ATRUMP
MACHINERY

K SERIES
VERTICAL TURRET MILLING MACHINE

KV2
KV3
KV4

Operator's Manual & Parts List

TABLE OF CONTENTS

**Specifications subject to change without prior notice.*

BASIC MACHINE SPECIFICATIONS

Machine Model	**KV2**	**KV3**	**KV4**
Table size	9x49"	10X54"	10"x54"
No. of T slot	3	3	3
Width of T slot	0.62"(16mm)	0.62"(16mm)	0.62"(16mm)
Slideway dovetail	X/Y/Z	X/Z	X
Slideway square	–	Y	Y/Z
X axis travel	36"(914mm)	36"(914mm)	36"(914mm)
Y axis travel	12"(305mm)	15.75"(400mm)	15.75"(400mm)
Z axis travel	16"(406mm)	16"(406mm)	16"(406mm)
Ram travel	12"(305mm)	24"(610mm)	24"(610mm)
Main motor	3HP/4P	3HP/4P	5HP/4P
Spindle Drive	Variable Speed	Variable Speed	Variable Speed
Spindle speed (Inverter variable)	70-4200rpm	70-4200rpm	70-3800rpm
Spindle taper	R8/NT30	R8/NT30	NT40
Quill travel	5" (127mm)	5" (127mm)	5.5" (140mm)
Quill feed rate	0.0015, 0.003, 0.006 (inch/rev.)		
Quill diameter	3.38"(86mm)	3.38"(86mm)	4.17"(106mm)
Travel reduced for power feed X axis	3.5"(89mm)	3.5"(89mm)	3.5"(89mm)
Head swivel angle(R/L)	±90°	±90°	±90°
Head tilting angle (Up/down)	±45°	±45°	none
Machine weight	2420 LBS (1100KGS)	2860 LBS (1300KGS)	3960 LBS (1800KGS)

UNCRATING:

Carefully remove the protective packaging to avoid damage to the machine and parts.

If damage occurs during transportation, please notify your distributor immediately, as well as the transportation company making the delivery.

SHORTAGES:

Check the shipment carefully against the packing list. If there is a shortage, report them IMMEDIATELY to the distributor from whom the machine was purchased.

CLEANING:

Thoroughly clean protective coating from machine with suitable cleaning solution.

WARNING

IT IS NOT RECOMMENDED THAT GASOLINE OT OTHER HIGHLY INFLAMMABLE AGENT BE USED.

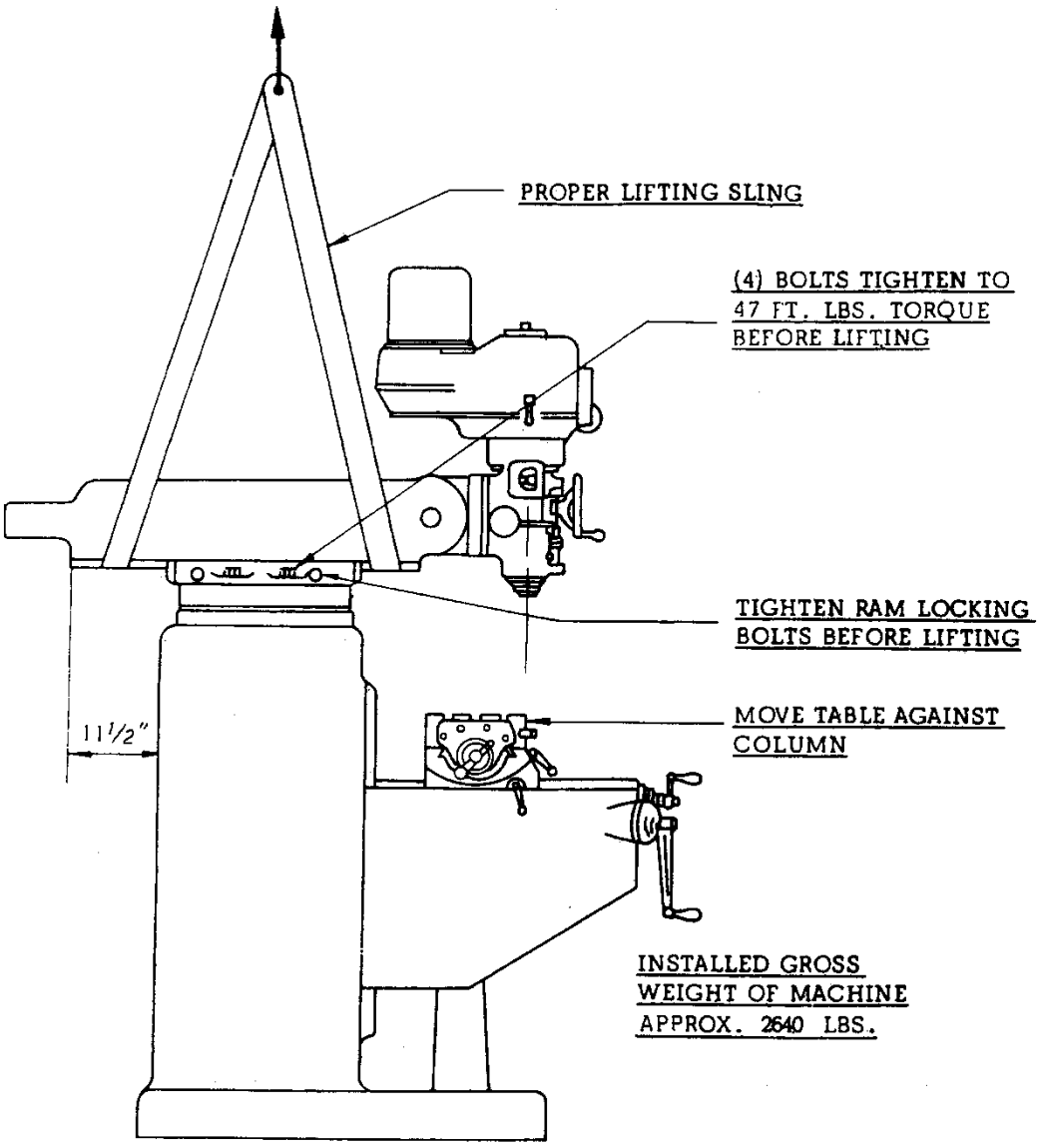
Do not move the table, knee, saddle or ram until all ways have been well cleaned and lubricated. Then, by hand, move table, saddle, and knee to limit stop in one direction. Clean and lubricate exposed ways and then move each unit to the opposite limit stop and similarly clean and lubricate the exposed ways. Loosen bolts to unlock ram and move forward and backward the full length to clean and lubricate.

POSITIONING HEAD UPRIGHT:

Loosen four locknuts (#157, Page 32), out to detent and rotate head to vertical position. Proceed with alignment of head as described on Page 6 Tighten nuts evenly, using normal pressure. Care should be taken to avoid excessive tightening since this will cause distortion in the quill. Tighten all nuts to 25 ft.lbs. torque, then repeat to 50 ft.lbs.

LIFTING THE MACHINE

Note position of ram and table when lifting with sling.



LIFTING AND PLACING ON SOLID FOUNDATION

Machine should be lifted by placing a sling under the ram as illustrated on page 3.

The column and base are one-piece casting. When setting machine on a concrete foundation, it is advisable to use a little grout (thin mortar) to take care of any unevenness in the concrete as well as to provide a solid foundation at all points.

When setting machine on floor that is uneven, shims should be used to correct this condition. See Figure 2 for installation layout.

NOTE

IT IS RECOMMENDED THAT THE MACHINE BE SECURED TO THE FLOOR TO PREVENT MOVEMENT OR TIPPING DUE TO OFF-CENTER LOADING

Before securing machine to floor (i.e. tightening hold down bolts), make certain four corners are making contact with floor or shims, after machine is leveled. If this is not done, it is possible to twist the column and put a bind in the ways.

LEVELING MACHINE

Set machine by leveling the work table lengthwise and crosswise with a precision level.

HANDLES

When crating the three ball crank handles are sometimes turned to face the machine. In these cases the handles should be reversed before operating.

CONNECTING POWER SUPPLY

To connect the power, have a qualified electrician proceed as follows:

1. Check out wiring to ensure it is compatible with power supply.
2. Connect machine wiring to power supply making sure connection complies to all local electrical code.
3. Check for correct spindle rotation. In the HIGHSPEED range, the spindle should rotate clock wise when viewed from the top of the machine.

NOTE

DRUM SWITCH AND HI-NEUTRAL-LO LEVER MUST BE IN HI RANGE

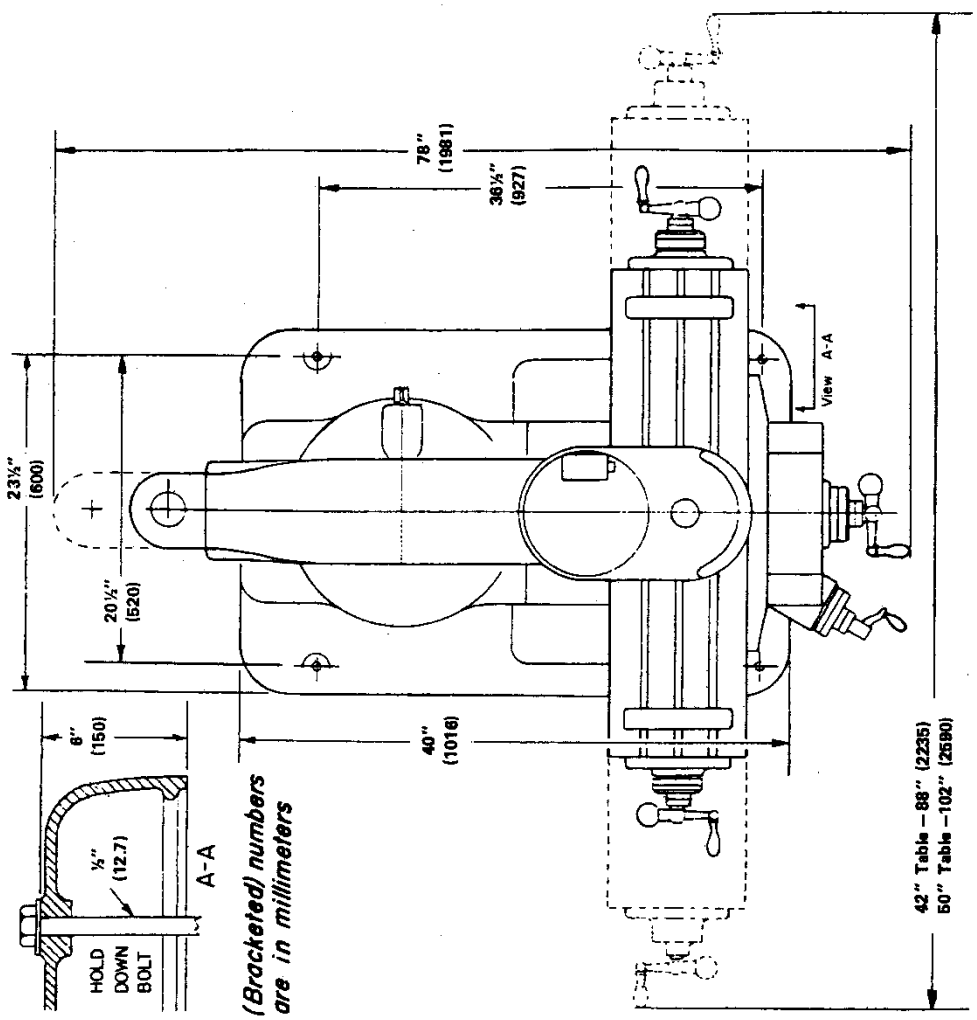


Figure 2. Installation Layout

ALIGNMENT OF HEAD

In case of precision work where it is necessary to have head perfectly square with the table, use method described below. To set head square with the table, see Figures 3 & 4. This must be done with ram adapter (#2, .page 23) on Ram(# 10, page 23), by adjusting ram adapter through vertical adjusting worm shaft (#8. page 23). Loosen four locknuts (#157, page 31), but leave some drag on them for fine adjustment. To square head to table in the longitudinal axis, mount indicator as shown in Figure 4.

NOTE

INHEN INDICATING AS IN FIGURE 3. IT SHOULD BE NOTED THAT THE TABLE IS FITTED TO BE SLIGHTLY HIGHER IN FRONT. USUALLY ABOUT .0005".

