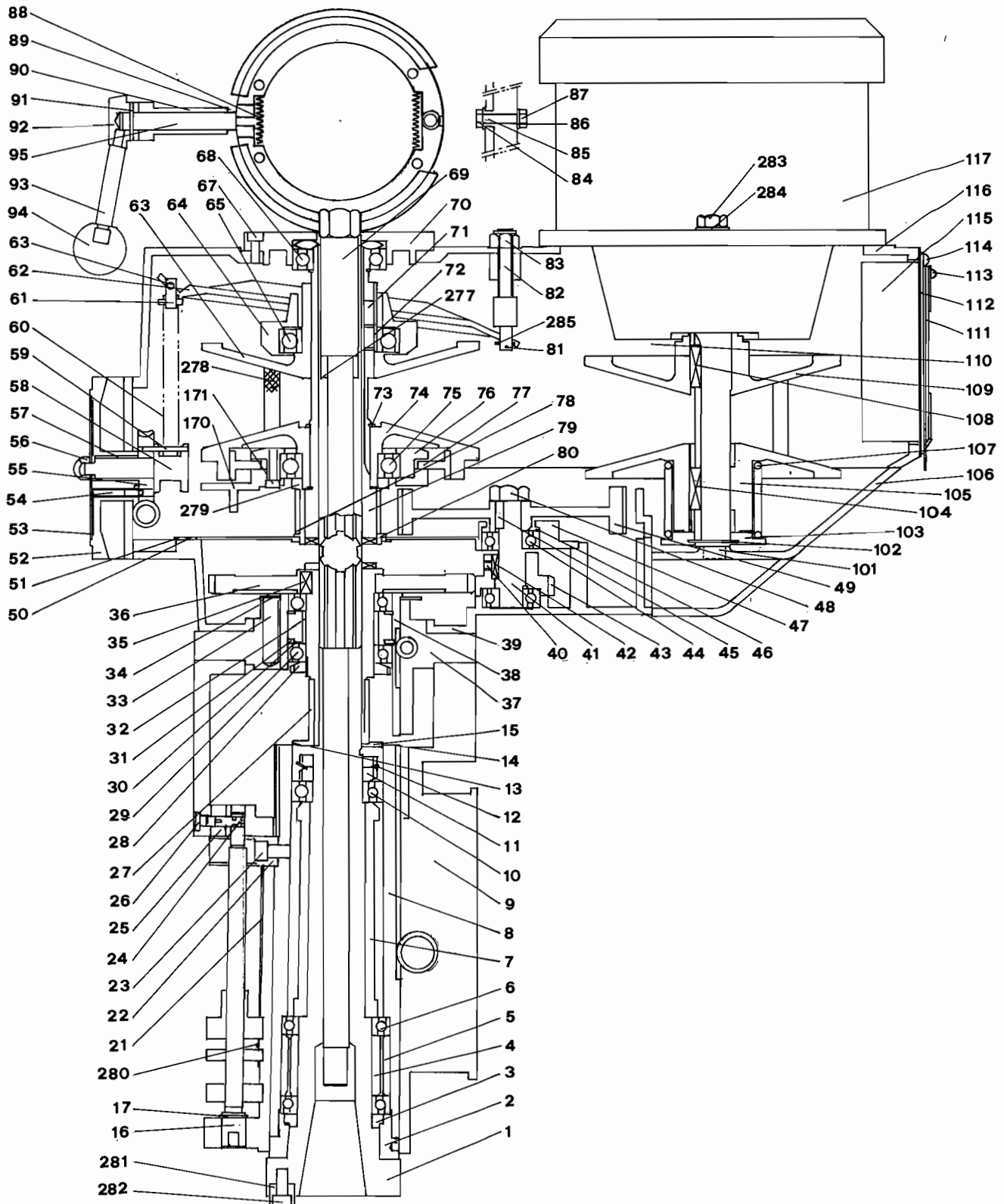


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
403	FD - 306	Guide plate (right)	1	429	FE - 028A	Elevating screw nut (metric)	1
404	600140250	Hex-Socket head cap screws (M14 x 25)	5		FE - 208B	Elevating screw nut (inch)	1
405	AC - 090	Screws	2	430	FE - 027A	Elevating screw (metric)	1
406	FD - 302	Gib	1		FE - 027B	Elevating screw (inch)	1
407	FE - 307	Gib	1	431	FE - 301	Elevating screw housing	1
408	AC - 090	Screws	2				
409	FD - 023	Spider	1				
410	FD - 302	Gib	1				
411	AC - 090	Screws	2	433	FE - 321A	Feed nut (metric)	1
412	600140250	Hex-Socket head cap screws (M14 x 25)	5		FE - 321B	Feed nut (inch)	1
413	FD - 305	Guide plate (oeft)	1	434	FD - 325	Cover	2
414	FD - 300B	Column	1	435	FE - 300A	13" knee	1
415	605050120	Round head screws (M5 x 12)	6		FE - 300B	16" knee	1
416	FD - 311	Cover	1	436	FE - 320	Feed nut bracket	1
417	FD - 021	Cover	1	437	FE - 322A	Feed nut bracket. ring	1
418	FD - 312	Chip guard plate (left)	1	438	600050200	Hex-Socket head cap screws (M5 x 20)	3
	FD - 312A	Chip guard plate (right)	1	439	FE - 304A	Cross feed screw (metric)-13" knee	1
419	FD - 318	Left wiper	1		FE - 304B	Cross feed screw (inch)-13" knee	1
	FD - 319	Right wiper	1		FE - 314A	Cross feed screw (metric)-16" knee	1
421	FE - 034 A	Cap screw	1		FE - 314B	Cross feed screw (inch)-16" knee	2
422	FL - 328	Chip Guard 16" Knee	1	440	FC - 010	Stop piece T-bolts	2
423	FL - 329	Chip Guard 16" Knee	1	441	FC - 011	Table stop pieces	2
