
INSTRUCTION MANUAL

FOR

'SENIOR' MILLING MACHINES

C O N T E N T S

SECTION 1	DESCRIPTION
SECTION 2	INSTALLATION
SECTION 3	OPERATING INSTRUCTIONS
SECTION 4	MACHINE MAINTENANCE
SECTION 5	ATTACHMENTS
SECTION 6	PARTS LIST

INTRODUCTION

This Instruction Manual has been prepared as a guide to the users of the 'SENIOR' range of precision milling machines and attachments. It is not intended as an exhaustive treatise of the subject and should not be taken to constitute a specification.

The machines covered by this publication are as follows :-

- Model 'M.1' Horizontal Milling Machine.
- Model 'Major' Horizontal Milling Machine.
- Model 'E.L.T.' Horizontal Milling Machine.
- Model 'V.S.' Horizontal Milling Machine.
- Model 'Junior' Milling Machine.
- Model 'Universal' Horizontal Swivel Table Milling Machine.
- Hand Lever Operated Horizontal Milling Machine.
- Light Vertical Type 'S' Milling Machine.

The following accessories are also covered by this Manual :-

- Sliding Spindle Vertical Attachment.
- Rotary Tables.
- Dividing Heads.
- Vice.
- Standard Vertical Attachment.

The 'SENIOR' range of milling machines utilise a basic range of proven components and the instructions given in this publication are applicable to all the Types listed above except where stated in the text.

Mark I Machines cover top mounted Motors.

Mark II Machines cover Motors housed in the base.

SECTION 1 DESCRIPTION

"SENIOR" Milling Machines utilise a basic range of standard components and the information contained in this section is applicable to all machines unless otherwise stated.

Machine Base

The machine base is a sturdy steel fabrication to form a coolant tank and 2½ gallons (approx.) capacity. Access for filling purposes is gained through two gauze covered holes in the coolant tray that is bolted to the top of the base. The coolant drain pipe is normally closed by a screw cap. A raising screw gland and nut assembly is bolted to the tray and the screw extends through the tray, the coolant tank and into the base via a steel tube. In Mark II machines, the base unit also houses the drive motor.

Transmission System

With the exception of the 'Hand Lever' Vertical and Universal model, all machines are supplied with twelve spindle speeds and three table traverse rates for each speed. The 'Hand Lever' model has six spindle speeds and is not fitted with powered table feed. The basic drive path, in all machines, is from an a.c. motor by vee-belt to a countershaft; then by a second vee-belt to the spindle. Provision is made to interpose a backgear cluster in the spindle drive of twelve-speed machines and the table feed drive is taken from the rear end of the spindle. Precise drive details differ according to model and mark as described in the following paragraphs :-

Countershaft Drive (Mark I Machines)

The drive motor is mounted on top of the main column. Primary reduction and three speeds are obtained by a three-step pulley on the motor spindle driving a three-step pulley on the countershaft. A second belt transmits the drive from a pulley on the countershaft down to the coolant pump. This is a vee-belt. Access to the drive is gained by opening the enclosure on the rear face of the main column.

Countershaft Drive (Mark II Machines)

The drive motor is mounted on a hinged base-plate and a lever actuated cam mechanism locks the plate in the horizontal position. When the cam is released, the plate hinges upward to relax the belt tension for speed changing. Primary reduction and three speeds are obtained by a three-step pulley on the motor spindle driving a three-step pulley on the countershaft. The coolant pump is housed within the main column in Mark II machines, the drive pulley being mounted on the inner end of the countershaft.

Spindle Drive (12 Speed Machines)

The countershaft extends into the main column being supported in the column rear member by an eccentric bush and housing mounted on ball bearings. The inner end of the countershaft carries a two-step pulley. From the selected pulley a vee-belt transmits the drive to the corresponding pulley on the spindle. The spindle pulleys form an integral

Transmission System (Cont'd).....

part of a cone that is carried on the spindle by bushes. It is, therefore, free to idle about the spindle. A gear wheel is positioned adjacent to the cone and located on the spindle by a key. The cone and gear can be locked together, by a spring loaded pin, to provide a direct drive from pulley to spindle.