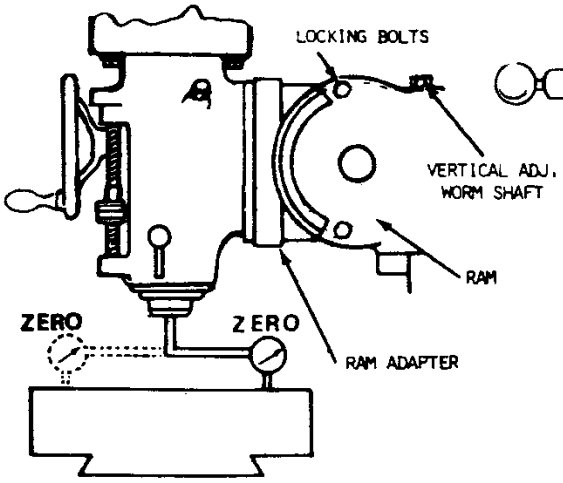


Figure 3. Head Alignment Y Axis

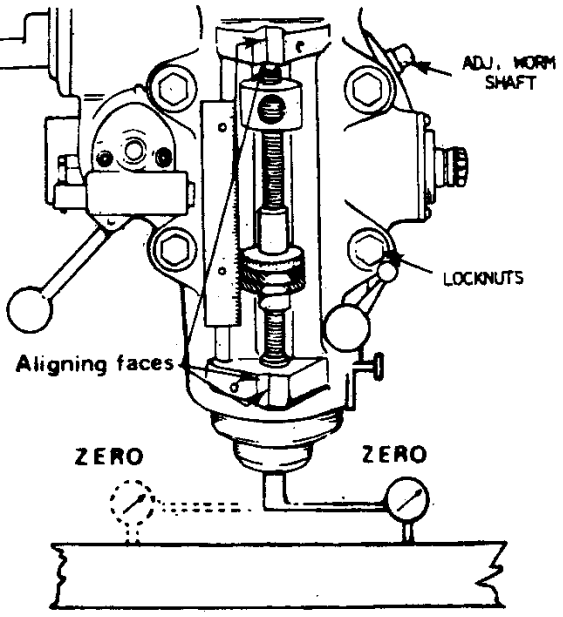


Figure 4. Head Alignment X Axis

LUBRICATION

Do not operate until properly lubricated:

(A) Way surfaces and lead screws
Sunoco waylube #80 or equivalent

(B) Milling Heads (Spindle Bearing)
SAE 10 or light oil

(C) Motors are pared for life of bearings

ADJUSTMENT OF TABLE GIB.
The table is provided with a full length tapered gib(#43 page 23) in the saddle, and an adjusting screw on the left side. To take up gib, tighten gib adjusting screw (#41 page 23) slightly and repeat until slight drag is felt when moving the table by hand.

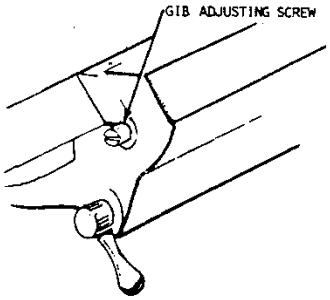


Figure 5. Saddle/Table Gib (#43 page 23)

ADJUSTMENT OP SADDLE GIB.
A tapered gib(#49 page 23) is used for adjusting the saddle bearing on the knee. This forms a guide for the saddle. To tighten gib, remove chip wiper and use the same method as described above. Replace chip wiper after has been adjusted.

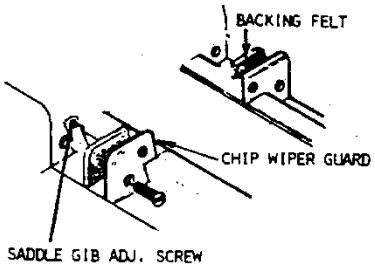


Figure 6. Saddle-Knee Gib (#49 page 23)

ADJUSTMENT OF KNEE GIB.
Remove chip wiper and adjust screw until smooth movement is attained
Replace the wiper.

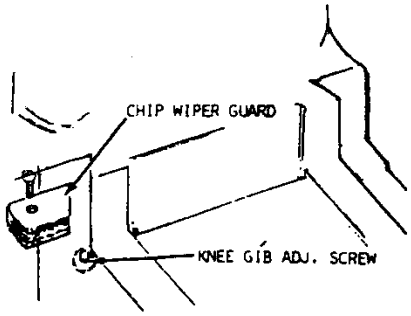
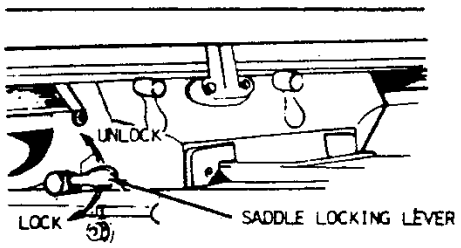


Figure 7. Knee-Column Gib(#55 page 23)

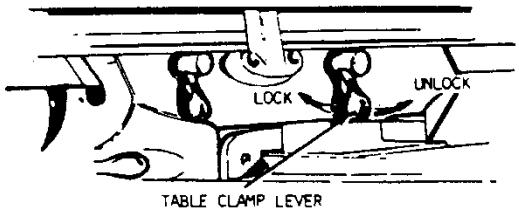
CLAMPING TABLE, SADDLE AND KNEE

When milling with longitudinal table feed only. It is advisable to clamp the knee to the column and the saddle to the knee to add rigidity to these members and provide for heavier cuts with a minimum of vibration. The saddle locking lever is located on the left-hand side of saddle.

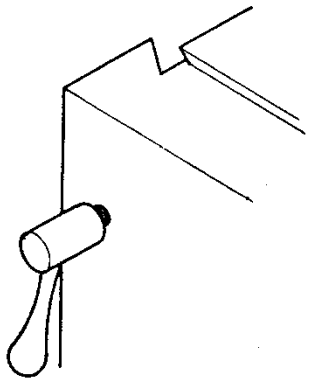


Excessive pressure can cause slight table bind. Use moderate clamping pressure as this will hold saddle sufficiently.

The table clamp levers are located on the front of saddle and should always be clamped when longitudinal movement is not required.



The two clamps on the left rear of the knee should only be used when the knee will not be moved.



REMOVING TABLE

Remove the following: ball crank, handles, dial holders and bearing brackets. Turn the lead screw all the way out and slide the table from the saddle. See Fig. 8

REMOVING SADDLE

Follow the same procedures as removing table; however, it is necessary to remove the entire front bracket assembly. Next, remove the cross-feed nut bracket which can only be done by removing the table. See Fig.8.

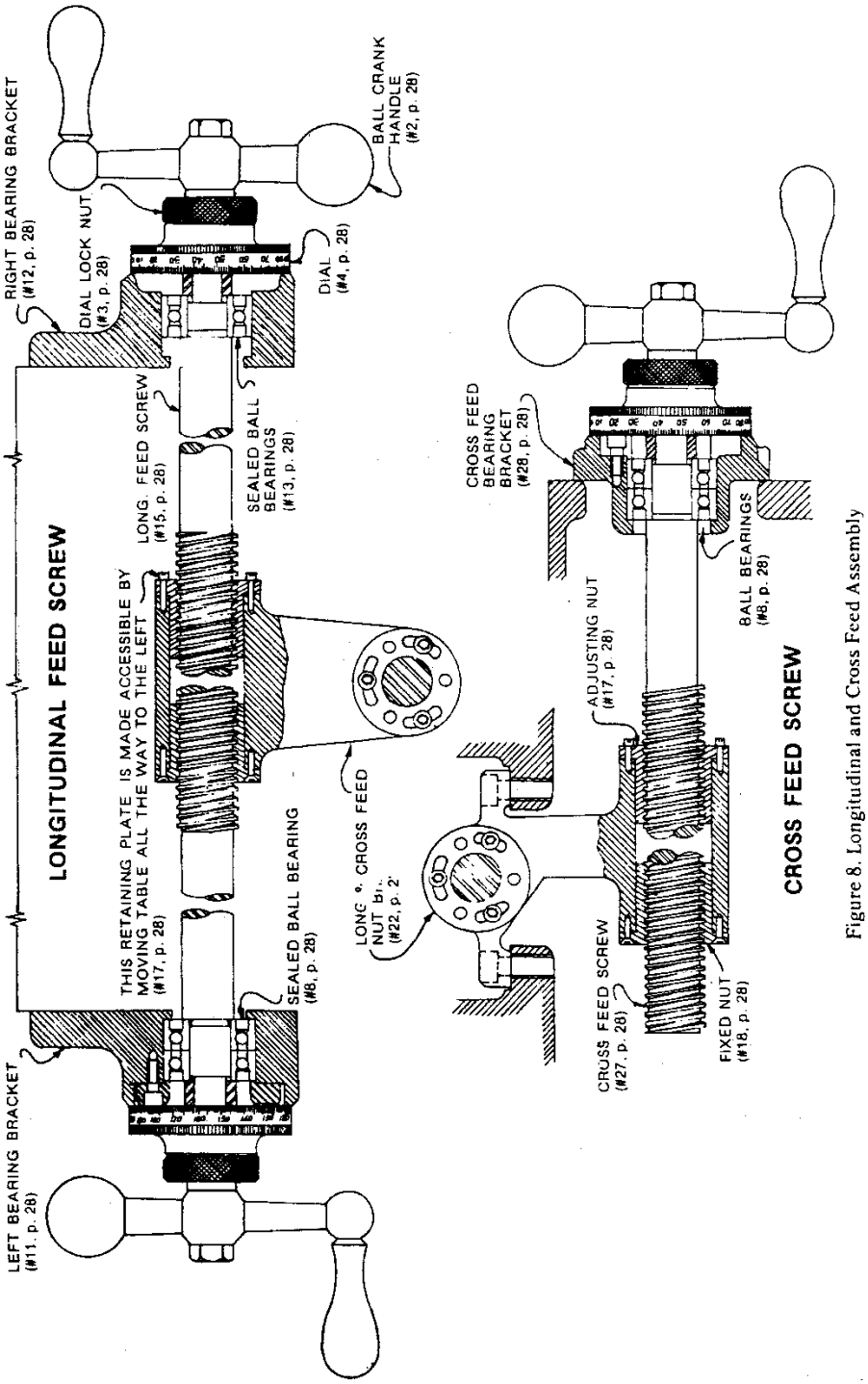


Figure 8. Longitudinal and Cross Feed Assembly

ASSEMBLY INSTRUCTIONS
FOR MOUNTING 2VS VARIDRIVE HEAD TO RAM ADAPTOR

Insert the four (4) tee bolts into the ram adaptor and position them to match the bolt holes in the head.

Slide the head on to the bolts, insert the spacers and washers and secure with the nuts.

Tighten all nuts to 25 ft. lbs. of torque, and then repeat to 50 ft. lbs.

CAUTION
IMPROPER TIGHTENING OF THESE COULD CAUSE A CHOPPY QUILL MOVEMENT

LUBRICATION

The useful life of the Vari-Speed Head will be determined to a large extent by whether proper lubrication methods are followed. Carefully follow the lube plate recommendations and avoid substitutions.

OPERATING INSTRUCTIONS

SPEED CHANGE HANDWHEEL (16, Figure 9) :
DO NOT attempt to change spindle RPM unless the motor is running. Dial speeds will only be approximate. Belt wear will cause a slight variation in speeds from what is indicated on the dial.

When tightening or loosening the drawbar (#14, page 35) . It is necessary to lock the spindle. To do this, use the spindle brake (3) which is located on the left side of the belt housing, turning it either right or left until it binds. Make sure the quill is raised all the way.

Drawbar (#14, page 35) has 7/16-20 right hand thread and should be tightened with normal pressure using wrench furnished with machine. To loosen collet, back off drawbar and if collet does not open, given top of drawbar a slight tap. Spindle has non-sticking taper and collet should release readily.

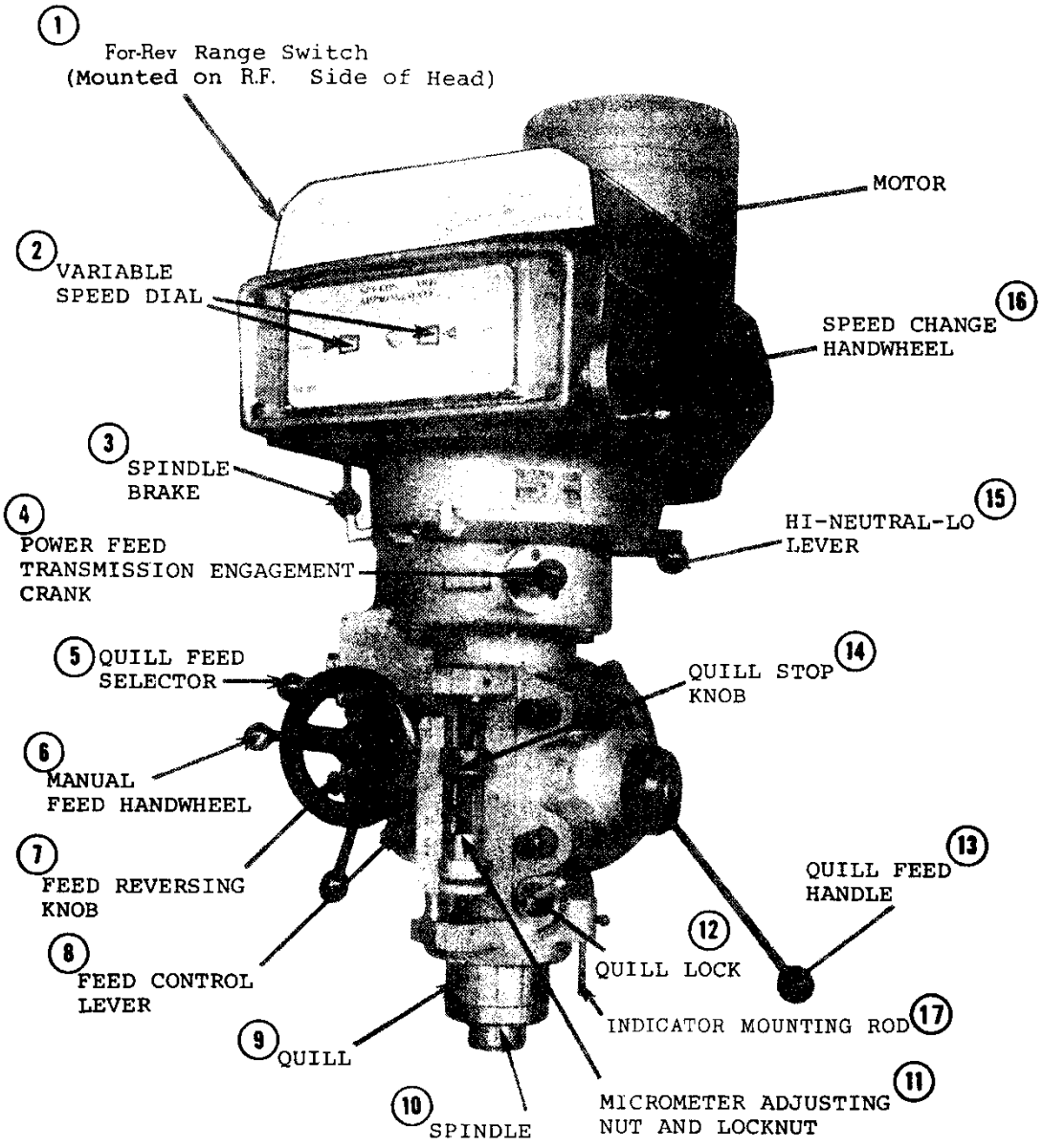


Figure 9. Milling Head (Variable Speed)