	FL - 330	Chip Guard 16" Knee	1	442	FC - 011A	Washers	2
	FL - 331	Chip Guard 16" Knee	1	443	615038001	Hexagon nuts (3/8"-16 UNC)	1
424	600060200	Hex-Socket head cap screws (M6 x 20)	3	444	FC - 005	Bearing retainer ring	1
425	600100250	Hex-Socket head cap screws (M10 x 25)	2	445	FE - 008	Cross feed bearing bracket	1
426	622080040	Spring pins (8 x 40)	2	446	FC - 003A	Dial with 250 graduation (metric)	1
427	600100250	Hex-Socket head cap screws (M10 x 25)	4		FC - 003B	Dial with 200 graduation (inch)	
428	076008000	Nipple	1	447	701062042	Ball bearings (6204 2Z)	2
				448	FC - 002	Dial lock nut	1

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
449	FC - 001B	Handwheel	1	454	615002003	Nut (1/2"-20UNF)	1
450	600060160	Hex-Socket head cap screws (M6 x 16)	3	455	AC - 053	Grip	1
451	FC - 004	Dial holder	1	456	FC - 002A	Grip shaft	1
452	630040250	Key (4 x 4 x 25)	1	457	AA - 029	Screw	1
453	FC - 001D	Washer	1	458	FE - 315A	Knee lock plungers	2
				459	FE - 039	Knee lock handles	2



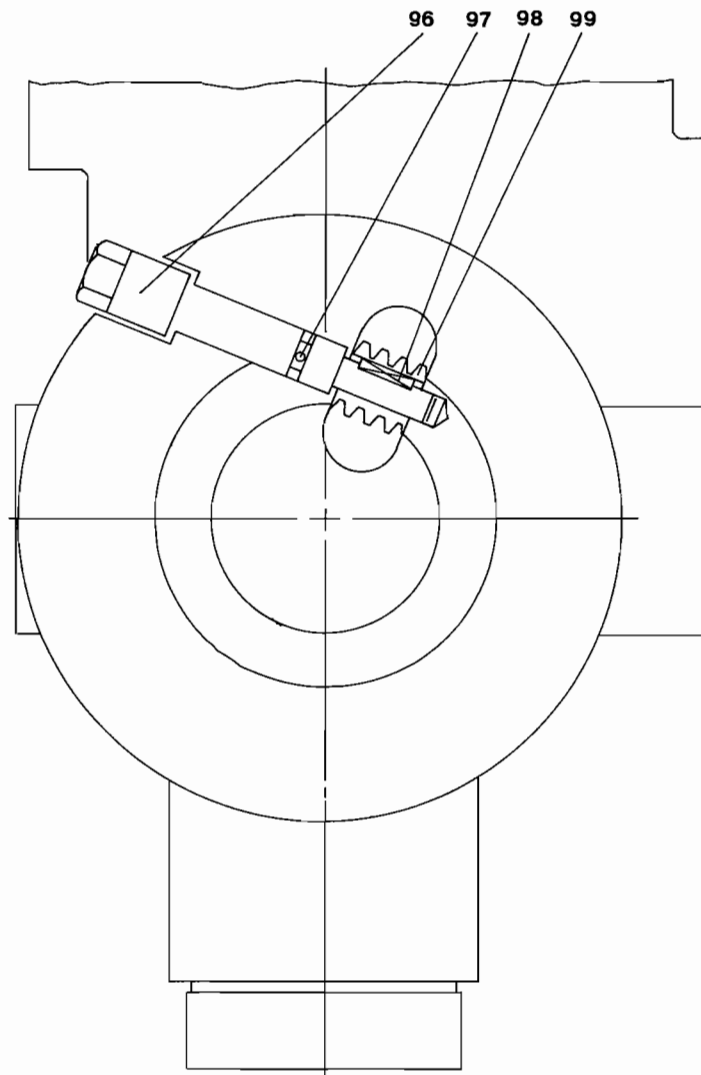
NST #40 HEAD

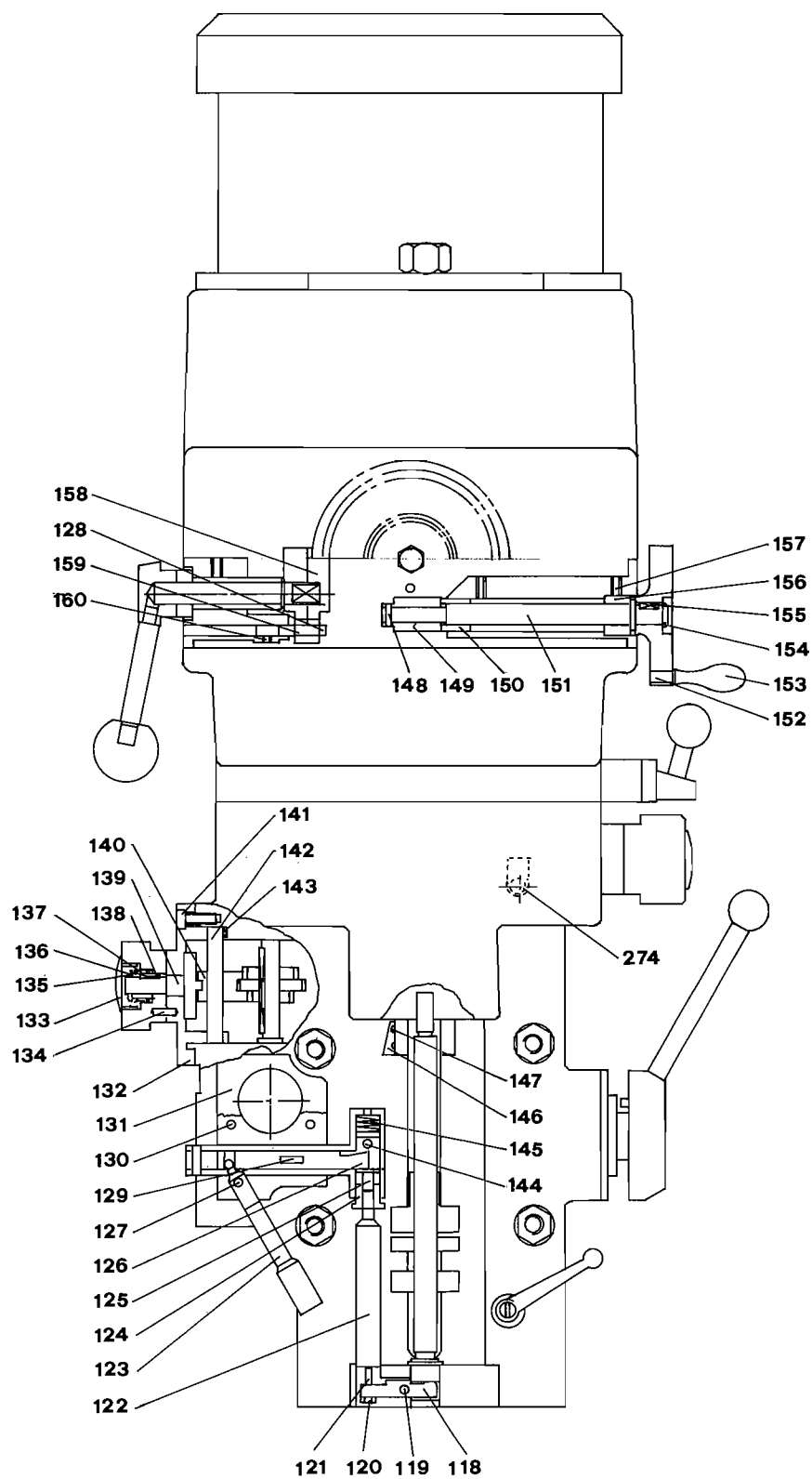


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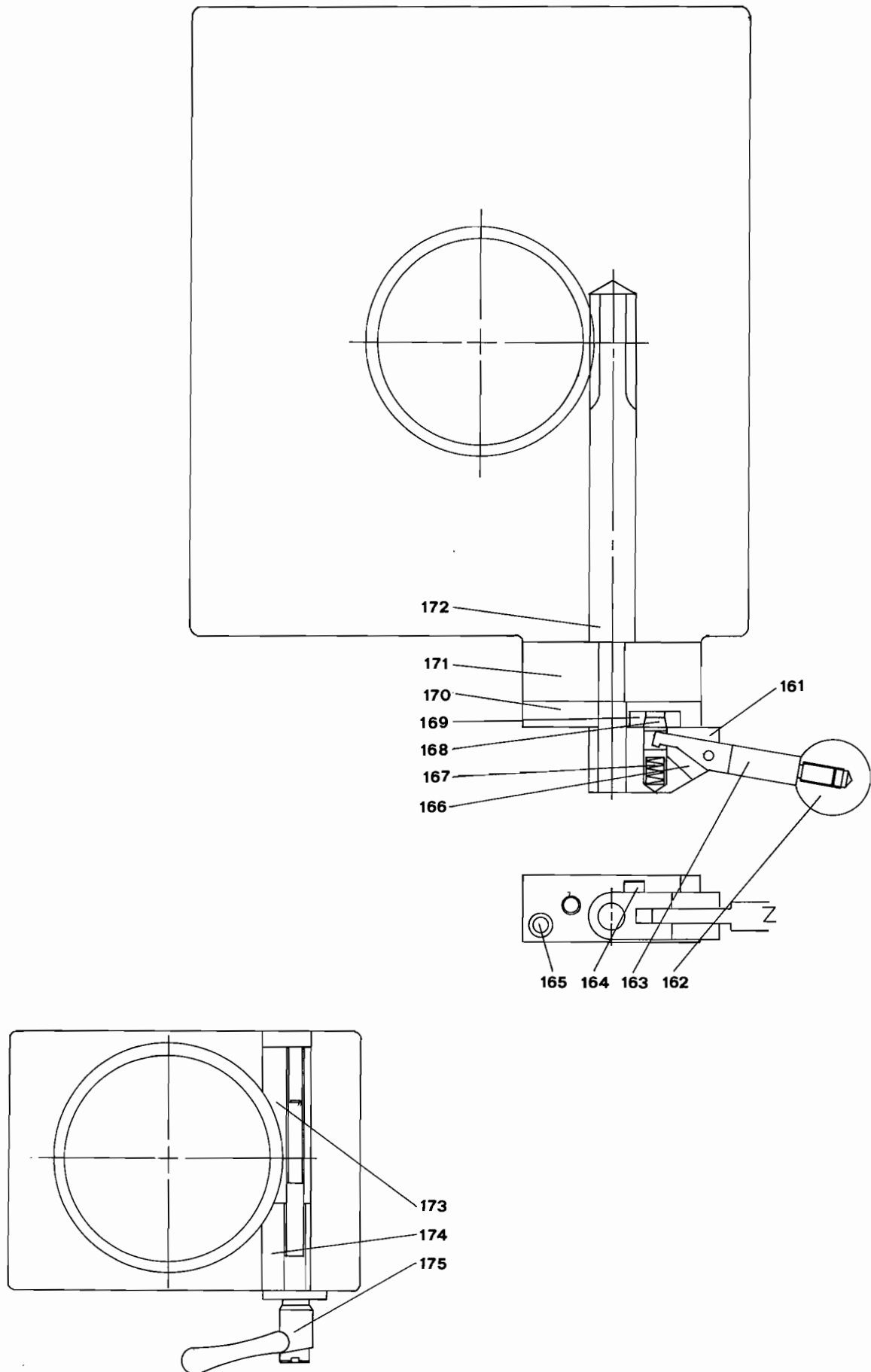
ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
1	FA-401	Spindle(NST #40)	1	45	630050180	Parallel key (5x5x18)	1
2	FA-402	Quill seal oil	1	46	FB-038	Ware spring washer	2
3	FA-403	Spacer	1	47	FB-031	Pinion bearing cap	1
4	FA-404M	Spindle inner spacer & outer	1	48	615058001	Nut(5/8")	1
6	714719021	Angular ball bearing	2	49	FB-041	Timing belt pulley	1