Alternatively, the power can be transmitted through a back gear which is carried by phosphor bronze bushes on the back gear shaft. The back gear may be moved to engage the spindle gear and the spindle cone gear. When the back gear is in mesh, the spring loaded locking pin must be disengaged to uncouple the cone gear and the spindle gear wheel. In this configuration the drive passes from the selected cone pulley, through the cone gear to the back gear, thence to the spindle gear and spindle.

A back gear selector provides the means of locating the back gear in the meshed or unmeshed positions. With the exception of the 'Junior' model, the back gear on all machines is moved axially to engage or disengage the spindle gears. The selector mechanism comprises a selector fork, that engages the back gear, and a spring loaded plunger which engages alternative locations in the back gear shaft. When the plunger is disengaged, the selector can be moved to position the back gear at the alternative location by sliding.

In the 'Junior' model, the back gear is carried in an eccentric bush in the wall of the column. This can be rotated by turning a knurled knob, in the primary drive enclosure, to swing the back gear out of mesh. The knob is located in both the engaged and disengaged positions by a spring loaded locking pin engaging alternative locations in the column back face.

Table Feed Drive (Powered Table Machines)

The spindle is supported in the column by two precision taper roller bearings. It extends the drive forward to the cutter arbor and rearward into the enclosure on the rear face of the main column. From the pulley mounted on the rear end of the spindle, the power is transmitted to the table traverse gear box pulley by a single vee-belt. A belt tensioning jockey wheel and pulley arrangement is included in this drive.

The table traverse gear box has three ratios selected by the hand lever positioned on the gear box lid. This lever is positioned at each of the three positions - 'LOW', 'HIGH' and 'MEDIUM' - marked on the lid. Within the gear box are two shafts. The driver shaft carrying a triple cluster of straight spur gears and the driven shaft that carries three suitably spaced driven gears, mounted on a layshaft. The gear box operates on the sliding mesh principle in which the driver gear cluster is moved axially along its shaft to engage the corresponding driven gear.

A universal ball joint connects the gear box driven shaft to a telescopic shaft housed in a protective tube. The telescopic shaft extends the drive to the table traverse worm mechanism through the medium of a second universal ball joint.

Hand Lever Model

In this model, only six spindle speeds are obtainable.

Work Head.

Alternative types of overarm supports may be supplied. A round bar that extends through the column or a box type vee slide. The cutter arbor is fitted with a hardened running bush which is a precise fit in the arbor support bracket. This bracket is fitted with an adjustable spacer (not all models).

Table.

The table has three dead $\frac{1}{2}$ " tee-slots for work piece location. It traverses on an inverted vee-form slide in the saddle, the limits of movement being determined by two dogs working in conjunction with a knock-off lever and a dead stop. The positional relationship of these components can be varied, by moving the dogs in a slot in the table front, to establish the working traverse of the table.

In powered table machines, the gear box output terminates in a worm on the telescopic shaft. This worm is located in the saddle assembly and it meshes with a gunmetal worm wheel which extends the drive through 90° to the table feed screw. Alternative hand feed is provided by a ball handle when the power feed is disengaged by the dog clutch in the saddle assembly.

Saddle Assembly.

In all machines except the 'Universal' model, the saddle traverses along inverted vees on the knee with the hand feed forming an integral part of the knee assembly. The saddle houses the gunmetal table feed nut, table feed worm wheel and the knock-off dog clutch. These components are lubricated from a well in the saddle to form an oil bath. A level sight glass is fitted to the saddle front face.

The dogclutch is actuated by a knock-off lever located in the saddle front face. This lever may be operated by hand, using the knob provided, or automatically by the table right-hand dog at the present limit of effective traverse.