SPINDLE BRAKE (3. Figure 9)

Brake lever can be moved in either direction to stop spindle. When locking spindle, lever should be moved right or left and then raised. There are no adjustments on brake so it must be replaced when warn out.

> CAUTION
> BE CERTAIN THAT THE SPINDLE BRAKE IS RELEASEDBEFORE STARTING THE MOTOR.
> THIS IS IMPORTANT AS THE MOTOR CAN BE DAMAGED IF SWITCH IS TURNED
> ON WITH BRAKE IN LOCKED POSITION.

FORWARD-REVERSE SWITCH (#5. Fig. 9)

This is the motor reversing switch. When the head is in direct drive (High Range), the motor and spindle are turning the same direction. When the head is in "Back Gear" (Low Range), the spindle runs backwards unless the motor direction is reversed.

HI-NEUTRAL-LO LEVER (#15. Fig. 9)

The lever is used to put the head into either direct drive or back-gear. Rotate the spindle by hand to facilitate meshing of clutch or gears.

Neutral can be obtained at mid-way position, and is provided to permit free spindle rotation for indicating and set-up.

After an extended period of use, the neutral position may cause noise by allowing the clutch teeth to rub each other. This can be corrected by loosening set screw (#64, page 33), and reversing the position of the detent plate (#65, page 33).

In high speed (Direct Drive), the spindle is driven by tapered clutch teeth. If the clutch is not meshed tightly, clutch rattle will be heard. This can be corrected by moving the detent plate upward as the clutch wears. This is also the reason for possible loss of neutral, requiring the reversal of the detent plate.

> CAUTION
> DO NOT shift Hi-Lo Lever while motor in running

POWER FEED ENGAGEMENT CRANK (4. Fig)

Engage power feed worm gear. When lever is in right hand hole, power feed is engaged. To disengage, pull knob out and turn crank in clockwise or down direction and move to opposite position.

NOTE
HANDLE MUST BE MOVED IN CLOCKWISE DIRECTION TO ENGAGE OR DISENGAGE POWER FEED. IF HANDLE IS MOVED COUNTER-CLOCKWISE NO DAMAGE WILL BE DONE. BUT NOTHING WILL HAPPEN.

CAUTION
POWER FEED GEAR MAY BE ENGAGED WHILE SPINDLE IS TURNING. HOWEVER, IT SHOULD BE ENGAGED SLOWLY TO AVOID DAMAGE TO THE WORM GEAR. THE GEAR MAY BE DISENGAGED AT ANY TIME. DO NOT USE POWER FEED AT SPEED ABOVE 3000 RPM.

IMPORTANT
It is recommended that the Power Feed worm gear be disengaged whenever the power feed is not required. This will avoid unnecessary wear on power feed worm gear.

QUILL FEED SELECTOR (#5. Fig. 9)

This crank is used to select the feed rate to be used. It is shifted by pulling knob out and turning from one position to another. Feed rates are stamped on cover below each hole. Feed is more readily engaged with spindle running.

FEED REVERSE KNOB (#7. Fig. 9)

Position of this knob depends upon direction of spindle rotation. If boring with right hand cutting tools, pull feed handle towards operator until clutch becomes engaged.

Neutral position is between forward and reverse position. It is recommended that the handle be left in neutral position when not in use.

MANUAL FEED HANDWHEEL (#6. Fig. 9)

Feed reversing knob should be in neutral position and feed control lever (#8. Fig. 9) engaged. Clockwise rotation of handwheel moves quill down. Manual Feed Handwheel and quill feed handwheel may be disengaged by moving them outward approximately 1/8".

NOTE
The feed control lever must be engaged in order to use manual feed controls.
The Quill Feed Handle and Manual Feed Handwheel may be taken off when not in use.

FEED CONTROL LEVER (#8. Fig. 9):

Engages over-load clutch on pinion shaft when moved left and will stay engaged until either quill stop comes in contact with micrometer adjusting nut forcing feed control lever to disengage automatically, or released manually by moving lever to right.

NOTE
The Feed Control Lever is carefully set at plant to disengage automatically when quill stop goes against micrometer adjusting nut or against throw out pin at top. However, if this should go out of adjustment, it may easily be brought back by regulating the socket set screw located at bottom of tripping rod (item no. 144 page 32)

CAUTION
WHEN ADJUSTING THE SOCKET SET SCREW, CHECK AUTOMATIC DISENGAGEMENT IN BOTH DIRECTIONS: THAT IS WITH QUILL-STOP NUT (#161, PAGE 32) AGAINST THE FEED TRIP LEVER (#145.PAGE 32) FOR DOWN POSITION, AND AGAINST REVERSE TRIP BALL LEVER (#183,PAGE 32) FOR THE UP POSITION.

QUILL FEED HANDLE (#13. Fig. 9)

May be removed by simply pulling handle off. It is recommended that handle be disengaged when using power feed.

QUILL STOP KNOB (#14. Fig. 9)

Is used to disengage power feed in either direction as well as acting as a depth stop when working to a given depth.

MICROMETER NUT (#11. Fig. 9)

This nut is used for setting of depths. Each graduation on nut indicates .001" of depth. It reads directly to scale mounted along side of it. Depths may be obtained by setting micrometer nut in conjunction with quill stop.

QUILL LOCK (#10. Fig. 9)

This is a friction lock to be used when quill is in stationary position such as for milling. It is recommended this lock be used whenever quill movement is not desired.

RAM POSITION

Ram can be moved by loosening two ram lock studs (#119, page 23) on turret (#124, page 23) and moving to desired position.

CAUTION
CARE SHOULD BE TAKEN TO LOCK RAM SECURELY AFTER SETTING.

NOTE
It is recommended that on heavy milling work, head should be kept as close to column as possible, where maximum rigidity is obtained.

RECOMMENDATIONS:
Use 2, 3, or 4 flute end mills. Eight flute end mills are usually not as satisfactory for general milling. When using shell mills, face mills or any other tooling, proper machining practice should be observed.

Power feed can be used for drills up to 3/8" diameter in mild tool steel. Overload clutch is preset to hold up to 200 lbs. down pressure on quill. Use manual feed for drills over 3/8”.

CAUTION
THIS CLUTCH SHOULD NOT BE TAMPERED WITH IN THE FIELD.

OPERATING INSTRUCTIONS

CAUTION
DO NOT TRY TO CHANGE SPINDLE SPEED ON VS VARI-DRIVE HEAD UNTIL MOTOR IS RUNNING.
THIS COULD CAUSE PARTS BREAKAGE

Spindle Feeds are adjusted by turning speed change handwheel (#21, page 33) on the front of the belt housing. There are two ranges shown; 60 to 500 and 500 to 4200.

60-500 RPM is obtained through the back-gear drive and is referred to as low range. To engage the back-gears, use the lever marked Hi-Neutral-Lo on the right side of the head. Move this lever to the "LO" position and use low range on the variable speed dial.

When shifting to "LO" DO NOT FORCE THE LEVER If the back gears do not mesh. Hold the lever so that the gears are clear of one another, rotate the spindle nose by hand until the gears line up. then put the unit in "LO"(back gear).

500-4200 RPM is direct drive and is the high range. The same procedure as previously described is used to select this range except the Hi-Neutral-Lo lever is set in the Hi position.

Wear on the vari-drive belt will cause a slight change in the speeds to that shown in windows (#23, page 33) on the dial. This can be corrected as follows. Crank the speed change handwheel (#16. Figure 9) snugly against the Highspeed stop. (This will be near the 4200 reading on the dial.) Use a tachometer to determine the spindle speed, then turn the pivot stud (#16 page 35), after loosening the jam nut (# 17, page 35) until the spindle speed registers 4200 on the tachometer: tighten jam nut.

Now reposition the speed dial plate to match the tachometer reading. This is done by loosening the Hex nut (#1, page 33) until the spindle speed registers 4200 the tachometer; tighten jam nut.

CAUTION
DO NOT SHIFT THE HI-NEUTRAL-LO LEVER WHEN THE FEED GEAR IS ENGAGED

DO NOT LOOSEN the 3 hex nuts (#61, page 33) on the upper part of the Quill Housing (#192, page 31). These are set at the factory and are used only for alignment.

SWIVELING THE VARI-DRIVE may be accomplished by loosening the lower 3 hex nuts (#47, page 33) attaching the Vari-Drive unit to the quill housing and then swiveling to any desired position. See arrangement of T-Bolts (#45, page 33) in Gear Housing (#63, page 33) for this purpose.

WARNING
CARE MUST BE TAKEN TO SECURE THE NUTS (#47, page 33) WHEN THE ATTACHMENT IS IN POSITION, BEFORE THE MOTOR IS TURNED ON.

REMOVING THE MOTOR (See Fig. 10)

1. Run the head to the lowest speed of either range and shut off the motor. This puts the Vari-Drive belt in the best position for disassembly.

   DISCONNECT THE POWER and then remove the switch from the side of the belt housing.

2. Remove the cover (#54, page 33) (B. Figure 10) at the lower end of the motor shaft. Use two cover screws (#55, page 33)(A) to fasten the spring (#44, page 35) (C) on the lower end of the motor shaft to the lower motor vari-drive pulley(#43, page 35). This will reduce the hazard of personal that is always present when a heavy spring is under compression. When the pulley, spring retainer (#45, page 35) and spring are securely fastened as a single unit, crank the speed change handwheel (#16. Figure 9) to top speed position.

3. Now remove the screws (#9, page 35) (D) that fasten the motor to the belt housing. The motor should be lifted slightly and pulled firmly away from the spindle and toward the rear of the belt housing. This will pull the vari-drive belt (#27, page 35) deeply into the spindle pulley (#25, page 35) providing the slack needed to shift the belt over the motor pulley (#43, page 35).

4. Now lift the motor high enough to rest the motor base GENTLY on the adjusting screw (#16, page 35)
   (E) seen directly in front of the motor range. The belt can now be slipped over the lower pulley and the motor removed from the housing.