7	FA-406	Bearing spacer	1	50	606360381	Pan head screw ($\phi 3/16$ "x3/8")	3
8	FA-058	Spindle quill	1	51	FB-325	Gear housing cover	1
9	FA-300	Head stock	1	52	FB-303	Speed change housing	1
10	701060072	Ball bearing	1	53	403092070	Name plate	1
11	617035000	Lock nut(AN-07)	2	54	FB-085	Full dog	1
12	653035000	Washer(AW-07)	1	55	FB-310	Speed changer gear	1
13	601050100	Hsh cap screw (M5x10)	2	56	FB-056	Hex cap nut	1
14	FA-057	Felt cover	1	57	FB-317	Bush	1
15	FA-422	Felt	1	58	FB-311	Speed change chain drum	1
16	FA-331	Quill stop set screw	1	59	622030030	Spring pin($\phi 3$ x30)	1
17	665016000	Outer retaining rings(A-16)	1	60	FB-315	Roller chain	1
	FA-332	Set nut	1	61	FB-059	Speed change chain stud	1
	FA-306	Set nut	1	62	FB-057	Speed change plate	1
	FA-307	Set nut	1	63	622040030	Spring pin($\phi 4$ x30)	1
21	403092040	Name plate	1	64	FM-159AM	Pulley	1
22	FA-305	Quill stopper	1	65	FB-014	Spindle pulley bear slide housing	1
23	600100140	Hsh cap screw (M10x14)	1	66	701060104	Bearing(6010-2RS)	1
24	FA-113	Reverse trip ball lever	1	67	600060200	Hsh cap screw (M6x20)	3
25	FA-114	Feed reverse trip plunger	1	68	701060072	Bearing(6007-2Z)	1
26	FA-124	Reverse trip ball lever screw	1	69	FB-409	Draw bar	1
27	FB-401	Spindle output clutch	1	70	FB-006	Top bearing cap	1
28	FB-402	Lock nut	1	71	FB-010A	Key	1
29	701069094	Bearing(6909-2RS)	2	72	606040060	Pan head screw (M4x6)	1
30	FB-403	Wave spring	1	73	665040000	Outer retaining rings(A-40)	1
31	666068000	Inner ring(B-68)	2	74	FB-012	Stationary driven varidisc	1
