

MANUAL NO. M-105D

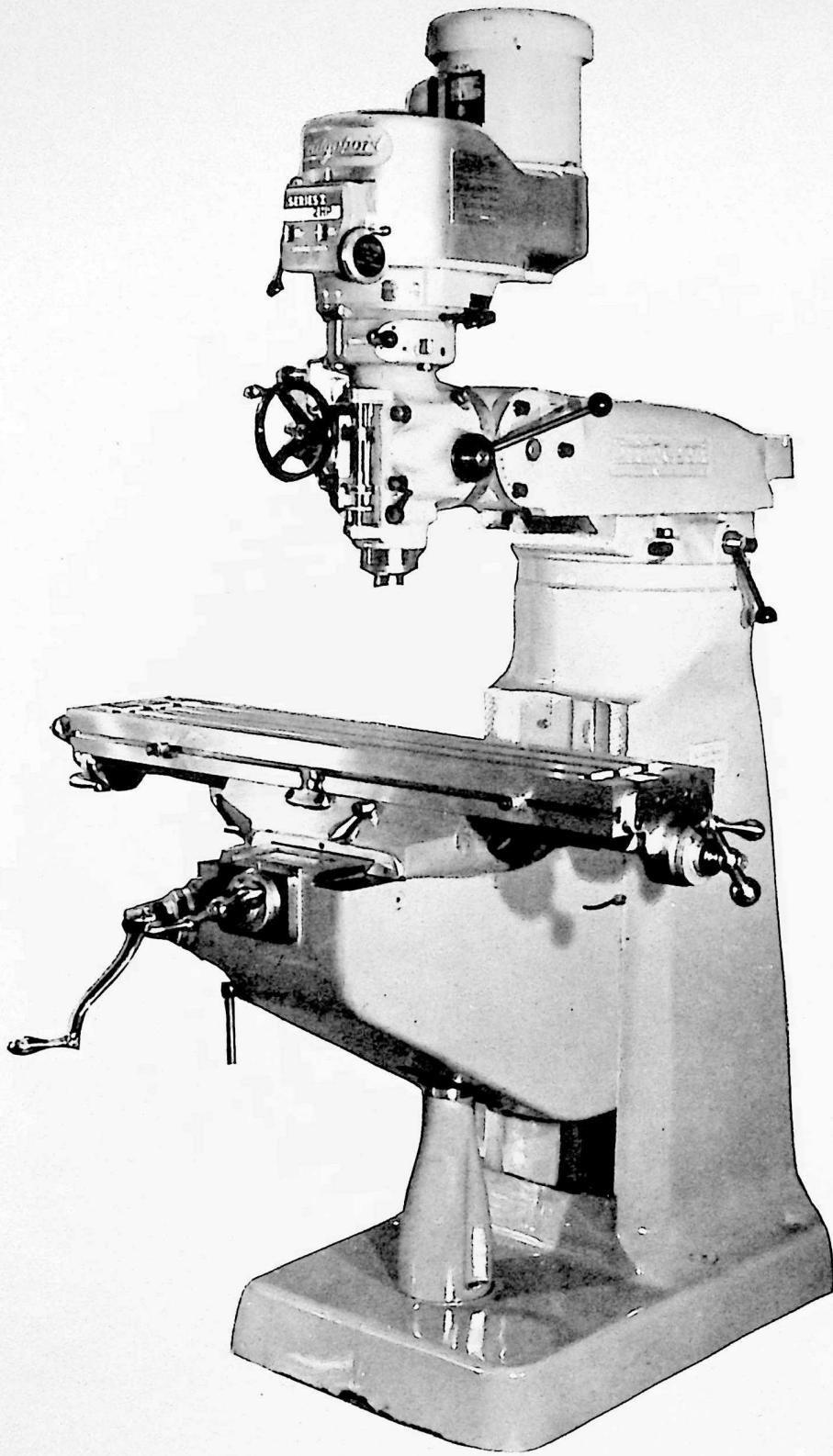
**BRIDGEPORT SERIES I
MILLING MACHINE**

NOVEMBER, 1978

**INSTALLATION, OPERATION
AND
MAINTENANCE**

Bridgeport® **TEXTRON**

Bridgeport Machines Division of Textron Inc.



BRIDGEPORT SERIES I TURRET MILLER MODEL BR2J

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IMPORTANT

POINT OF OPERATION SHIELDING

The proper type of shielding at point of operation on a milling machine necessitates sound judgement by the user for the provision of adequate shielding in accommodating the specific type of workpiece being machined.

For an in-depth understanding of "Point of Operation Guarding", Bridgeport recommends the following publication:

"Machine Guarding – Assessment of Need"

Published by:
U.S. Department of Health, Education and Welfare
Public Health Service
Center for Disease Control
National Institute for Occupational
Safety and Health
Division of Laboratories and
Criteria Development

The design of specific type shielding for protection at point of operation on a milling machine can only be completed when the particular workpiece to be machined has been determined. As such, most industrial centers today have numerous manufacturers of machine type shielding. These manufacturers can provide both general purpose type shielding and special design type, using both metal and plastic materials.

To assist Bridgeport users, there are many manufacturers available that are typical of the below noted who can build to your specifically designed shielding requirements.

- (1). The Cincinnati Ventilating Co., Inc.
7410 Industrial Road
Florence, Kentucky 41042

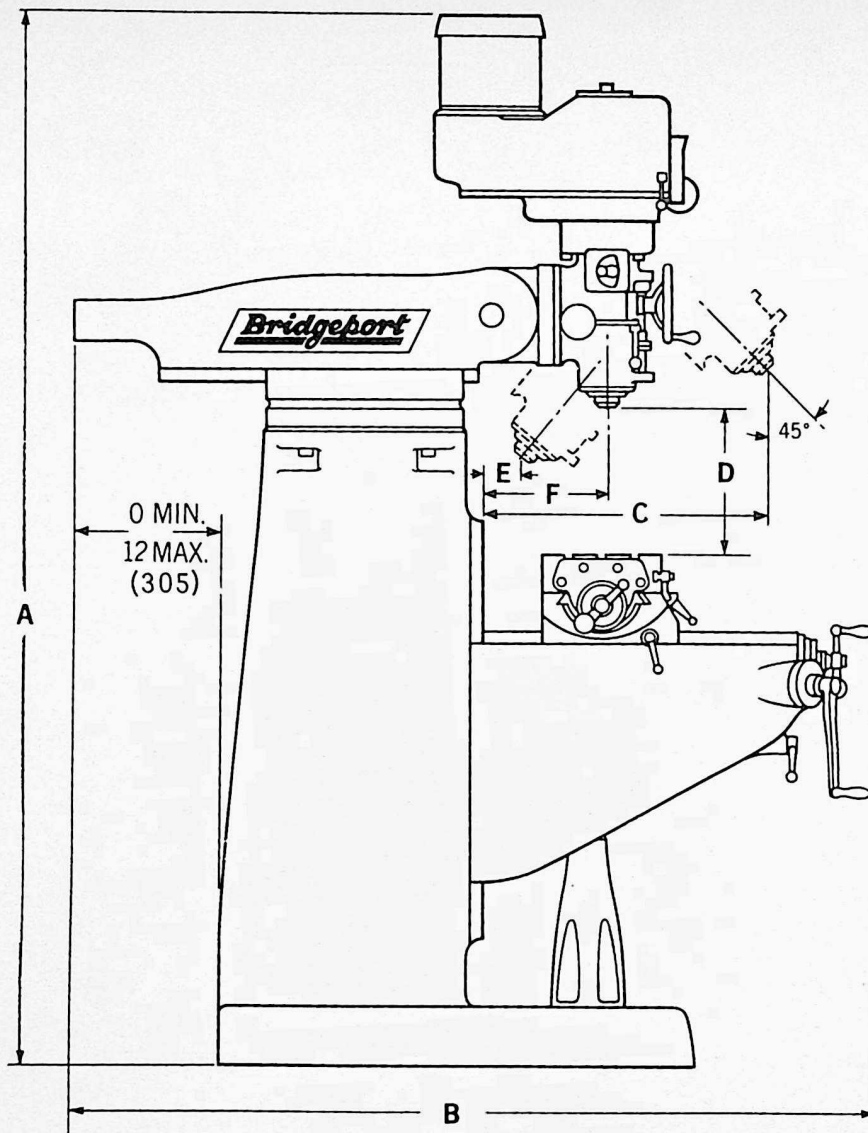
(1-606-371-1320) – Mr. R. Kevin Martin

- (2). Willco Plastics
918A South 4th Street
St. Louis, Missouri 63102

(1-314-241-2490) – Mr. R. R. Will

- (3). Plastics Composites Corporation
8301 North Clinton
Fort Wayne, Indiana 46805

(1-219-484-3139) – Mr. John R. Larimore



	LONGITUDINAL TRAVEL			TABLE LENGTH		
	30 in. (762mm)			42 in. (1067mm)		
	36 in. (914mm)			48 in. (1219mm)		
	A	B	C	D	E	F
MIN.	82 3/16(2088)	51(1295)	8 3/4(222)	0	0	6 3/4(171)
MAX.	82 3/16(2088)	63(1600)	20 3/4(527)	18-1/2(470)	12(305)	18 3/4(476)

NOTE: Metric specifications in parenthesis

Figure 1. Principal Dimensions

MACHINE SPECIFICATIONS

Range

Table travel (X-axis)	30 in. (762mm) (42" table)	36 in. (914mm) (48" table)
Saddle travel (Y-axis)	12 in. (305mm)	
Quill travel	5 in. (127mm)	
Knee travel (Z-axis manual)	16 in. (406mm)	
Ram travel	12 in. (305mm)	
Throat distance (min.)	6-3/4 in. (171mm)	
(max.)	18-3/4 in. (476mm)	
Table to spindle nose gage line (min.)	2-1/2 in. (64mm)	
Max. weight of workpiece	750 lbs. (340 kg.)	

Table

Overall sizes	9 x 42 in. (229 x 1067mm)	9 x 48 in. (229 x 1219mm)
T-Slots	3 on 2-1/2 in. (64mm) centers	
T-Slot size	5/8 in. (16mm)	
Height above floor (max.)	47-1/4 in. (1200mm)	

Milling

	<u>Std. Power Feed</u>	<u>High Torque Power Feed</u>
Feed rate*	(X) 3/4-35 ipm (19-889mm/min.)	(X) 3/8-15 ipm (9.5-381mm/min.)

Space and weight

Floor area	7 x 10 ft. (2.1 x 3.1m)
Height	82-1/16 in. (2088mm)
Net weight	1988 lbs. (900 kg)
Shipping weight	2180 lbs. (989 kg)

Power

Electrical supply-60 Hz., 3 phase	208/230/460/575V
--------------------------------------	------------------

Color

Standard - Bridgeport Gray

*Power optional

1.2 MILLING HEAD SPECIFICATIONS

MODEL	"M" HEAD	"M" HEAD HI Speed	"J" HEAD	"J" HEAD HI Speed	"J" HEAD HI Speed	"2J" (Before 1977)	"2J" (After 1977)
Power	.5 HP	.5 HP	1.0 HP	1.5 HP	1.5 HP	1.5 HP	2.0 HP
Motor RPM	1200 RPM	3600 RPM	1800 RPM	3600 RPM	3600 RPM	1800 RPM	1800 RPM
Speed Ranges - RPM LOW HIGH	6 Steps 275 - 4550	6 Steps 300 - 8000	8 Steps 80 - 325 660 - 2720	8 Steps 160 - 660 1320 - 5440	8 Steps 160 - 660 1320 - 5440	Stepless 60 - 500 500 - 4200	Stepless 60 - 500 500 - 4200
Quill Travel Quill Diameter	3.5 in (88.9 mm) 2.562 in (65 mm)	3.5 in (88.9 mm) 2.562 in (65 mm)	5.0 in (127 mm) 3.375 in (86mm)	5.0 in (127 mm) 3.375 in (86 mm)	5.0 in (127 mm) 3.375 in (86 mm)	5.0 in (127 mm) 3.375 in (86 mm)	5.0 in (127 mm) 3.375 in (86 mm)
Spindle Tapers:	#2 Morse #7 B&S B-3	#2 Morse #7 B&S B-3	R-8 #30 Q.C.	R-8 #30 Q.C.	R-8 #30 Q.C.	R-8 #30 Q.C.	R-8 #30 Q.C.
Spindle Diameter	1.437 in (36.5mm)	1.875 in (48 mm)	1.875 in (48 mm)	1.875 in (48 mm)	1.875 in (48 mm)	1.875 in (48 mm)	1.875 in (48 mm)
Spindle Feed Rate	Manual	Manual	.0015/Rev (.038mm) .003/Rev (.076mm) .006/Rev (.152mm)	.0015/Rev (.038mm) .003/Rev (.076mm) .006/Rev (.152mm)	.0015/Rev (.038mm) .003/Rev (.076mm) .006/Rev (.152mm)	.0015/Rev (.038mm) .003/Rev (.076mm) .006/Rev (.152mm)	.0015/Rev (.038mm) .003/Rev (.076mm) .006/Rev (.152mm)
Drilling Capacity -Manual Drilling Capacity -Power	.50 in (12.7mm)dia. 1.50 in (38mm)dia.	.50 in (12.7mm)dia. 1.50 in (38mm)dia.	.75 in (19 mm) dia. .37 in (9.4mm)dia.	.75 in (19 mm) dia. .37 in (9.4 mm) dia.	.75 in (19mm) dia. .37 in (9.4mm) dia.	.75 in (19mm) dia. .37 in (9.4mm) dia.	.87 in (22mm) dia. .37 in (9.4mm) dia.
Boring Capacity	1.50 in (38mm)dia.	1.50 in (38mm)dia.	6.0 in (152.4mm)dia.	6.0 in (152.4mm)dia.	6.0 in (152.4mm)dia.	6.0 in (152.4mm)dia.	6.0 in (152.4mm)dia.
Milling Capacity	1.0 in ³ /min (16cc/min)	1.0 in ³ /min (16cc/min)	1.5 in ³ /min (24cc/min)	1.5 in ³ /min (24cc/min)	2.0 in ³ /min (32cc/min)	2.0 in ³ /min (32cc/min)	2.0 in ³ /min (32cc/min)
Spindle to Column-Minimum Maximum	7.5 in (190.5 mm) 19 in (483 mm)		6.75 in (171mm) 18.75 in (476mm)	6.75 in (171mm) 18.75 in (476 mm)	6.75 in (171mm) 18.75 in (476mm)	6.75 in (171mm) 18.75 in (476 mm)	6.75 in (171mm) 18.75 in (476 mm)

UNCRATING

Carefully remove protective crating and skids so that the machine and parts are not marred, scratched or impaired. In the event of damage in transit, communicate AT ONCE with our representative and the transportation company making delivery.

Machine should be lifted by placing a sling under the ram as illustrated on page 5.

SHORTAGES

Check shipment carefully, against the itemized packing list which is included in the parts box. In case of shortages, report them IMMEDIATELY to the representative from whom the machine was purchased, indicating parts not received which have been checked on the packing list.

CLEANING

Thoroughly clean protective coating from machine with suitable cleaning solution.

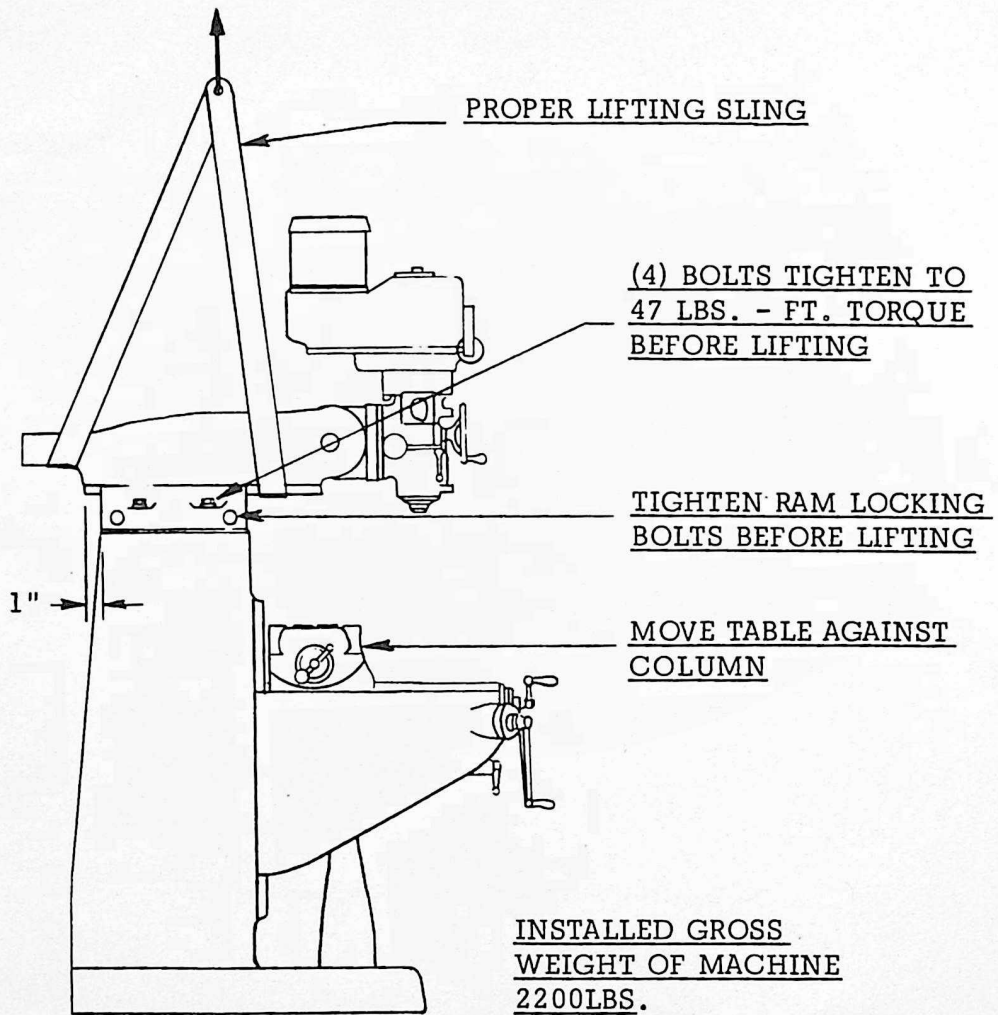
WARNING: It is not recommended that gasoline or any other highly inflammable cleaning agent be used.