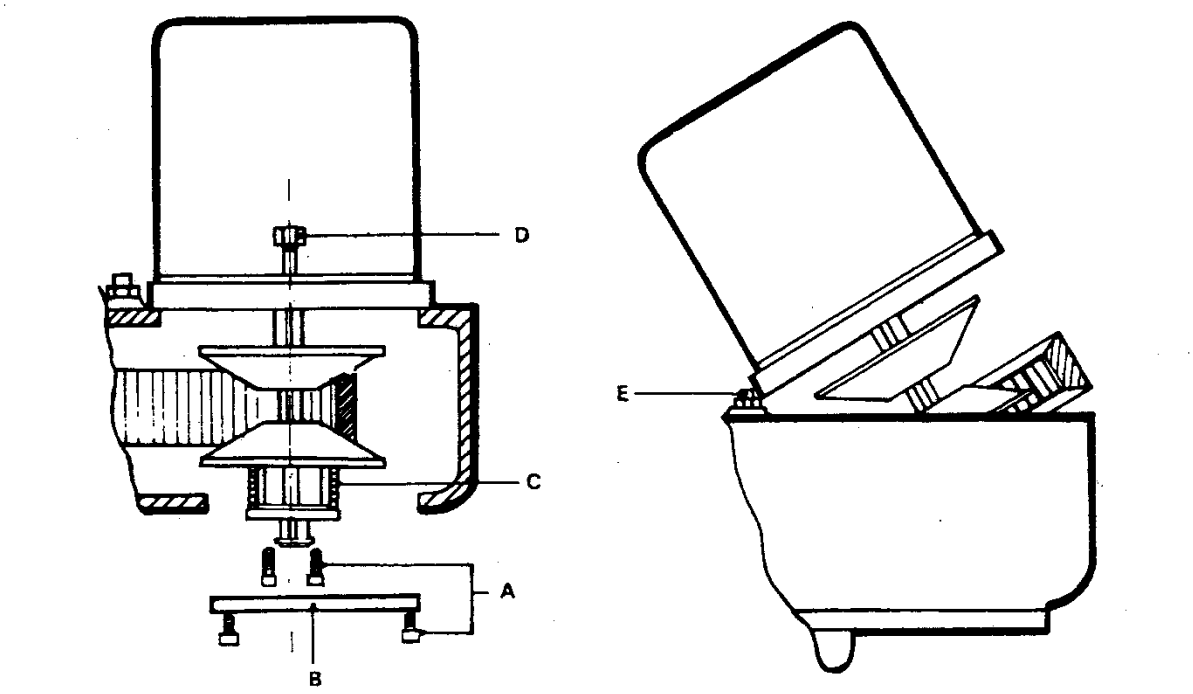


Figure 10. Removing the Motor (Side View)

CHANGING VARI-DRIVE BELT (Figure 11)

Complete the previous procedures for removing the motor, then remove the three screws (#1, page 35) (A. Fig. 11) and lift out the top bearing cap (#13, page 33) (B). Looking down inside of the housing, locate and remove the socket head cap screws (#17, page 35) and sleeves (#19, page 35) (C). Next, remove the six screws (#64, page 35) (D), then holding the belt housing (E) to the base (#63, page 35).

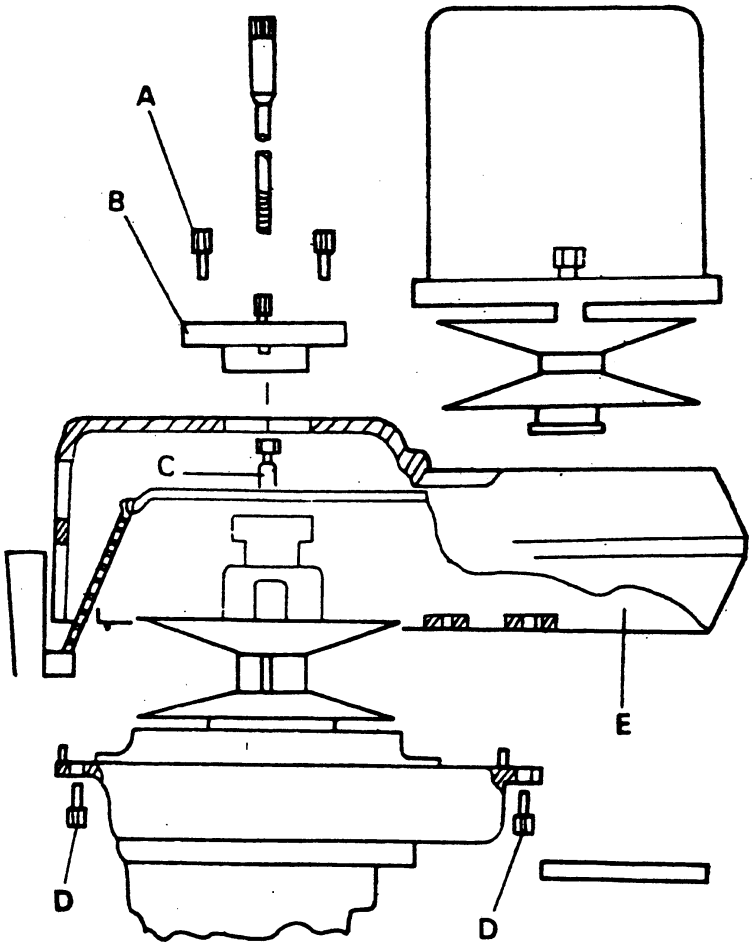


Figure 11. Removing the Vari-Drive Belt

Remove the old belt (#27, page 35) and replace it with a new belt. Do not use a substitute belt purchased from other than Bando Variable Belt 875vs. Vibration and heat could result from the use of the wrong belt.

CHANGING TIMING BELT (Figure 12)

Complete the operation for removing the motor. Then put the Hi-Neutral-Lo lever (#15, Figure 9) in the Lo position, remove the drawbar (#14, page 35)(A, Figure 12) and lower the spindle.

Remove screws (#55, page 35) (B) holding the upper and lower housings (#63, page 35) together, including the two lower screws(C) in speed changer bracket just below the speed dial.

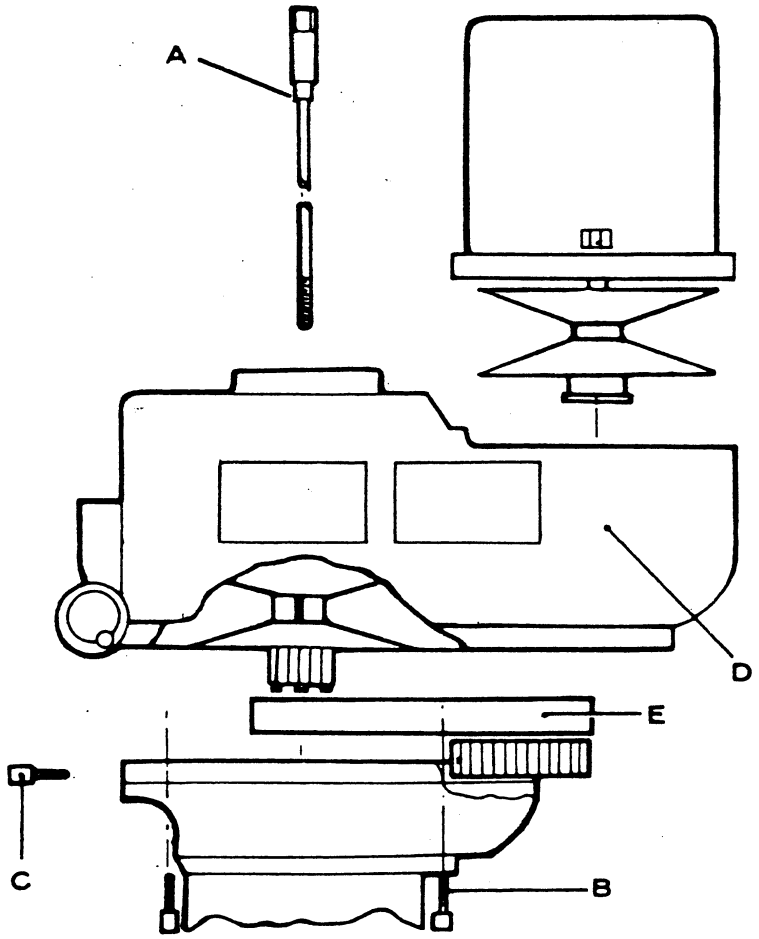


Figure 12. Removing Timing Belt

A slight blow under the speed changer bracket (#5, page 33) may be needed to separate the upper housing (D) from its base.

As the housings are being separated, the HTD belt (E) (#36, page 33) still connects them, resisting the separating movement. The separation can be assisted by gently pushing the belt off the large pulley (#86, page 33) as the upper housing is being raised.

Remove the old belt and replace with a new belt.

General Speed Recommendation

Material to be Cut	Feet Per Minute		
	Rough Cut	Rough and Finish	Light and Finish Cut
Cast Iron-Soft-(Under 200 Brinnell)	70	80-90	120
Cast Iron-Medium-(200-300 Brinnell)	55	60-70	90
Cast Iron-Hard-(Over 200 Brinnell)	40	50-60	70
Steel(Chrome Nickel 40-45 Shore)	30	40	50
Steel(Stainless)	60	80	90
Steel(Low Carbon)	80	90	140
Steel(High Carbon)	40	50	70
Bronze(Medium)	90	120	150
Bronze(Hard)	65	90	130
Brass(Hard)	100	150	200
Copper	150	200	300
Duraluminum	400	–	600
Aluminum	600	–	1000

TABLE OF CUTTING SPEEDS AND FEEDS

Feet Per Minute	15	20	25	30	40	50	60	70	80	90	100
Diameter Inches	Revolutions Per Minute										
1/16"	917	1222	1528	1833	2445	3056	3667	4278	4889	5500	6112
1/8"	458	611	764	917	1222	1528	1833	2139	2445	2750	3056
3/16"	306	407	509	611	815	1019	1222	1426	1630	1833	2037
1/4"	229	306	382	458	611	764	917	1070	1375	1375	1528
5/16"	183	244	306	367	489	611	733	856	978	1100	1222
3/8"	153	204	255	306	407	509	611	713	815	917	1019
7/16"	131	175	218	262	349	437	524	611	698	786	873
1/2"	115	153	191	229	306	382	458	535	611	688	764
5/8"	91	122	153	183	244	306	367	428	489	550	611
3/4"	76	102	127	153	204	255	306	357	407	458	509
7/8"	65	87	109	131	175	218	262	306	346	393	437
1"	57	76	95	115	153	191	229	267	306	344	382
1 1/8"	50	67	84	102	136	170	204	238	272	306	340
1 1/4"	45	61	76	91	122	153	183	214	422	275	306
1 3/8"	41	55	69	83	111	139	167	194	222	250	278
1 1/2"	38	50	63	76	102	127	153	178	204	229	255
1 5/8"	35	47	58	70	94	118	141	165	188	212	235
1 3/4"	32	43	54	65	87	109	131	153	175	186	218
1 7/8"	30	40	50	61	81	102	122	143	163	183	204
2"	28	38	47	57	76	95	115	134	153	172	191

MILLING HEAD

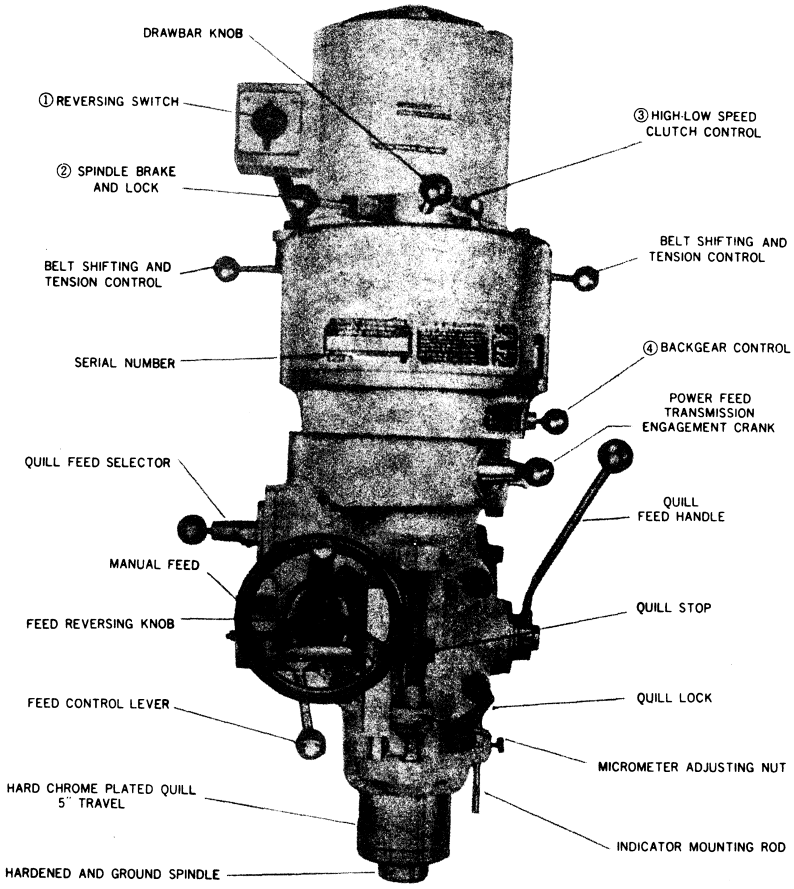


Figure 13. Milling Head (Step speed)

①**REVERSING SWITCH** is used to obtain clockwise or counter clockwise rotation of spindle.

Note: Due to back gear construction, when machine is running in low speed range, spindle rotation is opposite to that of high speed range. Therefore, forward on your reversing switch becomes revers switch in low speed range.

② **SPINDLE BREAK** Lever can be moved in either direction to stop spindle; however, when locking spindle, lever should be moved to right or left and then raised.