32	FB-404	Bearing inner spacer	1	75	701060104	Bearing(6010-2RS)	1
33	FB-024	Spring	3	76	FB-307	Bearing housing cover	1
34	FB-405	Washer	1	77	FB-062	Brake shoes	1
35	635080140	Paraller key(8x8x 14)	1	78	066225110	Timing belt (225L110)	1
36	FB-406	Deceleration gear	1	79	FM-140	Spindle pulley hub	1
37	FB-407	Bush bearing	1	80	FB-017	Timing pulley clutch sleeve	1
38	FB-408	Clutch seat	1	81	633061001	Split pins(1/16"x 1")	1
39	FB-302	Gear box	1	82	FB-318	Screw	1
40	604060080	Hsh cap screw (M6x8)	1	83	615038001	Nut(3/8")	1
41	Fb-039	Pinion shaft	1	84	602041001	Hexagon head (1/4"x1")	1
42	630050180	Parallel key (5x5x18)	1				
43	FB-040A	Pinion	1				
44	701062034	Bearing(6203-2RS)	2				

ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
85	FB-069	Brake shoe pivot sleeve	1	102	665024000	Outer retaining rings(A-24)	1
86	652004001	Spring washer(1/4")	1	103	FB-036	Adjust varidisc spring collar	1
87	618004001	Nut(1/4")	1	104	FB-034A	Key	1
88	FB-063	Brake spring	2	105	FB-029AM	Varidisc set	1
89	665012000	Outer retaining rings(A-12)	1	106	FB-305	Cover	1
90	FB-065	Sleeve for brake lock shaft	1	107	FB-035	Spring varidisc motor shaft	1
91	622040024	Spring pin($\phi 4 \times 24$)	1	108	FB-033	Drive key	1
92	FB-319	Brake base	1	109	FB-030	Stationary motor varidisc	1
93	FA-074	Spindle clutch lever	1	110	604060100	Set screw(M6x10)	1
94	AA-039	Ball grip	1	111	FB-088	Iron wire	1
95	FB-313A	Brake lock shaft	1	112	FB-091	Fan plate	1
96	FA-017	Adj worm shaft	1	113	605080581	Round head screws (1/8"x5/8")	4