Do not move the table, saddle, knee or any moveable part 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 the ram, and move it forward and backward to the full length in order to clean and lubricate.

POSITIONING HEAD IN UPRIGHT POSITION

Loosen four locking bolts, pull stop pin, item no. 133 page 26, out to detent and rotate head to vertical position. Proceed with alignment of head as described on page 8. Tighten nuts evenly, using normal pressure. Care should be taken to avoid excessive pressure since this will cause distortion in the quill. Tighten all nuts to 25 ft. lbs. torque - no more, no less - then repeat to 50 ft. lbs.

LIFTING THE MACHINE



PLACING ON SOLID FOUNDATION

The column and base are cast in one piece. 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 a floor that has any surface irregularities, shims should be used to correct this condition to the greatest extent possible.

NOTE: It is recommended that the machine be secured to the floor to prevent movement or tipping due to off-center loading.

See Figure 2 for installation layout.

LEVELING MACHINE

Set machine by levelling the work table lengthwise and crosswise with a precision instrument. After levelling machine, lower the knee and remove protective material from between head and table.

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 machine to the plant power supply, have qualified electrician proceed as follows:

1. Check required machine voltage against power supply to ensure that they are compatible.
2. Connect machine wiring to power supply making sure connection is in compliance with local safety regulations.
3. Check for correct spindle rotation. In the HIGH SPEED range, the spindle should rotate clockwise when viewed from the top of the machine.

NOTE: Drum switch and HI-NEUTRAL-LO lever must be in HI range.

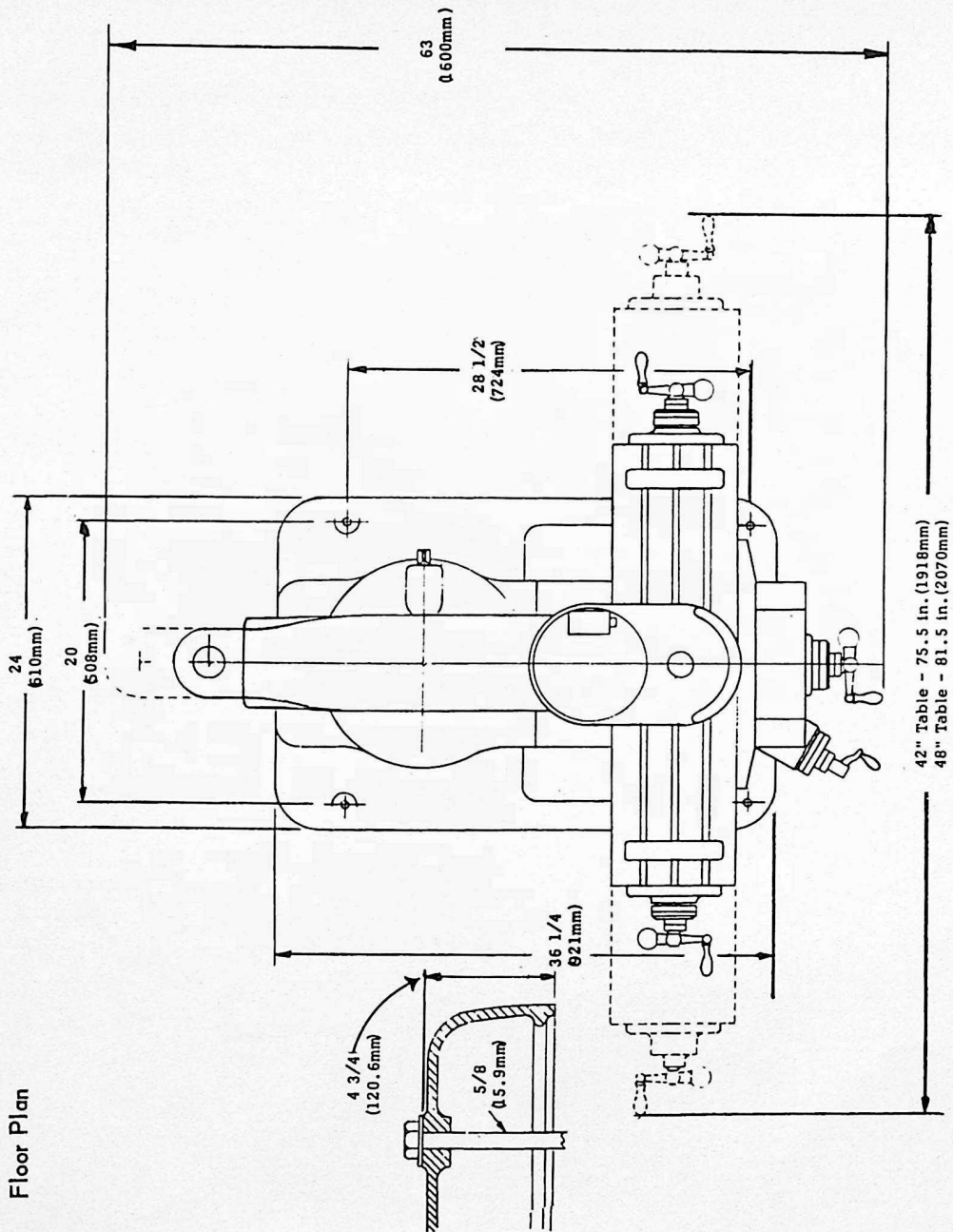


Figure 2. Installation Layout

ALIGNMENT OF HEAD

In case of precision boring or work of that nature, where it necessary to have head perfectly square with the table, use method prescribed below. For normal milling, graduations on the head are close enough. To set head perfectly square with table, see Figure 3. This may be done with head and adapter on overarm, by adjusting adapter through worm gear on adapter. Loosen three locking bolts but leave drag on same for fine adjustment. To square head to table in the longitudinal axis, mount indicator as shown in Figure 4.

NOTE: When indicating as in Figure 3, it should be noted that the table is fitted to be slightly high in front, usually about $.0005''$.

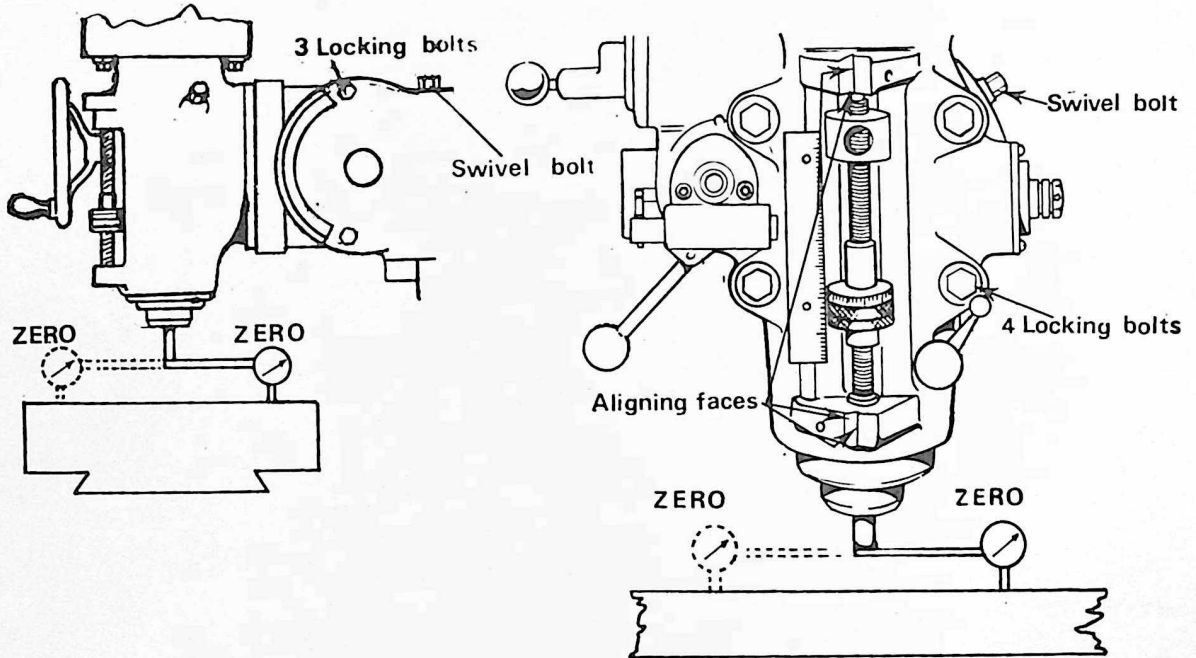
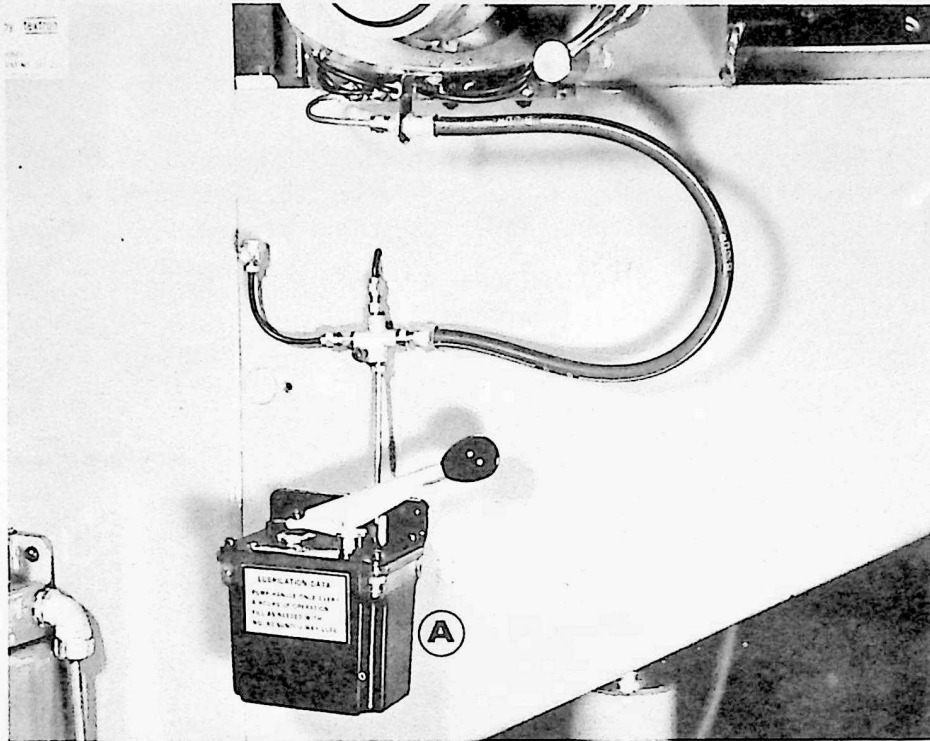


Figure 3. Head Alignment Y Axis

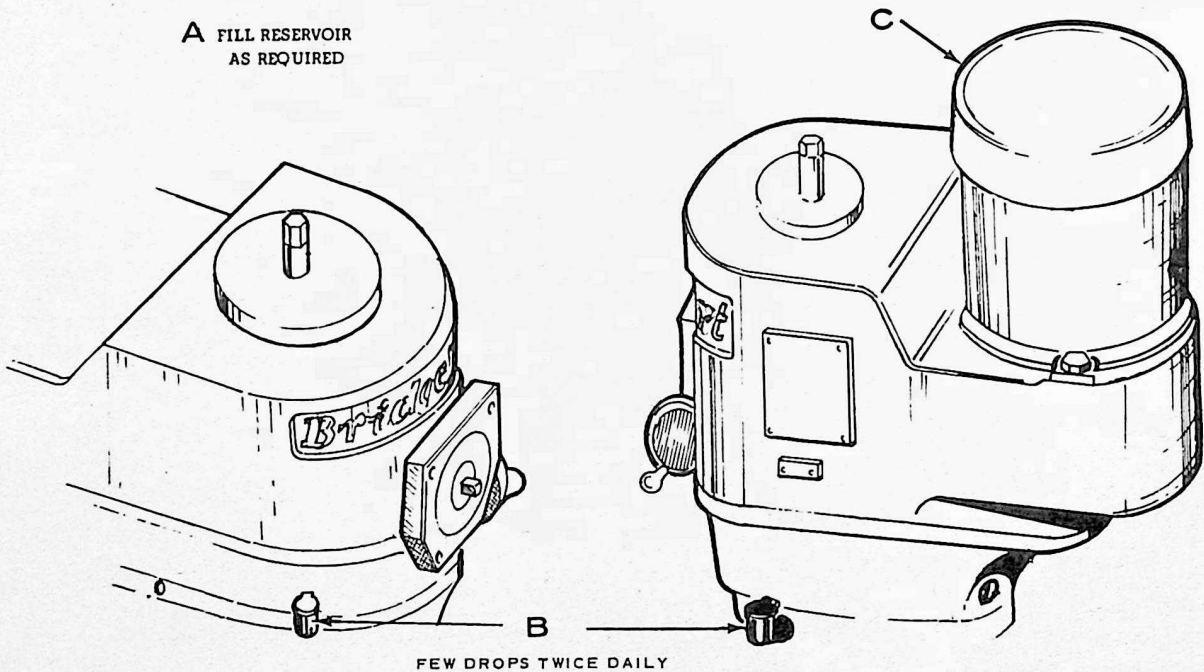
Figure 4. Head Alignment X Axis

LUBRICATION

Do not operate machine until properly lubricated. Follow the instructions given in Figure 5.



A FILL RESERVOIR
AS REQUIRED



FEW DROPS TWICE DAILY

Figure 5. Recommended Lubrication

- A. Way Surfaces—Lead Screws**
"Sunoco" Waylube #80
or equivalent
- B. Milling Heads (Spindle Bearings)**
S.A.E. 10 or 10W Light Oil
(none on grease packed heads)
- C. Motors are greased for life of bearings**
For further instructions refer to
motor manufacturer's instruction book

ATTACHMENTS: POWER FEED

Oil to sight level with
Mobilube No. 46 S.A.E. 140

SHAPING ATTACHMENT

Shell Nassa Oil J78 or K79
Socony Gargoyle Vactra
Oil (Heavy Medium)

SHAPING ATTACHMENT (Worm drive)

Shell Nassa Oil J78 or K79
Socony Cylinder Oil 600W

ADJUSTMENT OF TABLE GIB

The table is provided with a full length tapered gib in the saddle, with an adjusting screw on the left side. To take up gib, tighten gib screw slightly and repeat until a slight drag is felt when moving the table by hand.

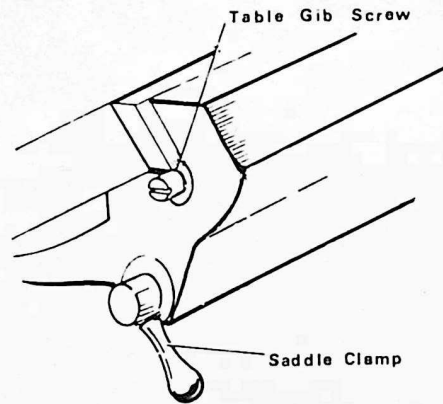
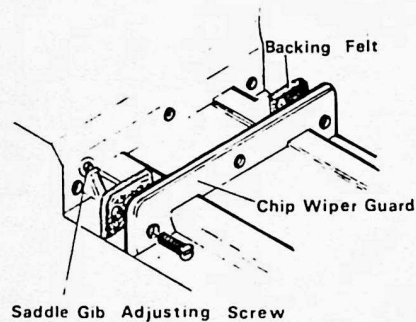


Table-saddle gib

ADJUSTMENT OF SADDLE AND KNEE GIBS

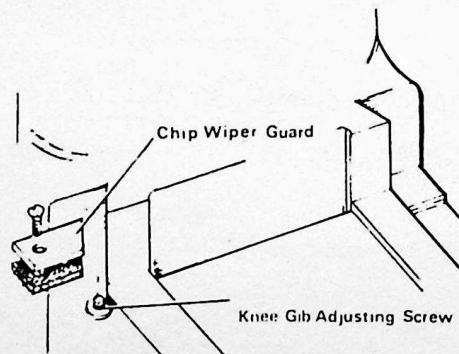
A tapered gib is used for adjusting the saddle bearing on the knee. This forms a guide for the saddle. To tighten gib same principal as described above is used; however, chip wiper has to be removed first.



Saddle-knee gib

ADJUSTMENT OF KNEE GIB

Remove chip wiper and adjust screw until smooth movement is attained.

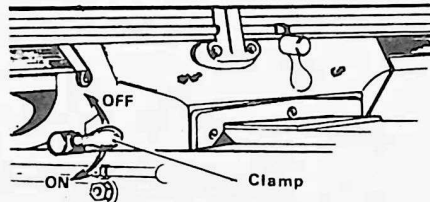


Knee-Column gib

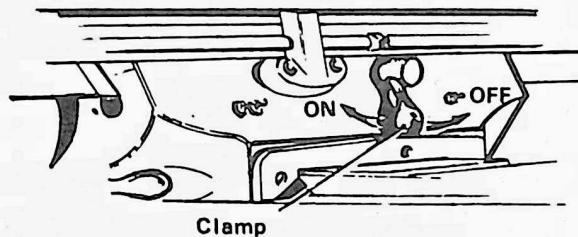
CLAMPING TABLE, SADDLE AND KNEE

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.