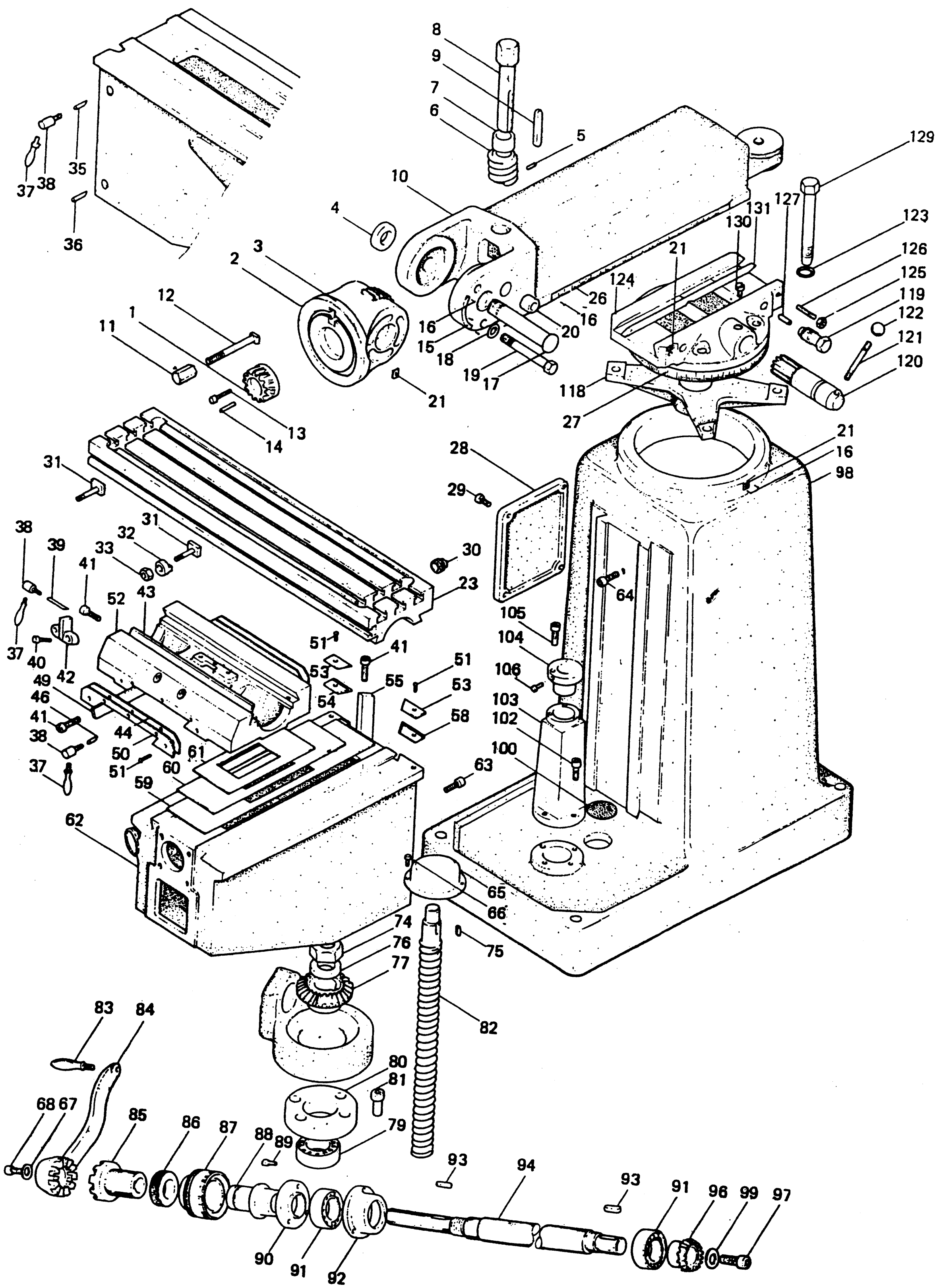
CAUTION: Be certain that the spindle brake is released before starting the motor. This is important as the motor can be damaged if switch is left on with brake in locked position.

③ **HIGH LOW SPEED CLUTCH CONTROL** is directly in front of the motor. When knob is in position, as shown on picture, clutch is in high speed position. To put clutch into low speed position turn lever to the extreme right. It is necessary to rotate spindle while engaging high speed clutch. This can be accomplished by either turning spindle nose by hand or by turning drawbar knob using wrench, providing drawbar is pulled up tightly.

CAUTION: Do not shift clutch while motor is running

④ **BACK GEAR CONTROL** is used in conjunction with the high low speed clutch control above back gear control handle is stamped IN and OUT. When back gear control handle is in OUT position, which is the position furthest from face of machine, then HIGH LOW speed clutch control should be located as illustrated in photograph. With these controls in position as explained, head is set for operation in high speed range (660-2720 RPM).When back gear control lever moved to IN position and HIGH LOW speed clutch control moved to extreme right then the head is ready for operation in the low speed range(80-325 RPM)

PARTS LIST



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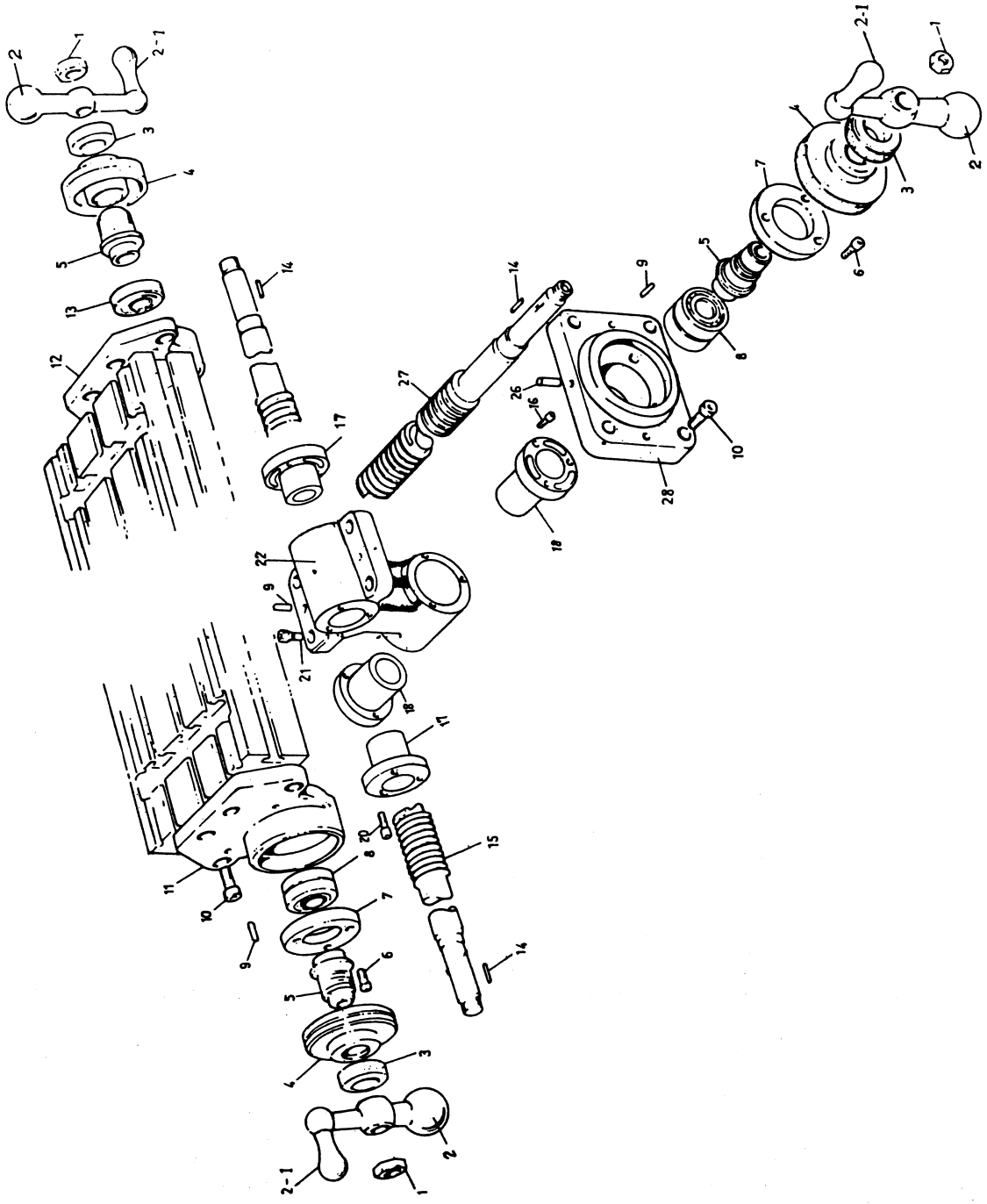
BASIC MACHINE

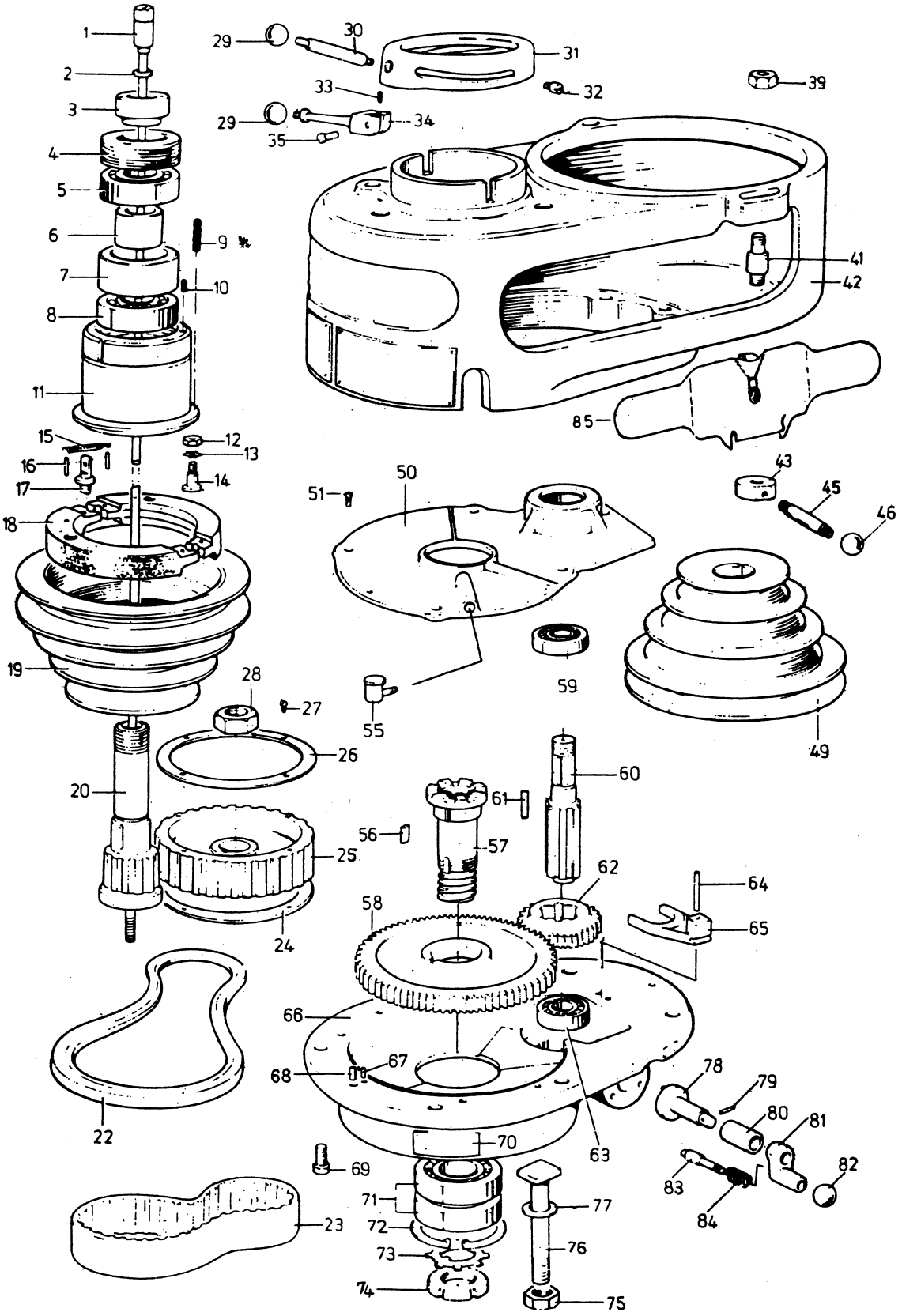
ITEM NO.	PARTS NO.	DESCRIPTION
1	5033	Quill Housing ADJ. Gear
2	5019	Ram Adapter
3	5016	Ram Adapter Plate
4	5027	Nut
5	5023	Set Screw
6	5020	Vertical Adjusting Worm
7	5022	Worm Thrust Washer
8	5021	Vertical Adjusting Worm Shaft
9	5023-1	Worm Key
10	5018	Ram
11	5038	Nut (4 Req)
12	5036	Locking Bolt (4 Req)
13	5035	Socket Cap Screw (2 Req)
14	5034	Roll Dowel Pin
15	5043	Angle Plate
16	5032	Round HD Drive Screw (15 Req)
17	5026	Adapter Pivot Pin
18	5029	Chamfered & Hardened Washer (7 Req)
19	5028	Adapter Locking Bolt (3 Req)
20	5028-1	Adapter Locking Bolt Washer
21	5031	Plate (5 Req)
23	2001-50	Table 50"
26	5044	Ram Plate
27	5030	Turret Plate
28	1002	Column Cover
29	1003	Socket Head Cap Screw (4 Req)
30	2035	Plug (2 Req)
31	2031	Stop Piece T-Bolt (2 Req)
32	2030	Table Stop Bracket (2 Req)
33	2032	Hex Nut (2 Req)
35	4043	Knee Lock Plunger
36	4044	Knee Lock Plunger
37	3031	Table Lock Bolt Handle (5 Req)
38	3030	Saddle Lock Bolt (5 Req)
39	3032	Saddle Lock Plunger
40	3036	Socket HD Cap Screw (2 Req)
41	3028	Gib Adjusting Screw (6 Req)
42	3035	Table Stop Bracket
43	3026	Saddle / Table Gib
44	3037	Felt Wipers (4 Req)
46	3029	Table Lock Plunger
49	3027	Saddle/Knee Gib
50	3037-1	Saddle Knee Wiper Plate (4 Req)
51	3038	Oval Head Screw (12 Req)
52	3001	Saddle
53	4028-2	Left Hand Column Wiper Holder (2 Req)
54	4028-1	Knee Wiper Felt
55	4038	Knee/Column Gib
58	4028	Knee Wiper Felt
59	3039	Chip Guards
60	3039-1	Chip Guards
61	3040	Chip Guards