97	FA-173	Socket set screw	1	114	601050100	Hsh cap screw (M5x10)	4
98	630040180	Parallel key (4x4x18)	1	115	FB-089	Fan	1
99	FA-018	Worm gear	1	116	FB-300	Belt housing	1
100	600080650	Hsh cap screw (M8x65)	2	117	413062156	Motor	1

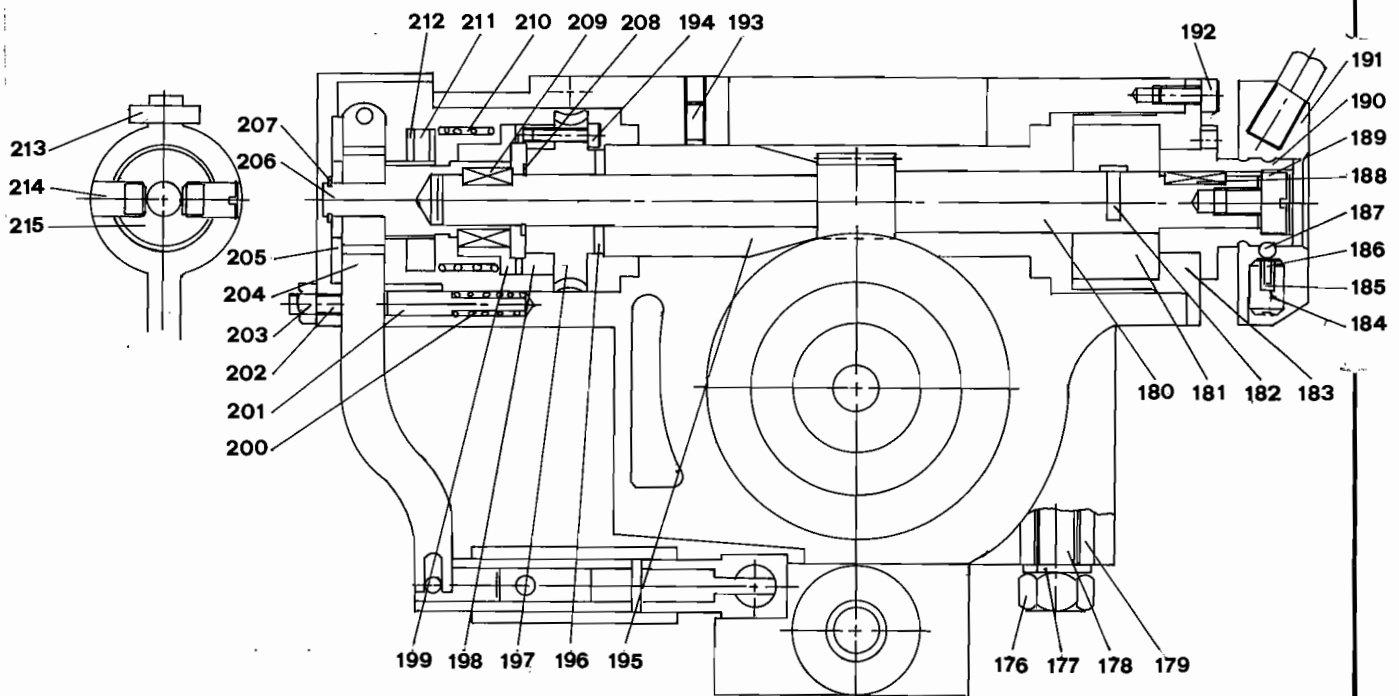


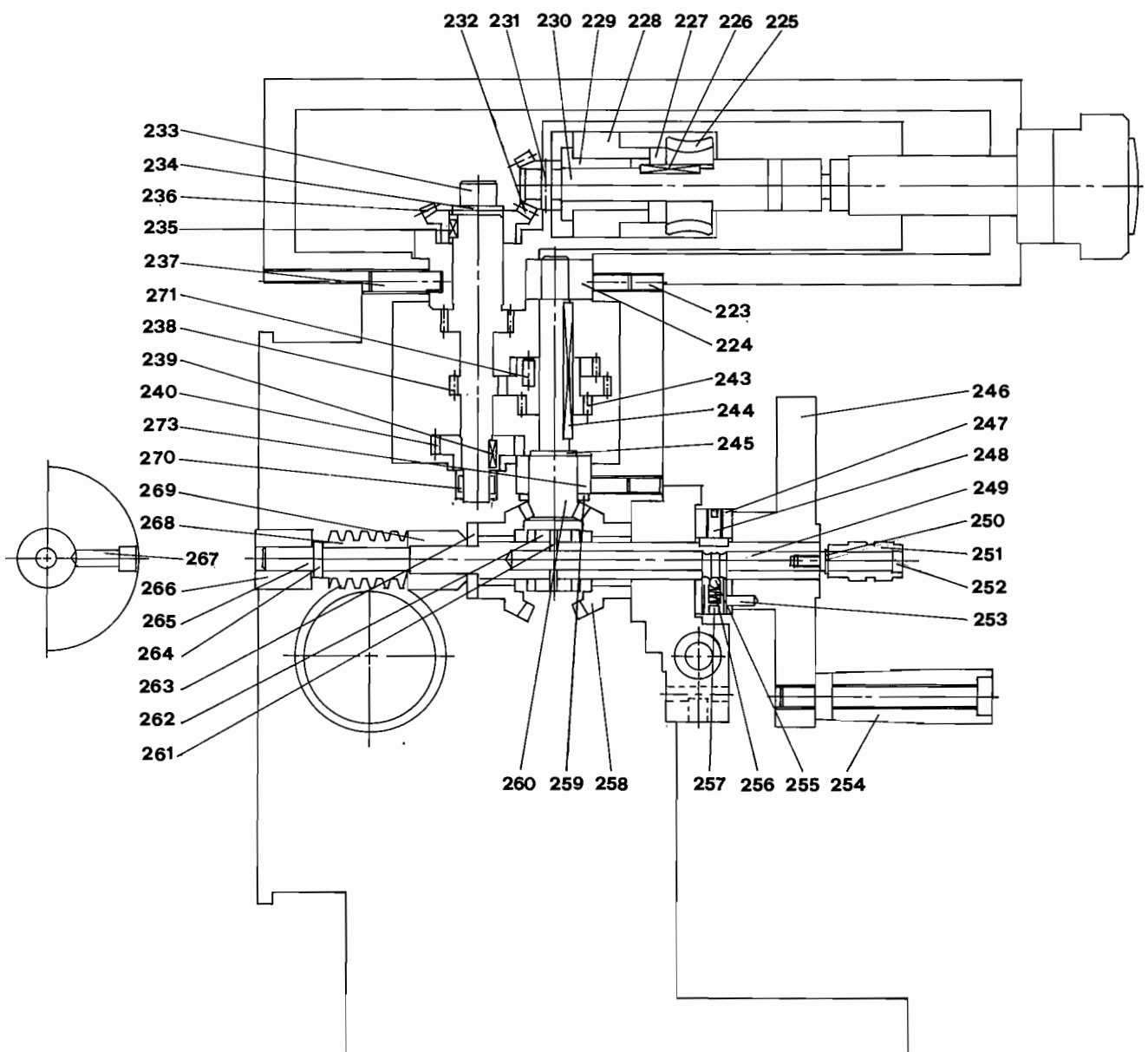
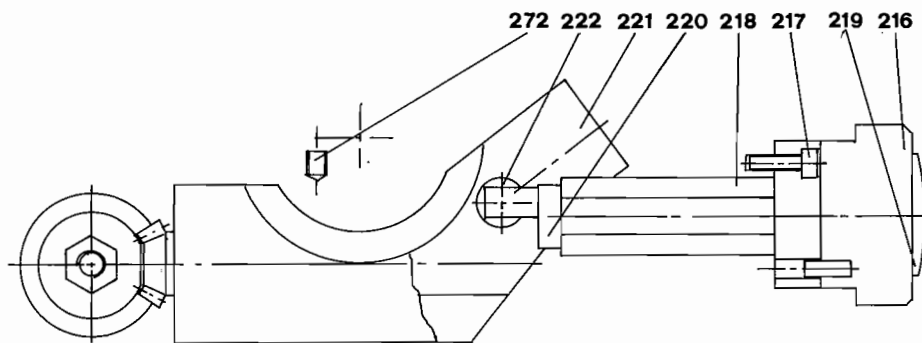


ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
118	FA-098	Feed trip lever	1	161	FB-075	Hi-low pinion block	1
119	FA-099	Trip lever pin	1	162	FA-006	Black plastic ball	1
120	615004000	Nut(M4)	1	163	FB-070	Hi-low shaft crank	1
121	604040200	Set screw(M4x20)	1	164	600040140	Hsh cap screw (M4x14)	2
122	FA-329	Feed trip plunger	1	165	600050350	Hsh cap screw (M5x35)	2
123	FA-328	Trip handle	1	166	622030015	Spring pins(ø3x15)	1
124	FA-121	Trip plunger bushing	1	167	FB-072	Spring	1
125	FA-095	Trip plunger	1	168	FB-071	Hi-low petent plunger	1
126	FA-091	Cam rod	1	169	FB-073B	Position	1
127	FA-077	Dowel pin	1	170	FB-073A	Position block base	1
128	665006000	Outer retaining Rings(A-6)	2	171	FB-324B	Clutch set block	1
129	622030008	Spring pins(ø3x8)	1	172	FB-314	Bull gear shaft	1
130	600060200	Hsh cap screw (M6x20)	2	173	FA-310	Quill lock sleeve	1
131	FA-330	Feed trip bracket	1	174	FA-309	Quill lock sleeve	1
132	FA-337	Cluster gear shaft crank	1	175	FA-088M	Handle	1
133	FA-304	Wheel cover	1	176	FA-040	Vertical head fixel nut	12
134	622040012	Spring pins(ø4x12)	1	177	FA-042	Fixed washer	4