A retractable dead-stop is also fitted to the saddle. This is used in conjunction with the table left-hand stop to provide a positive positional reference when cutting blind slots, i.e. channels, keyways, etc. The dead-stop is normally locked in the down position by a knurled locking screw.

Positioned adjacent to the oil level glass, a clamping lever provides the means of locking the table. A saddle clamp lever is positioned on the left-hand end of the saddle.

'Universal' machines are fitted with two saddles comprising an upper and a lower component. The lower member traverses along an inverted vee on the knee. A centrally disposed spigot on the upper member locates in the lower component permitting a swivelling motion whilst restraining axial movement.

Knee Assembly.

The knee bracket encloses the saddle feed nut together with the knee raising mechanism. An inverted vee slide guides the knee on the main column, adjustable gibs being provided to compensate for wear. The gibs are adjusted by screws.

The saddle feed screw extends into the knee bracket to engage the feed nut which is fastened to the saddle.

From its hand wheel, the raising shaft extends to a bevel pinion fitted to its innermost end. This pinion transmits the drive through 90° to a bevel wheel keyed to the raising screw. The upper end of the raising screw is supported by a bush. The raising screw engages the raising nut which is screwed to the gland. A knee clamping lever is positioned on the left hand side of the knee bracket.

Hand Drive Calibration.

Micrometer collars are fitted to all lead screws.

Coolant System.

The coolant pump is an eccentric vane type with belt drive from the countershaft.

Rigid inlet and outlet pipes are fitted, the former extending downwards into the coolant tank. A ball valve returns excess coolant back to the tank and relieves pressure when the coolant supply cock is closed. The supply is extended to the cutter head through a flexible pipe.

Electrics.

The standard system provides a three-phase drive motor with a push-button starter. This incorporates a thermal overload and a 'no-volt' release. Alternative single-phase systems may be fitted in compliance with special orders.

Electrical Connections.

The machine internal wiring is complete. An isolator is fitted to the base of the machine and this should be connected to the mains supply in accordance with the relevant standard codes and practices.

SECTION 2 INSTALLATION

On Receipt

When the machine is received, carefully remove the crate and/or protective covers. Inspect for damage caused in transit and report any discrepancies to the Carriers and to Sales Agency concerned within five days.

Slinging

Place the sling around the overarm bar using packing as required to prevent damage to the machine finish. Ensure that the lifting equipment is rated to accommodate the machine weight as listed in Section 1, 'MACHINE DATA'.

Positioning and Levelling

The foundation requirements are not critical but the base should be flat and of adequate load bearing capacity. Do not move the machine by exerting force on the workhead, table or saddle. These are precision assemblies that could be distorted by incorrect handling. Push or pull the machine base or the coolant tray.

Carefully level the machine, with the aid of a spirit level placed longitudinally, and then laterally, on the table. Use wedges of wood or soft metal to achieve the correct level. It is preferable, but not essential, to float in grout or use cushion pads to make up the level. Securely bolt the machine to the foundation using rawlbolts provided.

Cleaning

Prior to despatch, the exposed unpainted surfaces of the machine are covered with a protective coating to retard corrosion. Do not disturb any moving parts until these surfaces are scrupulously clean. The coating may be removed by lint-free wipers soaked in a liquid solvent such as paraffin or white spirit.

SECTION 3. OPERATING INSTRUCTIONS

Controls. ()

1. Start/Stop Pushbuttons.
Coloured Green and Red respectively.
2. Table Feed Gear Lever (Gear Box).
Can be set at any one of three positions : 'HIGH', 'LOW' or 'MEDIUM'.