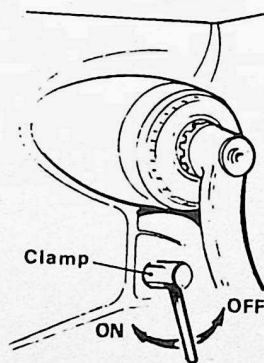
Excessive pressure can cause slight table bind. Use moderate clamping pressure, as this will hold saddle sufficiently.



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



The knee clamping lever is at the left side of the knee and should be drawn upward to clamp the knee. This is only a tension brake and will not lock the knee completely. Leave clamped at all times unless using knee in operation.



REMOVING TABLE

Remove as follows: Ball crank handles, dial holders, bearing brackets. Screw will then turn all the way so that it can be removed. When this is accomplished, the table can easily be taken off merely by sliding from saddle. See Figure 6.

REMOVING SADDLE

Follow along the same lines as removing table; however, it is necessary to remove entire front bracket assembly completely. Then remove nut bracket which has become accessible after table has been removed. See Figure 6.

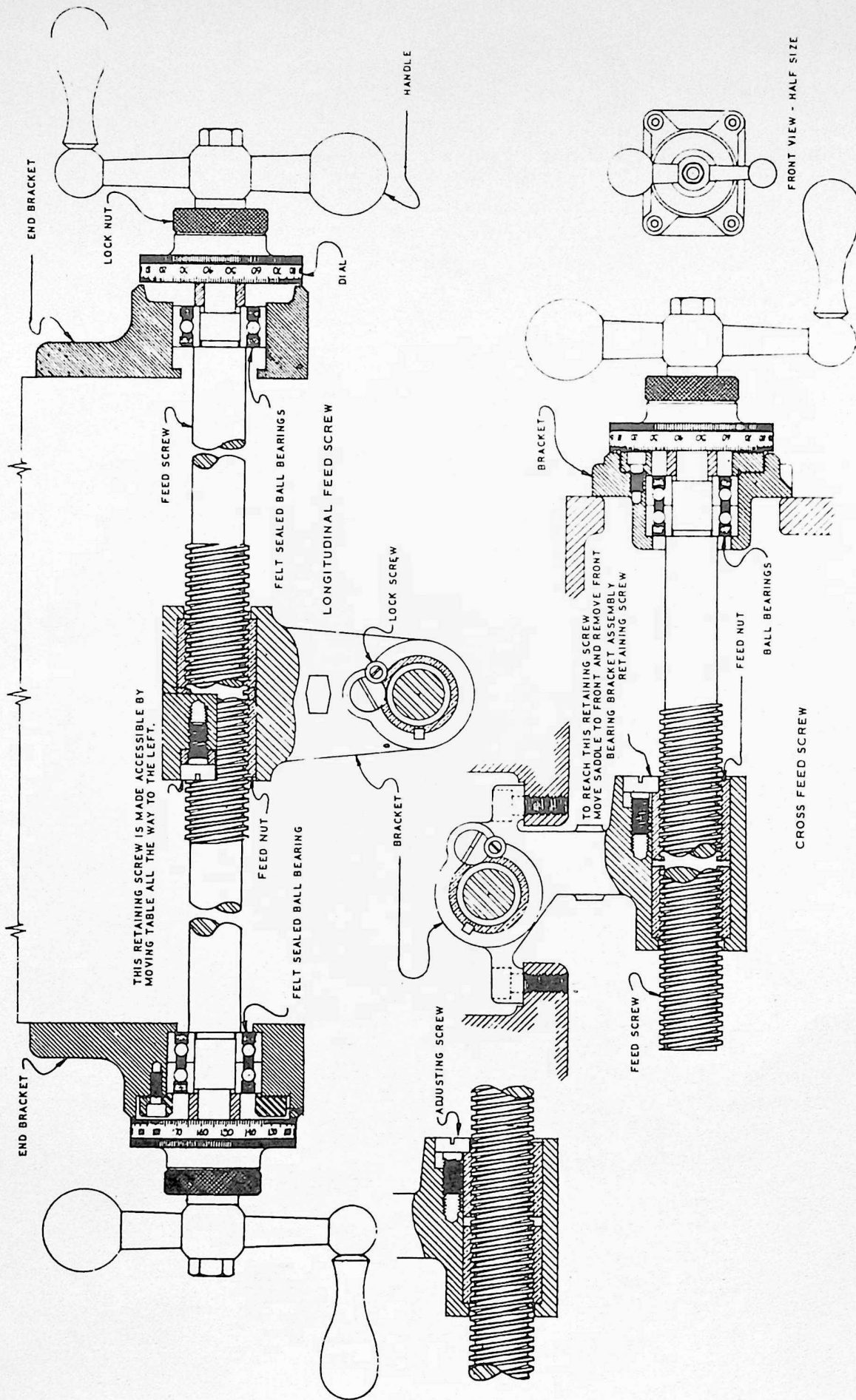


Figure 6. Longitudinal and Cross Feed Assembly

ASSEMBLY INSTRUCTIONS
FOR MOUNTING 2-J VARIDRIVE ATTACHMENT TO RAM ADAPTER

Lift the attachment . Insert the four tee bolts into the ram adapter and position them to match the bolt holes in the attachment.

Slide the attachment onto the bolts, insert the spacers and washers and secure with the nuts.

Tighten all the nuts with 25 ft. lbs. of torque, no more -- no less, and then repeat with 50 ft. lbs.

CAUTION: Improper tightening of these could cause a choppy quill movement.

LUBRICATION:

The useful life of this attachment will be determined to a large extent by proper lubrication. Carefully observe the nameplate recommendations and avoid substitutions.

OPERATING INSTRUCTIONS:

DO NOT attempt to change spindle RPM unless the motor is running. Dial speeds will only be approximate. Belt wear will cause a slight inaccuracy in speeds as indicated by the dial.

When tightening or loosening the drawbar it is necessary to lock the spindle. To accomplish this, use spindle brake and lock, which is located on the left side of belt housing, turning it either to the right or left until it binds, then raise handle.

Drawbar has 7/16-20 right hand thread and should be tightened with normal amount of pressure using wrench furnished with machine. To loosen collet back off drawbar and if collet does not open immediately, give knob on top of drawbar a slight tap. Spindle has non-sticking taper and collet should release readily.

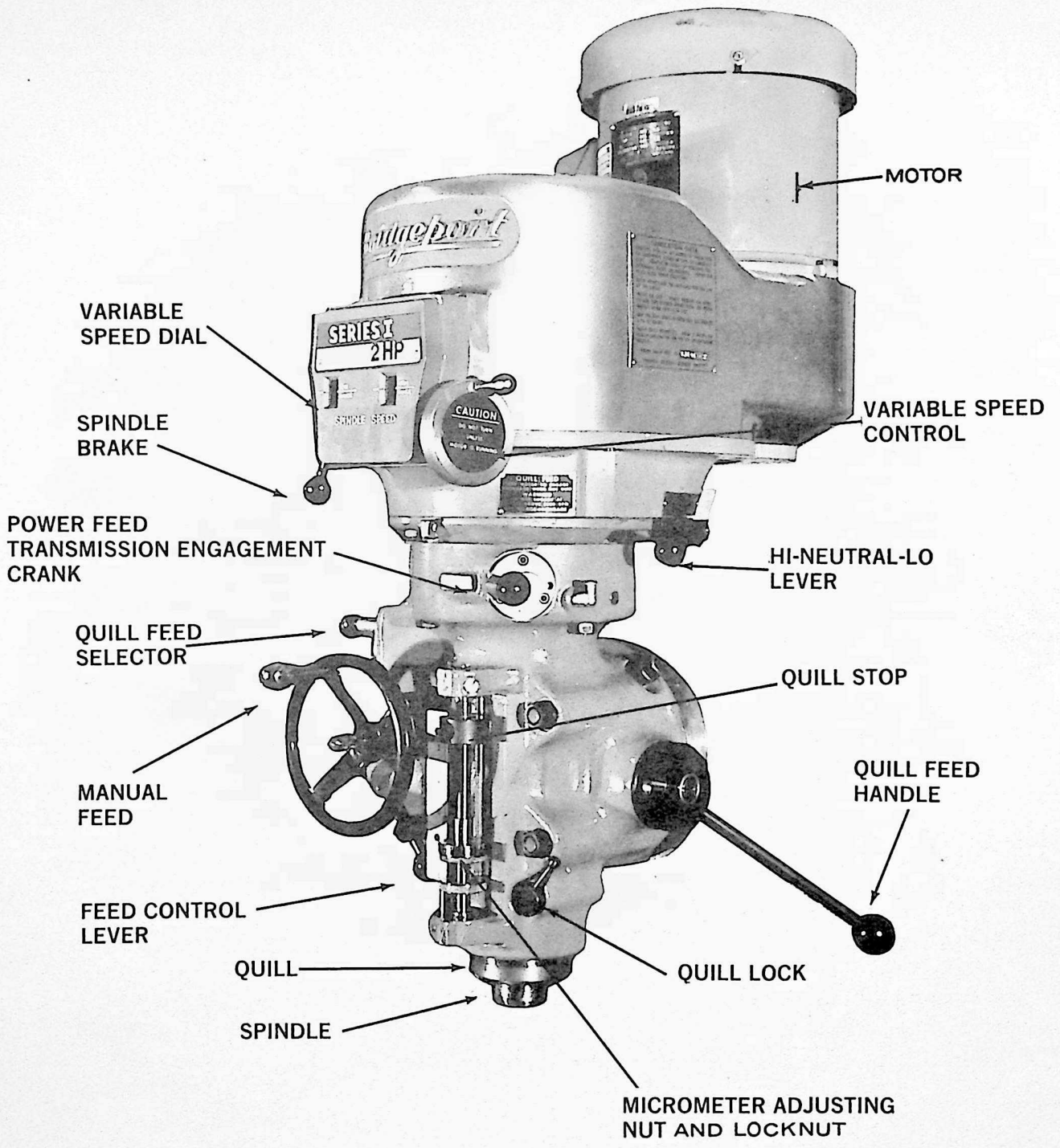


Figure 7. 2J Milling Attachment

SPINDLE BRAKE:

Brake 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. When brake is worn out it has to be replaced. There are no adjustments to be made.

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 turned on with brake in locked position.

HIGH-LOW RANGE SWITCH:

This is the motor reversing switch. When the attachment is in direct drive (High Speed) the motor and spindle are turning in the same direction. When the attachment is in "Back Gear" (Low Speed) the spindle would run backwards unless the motor direction is reversed.

The back-gear lever is marked Hi-Lo. This will indicate the proper switch position. They should be alike or the spindle will run backwards.

HI-NEUTRAL-LO LEVER:

This lever is used to put the attachment into either backgear or direct drive. Rotate the spindle by hand to facilitate meshing of clutch or gears.

Neutral can also be obtained at mid-way position. After a long period of use, the neutral position may cause noise (in neutral only) by allowing the clutch teeth to rub each other.

This can be corrected by reversing the position of the detent plate.

Neutral is provided to permit free spindle rotation for indicating and set-up work.

HI POSITION:

In the high speed position (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 avoided by moving the detent plate upward as the clutches wear. This is also the reason for possible loss of neutral, requiring the reversal of the detent plate.

CAUTION: DO NOT shift while motor is running.

POWER FEED TRANSMISSION ENGAGEMENT CRANK:

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

NOTE: Crank cannot be swung around in counter clockwise direction; however, no damage will occur if moved in this direction. To engage the worm a clockwise movement is required.

CAUTION: Power feed worm gear may be engaged when spindle is rotating, however, it should be engaged gently to avoid damage to worm gear. The worm gear may be disengaged at any time. DO NOT use Power Feed at speeds 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:

This crank is used for selecting the three feeds; .0015", .003" and .006" per revolution. It is shifted by pulling knob out and turning from one position to the other. Feeds are stamped on cover below indentation hole. Feed is more readily engaged when spindle is running.

FEED REVERSING KNOB:

Position of this handle 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:

Reversing clutch knob should be in neutral position and feed control lever engaged. Clockwise rotation of handwheel moves quill down. The Manual Feed Handwheel and the Quill Feed Handle may be disengaged by moving them outward about 1/8".

NOTE: 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:

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

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

CAUTION: When adjusting the screw, check automatic disengagement in both directions; that is with micrometer nut against the quill stop for down position and quill stop against throw out pin for up position.

QUILL FEED HANDLE:

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

QUILL STOP:

Is used to disengage automatic feed in either direction as well as the setting point for working to given depths.

MICROMETER ADJUSTING NUT:

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:

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

POSITION OF RAM:

Can be regulated by loosening two bolts on turret and pulling the ram in or out 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 face of turret as possible, as maximum rigidity is then obtained.

RECOMMENDATIONS:

Use 2, 3, or 4 flute end mills. Eight flute end mills are usually not as satisfactory. 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" in diameter. Use manual feed for drills larger than 3/8".

Overload clutch is set at factory to hold up to 200 lbs. down pressure on quill, which will accommodate drills up to 3/8" diameter in mild tool steel.

CAUTION: This clutch should not be tampered with in the field.

OPERATING INSTRUCTIONS

CAUTION: DO NOT try to change speed position until motor is running. This could cause breakage of parts.

Spindle Speeds are adjusted by turning the small handwheel on the front of the belt housing. There are two ranges shown; 60 to 500 and 500 to 4200.

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

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, then rotate the spindle nose by hand until the gears line up, then put the unit in "LO" (back gear).

500 to 4200 is obtained through direct drive and is the high range. The same lever and switch as above are used; selecting the "HI" range.

When shifting to "Hi," do not force the lever if the clutch teeth do not mesh. It is a simple matter to engage the brake and rotate the spindle nose by hand until the clutches engage.

Wear on the vari-drive belt will cause a slight change in the speeds as shown on the dial. This can be corrected as follows. Crank the speed control snugly against the high speed stop. (This will be near the 4200 reading on the dial.) Use a tachometer to determine the spindle speed, and turn the adjusting screw (after loosening the jam nut) 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 acorn nut in the center of the dial and setting the dial accordingly.

CAUTION: Try to avoid shifting the HI-LO lever when the feed worm is engaged.

DO NOT LOOSEN the upper 3 hex nuts on the spindle housing. These are set at the factory and are used only for clutch alignment.

SWIVELING THE VARI-DRIVE may be accomplished by loosening the lower 3 hex nuts attaching the Vari-Drive unit to the spindle housing and then swiveling to any desired position.

WARNING: Care must be taken to secure the nuts when the attachment is in position, before the motor is turned on.

REMOVING THE MOTOR (See Figure 8)

Run the attachment to the bottom of either speed range and shut off the motor. This puts the vari-drive belt in the best position for disassembly.

1. **DISCONNECT THE POWER AND THEN REMOVE THE SWITCH** from the side of the belt housing.
2. Remove the cover (B) (lower end of motor shaft). Use two cover screws (A) to fasten the spring (C) on the lower end of the motor shaft, to the lower motor vari-drive pulley. This will reduce the hazard of personal injury that is always present when a heavy spring is under compression. When the pulley, spring retainer, and spring are securely fastened as a single unit, crank the speed dial to top speed position.
3. Now remove the screws (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 deeply into the spindle pulley, providing the slack needed to slip the belt over the motor pulley.

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

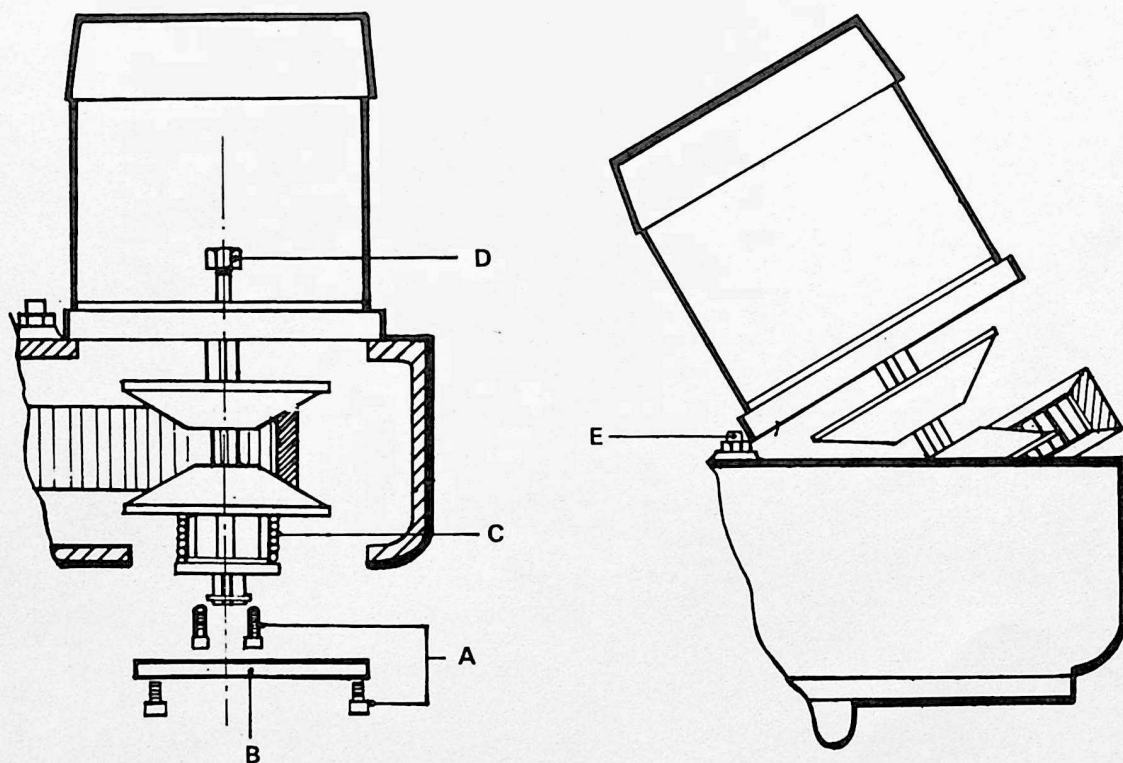


Figure 8. Motor Removal

CHANGING VARI-DRIVE BELT (Figure 9)

Complete the above procedures for removing the motor, then remove the three screws (A) and lift out the top bearing cap (B). Looking down inside of the housing, locate and remove two socket head cap screws and bushings (C). Next, the four screws (D) and the screw (E) holding the bell housing (G) to the sub-plate must be removed. Unscrew and remove the two lower screws in the speed changer bracket just below the speed dial (F).