135	665010000	Outer retaining rings(A-10)	1	178	FA-043	Vertical head fixed bolt	4
136	FA-327	Spring seat	1	179	FA-046	Lower clamping bolt spacer	2
137	FA-326	Spring	3	180	FA-101	Quill pinion shaft	1
138	630030100	Parallel key (3x3x10)	1	181	FA-102	Clock spring	1
139	FA-311	Cluster gear shaft	1	182	FA-101A	Pin	1
140	FA-149	Feed gear shaft fork	1	183	FA-103	Spring cover	1
141	600050100	Hsh cap screw (M5x10)	4	184	FA-105B	Set screw	1
142	FA-150	Feed shaft rod	1	185	FA-105A	Spring	1
143	604050100	Set screw(M5x10)	1	186	FA-105	Steel ball support bar	1
144	622030012	Spring pins(ø3x12)	1	187	035036000	Steel ball(ø3/16")	1
145	FA-094	Compression spring	1	188	630040180	Parallel key (4x4x18)	1
146	FA-305A	Indictor	1	189	FA-107	Pinion shaft hub screw	1
147	625020006	Rivet(ø2x6)	2	190	FA-104	Pinion shaft hub screw	1
148	622030012	Spring pins(ø3x12)	1	191	FA-106	Back feed handle hub	1
149	FA-139	Worm	1	192	600050120	Hsh cap screw (M5x12)	2
150	FB-322	Bush	1	193	604060120	Set screw(M6x12)	1
151	FB-309	Worm shaft	1	194	600040160	Parallel key(M4x16)	3
152	FB-308	Speed change handle	1	195	FA-123	Quill pinion shaft bushing	1
153	FB-053	Machine handle	1	196	FA-122	Pinion shaft worm gear spacer	1
154	665010000	Outer retaining rings(A-10)	1	197	FA-087	Overload clutch worm gear	1
155	630030150	Parallel key (3x3x15)	1	198	FA-086	Overload clutch ring	1
156	FB-316	Bush	1				
157	604060100	Set screw(M6x10)	2				
158	FB-067A	Brake operating finger	2				
159	FB-068	Brake operating finger	1				
160	604060060	Set screw(M6x6)	2				



ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
199	FA-084	Overload clutch	1	223	604060120	Set screw(M6x12)	2
200	FA-090	Compression spring	1	224	FA-147	Bushing	1
201	FA-089	Plunger	1	225	FA-423	Worm gear	1
202	604060160	Set screw(M6x16)	1	226	630030200	Parallel key (3x3x20)	1
203	615006000	Nut(M6)	1	227	FA-163	Worm gear spacer	1
204	FA-079	Overload clutch trip lever	1	228	FA-162	Worm cradle bushing	1
205	FA-078	Washer	1	229	FA-161	Feed worm gear shaft sleeve	1
206	FA-085	Overload clutch shaft	1	230	FA-165	Feed drive worm gear shaft	1
207	665009000	Outer retaining rings(A-9)	1	231	622030016	Spring pin(ø3x16)	1
208	665015000	Outer retaining ring(A-15)	1	232	FA-160	Feed bevel pinion	1
209	630030100	Parallel key (3x3x10)	1	233	600080160	Hsh cap screw (M8x16)	1
210	FA-083	Safety clutch spring	1	234	650008000	Plain washer(M8)	1
211	FA-081	Clutch ring pin	1	235	630030080	Parallel key (3x3x8)	1
212	FA-082	Overload clutch lock nut	1	236	Fa-154	Feed reverse bevel gear	1
213	FA-077	Dowel pin	1	237	FA-171	Set screw	1
214	FA-081	Clutch ring pin	1	238	FA-156A	Cluster gear input shaft	1
215	FA-080	Clutch ring	1	239	630030100	Parallel key (3x3x10)	1
216	FA-304	Wheel cover	1	240	FA-157	Feed drive gear	1
217	600040100	Hsh cap screw (M4x10)	3	243	FA-146	Cluster gear	1
218	FA-322	Crank seat	1		FA-145	Cluster gear	1
219	FA-323	Hand wheel	1		FA-144M	Cluster gear	1
220	FA-325	Worm gear cradle throw-out	1	244	630030460	Parallel key (3x3x46)	1
221	FA-320A	Gear sleeve	1	245	665016000	Outer retaining rings(A-16)	1