ITEM NO.	PARTS NO.	DESCRIPTION
62	4001	Knee 12"
63	1001-1	Stop Screw
64	1001-2	Stop Screw
65	4034	Bevel Gear Cover
66	4036	Socket Head Cap Screw (2 Req)
67	4004	Washer
68	4005	Socket Head Cap Screw
74	4023	Jam Nut
75	4020	Key
76	4022	Washer
77	4019	Bevel Gear
79	4040	Sealed Ball Bearing
80	4039	Bearing Retainer Ring
81	4041	Socket Head Cap Screw (4 Req)
82	4021	Elevating Screw Assembly
83	4003	Handle
84	4002	Elevating Crank
85	4013	Gearshaft Clutch Insert
86	2016	Dial Lock Nut
87	4010	Dial with 100 Graduations
88	4011	Dial Holder
89	4009	Socket Head Cap Screw (3 Req)
90	2011	Bearing Retaining Ring
91	2008	Grease Sealed Bearing
92	4006	Bearing Cap
93	4015	Key (2 Req)
94	4017	Elevating Shaft for 12" Knee
96	4014	Bevel Pinion
97	4042	Set Screw
98	1001	Column
99	4017-1	Washer
100	1004	Filter
102	4027	Socket Head Cap Screw (4 Req)
103	4026	Pedestal
104	4024	Elevating Screw Nut
105	4025	Socket Head Cap Screw (3 Req)
106	4024-1	Grease Nipple
118	5003	Spider
119	5010	Ram Lock Stud (2 Req)
120	5012	Ram Pinion
121	5013	Ram Pinion Handle
122	5014	Plastic Ball
123	5005	Chamfered x Hardened Washer (4 Req)
124	5001	Turret
125	5007-1	Gib Screw Nut (2 Req)
126	5007	Gib Screw (2 Req)
127	5006	Ram Lock Plunger (2 Req)
129	5004	Locking Bolt (4 Req)
130	5015	Ram Pinion Screw
131	5002	Ram/Turret Gib



LEADSCREW ASSEMBLY

ITEM NO.	PARTS NO	DESCRIPTION
1	2004	Jam Nut (3 Req.)
2	2018	Ball Crank Handle (3 Req.)
2-1	2018 -1	Ball Crank Handle Grip (3 Req.)
3	2016	Dial Lock Nut (3 Req.)
4	2012	Dial with 200 Graduations (3 Req.)
5	2014	Dial Holder (3 Req.)
6	2036	Socket Cap Screw (6 Req.)
7	2011	Bearing Retainer Ring (2 Req.)
8	2008	Grease Sealed Ball Bearings (2 Req.)
9	2027	Roll Pin (10 Req.)
10	2026	Socket Cap Screw (12 Req.)
11	2006	Left Bearing Bracket
12	2006	Right Bearing Bracket
13	2008	Grease Seal Ball Bearing
14	2003	Key (3 Req.)
15	2002	Longitudinal Feed Screw 42" or 48"
16	3021	Socket Screw (6 Req.)
17	3020–1	Long Feed Nut (2 Req)
18	3020–2	Cross Feed Nut (2 Req.)
20	3041	Fixed Socket Screw (6 Req.)
21	3024	Socket Cap Screw (4 Req.)
22	3025	Feed Nut Bracket
26	3005-1	Stop Screw
27	3002	Cross Feed Screw for 12" Knee
28	3005	Cross Feed Bearing Bracket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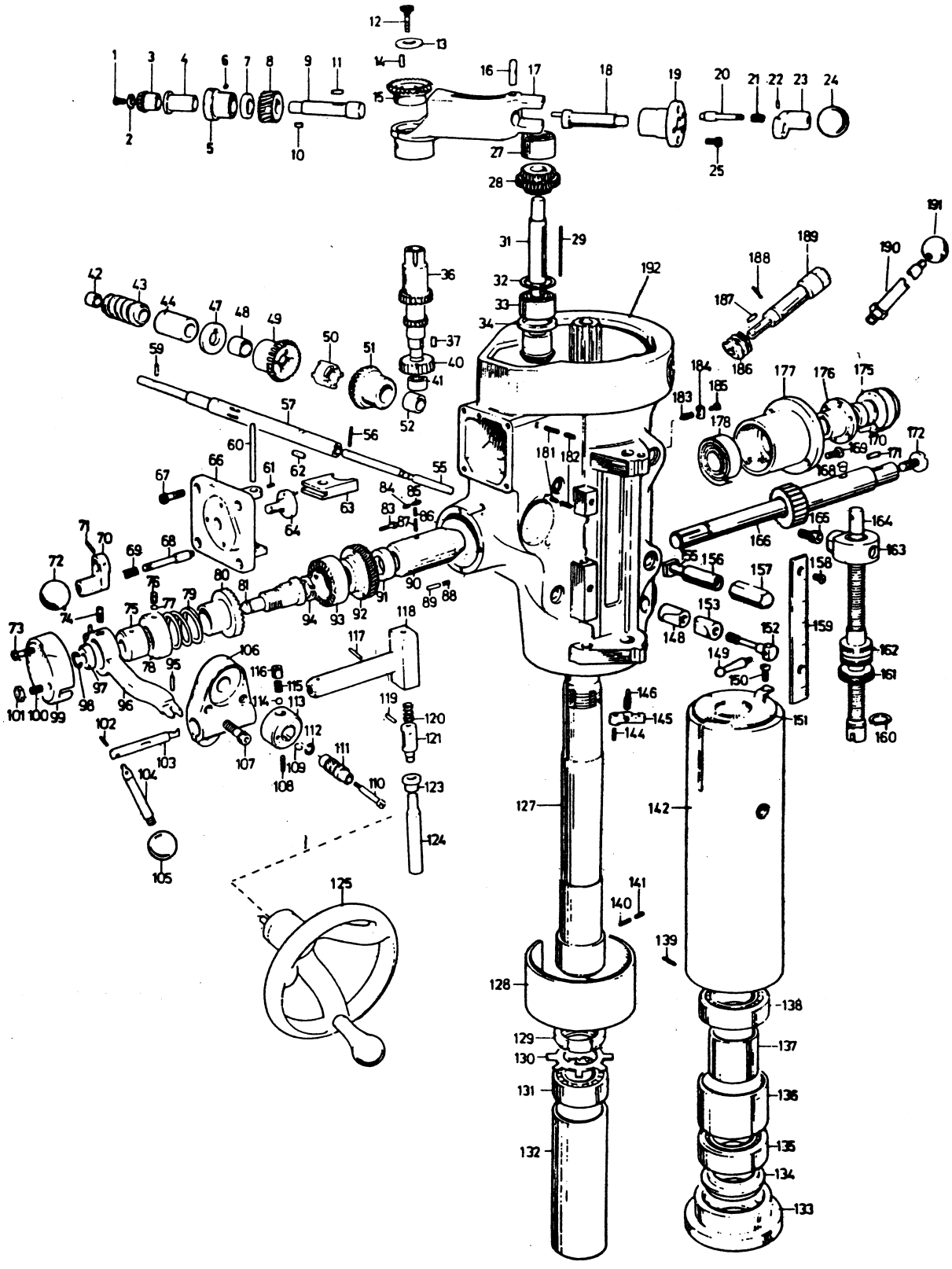
STEP SPEED HEAD TOP HOUSING

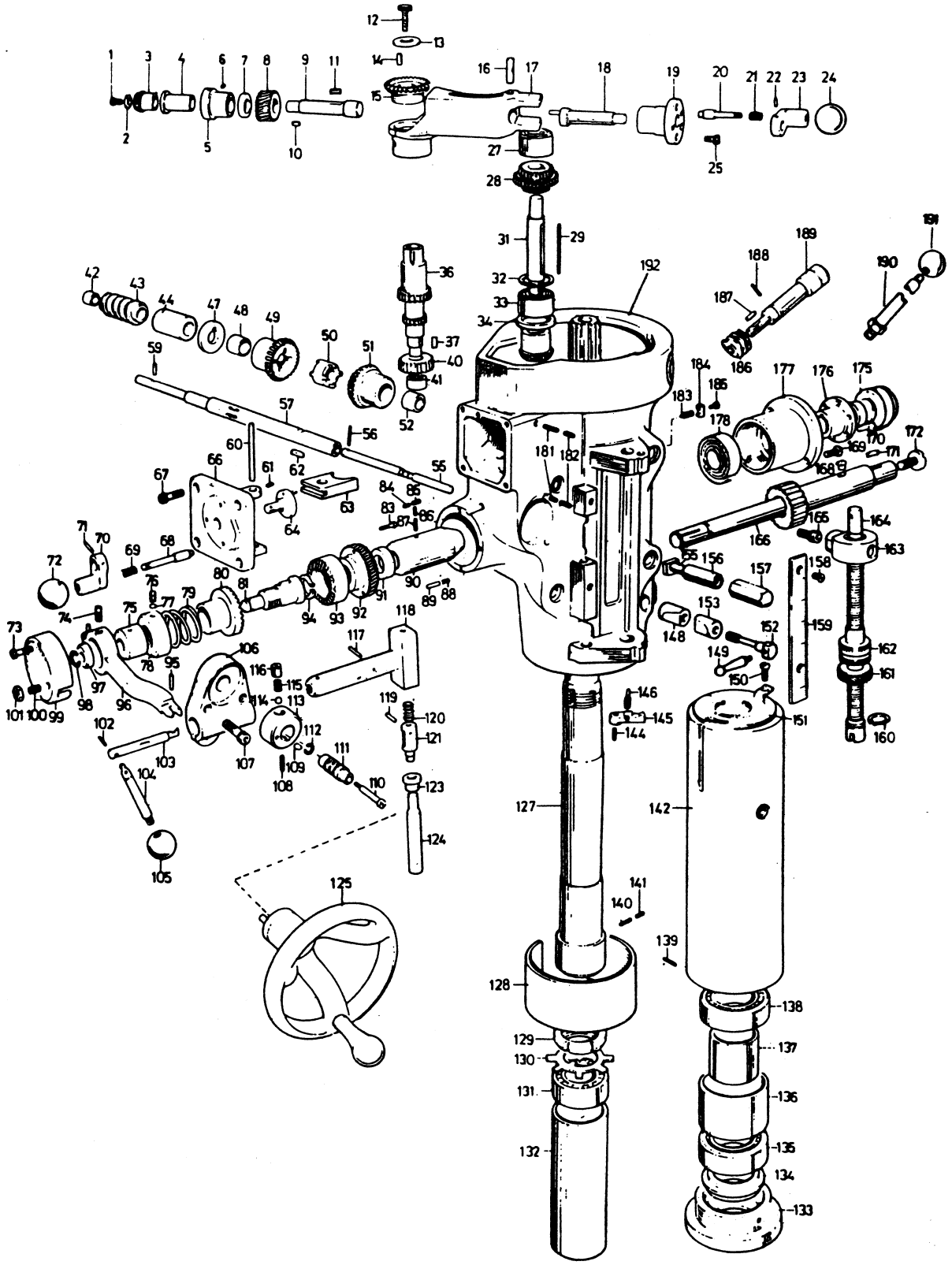
ITEM NO.	PARTS NO.	DESCRIPTION
1	6031	Drawbar for R.8 Collet
2	6032	Drawbar Washer
3	6041	Upper Bearing Locknut
4	6042	Bearing Sleeve Locknut
5	6043	Ball Bearing
6	6044	Upper Bearing Spacer (small)
7	6045	Upper Bearing Spacer (large)
8	6043	Ball Bearing
9	6049	Compression Spring (4 Req.)
10	6249	Socket Set Screw (2 Req.)
11	6047	Spindle Pulley Bearing Sleeve
12	6019	Jam Nut
13	6022	External Lock Washer
14	6018	Brake Ring Screw (3 Req.)
15	6024	Spring (2 Req.)
16	6025	Machine Screw (4 Req.)
17	6020	Brake Lock Stud
18	6014	Brake Assembly
19	6048	Spindle Pulley
20	6040	Spindle Pulley Hub
22	6034	'V' Belt
23	6035	Timing Belt
24	6072	Timing Belt Pulley Flange
25	6071	Timing Belt Pulley
26	6072	Timing Belt Pulley Flange
27	6073	Flat Head Screw
28	6070	Hex Jam Nut
29	6038	Black Plastic Ball Handle (2 Req.)
30	6037	Spindle Clutch Lever
31	6036	Cam Ring
32	6039	Cam Ring Pin (2 Req.)
33	6023	Socket Set Screw
34	6016	Brake Lock Handle
35	6021	Brake Lock Pin
39	6008	Hex Jam Nut (2 Req.)
41	6002	Motor Mounting Studs (2 Req.)
42	6013	Belt Housing