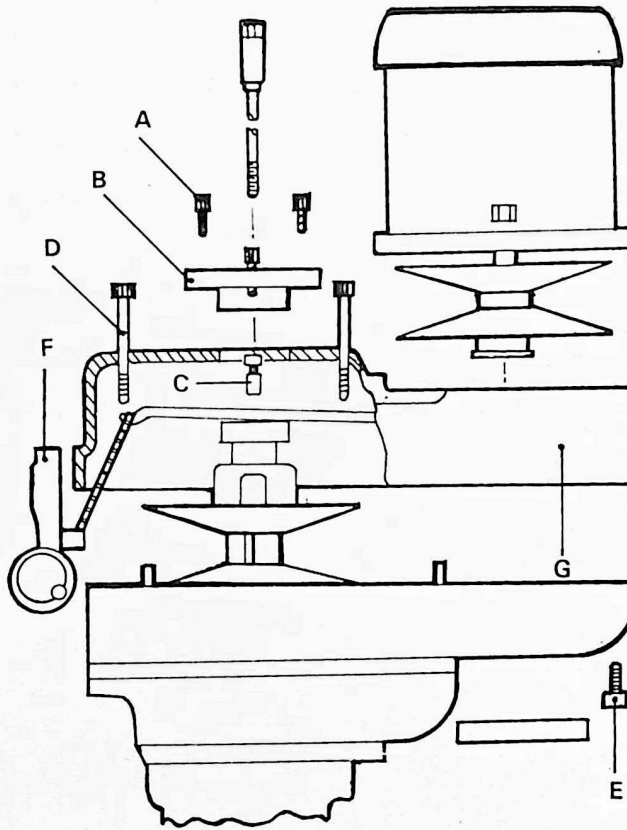


Figure 9. Removing Vari-Drive Belt

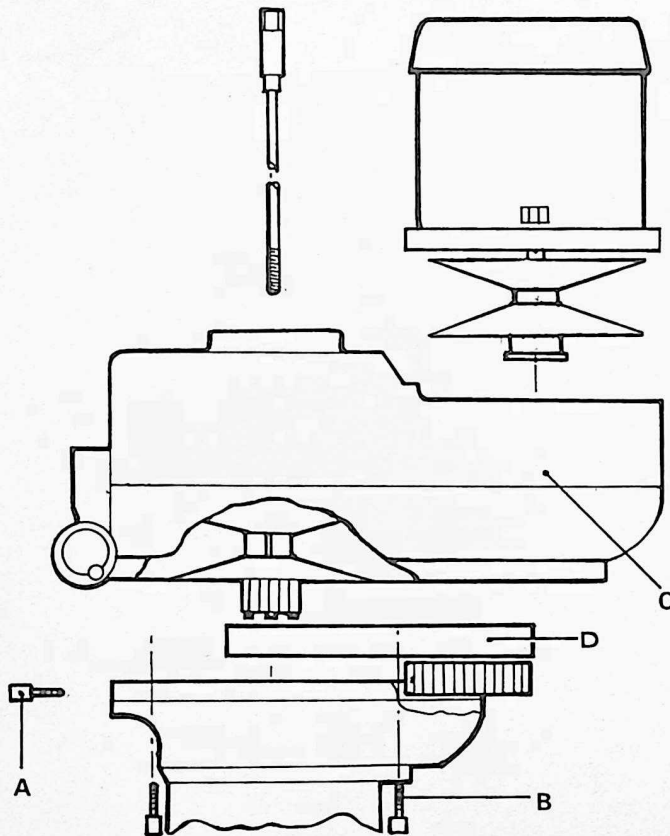
The belt housing, complete with speed changer bracket, is now removed from its sub-plate. A slight blow under the speed changer bracket may be needed to separate the housing from its base.

Remove the old belt and replace it with a new belt. **DO NOT** use a substitute belt purchased from other than a Bridgeport Dealer. Vibration and heat could result from the use of the wrong belt.

CHANGING TIMING BELT (Figure 10)

Complete the operation for removing the motor. Then put the (Hi-Neutral-Lo) lever in the Lo position, remove the drawbar and lower the spindle.

Remove screws (B) holding the upper and lower housings together, including the two lower screws (A) in speed changer bracket just below the speed dial.



CHANGING H.T.D. BELT (Figure 10)

A slight blow under the speed changer bracket may be needed to separate the upper housing (C) from its base. The two upper screws on the speed changer bracket should be loosened now.

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

Remove the old belt and replace with a new belt.

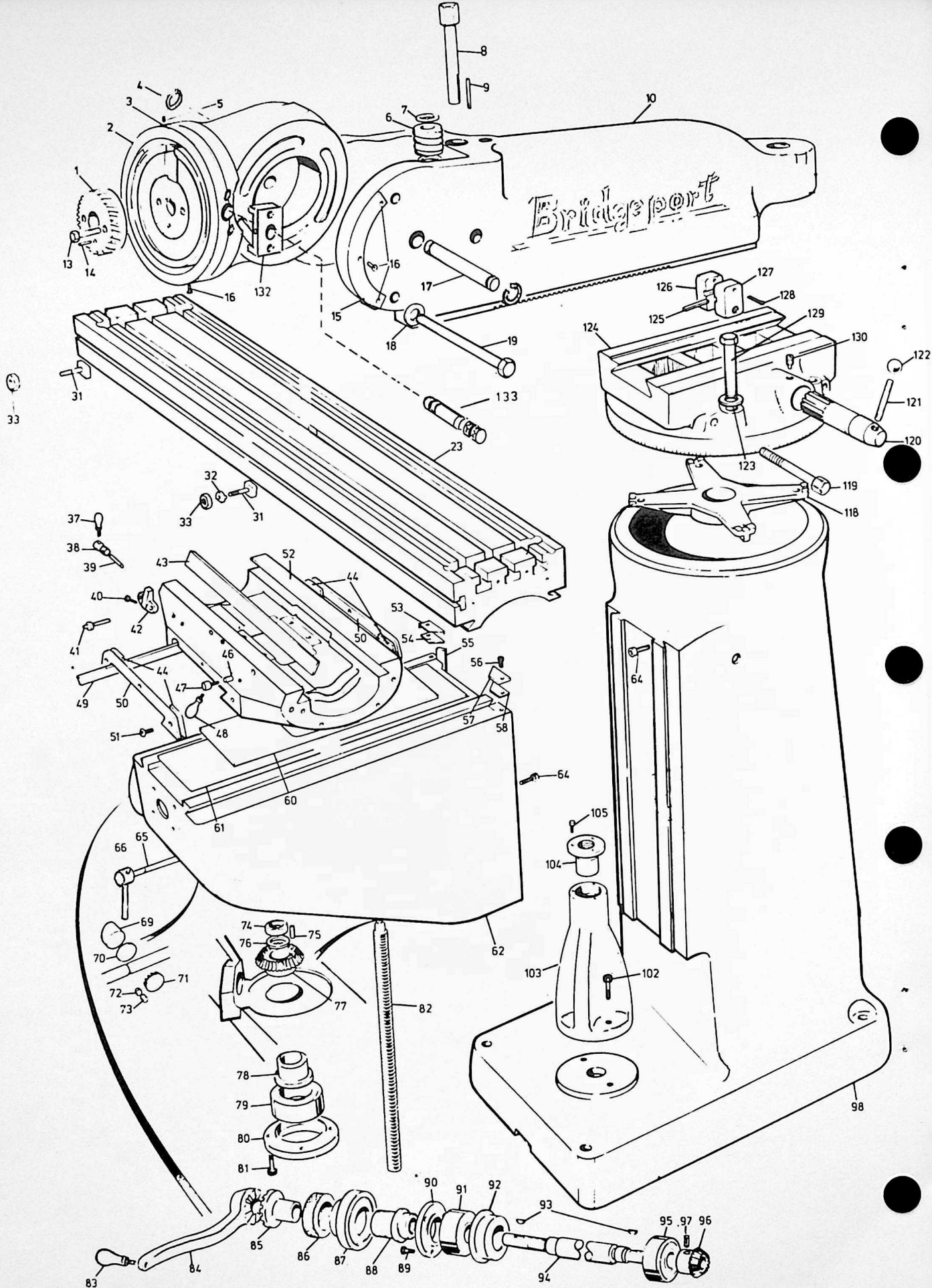
GENERAL SPEED RECOMMENDATIONS

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-Med.-(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	349	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	244	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	196	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

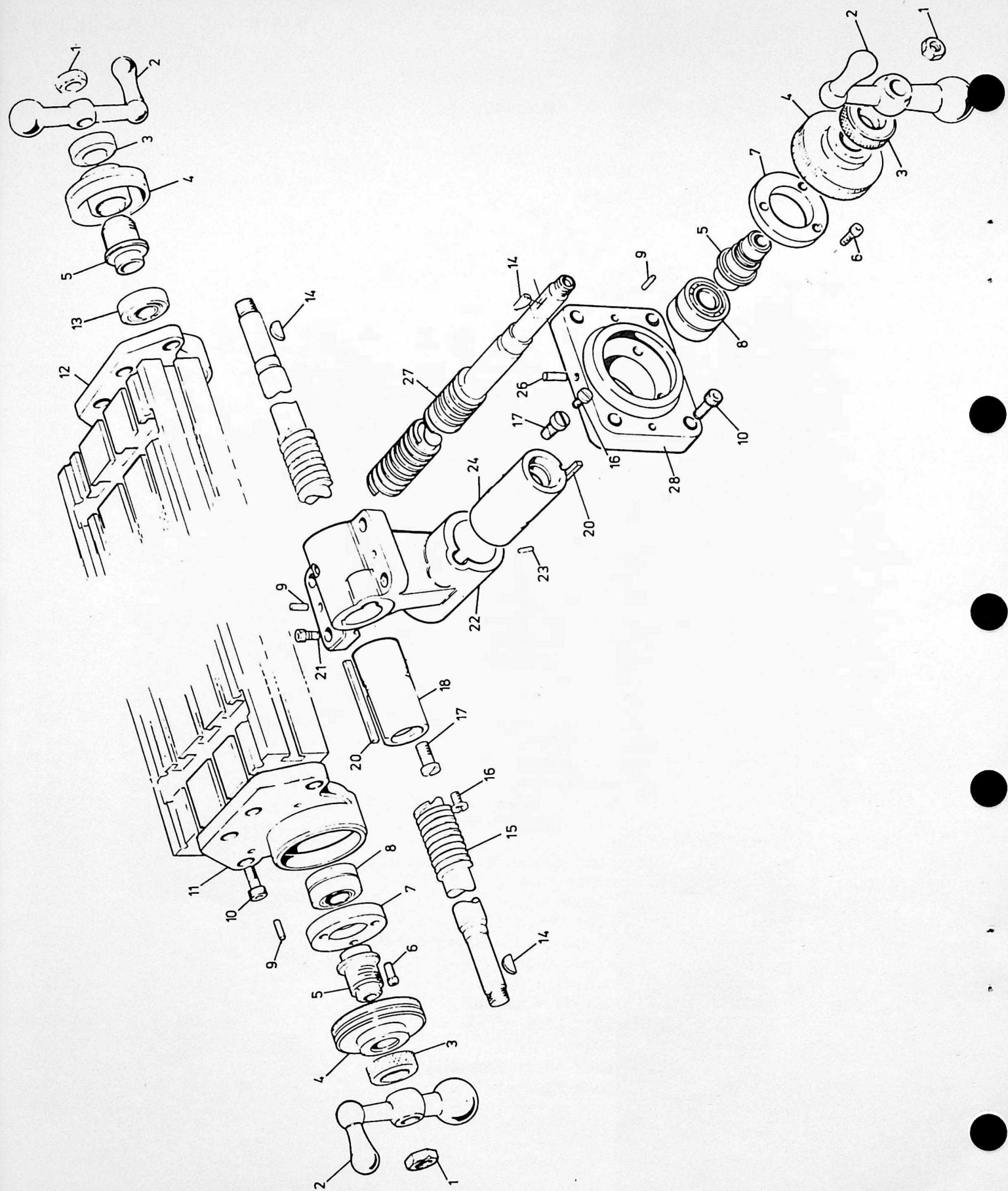
PARTS IDENTIFICATION



ITEM NO.	CODE NO.	DESCRIPTION
1	2193500	Quill Housing ADJ. Gear
2	2060129	Ram Adapter
4	1060892	Snap Ring
5	1011216	Socket Set Screw (2 Req.)
6	1062206	Vertical Adjusting Worm
7	2060135	Worm Thrust Washer (2 Req.)
8	2060130	Vertical Adjusting Worm Shaft
9	2060138	Worm Key
10	2060128	Ram
13	1011035	Socket Cap Screw (2 Req.)
14	1010590	Roll Dowel Pin
15	1062826	Angle Plate
16	1011555	Round HD Drive Screw (5 Req.)
17	2061028	Adapter Pivot Pin
18	2200109	Chamfered & Hardened Washer (7 Req.)
19	1061180	Adapter Locking Bolt (3 Req.)
23	2060021	Table 36" (2060022 - 42" - 2060023 - 48")
31	1061602	Stop Piece T-Bolt (3 Req.)
32	1062301	Table Stop Piece (2 Req.)
33	1011720	Hex Nut (3 Req.)
37	2060120	Table Lock Bolt Handle
38	2060126	Saddle Lock Bolt
39	2060125	Saddle Lock Plunger
40	1011071	Socket HD Cap Screw (2 Req.)
41	2060088	Gib Adjusting Screw (3 Req.)
42	2060121	Table Stop Bracket
43	2060117	Saddle/Table Gib
44	1062406	Felt Wipers (4 Req.)
46	2060118	Table Lock Plunger
47	2060119	Table Lock Bolt
48	2060120	Table Lock Bolt Handle
49	2060124	Saddle/Knee Gib
50	2060123	Saddle Knee Wiper Plate (2 Req.)
51	1011580	Oval Head Screw (6 Req.)
52	2060097	Saddle
53	2060093	Left Hand Column Wiper Holder
54	1062405	Knee Wiper Felt
55	2060146	Knee/Column Gib
56	1011035	Allen Cap Screw (2 Req.)
57	2060094	Right Hand Column Wiper Holder
58	1062405	Knee Wiper Felt
60	1060152	Chip Guards - Upper
61	1060153	Chip Guards - Lower
62	2060206	Knee 12"
64	2060095	Stop Screw
65	2061230	Knee Lock Shaft Assembly
69	2060089	Knee Lock Plunger