222	FA-167	Feed engage pin	1				





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ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.	ITEM NO.	COMP NO.	DESCRIPTION	Q.T.Y.
246	FA-321A	Hand wheel	1	265	FA-133	Feed worm shaft	1
247	FA-129	Hand wheel clutsh	1	266	FA-168	Bushing	1
248	604060100	Set screw(M6x10)	1	267	604060200	Set screw(M6x20)	1
249	FA-132	Reverse clutch rod	1	268	FA-139	Worm	1
250	665006000	Outer retaining rings(A-6)	1	269	FA-138	Feed worm shaft bushing	1
251	FA-131	Reverse knob	1	270	735000660	Bearing	1
252	FA-130	Feed reverse knob stud	1	271	EA-018	Pin	2
253	622030012	Spring pins($\phi 3 \times 12$)	1	272	604060060	Set screw(M6x6)	1
254	FA-312	Hand wheel	1	273	Fa-142	Bevel gear bushing	1
255	035036000	Steet ball($\phi 3/16$ ")	1	274	075008000	Oil cap(PT-1/8")	1
256	FA-129B	Spring	1	275	FB-028	Wave spring	1
257	FA-129A	Screw	1	276	665035000	Outer retaining rings(A-35)	1
258	FA-135M	Feed reverse bevel gear	1	277	FA-426	Spacer ring	1
259	FA-141	Bevel gear thrust spacer	1	278	FB-082	Belt(875VC-3830)	1
260	FA-140A	Bevel gear	1	279	FB-016	Spindle pulley spacer	1
261	622025020	Spring pins($\phi 2.5 \times 20$)	1	280	625020006	Rivet(P2x6)	2
262	FA-136	Feed reverse clutch	1	281	AA-001	Arbor driving key	2
263	FA-137	Feed worm shaft thrust washer	1	282	600080160	Hsh cap screw	2
264	622030180	Spring pin($\phi 3 \times 18$)	1	283	602381041	Hexagon head ($\phi 3/8 \times 1 1/4$ ")	2
				284	652038001	Spring washer (SW3/8")	2
				285	FB-084	Washer	1