Caution Do not attempt to change gear unless the machine is stationary.
3. Table Traverse Ball Handle.
Provides hand traverse motion when the knock-off lever is in the 'clutch disengaged' position.
4. Right Hand Dog.
Determines the limit of powered table traverse by actuating the knock-off lever to disengage the feed.
5. Table Clamp Lever.
Locks the table against motion.
6. Knock-off Lever.
Actuates the dog clutch in the table feed mechanism. Move to the left to disengage the clutch for hand feed; move to the right for power feed.
7. Saddle Traverse Hand Wheel.
Provides the saddle traverse motion.
8. Knee Raising Hand Wheel.
Provides the vertical motion.
9. Left Hand Dog.
Used in conjunction with the Dead Stop to provide a position positional reference when cutting keyways, etc.
10. Dead Stop.
In the raised position it is used in conjunction with the Left Hand Dog. For straight milling operations, the stop is retracted.
11. Coolant Clock.
Controls the coolant flow to the cutting head.
12. Cutter Arbor Draw Bar.
Remove draw bar from spindle to facilitate removal of the arbor.
13. Saddle Clamp Lever.
Locks the saddle against motion.
14. Knee Clamp Lever.
Locks the knee (against vertical movement).

Operation.

To promote a long and trouble-free lift, it is recommended that the machine is operated at low load, i.e. light cuts; and at medium speeds for an initial 'running-in' period. Overloading is particularly ~~damaging to a new machine and could cause overheating, with serious~~ damage to the bearings.

Changing Spindle Speed.

There are two methods of changing spindle speed :-

1. To re-position the countershaft drive belt; three speeds are available.
2. To re-position the spindle drive belt; two speeds are available.

Initial Start Preparations

Before attempting to start the machine for the first time after installation, carry out the following operations. Refer to Section 4 for details of procedure and for lubricant recommendations.

1. Lubricate the machine at all specified points.
2. Fill the table traverse worm box and the table drive gear box (if fitted) with oil of the approved grade.
3. Check all belt drives for correct tension and adjust as necessary.
4. Check all hand feed motions for freedom of operation.
5. Fill the coolant tank with approved lubricant.
6. If coolant is to be used, prime the pump if necessary. If coolant is not being used, it is recommended that the pump drive belt be removed.
7. Start the machine and check the direction of spindle rotation. This **MUST** be anti-clockwise. If the rotation is clockwise stop the machine, isolate the electrical supply and check the connections to the starter. If the machine is fitted for 3-phase supply, change any two wires in the starter. For single phase supply, change two wires in the motor.

Routine Pre-Start Procedure.

1. Before starting the machine at any time, ensure that the daily lubrication procedure - detailed in Section 4 - has been carried out.

Caution : It is important to ensure that the spindle cone pulley bush is adequately lubricated at all times. This is vital to the prevention of bush damage, particularly during the 'running in' period.

2. If coolant is required, ensure that the pump is primed and the pump drive belt fitted.
3. Ensure that the selected cutter is correctly fitted to the arbor and the draw bar tight. To fit a cutter or cutters, proceed as follows :

SECTION 4. MACHINE MAINTENANCE

Lubrication Schedule.

Regular attention to lubrication is essential to efficient operation and long machine life. Use good quality lubricants, preferably selected from the Table appended to this Section. If the machine is not in continuous or daily use, carry out the checks detailed under 'Daily' before using the machine.

Daily.

1. Lubricate the spindle cone pulley bushes by removing the grub screw in the rim of the pulley and freely apply fresh oil using the oil can. Replace the grub screw and carefully wipe excess oil from the cone pulley to prevent contamination of the driving belt.
2. Oil the back gear bushes through the oiler in the gear shank. Carefully remove surplus oil from around the oiler.
3. Through the sight glass, check the oil level in the table traverse feed oil bath. If necessary restore to the centre mark on the glass, by filling above the cover plate fitted on the right hand side of the saddle.
4. If a table traverse gear box is fitted, check the oil level with the dip-stick. If necessary restore the level to the mark on the dip-stick. The filler cap is positioned on top of the gear box.
5. Oil the arbor bearing through the oiler located in the arbor support bracket.
6. Lubricate the table lead screw through the Springwell Oiler in the end brackets.
7. Oil the saddle traverse screw through the Springwell Oiler in the screw gland.
8. Lubricate the raising screw through the Springwell Oiler in the side of the knee bracket.
9. Oil the raising screw shaft through the Springwell Oiler in the boss.