M A C H I N E

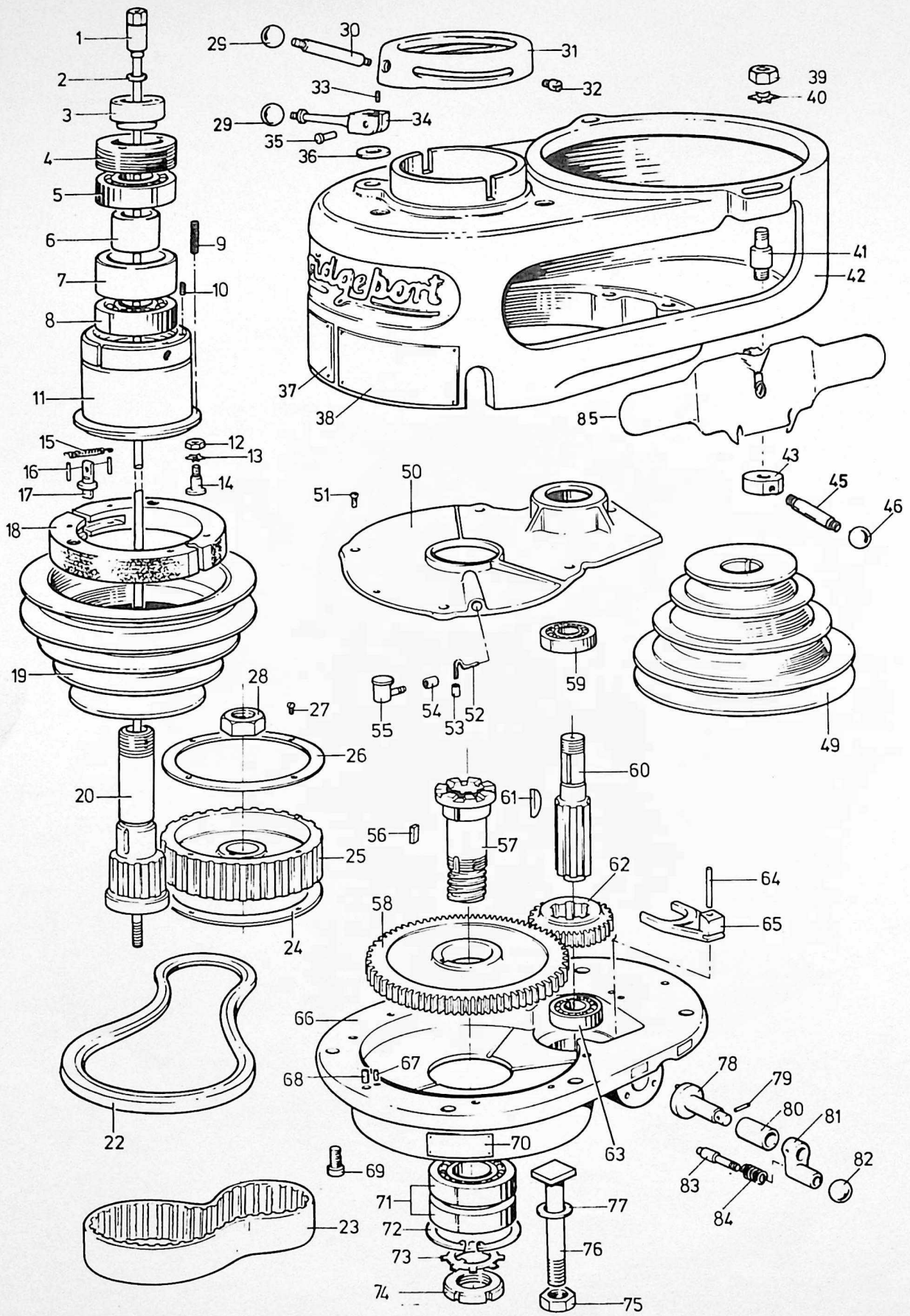
ITEM NO.	CODE NO.	DESCRIPTION
70	1111912	Washer
71	1010786	Knee Binder Plug (Plastic)
72	1011375	Dog Point Set Screw
73	1011270	Set Screw
74	1011755	Jam Nut
75	2060071	Key
76	2060072	Washer
77	1062204	Bevel Gear
79	1060205	Sealed Ball Bearing
80	2060070	Bearing Retainer Ring
81	1011030	Socket Head Cap Screw
82	2061238	Elevating Screw Assembly
83	2060060	Handle
84	2060080	Elevating Crank
85	2060079	Gearshaft Clutch Insert
86	2060078	Dial Lock Nut
87	2060076	Dial with 100 Graduations
88	2060077	Dial Holder
89	1011030	Socket Head Cap Screw
90	2060210	Bearing Retaining Ring
91	1060204	Grease Sealed Bearing
92	2060074	Bearing Cap
93	1013078	Key
94	2060147	Elevating Shaft for 12" Knee
95	1060204	Grease Sealed Bearing
96	1062205	Bevel Pinion
97	1011220	Set Screw
98	2060209	Column
102	1011074	Socket Head Cap Screw
103	2060207	Pedestal
104	2060051	Elevating Screw Nut
105	1011033	Socket Head Cap Screw
118	2060144	Spider
119	2060133	Ram Lock Stud
120	2060134	Ram Pinion
121	2060139	Ram Pinion Handle
122	1192150	Plastic Ball
123	2200109	Chamfered x Hardened Washer
124	2060143	Turret
125	2060137	Ram Clamp Bar
126	2060141	Ram Clamp Untapped
127	2060136	Ram Clamp Tapped
128	1010770	Split Pin
129	1061178	Locking Bolt
130	2060140	Ram Pinion Screw
131	1113051	Wrench
132	2650180	Stop Bracket
133	2069999	Stop Pin



LEADSCREW ASSEMBLY

(See pages 48 thru 50 for Metric Kits)

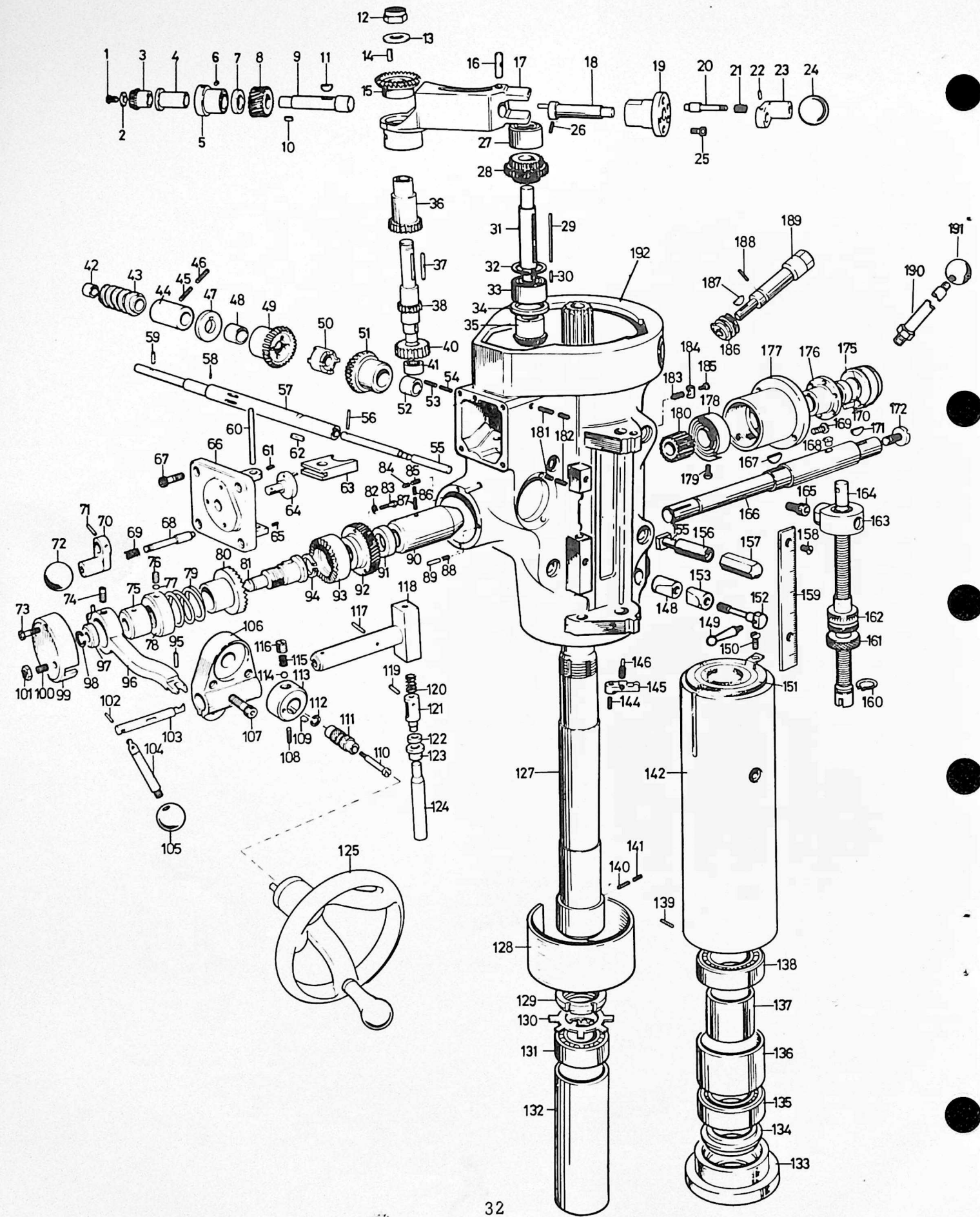
ITEM NO.	CODE NO.	DESCRIPTION
1	1011755	Jam Nut (3 Req.)
2	2060085	Ball Crank Handle (3 Req.)
3	2060078	Dial Lock Nut (3 Req.)
4	2060083	Dial with 200 Graduations (3 Req.)
5	2060084	Dial Holder (3 Req.)
6	1011030	Socket Cap Screw (6 Req.)
7	2060075	Bearing Retainer Ring (2 Req.)
8	1060203	Grease Sealed Ball Bearings (2 Req.)
9	1010543	Roll Pin (8 Req.)
10	1011074	Socket Cap Screw (12 Req.)
11	2060116	Right Bearing Bracket
12	2060115	Left Bearing Bracket
13	1060204	Grease Seal Ball Bearing
14	1013078	No. 7 Woodruff Key (3 Req.)
15	2061222	Longitudinal Feed Screw 42" (48" also available 2061223)
16	1011592	Washer Head Screw (2 Req.)
17	2060100	Cross Feed Nut Retaining Screw (2 Req.)
18	2060102	Longitudinal Feed Nut
20	2060099	Key (2 Req.)
21	1011074	Socket Cap Screw (4 Req.)
22	2061250	Feed Nut Bracket
23	2060096	Key Pin
24	2060098	Cross Feed Nut
26	2190188	Stop Pin
27	2061233	Cross Feed Screw for 12" Knee
28	2060082	Cross Feed Bearing Bracket



ITEM NO.	CODE NO.	DESCRIPTION
1	2193502	Drawbar for R.8 Collet
2	2190183	Drawbar Washer
3	2190126	Upper Bearing Locknut
4	2190125	Bearing Sleeve Locknut
5	1190232	Ball Bearing
6	2193506	Upper Bearing Spacer (small)
7	2193506	Upper Bearing Spacer (large)
8	1190232	Ball Bearing
9	1192032	Compression Spring (4 Req.)
10	1011258	Socket Set Screw (2 Req.)
11	2193512	Spindle Pulley Bearing Sleeve
12	1011743	Jam Nut
13	1191965	External Lock Washer
14	2193516	Brake Ring Screw (3 Req.)
15	1192084	Spring (2 Req.)
16	1010507	Roll Pin (4 Req.)
17	2190131	Brake Lock Stud
18	2193477	Brake Assembly
19	2190055	Spindle Pulley
20	2193478	Spindle Pulley Hub
22	1192101	'V' Belt
23	1182106	Timing Belt
24	2190058	Timing Belt Pulley Flange
25	2193509	Timing Belt Pulley
26	2190058	Timing Belt Pulley Flange
27	1011506	Flat Head Screw
28	1191738	Hex Jam Nut
29	1192151	Black Plastic Ball Handle (2 Req.)
30	2190128	Spindle Clutch Lever
31	2190127	Cam Ring
32	2190129	Cam Ring Pin (2 Req.)
33	1011215	Socket Set Screw
34	2190133	Brake Lock Handle
35	2190134	Brake Lock Pin
36	2190132	Brake Lock Washer
37	1192830	Spindle Speed Plate
38	1192832	Operating Instruction Plate
39	1191796	Hex Jam Nut (2 Req.)
40	1191922	Lock Washer
41	2190173	Motor Mounting Studs (2 Req.)

TOP HOUSING

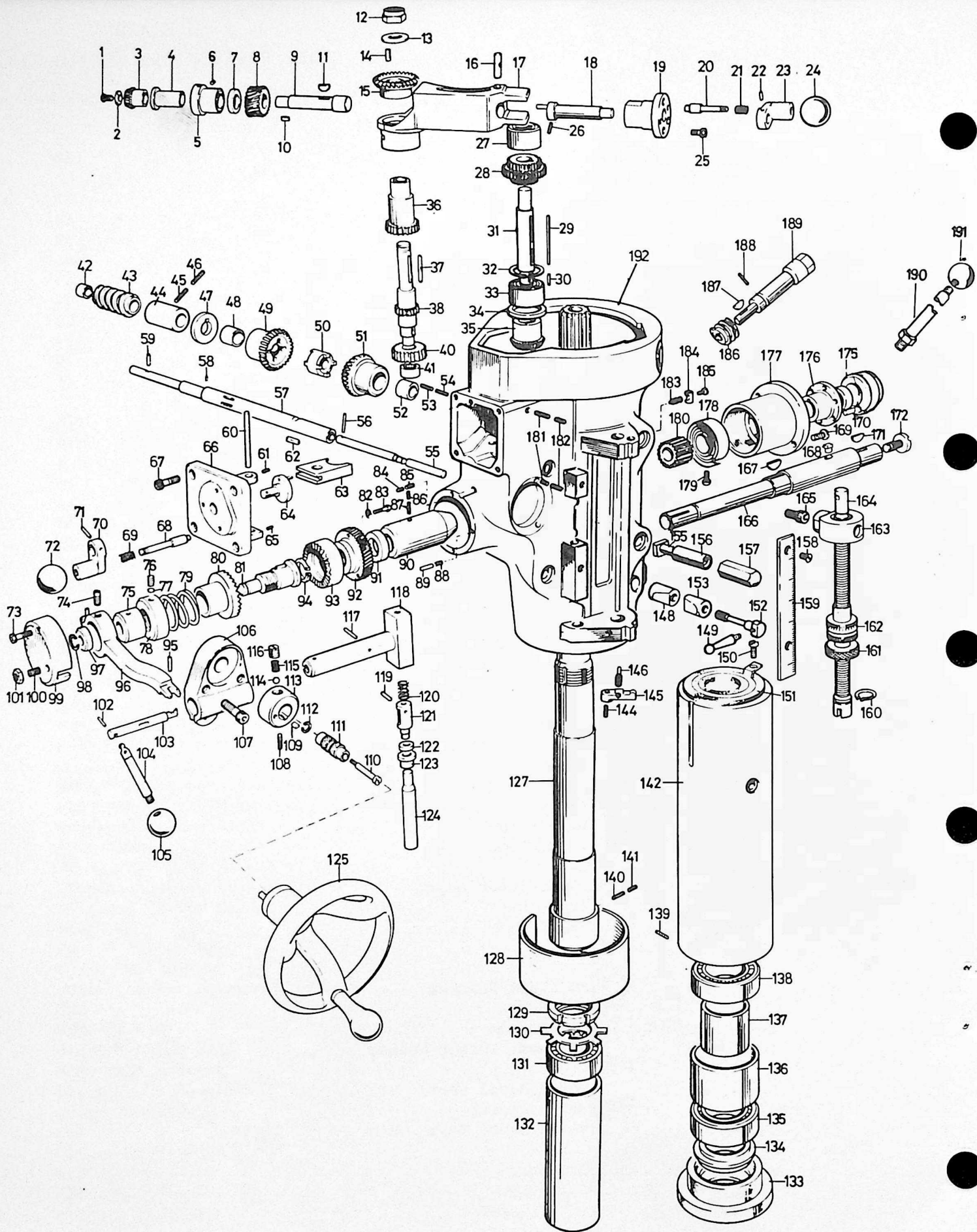
ITEM NO.	CODE NO.	DESCRIPTION
42	2193507	Belt Housing
43	2193541	Motor Locknut (2 Req.)
45	2190172	Motor Locknut Handle (2 Req.)
46	1192151	Black Plastic Ball (2 Req.)
49	2193508	Motor Pulley
50	2193452	Gear Housing Cover
51	1011455	Round HD Screw (5 Req.)
52	1195720	Wick
53	2190120	Oiler Tube
54	2190121	Oiler Plug
55	1193105	Oil Cup
56	2190116	Bull Gear Key
57	2190115	Splined Gear Hub
58	2193548	Spindle Bull Gear Assembly
59	1180235	Bearing
60	2190136	Countershaft
61	1013079	Key
62	2190137	Countershaft Gear
63	1180235	Bearing
64	1010747	Dowel Pin
65	2190062	Back Gear Shifter Fork
66	2193505	Gear Housing
67	1010540	Dowel Pin (2 Req.)
68	1010555	Roll Pins (2 Req.)
69	1011104	Socket Cap Screw (6 Req.)
71	1190230	Ball Bearing
72	1190806	Snap Ring
73	1191944	Lockwasher
74	1191793	Bearing Locknut
75	1011718	Hex Nut Hardened (3 Req.)
76	2193515	Vertical Tee Bolt (3 Req.)
77	2190114	Vertical Bolt Washer (3 Req.)
78	2193545	Back Gear Shift Crank
79	1010517	Roll Pin
80	2190186	Back Gear Shift Bushing
81	2193443	Shift Crank
82	1192151	Black Plastic Ball 1" Dia.
83	2190138	Gearshift Plunger
84	1192052	Compression Spring
85	2190040	Belt Guard Assembly



ITEM NO.	CODE NO.	DESCRIPTION
1	1011445	RD. HD. Screw
2	2190163	Bevel Pinion Washer
3	2190203	Feed Bevel Pinion
4	2190164	Feed Worm Gear Shaft Sleeve
5	1192303	Worm Cradle Bushing
6	1011287	Setscrew
7	2190165	Worm Gear Spacer (4 Req.)
8	2190166	Feed Drive Worm Gear
9	2190167	Feed Drive Worm Gear Shaft
10	2190162	Worm Shaft Key
11	1013078	Key
12	1011771	Locknut
13	2190199	Washer
14	2190176	Cluster Gear Key
15	1192209	Feed Reverse Bevel Gear
16	2190168	Feed Engage Pin
17	2190059	Worm Gear Cradle
18	2190169	Worm Gear Cradle Throw-out
19	2190170	Shift Sleeve
20	2190138	Gearshift Plunger
21	1192052	Compression Spring
22	1010517	Roll Pin
23	2193443	Shift Crank
24	1192151	Black Plastic Ball
25	1011010	Cap Screw (3 Req.)
26	1011258	Set Screw
27	2190181	Cluster Gear Shaft Upper Bearing
28	2193504	Cluster Gears Assembly
29	2190175	Cluster Gear Key
30	2190148	Round End Key
31	2193517	Cluster Gear Shaft
32	1190836	Snap Ring
33	2190149	Bevel Gear Bearing
34	2190150	Bevel Gear Thrust Spacer
35	2193544	Feed Reverse Bevel Pinion
36	2190146	Feed Driving Gear
37	2190176	Key
38	2193440	Cluster Gear Input Shaft
40	2193440	Feed Drive Gear
41	1190310	Needle Bearing
42	1193637	Bushing
43	1192208	Worm
44	2190155	Feed Worm Shaft Bushing
45	1011268	Socket Set Screw
46	1011542	Mock-it Lockscrew
47	2190152	Feed Worm Shaft Thrust Washer
48	1193635	Bushing
49	2193432	Feed Reverse Bevel Gear
50	2190153	Feed Reverse Clutch
51	2193432	Feed Reverse Bevel Gear
52	1193635	Bushing
53	1011547	Socket Set Screw
54	1011375	Socket Set Screw
55	2190157	Reverse Clutch Rod
56	1010509	Roll Pin
57	2190198	Feed Worm Shaft
58	2190200	Pin