ITEM NO.	PARTS NO.	DESCRIPTION
43	6003	Motor Locknut (2 Req.)
45	6006	Motor Locknut Handle (2 Req.)
46	6007	Black Plastic Ball (2 Req.)
49	6009	Motor Pulley
50	6078	Gear Housing Cover
51	6080	Round HD Screw (5 Req.)
55	6079	Oil Cup
56	6075-1	Bull Gear Key
57	6075	Splined Gear Hub
58	6074	Spindle Bull Gear Assembly
59	6056	Bearing
60	6068	Countershaft
61	6069	Key
62	6067	Countershaft Gear
63	6056	Bearing
64	6066	Dowel Pin
65	6065	Back Gear Shifter Fork
66	6050	Gear Housing
67	6051	Dowel Pin (2 Req.)
68	6052	Roll Pins (2 Req.)
69	6057	Socket Cap Screw (6 Req.)
71	6053	Ball Bearing
72	6054	Snap Ring
73	6077	Lockwasher
74	6076	Bearing Locknut
75	6083	Hex Nut Hardened (3 Req.)
76	6081	Vertical Tee Bolt (3 Req.)
77	6082	Vertical Bolt Washer (3 Req.)
78	6060	Back Gear Shift Crank
79	6167	Roll Pin
80	6058	Back Gear Shift Bushing
81	6168	Shift Crank
82	6171	Black Plastic Ball 1" Dia.
83	6169	Gearshift Plunger
84	6170	Compression Spring
85	6026	Belt Guard Assembly



MILLING HEAD

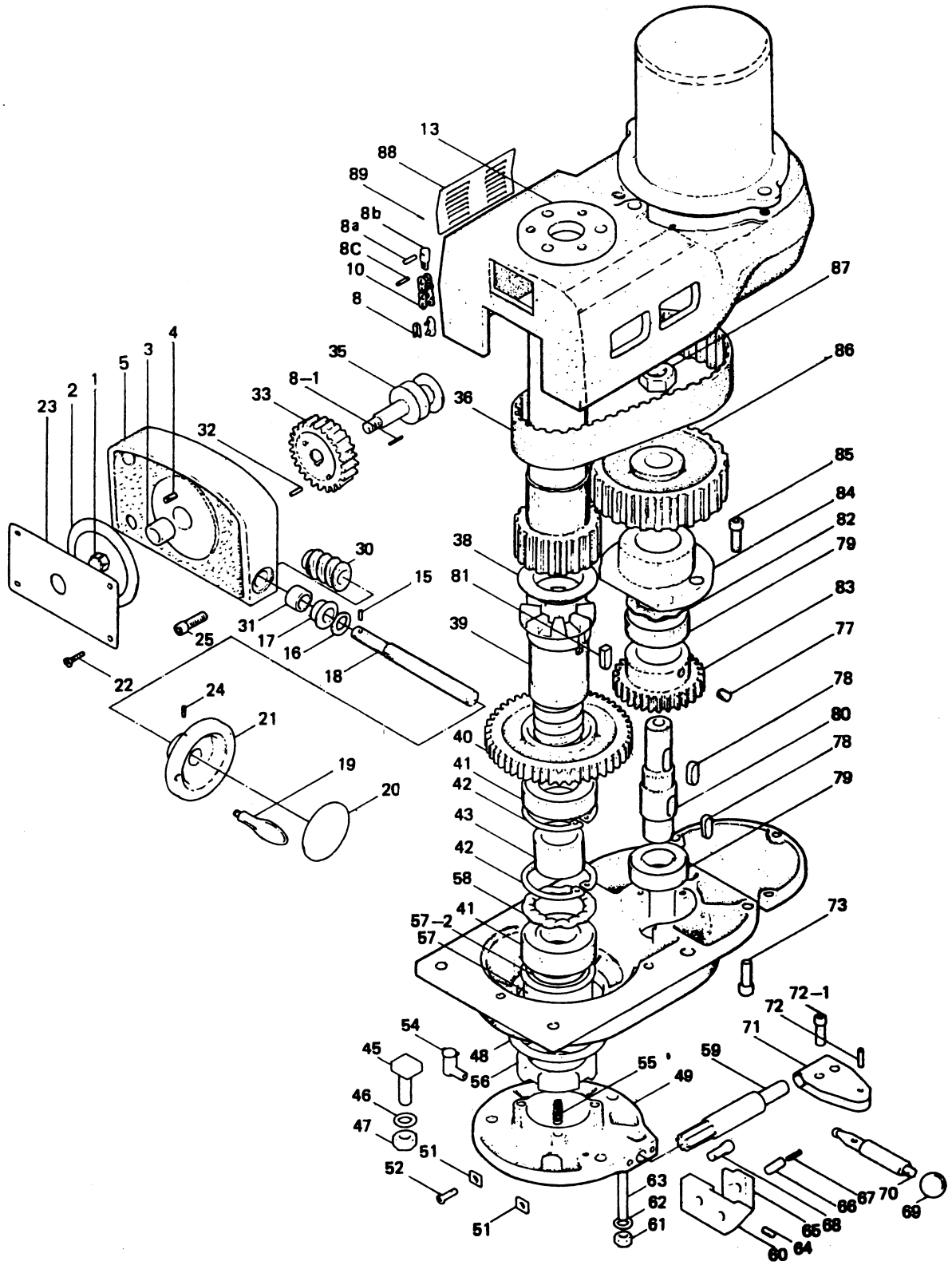
ITEM NO.	PARTS NO.	DESCRIPTION
1	6141	RD. HD. Screw
2	6140	Bevel Pinion Washer
3	6139	Feed Bevel Pinion
4	6138	Feed Worm Gear Shaft Sleeve
5	6137	Worm Cradle Bushing
6	6123	Setscrew
7	6136	Worm Gear Spacer (4 Req.)
8	6134	Feed Drive Worm Gear
9	6133	Feed Drive Worm Gear Shaft
10	6142	Worm Shaft Key
11	6135	Key
12	6150	Locknut
13	6149	Washer
14	6147	Cluster Gear Key
15	6148	Feed Reverse Bevel Gear
16	6122	Feed Engage Pin
17	6121	Worm Gear Cradle
18	6126	Worm Gear Cradle Throw-out
19	6125	Shift Sleeve
20	6169	Gearshift Plunger
21	6170	Compression Spring
22	6128	Roll Pin
23	6168	Shift Crank
24	6131	Black Plastic Ball
25	6132	Cap Screw (3 Req.)
27	6157	Cluster Gear Shaft Upper Bearing
28	6153	Cluster Gears Assembly
29	6160	Cluster Gear Key
31	6151	Cluster Gear Shaft
32	6158	Snap Ring
33	6156	Bevel Gear Bearing
34	6159	Bevel Gear Thrust Spacer
36	6143	Feed Driving Gear
37	6145	Key
40	6144	Feed Drive Gear
41	6252	Needle Bearing
42	6227	Bushing
43	6225	Worm
44	6224	Feed Worm Shaft Bushing
47	6223	Feed Worm Shaft Thrust Washer
48	6221	Bushing
49	6220	Feed Reverse Bevel Gear
50	6222	Feed Reverse Clutch
51	6220	Feed Reverse Bevel Gear
52	6221	Bushing
55	6216	Reverse Clutch Rod
56	6217	Roll Pin
57	6209	Feed Worm Shaft
59	6226	Pin
60	6163	Feed Shift Rod
61	6164	K.P. Set Screw
62	6230	Key
63	6162	Feed Gear Shift Fork
64	6166	Cluster Gear Shift Crank
66	6161	Cluster Gear Cover
67	6165	Cap Screw (4 Req.)
68	6169	Gear Shift Plunger
69	6170	Compression Spring
70	6168	Shift Crank
71	6167	Roll Pin
72	6171	Black Plastic Ball
73	6206	Cap Screw (2 Req.)
74	6202	Clutch Ring Pin (2 Req.)
75	6200	Clutch Ring
76	6199	Socket Set Screw
77	6199-1	Brass Plug
78	6198	Overload Clutch Locknut
79	6197	Safety Clutch Spring
80	6194	Overload Clutch
81	6195	Overload Clutch Sleeve
83	6189	Round Head Screw (3 Req.)
84	6228	Mock-it Lockscrew
85	6228	Socket Set Screw
86	6246	Lockscrew
87	6246-1	Socket Set Screw
88	6191	Compression Spring
89	6193	Overload Clutch Lever Spring Plunger
90	6186	Quill Pinion Shaft Bushing
91	6190	Pinion Shaft Worm Gear Spacer
92	6187	Overload Clutch Worm Gear
93	6188	Overload Clutch Ring
94	6188-1	Snap Ring
95	6236-1	Dowel Pin
96	6203	Overload Clutch Trip Lever
97	6201	Overload Clutch Washer
98	6195-1	Snap Ring
99	6205	Clutch Arm Cover
100	6207	Socket Set Screw
101	6208	Chem Blacked Locknut
103	6239	Cam Rod
104	6234	Trip Handle
105	6233	Black Plastic Ball
106	6231	Feed Trip Bracket
107	6232	Cap Screw (2 Req.)
108	6219	Socket Set Screw
109	6229	Key
110	6214	Feed Reverse Knob Stud
111	6213	Reverse Knob
112	6215	Snap Ring
113	6218	Handwheel Clutch
114	6255	Steel Ball



MILLING HEAD (Continued)

ITEM NO.	PARTS NO.	DESCRIPTION
115	6219-2	Compression Spring
116	6219-1	Handwheel Clutch Spring Screw
117	6237	Roll Pin
118	6236	Cam Rod Sleeve Assy.
119	6241	Roll Pin
120	6242	Compression Spring
121	6240	Trip Plunger
123	6118-1	Trip Plunger Bushing
124	6118	Feed Trip Plunger
125	6210	Handwheel
127	6084	Spindle
128	6086	Quill Skirt
129	6090	Locknut
130	6091	Lockwasher
131	6092	Bearing
132	6094	Sleeve
133	6098	Nose-piece
134	6097	Spindle Dirt Shield
135	6093	Bearing
136	6095	(Bearing Spacer—Large)
137	6096	(Bearing Spacer—Small)
138	6093	Bearing
140	6253	Special Socket Set Screw
141	6254	Collet Alignment Screw
142	6085	Quill
144	6113	Socket Set Screw
145	6111	Feed Trip Lever
146	6112	Trip Lever Pin
148	6116-1	Quill Lock Sleeve
149	6119	Lock Handle
151	6088	Felt Washer
152	6117	Quick Lock Bolt
153	6116	Quill Lock Sleeve Tapped
155	5036	T-Bolt Assy.
156	6120	Lower Clamping Bolt Spacer (2 Req.)
157	5038	Locknut