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FOR METRIC KIT)

ITEM NO.	CODE NO.	DESCRIPTION
59	2190201	Pin
60	2190179	Feed Shift Rod
61	1011260	KP. Set Screw
62	2190162	Key
63	2190061	Feed Gear Shift Fork
64	2193446	Cluster Gear Shift Crank
65	1011270	Socket Set Screw
66	2190065	Cluster Gear Cover
67	1011010	Cap Screw (4 Req.)
68	2190138	Gear Shift Plunger
69	1192052	Compression Spring
70	2193443	Shift Crank
71	1010517	Roll Pin
72	1192151	Black Plastic Ball
73	1011014	Cap Screw (2 Req.)
74	2190188	Clutch Ring Pin (2 Req.)
75	2190098	Clutch Ring
76	1011265	Socket Set Screw
77	2200110	Brass Plug
78	2190105	Overload Clutch Locknut
79	1192055	Safety Clutch Spring
80	1192302	Overload Clutch
81	2193549	Overload Clutch Sleeve
82	1191920	Single Spring Washer (3 Req.)
83	1011431	Round Head Screw (3 Req.)
84	1011542	Mock-it Lockscrew
85	1011268	Socket Set Screw
86	1011542	Lockscrew
87	1011268	Socket Set Screw
88	1192032	Compression Spring
89	2190096	Overload Clutch Lever Spring Plunger
90	2190106	Quill Pinion Shaft Bushing
91	2190104	Pinion Shaft Worm Gear Spacer
92	2190103	Overload Clutch Worm Gear
93	2190102	Overload Clutch Ring
94	1190870	Snap Ring
95	1010717	Dowel Pin
96	2193427	Overload Clutch Trip Lever
97	2190097	Overload Clutch Washer
98	1190822	Snap Ring
99	2190068	Clutch Arm Cover
100	1011308	Socket Set Screw
101	1011740	Chem Blacked Locknut
103	2190094	Cam Rod
104	2190095	Trip Handle
105	1192151	Black Plastic Ball
106	2190067	Feed Trip Bracket
107	1011035	Cap Screw (2 Req.)
108	1011222	Socket Set Screw
109	2190162	Key
110	2193547	Feed Reverse Knob Stud
111	2193433	Reverse Knob
112	1180818	Snap Ring
113	2193518	Handwheel Clutch
114	1192165	Steel Ball

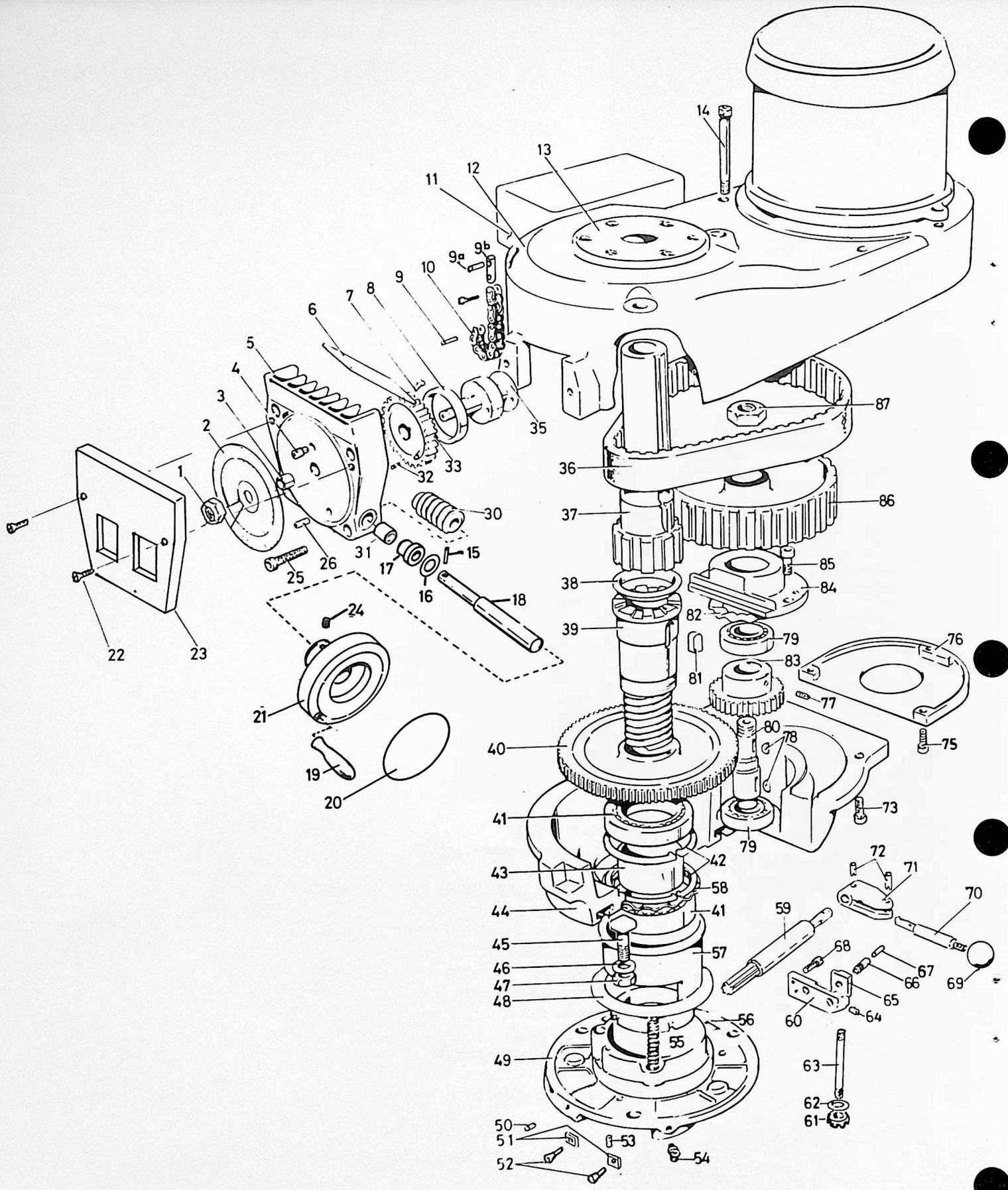


ITEM NO.	CODE NO.	DESCRIPTION
115	1192054	Compression Spring
116	2190154	Handwheel Clutch Spring Screw
117	1010515	Roll Pin
118	2190093	Cam Rod Sleeve Assy.
119	1010513	Roll Pin
120	1192053	Compression Spring
121	2193456	Trip Plunger
122	2190092	Feed Trip Plunger Bushing
123	2190090	Trip Plunger Bushing
124	2190089	Feed Trip Plunger
125	2193503	Handwheel
127	2193511	Spindle
128	2190081	Quill Skirt
129	1191790	Locknut
130	1191942	Lockwasher
131	1190237	Bearing
132	2190197	Sleeve
133	2190196	Nose-piece
134	2190193	Spindle Dirt Shield
135	1190239	Bearing
136	2193513	(Bearing Spacer - Large
137		(Bearing Spacer - Small
138	1190239	Bearing
140	1011545	Special Socket Set Screw
141	2193540	Collet Alignment Screw
142	2190192	Quill (O.D. Within .0001")
144	1011303	Socket Set Screw
145	2193498	Feed Trip Lever
146	2190185	Trip Lever Pin
148	2190110	Quill Lock Sleeve
149	2200098	Lock Handle
151	1192403	Felt Washer
152	2190111	Quick Lock Bolt
153	2190109	Quill Lock Sleeve Tapped
155	2193546	T-Bolt Assy.
156	2190135	Lower Clamping Bolt Spacer (2 Req.)
157	1191736	Locknut
158	1011411	Chem Blacked RD.HD. Screws (2 Req.)
159	1195306	Micrometer Scale
160	1190836	Snap Ring
161	2190190	Quill Micro-stop Nut
162	2190084	Micrometer Nut
163	2190082	Quill Stop Knob
164	2190083	Quill Stop Micro-screw
165	1011090	Screw
166	2193501	Quill Pinion Shaft
167	1013078	Key
168	2200111	Spring Pin
169	1011445	RD. Head Screw (2 Req.)

CONTINUED)

FOR METRIC KIT)

ITEM NO.	CODE NO.	DESCRIPTION
170	1010717	Roll Pin
171	1013076	Key
172	2190182	Pinion Shaft Hub Screw
173	1192165	Steel Ball
174	1192033	Compression Spring
175	2201031	Rack Feed Handle Hub
176	2190079	Pinion Shaft Hub Sleeve
177	2193436	Spring Cover
178	1192020	Clock Spring (Clock Spring Assy. 2193437)
179	2190184	Outside Spring Pin
180	2190108	Quill Pinion
181	1011268	Socket Set Screw
182	1011542	Lockscrew
183	2190085	Reverse Trip Ball Lever
184	2190086	Feed Reverse Trip Plunger
185	2190087	Reverse Trip Ball Lever Screw
186	1192207	Worm Gear
187	1013077	Key
188	1011370	Socket Set Screw
189	2190177	ADJ Worm Shaft
190	2201032	Pinion Shaft Hub Handle
191	1202170	Black Plastic Ball Handles
192	2193514	Quill Housing



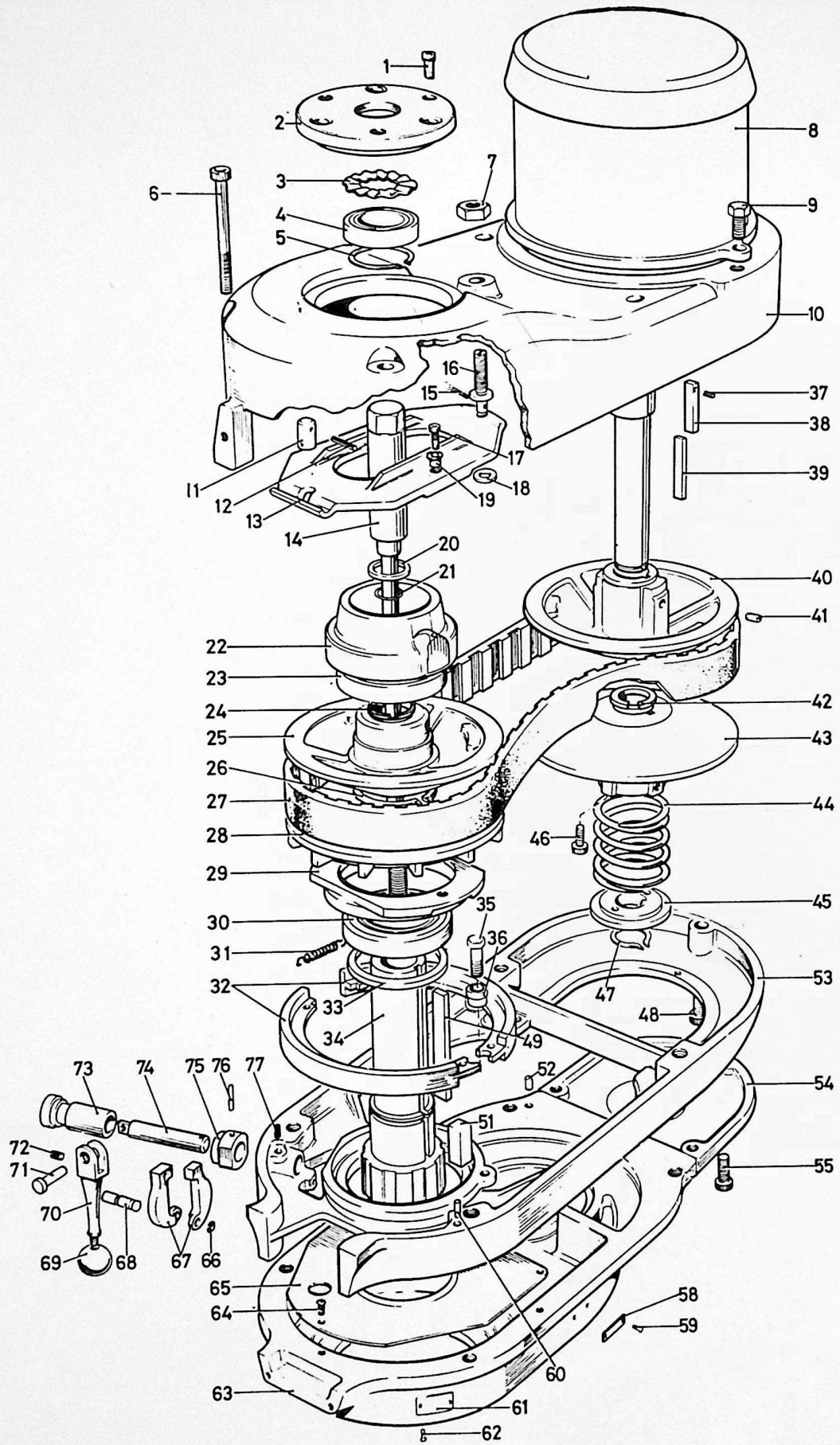
ITEM NO.	CODE NO.	DESCRIPTION
1	1011743	Hex Cap Nut
2	1180033	Vari-Speed Dial
3	1183646	Bronze Bearing
4	1011380	Full Dog Socket Set Screw
5	2180055	Speed Changer Housing
6	1185325	Speed Changer Chip Shield
7	1011420	Machine Screws (2 Req.)
8	1183655	Bearing
9	1010520	Roll Pin
9a	1010534	Roll Pin
9b	2180066	Speed Change Stud
10	1183720	Speed Changer Chain
11	1182655	Drum Switch
12	2183923	Belt Housing Assembly
13	2180094	Top Bearing Cap
14	1011065	Soc HD Cap Screw (2 Req.)
15	2190201	Roll Pin
16	1181923	Spring
17	1180214	Bearing
18	2182002	Speed Change Shaft
19	1182178	Handle
20	1182892	Caution Plate
21	2182001	Speed Change Handwheel
22	1011133	Flat Hd. Cap Screw (2 Req.)
23	1182901	Plastic Face Plate
24	1181233	Set Screw
25	1011037	Socket HD Cap Screw (4 Req.)
26	1011287	Socket Set Screw
27	1183645	Bronze Bearing
28	2190201	Pin
29	2180087	Speed Control Shaft
30	1192208	Worm Gear
31	1183636	Bearing
33	2180090	Speed Changer Spur Gear
35	2180065	Speed Change Chain Drum
36	1182106	Belt
37	2180060	Spindle Pulley Hub
38	2180064	Timing Pulley Clutch Sleeve
39	2180059	Splined Gear Hub
40	2183933	Spindle Bull Gear Assembly
41	1180254	Ball Bearing (2 Req.)
42	2180092	Snap Ring (2 Req.)
43	2180063	Bull Gear Bearing Spacer
44	2180053	Gear Housing
45	1181650	Vert. Tee Bolts (3 Req.)
46	1181906	Steel Washer (3 Req.)
47	1011750	Hex Jam Nut - Finished HDN. (3 Req.)
48	1181986	Ball Bearing Gear Sleeve Washer

TOP HOUSING

ITEM NO.	CODE NO.	DESCRIPTION
49	2180054	Fixed Clutch Bracket
50	1011246	Socket Set Screw
51	2180105	Guide for Clutch Bracket
52	1011016	Flat HD Socket Cap Screw (2 Req.)
53	1010511	Dowel Pin
54	1183104	Oil Cup
55	1182071	Compression Spring (3 Req.)
56	1181794	Bearing Locknut
57	2180061	Bearing Sleeve
58	1181977	Wave Spring Washer
59	2180067	Bull Gear Shift Pinion
60	2180097	HI-LOW Detent Plate
61	1181732	Hex Nut (3 Req.)
62	1181910	Lock Washer (3 Req.)
63	2180085	Studs (3 Req.)
64	1011284	Socket Set Screw
65	2180098	Adjustable Plate
66	2180100	HI-LOW Detent Plunger
67	1182072	Spring
68	1011017	Socket Cap Screw (2 Req.)
69	1192151	Bakelite Ball Handle
70	2180099	HI-LOW Shift Crank
71	2180096	HI-LOW Pinion Block
72	1010516	Roll Pin (2 Req.)
73	1011052	Socket Cap Screw (4 Req.)
75	1011012	Socket HD Cap Screw
76	2180088	Motor Pulley Cover
77	1011287	Socket Set Screw
78	1013079	Key (2 Req.)
79	1180235	Ball Bearing (2 Req.)
80	2180075	Bull Gear Pinion Counter Shaft
81	2180103	Key
82	1181975	Wave Spring Washer
83	2183933	Bull Gear Pinion
84	2180076	Bull Gear Pinion Bearing Cap
85	1011011	Socket HD Cap Screw (2 Req.)
86	2550016	Timing Belt Pulley
87	1191738	Jam Nut

FOR 2 HP HEAD, SUBSTITUTE THE FOLLOWING:

36	1552106	Belt
37	2550012	Pulley Hub
38	2550013	Clutch Sleeve
86	2550016	Pulley



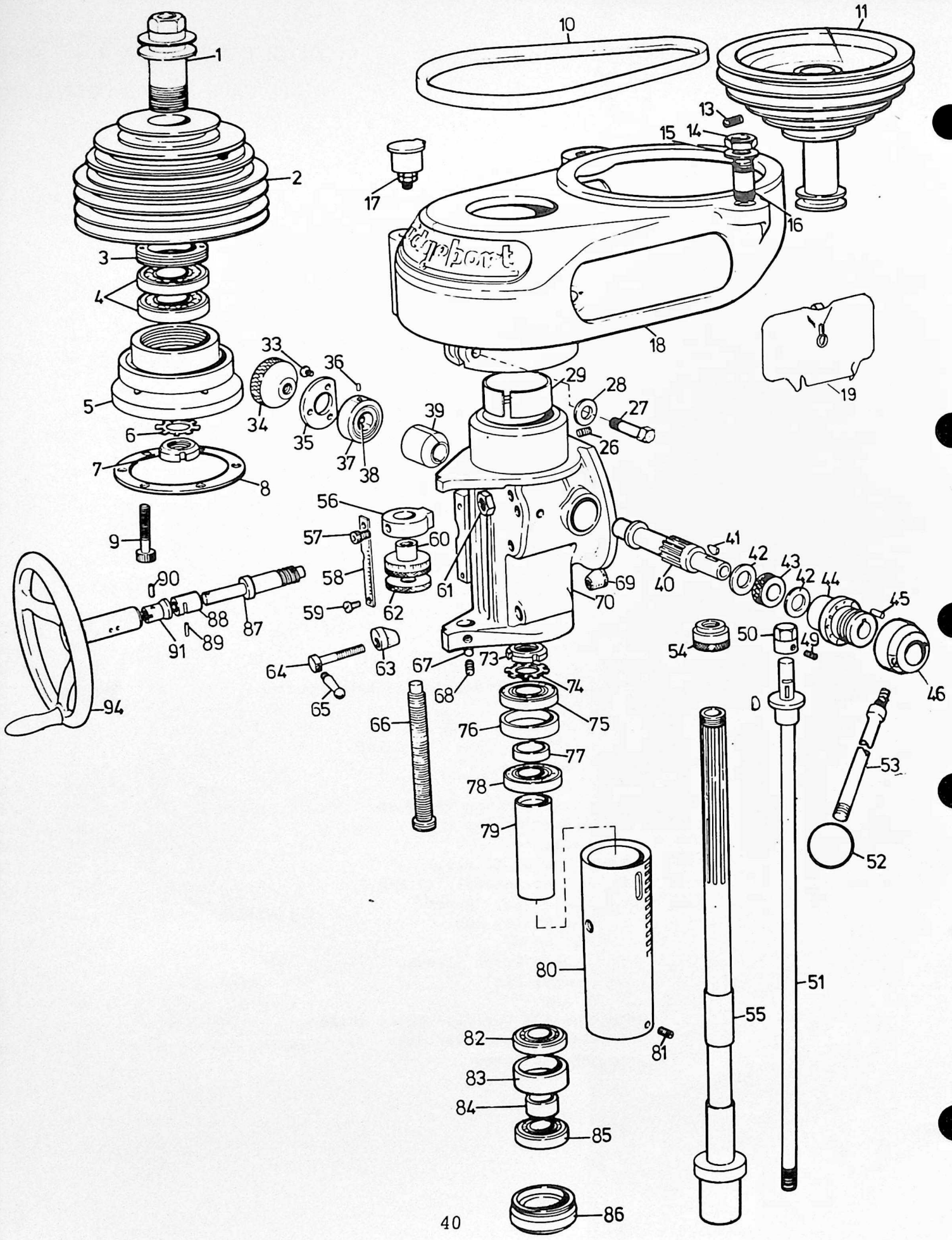
ITEM NO.	CODE NO.	DESCRIPTION
1	1011033	Socket Cap Screw (3 Req.)
2	2180094	Top Bearing Cap
3	1181977	Spring Washer
4	1180252	Ball Bearing
5	1180848	Snap Ring No.
6	1011069	Socket HD Cap Screw (2 Req.)
7	1011745	Hex Jam Nut
8	2015171	Motor 1 1/2 HP (complete unit) 230/460 3/60
8a	1550001	2 HP Motor
8b	2550019	2 HP Motor Assembly
9	1011148	Hex HD Screw (2 Req.)
10	2183923	Belt Housing
11	2180066	Speed Change Chain Stud
12	1010534	Roll Pin
13	2180058	Speed Change Plate
14	2183920	Drawbar
15	1010604	Cotter Pin
16	2180074	Speed Change Plate Pivot Stud
17	1011125	Socket HD Cap Screw (2 Req.)
18	2180095	Washer
19	2180089	Pivot Sleeve (2 Req.)
20	2180093	Draw Bar Washer
21	1180915	"O" Ring
22	2180056	Spindle Pulley Bearing Sliding Housing
23	1180253	Ball Bearing
24	1182124	Plastic Insert (2 Req.)
25	2183934	Adjustable - Driven Varidisc
26	1180855	Snap Ring No.
27	1182120	Belt
28	2180082	Stationary Driven Varidisc
29	2180057	Brake Bearing Cap
30	1180253	Ball Bearing
31	1182081	Brake Spring (2 Req.)
32	2180073	Brake Shoe Assembly (2 Req.)
33	2180078	Spindle Pulley Spacer
34	2180060	Spindle Pulley Hub
35	1011140	Hex HD. Screw
36	2180071	Brake Shoe Pivot Sleeve
37	1010501	Roll Dowel Pin
38	2180102	Drive Key
39	1182121	Key for ADJ Varidisc Motor Shaft
40	2180080	Stationary Motor Varidisc
41	1011287	Socket Set Screw

B A C K G E A R
 8 FOR METRIC KIT)

ITEM NO.	CODE NO.	DESCRIPTION
42	1182123	Plastic Insert (2 Req.)
43	2183931	Adjustable Motor Varidisc Assembly
44	1182083	Spring for Varidisc Motor Shaft
45	1182305	Adjustable Varidisc Spring Collar
46	1011065	Socket HD Cap Screw (2 Req.)
47	1180860	Ret. Ring
48	1011052	Socket Cap Screw
49	1182122	Plastic Key
51	2180084	Key
52	2180107	Taper Pin
53	2183923	Belt Housing Base
54	2180088	Motor Pulley Cover
55	1011012	Socket Cap Screw
56	1011552	Drive Screw (4 Req.)
58	1182893	HI-LOW Range Nameplate
59	1011552	Drive Screw (4 Req.)
60	2180107	Taper Pin (2 Req.)
61	1182894	Quill Feed Nameplate
62	1011552	Rivets (4 Req.)
63	2180053	Gear Housing
64	1011443	Round HD. Machine Screw (3 Req.)
65	1185030	Gear Housing Plate
66	1180818	Snap Ring
67	2180083	Brake Finger Pivot Stud
68	2180072	Brake Operating Finger
69	1192151	Bakelite Ball Handle
70	2190133	Brake Lock Handle
71	2190134	Brake Lock Pin
72	1011215	Socket Set Screw
73	2180104	Sleeve for Brake Lock Shaft
74	2180070	Brake Lock Shaft
75	2180069	Brake Lock Cam
76	1010534	Roll Pin
77	1011287	Socket Set Screw

FOR 2 HP HEAD, SUBSTITUTE THE FOLLOWING:

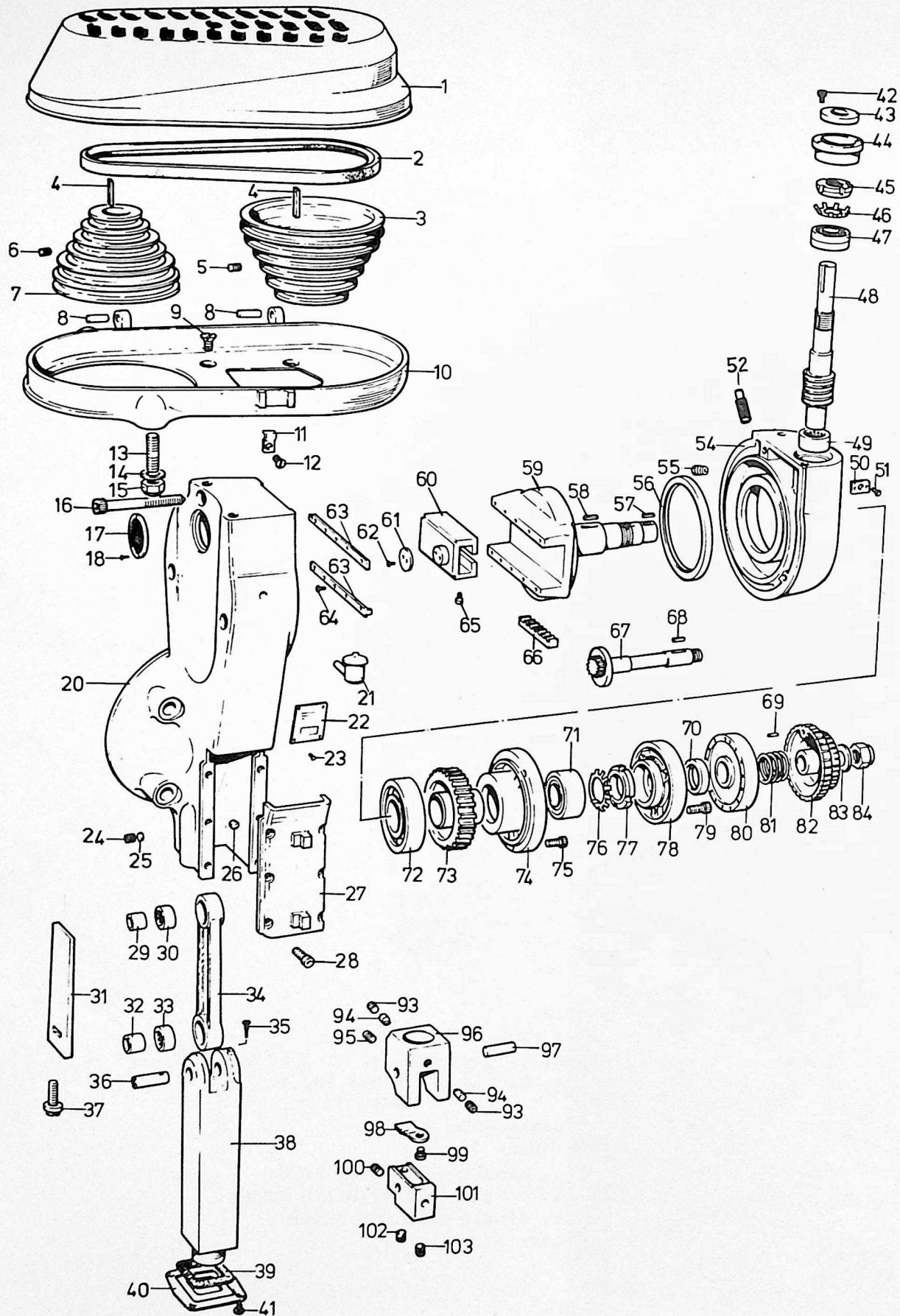
38	2550007	Key
39	2550004	Key
40	2550006	Stationary Varidisc
42	1182126	Plastic Insert (2 Req)
43	2550005	Adjustable Varidisc Assembly
43A	2550023	Adjustable Varidisc Assembly
44	1182083	Spring
45	2550003	Spring Collar



ITEM NO.	CODE NO.	DESCRIPTION
1	2204826	Spindle Pulley Hub, Single Belt Drive
2	2200069	Spindle Pulley, Single Belt Drive
3	2200072	Bearing Retainer Ring
4	1200202	Ball Bearings (2 Req.)
5	2204834	Bearing Housing
6	1241940	Bearing Lock Washer
7	1241786	Bearing Lock Nut
8	1202450	Paper Gasket
9	1011040	Cap Screw (6 Req.)
10	1202102	V Belt
11	2204847	Motor Pulley, Single Drive
13	1011240	Set Screw
14	1011715	Hex Nut (2 Req.)
15	2200109	Chamfered & Hardened Washer
16	1011855	Motor Mounting Ring Stud (2 Req.)
17	1203108	Oil Cup
18	2204833	Belt Housing, Single Belt Drive, 60 Cycle
19	2204854	Belt Guard Assembly
26	1011236	Set Screw
27	1011170	Hex Head Screw
28	2200109	Chamfered & Hardened Washer
29	2200106	Brass Quill Skirt
33	1011455	Round Head Screw (3 Req.)
34	2200093	Quill Feed Clutch Knob
35	2200092	Spring Cover
36	2200108	Outside Spring Pin
37	1202021	Clock Spring
38	2200111	Pinion Spring Pin
39	2200091	Split Bushing
40	2204837	Quill Feed Pinion
41	1013076	Pinion Key
42	1202452	Fibre Washer (2 Req.)
43	2200090	Quill Feed Worm Wheel
44	2204836	Quill Feed Clutch Hub
45	1010541	Roll Pin
46	2201031	Hub
49	1011265	Set Screw
50	2204835	Drawbar Knob
51A	2204845	Drawbar, Single Drive #2 MT & #7 B & S Taper
51B	2204846	Drawbar, Single Drive B-3 Taper
52	1202170	Ball
53	2203466	Rack Feed Handle
54	2201032	Drawbar Nut
55A	2204820	Spindle, Single Belt #2 MT Taper
55B	2204821	Spindle, Single Belt #7 B & S Taper
55C	2204822	Spindle, Single Belt B-3 Taper
56	2200073	Micrometer Stop

H E A D
 FOR METRIC KIT)

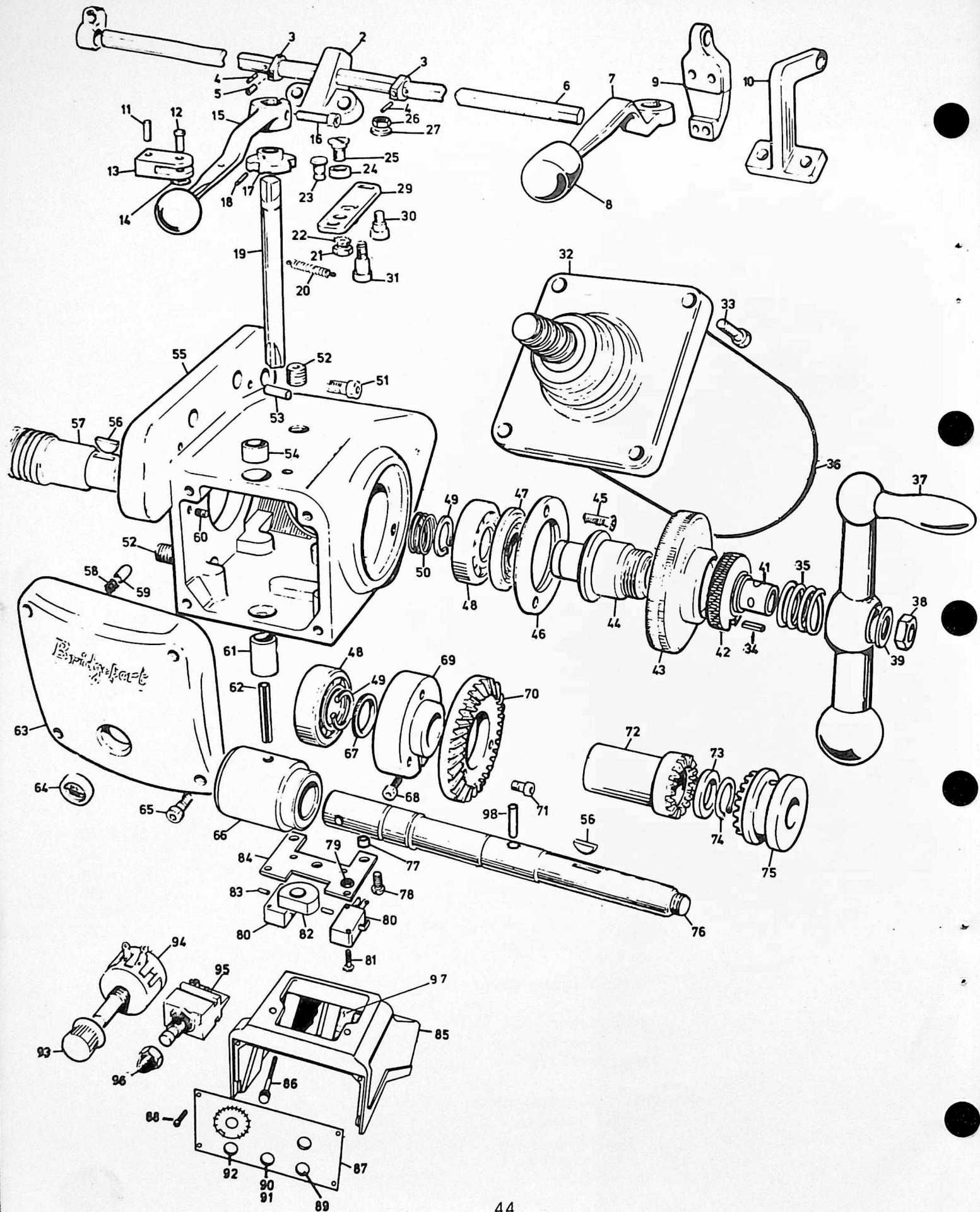
ITEM NO.	CODE NO.	DESCRIPTION
57	1011116	Cap Screw
58	1202845	Micrometer Scale
59	1011411	Flat Head Screw (2 Req.)
60	2190084	Micrometer Nut
61	1011720	Hex Nut (4 Req.)
62	2200076	Micrometer Lock Nut
63	2200100	Quill Lock Sleeve, Drilled
64	2200099	Quill Lock Bolt
65	2200098	Quill Lock Bolt Handle
66	2200077	Micrometer Screw
67	2200110	Brass Plug
68	1011265	Set Screw
69	2200101	Quill Lock Sleeve, Tapped
70	2204832	Quill Housing
73	1201788	Bearing Lock Nut
74	1191942	Bearing Lock Washer
75	1200201	Ball Bearing (4 Req.)
76	2204840	Outside Bearing Spacer)
77		Inside Bearing Spacer) Machined as unit
78	1200201	Ball Bearing (4 Req.)
79	2200064	Long Spacer aligner spring plunger assembly
80	2200053	Quill
81	1011265	Set Screw
82	1200201	Ball Bearing (4 Req.)
83	2204842	Outside Bearing Spacer)
84		Inside Bearing Spacer) Machined as unit
85	1200201	Ball Bearing (4 Req.)
86	2200060	Nosepiece
87	2200097	Quill Feed Worm
88	1633638	Bronze Bearing
89	2200107	Straight Pin
90	2200112	Straight Pin
91	2200096	Quill Feed Worm Hub
94	2204849	Quill Worm Feed Handwheel Assembly