ITEM NO.	PARTS NO.	DESCRIPTION
158	6244	Chem Blacked RD.HD. Screws (2 Req.)
159	6243	Micrometer Scale
160	6115	Snap Ring
161	6108	Quill Micro-stop Nut
162	6107	Micrometer Nut
163	6105	Quill Stop Knob
164	6104	Quill Stop Micro-screw
165	6106	Screw
166	6172	Quill Pinion Shaft
168	6185	Spring Pin
169	6180-1	RD. Head Screw (2 Req.)
170	6179	Roll Pin
171	6184	Key
172	6183	Pinion Shaft Hub Screw
173	6176	Steel Ball
174	6175	Compression Spring
175	6178	Rack Feed Handle Hub
176	6182	Pinion Shaft Hub Sleeve
177	6180	Spring Cover
178	6181	Clock Spring (Clock Spring Assy.)
181	6246-1	Socket Set Screw
182	6246	Lockscrew
183	6110	Reverse Trip Ball Lever
184	6109	Feed Reverse Trip Plunger
185	6114	Reverse Trip Ball Lever Screw
186	5039	Worm Gear
187	5041	Key
188	5042	Socket Set Screw
189	5040	ADJ Worm Shaft
190	6174	Pinion Shaft Hub Handle
191	6173	Black Plastic Ball Handles
192	6101	Quill Housing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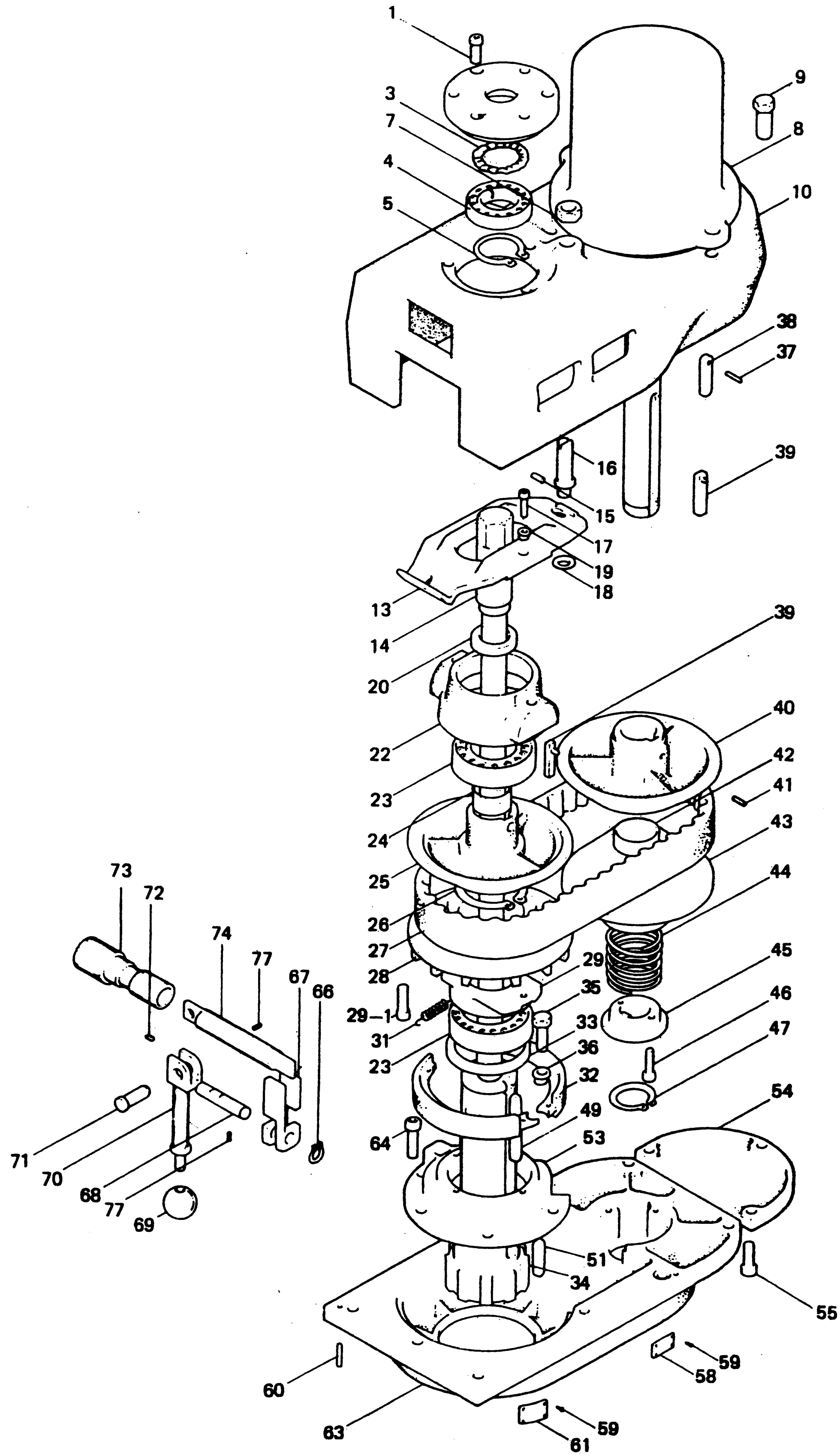
VARI-SPEED HEAD TOP HOUSING

ITEM NO.	PARTS NO.	DESCRIPTION
1	H7001	Hex Cap Nut
2	7002	Vari-Speed Dial
3	7003	Bronze Bearing
4	7004	Full Dog Socket Set Screw
5	H7005	Speed Changer Housing
8	7008	Chain Joint
8-1	7008-1	Roll Pin
8a	7008-a	Roll Pin
8b	7008-b	Speed Change Stud
8c	7008-c	Cotter Pin
10	7010	Speed Changer Chain
13	7013	Top Bearing Cap
15	7015	Roll Pin
16	7016	Spring
17	7017	Bronze Bearing
18	H7018	Speed Change Shaft
19	7019	Handle
20	7020	Caution Plate
21	H7021	Speed Change Handwheel
22	7022	Flat Hd. Cap Screw (4 Req)
23	H7023	Plastic Face Plate
24	7024	Set Screw
25	H7025	Socket HD Cap Screw (4 Req)
30	7030	Worm Gear
31	7031	Bronze Bearing
32	7032	Roll Pin
33	7033	Speed Changer Spur Gear
35	H7035	Speed Changer Chain Drum
36	7036	Belt
38	7038	Timing Pulley Clutch Sleeve
39	7039	Splined Gear Hub
40	7040	Spindle Bull Gear Assembly
41	7041	Ball Bearing (2 Req)
42	7042	Snap Ring (2 Req)
43	7043	Bull Gear Bearing Spacer
45	7045	Vert. Tee Bolts (3 Req)
46	7046	Steel Washer (3 Req)
47	7047	Nut (3 Req)
48	7048	Ball Bearing Gear Sleeve Washer

ITEM NO.	PARTS NO.	DESCRIPTION
49	7049	Fixed Clutch Bracket
51	7051	Guide for Clutch Bracket (2 Req)
52	7052	Flat HD Socket Cap Screw (2 Req)
54	7054	Oil Cap (2 Req)
55	7055	Compression Spring (3 Req)
56	7056	Bearing Locknut
57	7057	Bearing Sleeve
57-2	7057-2	Washer
58	7058	Wave Spring Washer
59	7059	Bull Gear Shift Pinion
60	7060	HI-LOW Detent Plate
61	7061	Hex Nut (3 Req)
62	7062	Lock Washer (3 Req)
63	7063	Studs (3 Req)
64	7064	Socket Set Screw
65	7065	Adjustable Plate
66	7066	HI-LOW Detent Plunger
67	7067	Spring
68	7068	Socket Cap Screw (2 Req)
69	7069	Bakelite Ball Handle
70	7070	HI-LOW Shift Crank
71	7071	HI-LOW Pinion Block
72	7072	Roll Pin
72-1	7072-1	Socket HD Cap Screw (2 Req)
73	7073	Socket Cap Screw (6 Req)
77	7077	Socket Set Screw
78	7078	Key (2 Req)
79	7079	Ball Bearing (2 Req)
80	7080	Bull Gear Pinion Counter Shaft
81	7081	Key
82	7082	Wave Spring Washer
83	7083	Bull Gear Pinion
84	7084	Bull Gear Pinion Bearing Cap
85	7085	Socket HD Cap Screw (2 Req)
86	7086	Timing Belt Pulley (2 Req)
87	7087	Jam Nut
88	H7088	Ventilator (2 Req)
89	H7089	Round HD. Machine Screw (12 Req)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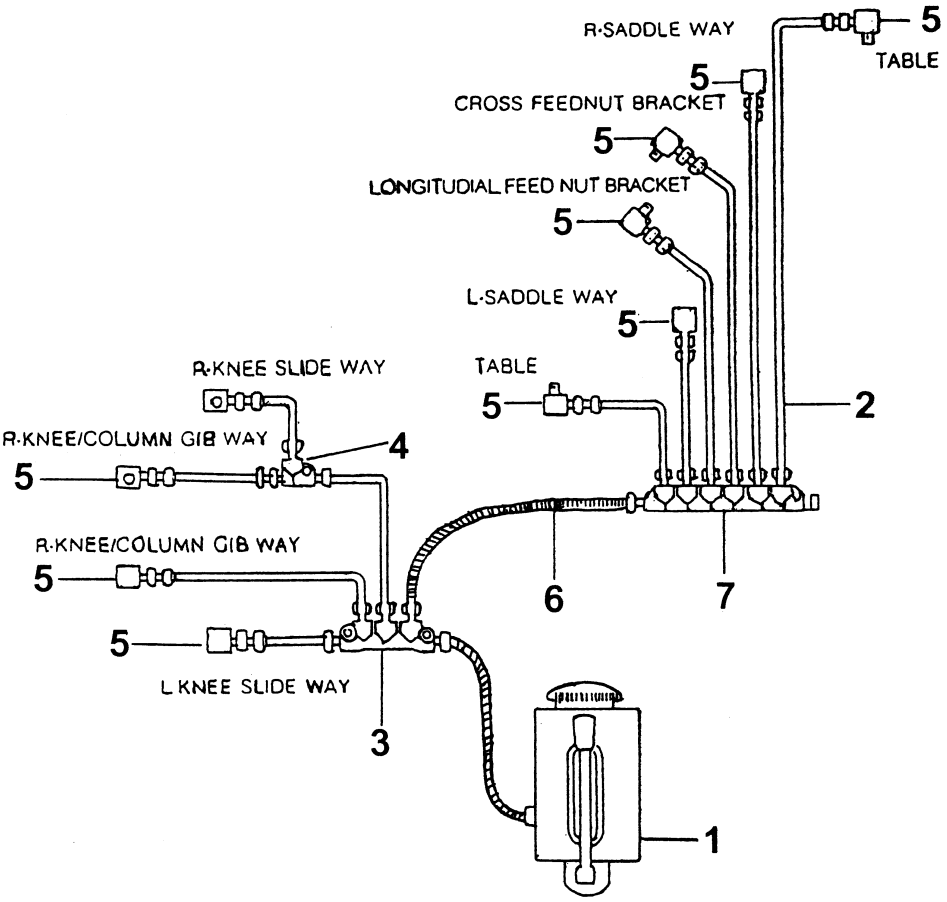
VARI-SPEED HEAD BACK GEAR

ITEM NO.	PARTS NO.	DESCRIPTION
1	8001	Socket Cap Screw (3 Req)
3	8003	Spring Washer
4	8004	Ball Bearing
5	8005	Snap Ring
7	8007	Hex Jam Nut
8	8008	Motor 2HP (complete unit) 230/460 3/60
9	8009	Hex HD Screw (2 Req)
10	H8010	Belt Housing
13	8013	Speed Change Plate
14	8014	Drawbar
15	8015	Cotter Pin
16	8016	Speed Change Plate Pivot Stud
17	8017	Socket HD Cap Screw (2 Req)
18	8018	Washer
19	8019	Pivot Sleeve (2 Req)
20	8020	Draw Bar Washer
22	8022	Spindle Pulley Bearing Sliding Housing
23	8023	Ball Bearing (2 Req)
24	8024	Plastic Insert (2 Req)
25	8025	Adjustable – Driven Varidisc
26	8026	Snap Ring No.
27	8027	Belt
28	8028	Stationary Driven Varidisc
29	8029	Brake Bearing Cap (4 Req)
29-1	8029-1	Socket HD Cap Screw (2 Req)
31	8031	Brake Spring (2 Req)
32	8032	Brake Shoe Assembly
33	8033	Spindle Pulley Spacer
34	8034	Spindle Pulley Hub
35	8035	Hex HD Screw
36	8036	Brake Shoe Pivot Sleeve
37	8037	Roll Dowel Pin

ITEM NO.	PARTS NO.	DESCRIPTION
38	8038	Drive Key
39	8039	Key for ADJ Varidisc Motor Shaft (2 Req)
40	8040	Stationary Motor Varidisc
41	8041	Socket Set Screw
42	8042	Plastic Insert (2 Req)
43	8043	Adjustable Motor Varidisc Assembly
44	8044	Spring for Varidisc Motor Shaft
45	8045	Adjustable Varidisc Spring Collar
46	8046	Socket HD Cap Screw (2 Req)
47	8047	Ret. Ring
48	8048	Socket Cap Screw
49	8049	Plastic Key
51	8051	Key
53	H8053	Belt Housing Base
54	8054	Motor Pulley Cover
55	8055	Socket Cap Screw (3 Req)
58	8058	HI-LOW Range Nameplate
59	8059	Drive Screw (8 Req)
60	8060	Taper Pin (2 Req)
61	8061	Quill Feed Nameplate
63	H8063	Gear Housing
64	H8064	Socket Cap Screw (5 Req)
66	8066	Snap Ring
67	8067	Brake Finger Pivot Stud (2 Req)
68	8068	Brake Operating Finger
69	8069	Bakelite Ball Handle
70	8070	Bake Lock Handle
71	8071	Brake Lock Pin
72	8072	Socket Set Screw
73	H8073	Sleeve for Brake Lock Shaft
74	H8074	Brake Lock Shaft
77	H8077	Socket Set Screw (2 Req)

CENTRAL LUBRICATING OIL-FEEDING EQUIPMENT



ITEM NO.	PARTS NO.	DESCRIPTION
1	9001	Hand Oiler
2	9002	Aluminum Pipe
3	9003	Oil Regulating Distributor
4	9004	Joint
5	9005	Elbow Joint
6	9006	Outside Steel Flexible Tube
7	9007	Oil Regulating Distributor

Figure 14. Oil Feeding System

ATRUMP MACHINREY INC

670 Union Ave. Pomona CA 91768
Tel: +1-909-623-6887 Fax:+1-909-922-7596

www.atrump.com
sales@atrump.com