ITEM NO.	CODE NO.	DESCRIPTION
1	2240061	Belt Cover
2	1242104	Belt
3	2240814	Worm Shaft Pulley
4	2240087	Key
5	1011240	Set Screw
6	1011239	Set Screw
7	2240811	Motor Pulley
8	2240086	Pin (2 Req.)
9	1011530	Flat Screw (4 Req.)
10	2240059	Belt Housing
11	2240090	Belt Cover Clip
12	1011590	Washer Head Screw
13	1011850	Motor Mounting Ring Stud (2 Req.)
14	2060122	Washer
15	1011720	Hex Head Nut
16	1011061	Cap Screw (3 Req.)
17	2240079	Air Vent Cover
18	1011592	Washer Head Screw (2 Req.)
20	2240810	Ram Housing
21	1243107	Oil Cup
22	1242808	Nameplate
23	1011552	Drive Screws
24	1011265	Set Screw
25	2240150	Brass Plug
26	1242402	Felt Plug
27	2240056	Ram Cover
28	1011030	Cap Screw
29	1240303	Inner Race
30	1240302	Bearing
31	2240057	Gib
32	1240305	Inner Race
33	1240304	Bearing
34	2240067	Connecting Rod
35	1011450	Ram Crankpin Lockscrew
36	2240072	Ram Crankpin
37	2060088	Gib Screw
38	2240065	Ram
39	1242404	Wiper Felt
40	2240078	Wiper Plate
41	1011407	Round Head Screw (4 Req.)
42	1011009	Cap Screw (3 Req.)
43	1243182	Oilseal
44	2240073	Worm Bearing Cover
45	1241784	Locknut
46	1241932	Lockwasher
47	1240217	Ball Bearing
48	2240058	Worm & Shaft
49	1240306	Bearing
50	1242805	Rotation Nameplate
51	1011552	Drive Screw
52	2240091	Vent Plug
54	2240051	Gear Housing
55	1010782	Pipe Plug

A T T A C H M E N T

ITEM NO.	CODE NO.	DESCRIPTION
56	1243180	Oilseal
57	2240082	Key
58	2240085	Key
59	2240063	Crank & Shaft
60	2240064	Crankpin Block
61	2240074	Bearing Retaining Washer
62	1011502	Round Head Screw
63	2240070	Crankpin Block Hold-Down
64	1011515	Flat Head Screw (10 Req.)
65	1011427	Round Head Screw (3 Req.)
66	2240069	Rack
67	2240080	Pinion Gear & Shaft
68	2240084	Key
69	2240083	Pin
70	1243181	Oilseal
71	1240216	Ball Bearing
72	1240214	Ball Bearing
73	2240071	Worm Gear
74	2240106	Gear Housing Cover
75	1011030	Cap Screw (3 Req.)
76	1241940	Lockwasher
77	1241786	Locknut
78	2240068	Crank Bearing Cover
79	1011033	Cap Screw (3 Req.)
80	2240066	Stroke Adjustment Plate
81	1242050	Dial Spring
82	2240055	Stroke Adjustment Dial
83	2240088	Washer
84	2240089	Acorn Nut
93	1011270	Set Screw
94	2240077	Clapper Box Clamp Shoe (2 Req.)
95	1011214	Set Screw
96	2240813	Clapper Box
97	1010748	Pin
98	2240062	Clapper Spring
99	1011427	Round Head Screw
100	1011239	Set Screw
101	2240076	Clapper
102	1011214	Set Screw
103	1011237	Set Screw
<u>AVAILABLE TOOLING</u>		
	1245250	#1 Shaping Tool
	1245251	#2 Shaping Tool
	1245252	#3 Shaping Tool
	1245253	#4 Shaping Tool
	1245254	#5 Shaping Tool
	1245255	#6 Shaping Tool
	1245256	#7 Shaping Tool
	2240128	High Speed Cutters
	2240129	Tools with cutting edge unground
	2240094	Complete Shaping Tools
	1245440	Tool Bit. 3/16" Sq. x 2" for Shaper



6 F L O N G I T U D I N A L

ITEM NO.	CODE NO.	DESCRIPTION
1	2430097	Stop Rod Clamp
2	2060300	Bracket
3	1632304	Stop Collar
4	1010507	Roll Dowel
5	1011265	Socket Set Screw
6A	2631054	Stop Rod - 42" Table
6B	2631055	Stop Rod - 48" Table
7	2630065	Control Lever
8	1632152	Ball
9	2270093	Stop Rod Clamp - Optics
10	2270088	Bracket - Optics
11	1010516	Roll Dowel
12	2430101	Fork Pin
13	2630071	Stop Rod Fork
14	1630890	Retaining Ring
15	2630065	Control Lever
16	1011277	Set Screw
17	2630072	Clutch Detent Cam
18	1010516	Roll Pin
19	2630054	Control Lever Shaft
20	1632005	Clutch Arm Spring
21	1011740	Locknut
22	1631925	Lockwasher
23	2630076	Clutch Arm Spring Pin
24	2630074	Detent Roller
25	2630087	Roller Pin
26	1011705	Hex Nut
27	1631925	Lockwasher
29	2630073	Clutch Arm
30	1630320	Bearing
31	1011575	Shoulder Screw
32	2631051	Motor Assembly
32A	2636423	Motor Assembly (Hi Torque)
33	1011033	Socket Cap Screw (4 Req.)
34	2630094	Roll Pin
35	1632006	Spring
36	1633728	Motor Cap
37	2630081	Handle Assembly
38	1011755	Jam Nut
39	2200109	Washer
41	1633653	Bushing
42	2060078	Dial Locknut
43A	2060083	Dial - Inch
43B	2069016	Dial - Metric
44	2630064	Dial Holder
45	1011011	Socket Hd Screw
46	2630089	Take-up Cap
47	2630067	Lead Screw Seal
48	1630261	Bearing
49	1630814	Retaining Ring

POWER FEED ASSEMBLY

ITEM NO.	CODE NO.	DESCRIPTION
50	1632074	Clutch Spring
51	1011074	Socket Hd Cap Screw
52	1635040	Taper Plug
53	1010543	Dowel Pin
54	1633638	Bronze Bushing
55	2630051	Main Housing
56	1013078	Woodruff Key (4 Req.)
57A	2630084	Longitudinal Lead Screw - 42"
57B	2630085	Longitudinal Lead Screw - 48"
58	1632073	Spring
59	2630068	Detent Pin
60	2630075	Pin
61	1633650	Bronze Bearing
62	1010411	Taper Pin
63	2630053	Side Cover
64	1633112	Oil Sight
65	1011011	10 - 24 x 5/8" Socket Cap Screw
66	2630060	Coupling
67	2630091	Thrust Washer
68	1011128	Socket Hd Screw
69	2630069	Gear Mounting Hub
70	1632216	Gear (Spiroid)
70A	1632218	Gear (Spiroid) (Hi Torque)
71	1011016	Socket Hd Cap Screw
72	2630062	Clutch - Driving
73	2630070	Thrust Bearing
74	1630838	Retaining Ring
75	2630063	Clutch - Driven
76	2630092	Drive Shaft
77	2630066	Spacer
78	1011447	Pan Hd Machine Screw
79	1011701	Hex Nut (4 Req.)
80	1632658	Limit Switch
81	1011404	Rd Head Machine Screw
82	2630058	Switch Actuator Housing
83	2630059	Switch Actuator Pin
84	1632610	Switch Mounting Plate
85	2630052	Control Box
86	1011046	Socket Hd Cap Screw (2 Req.)
87	1632576	Power Feed Control Plate
88	1011190	Button Hd Socket Screw (4 Req.)
89	1632659	Switch
90	1632607	Fuse Socket
91	1632606	Fuse
92	1632593	Pilot Light
93	1632153	Knob
94	1632618	Potentiometer
95	1632620	Pushbutton Switch
96	1632628	Boot
97	1632568	PC Board
98	1010545	Roll Pin

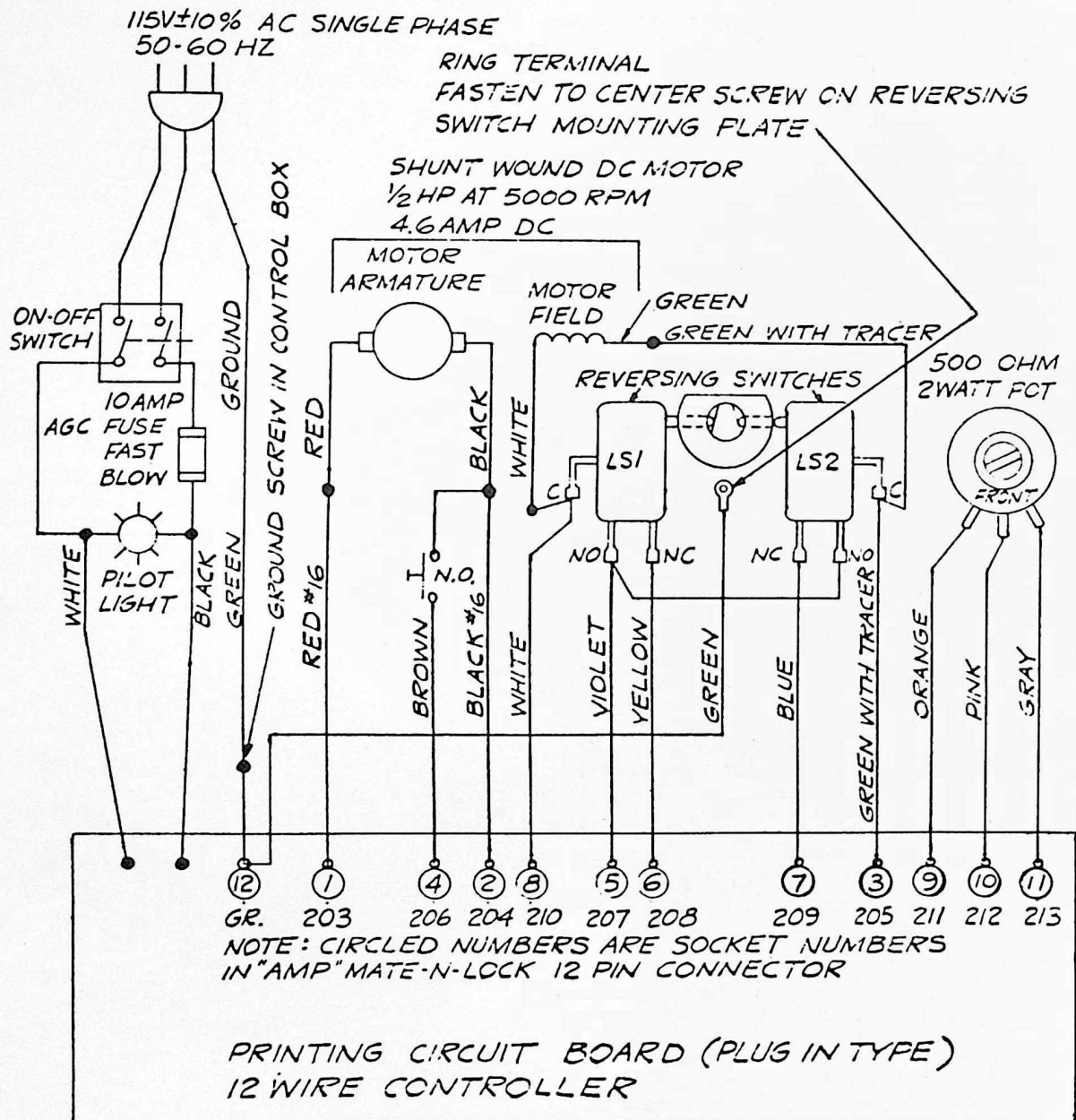


Figure 11. Circuit Diagram - Motors

METRIC CONVERSION KITS

The following metric conversion kits are available:

CODE NO. 2204000 - "M" HEAD, METRIC CONVERSION KIT

Consisting Of:

- 1202846 - Scale
- 2209002 - Stop Screw
- 2199002 - Micro Nut
- 2199005 - Stop Nut

CODE NO. 2184000 - "J" & "2J" HEAD, METRIC CONVERSION KIT

Consisting Of:

- 1195307 - Scale
- 2199001 - Stop Screw
- 2199002 - Micro Nut
- 2199005 - Stop Nut

CODE NO. 2064001 - METRIC CONVERSION KITS
FOR HANDFEED MACHINES WITH 36" TABLES.

Consisting Of:

- 2060175 - Table Leadscrew
- 2060183 - Elevating Leadscrew
- 2060172 - Table Feed Nut
- 2060171 - Saddle Feed Nut
- 2060170 - Elevating Nut
- 2069016 - Table & Saddle Dial (3)
- 2069015 - Elevating Screw Dial (1)
- 2060182 - Saddle Leadscrew

CODE NO. 2064002 - METRIC CONVERSION KITS
FOR HANDFEED MACHINES WITH 42" TABLES.

Consisting Of:

- 2060177 - Table Leadscrew
- 2060183 - Elevating Screw
- 2060172 - Table Feed Nut
- 2060171 - Saddle Feed Nut
- 2060170 - Elevating Nut
- 2069016 - Table & Saddle Dial (3)
- 2069015 - Elevating Screw Dial (1)
- 2060182 - 12" Saddle Feed Screw

CODE NO. 2064003 - METRIC CONVERSION KIT
FOR HANDFEED MACHINES WITH 48" TABLES.

Consisting Of:

- 2060179 - Leadscrew
- 2060183 - Elevating Screw
- 2060172 - Table Feed Nut
- 2060171 - Saddle Feed Nut
- 2060170 - Elevating Nut
- 2069016 - Table & Saddle Dial (3)
- 2069015 - Elevating Screw Dial (1)
- 2060182 - 12" Saddle Feed Screw

CODE NO. 2064004 - METRIC CONVERSION KIT
36" TABLE W/POWER FEED

Consisting Of:

- 2630096 - 36" Table Leadscrew
- 2060183 - Metric Elevating Screw
- 2060172 - Metric Table Feed Nut
- 2060171 - Metric Saddle Feed Nut
- 2060170 - Metric Elevating Nut
- 2069016 - Metric Table & Saddle Dial (3)
- 2069015 - Metric Elevating Screw Dial (1)
- 2060182 - Metric 12" Saddle Feed Dial

CODE NO. 2064005 - METRIC CONVERSION KIT
42" TABLE W/POWER FEED

Consisting Of:

- 2630097 - 42" Table Leadscrew
- 2060183 - Metric Elevating Screw
- 2060172 - Metric Table Feed Nut
- 2060171 - Metric Saddle Feed Nut
- 2060170 - Metric Elevating Nut
- 2069016 - Metric Table & Saddle Dial (3)
- 2069015 - Metric Elevating Screw Dial (1)
- 2060182 - Metric 12" Saddle Feed Screw

CODE NO. 2064006 - METRIC CONVERSION KIT
48" TABLE W/POWER FEED

Consisting Of:

- 2630098 - 48" Table Leadscrew
- 2060183 - Metric Elevating Screw
- 2060172 - Metric Table Feed Nut
- 2060171 - Metric Saddle Feed Nut
- 2060170 - Metric Elevating Nut
- 2069016 - Metric Table & Saddle Dial (3)
- 2069015 - Metric Elevating Screw Dial (1)
- 2060182 - Metric 12" Saddle Feed Screw

SPARE PARTS KITS

CODE NO. 2062000 - SERIES I STANDARD MACHINES
SPARE PARTS KIT

Consisting Of:

- 1062405 - Way Wiper, Knee/Column (2)
- 1062406 - Way Wiper, Knee/Column (4)
- 2060098 - Leadscrew Nut Cross Feed (1)
- 2060102 - Leadscrew Nut Long. Feed (1)

CODE NO. 2203000 - "M" MILLING HEAD - SPARE PARTS KIT

Consisting Of:

- 1202102 - Drive Belt
- 1202021 - Clockspring
- 1200202 - Spindle Bearings (4)
- 1191942 - Lockwasher (2)

CODE NO. 2193000 - "J" MILLING HEAD - SPARE PARTS KIT

Consisting Of:

- 1182120 - Drive Belt (1)
- 1182106 - Timing Belt (1)
- 2193477 - Brake Shoes (2)
- 1192084 - Brake Springs (2)
- 2193437 - Clocksprings Assy. (1)
- 2180117 - Gear Lube (1)
- 1190239 - Spindle Bearings (Pair)
- 1190237 - Spindle Bearing (1)
- 1192403 - Felt Wipers (2)
- 1191942 - Lockwashers (2)
- 1011392 - Collet Aligning Screws (6)

CODE NO. 2183000 - "2J" MILLING HEAD (1 1/2 H.P.) - SPARE PARTS KIT

Consisting Of:

- 1182120 - Drive Belt (1)
- 1182106 - Timing Belt (1)
- 2180073 - Brake Shoes (Set)
- 1182081 - Brake Springs (1)
- 1182121 - Key, Motor (1)
- 1182122 - Key, Driven (1)
- 2193437 - Clockspring Assembly (1)
- 2180117 - Gear Lubricant (1)
- 1183147 - Lubriplate (1)
- 1190240 - Spindle Bearings (Pair)
- 1190237 - Spindle Bearing (1)
- 1192403 - Wiper, Felt (2)
- 1191942 - Lockwasher (2)
- 2193540 - Collet Alignment Screw (6)

CODE NO. 2553000 - "2J" MILLING HEAD (2 H.P.) - SPARE PARTS KIT

Same as above except:

- 1552106 - Timing Belt
- 1552121 - Key, Motor
- 1552122 - Key, Driven