Weekly.

1. Thoroughly clean the machine exterior to remove old cutting oil, dust and dirty lubricant. Give particular attention to the slideways and lightly coat with fresh oil after cleaning.

Six Monthly.

1. Remove the end cover on each spindle bearing and repack the bearings with grease of suitable grade, if necessary.
2. Release the screw on each spigot end of the telescopic tube enclosing the table feed universal joints. If necessary, slide back each cover tube and pack the universal joints with fresh grease.

3. Lightly lubricate the Oilite Bushes in the Gear Box drive jockey pulley (or sprockets), applying an oil can to the lubricators fitted in the end of the bearing spindles.

Routine Adjustments.

Drive Belts (Mark I Machines).

The motor drive belt is tensioned by adjusting the four mounting screws under the motor base. To tension the internal vee-belt, unscrew the clamping screw in the countershaft tension bracket and rotate the bracket on the eccentric bush to eliminate all belt slackness. Securely tighten the clamping screw.

Drive Belts (Mark II Machines).

To adjust the countershaft drive belt tension proceed as follows :-

Remove the louvred cover from the back of the base unit. Adjust the screw beneath the cam on the motor base plate until all slackness is removed. Replace the cover.

CAUTION ; Do not overtighten vee-belts as this will overload the countershaft and/or spindle bearings.

The belts are correctly adjusted prior to despatch from the Works and should not require attention for a considerable period of time until 'stretch' becomes evident. When a replacement internal Vee-Belt is required, we recommend the fitting of a 'Brammer' link belt which we can supply at the correct length. The link type belt can be placed around the pulleys and connected without disturbing the spindle assembly and its housing.

Coolant Pump Drive Belt.

The coolant pump swivels on the mounting stud, and its weight is sufficient to keep the vee-belt at the correct tension.

Spindle Bearing Adjustment.

Wear is taken up by the split lock-nut at the rear end of the spindle. Access is gained by removing the rear bearing cover. To adjust the bearings, lightly turn the split lock-nut anti-clockwise until excessive play is removed.

CAUTION : Care must be taken not to overturn the split lock-nut otherwise over-heating and bearing failure could occur.

Overarm Support Bracket Adjustment.

The overarm support bracket is fitted with a spacer that may be ground down to compensate for wear.

SECTION 5. ATTACHMENTS.

Vertical Sliding Spindle.

This attachment comprises a fractional horsepower motor driving the vertical spindle, which is mounted in taper roller bearings, through the medium of a vee-belt on two four-step pulleys. The complete assembly is mounted on a dove-tailed backplate that is attached to the column face by a locking strip. Spindle movement is by hand-lever or by worm gear with the collar calibrated in Imperial or Metric graduations, or dual reading dials.

Fitting the Attachment.

Remove the cutter arbor and the overarm steady bar and slide the attachment backplate on to one angle of the column face above the spindle cover plate. The radius on the bottom edge of the backplate fits on, or adjacent to, the cover plate. Insert the strip and secure. Plug the power supply into the socket on the starter box.

The Attachment weighs 79 lbs. (37 kg.) approximately.

Changing Speeds.

Remove the two side doors from the pulley housing. Slacken the motor plate retaining nut on top of the housing to relax the belt tension and re-position the belt on the selected pulleys. Adjust the belt tension by tightening the motor plate retaining screws. Re-fit the side plates.

Lubrication.

Before using the machine each time, apply an oil can to the Springwell Oilers.

Rotary Tables.

Rotary Tables are supplied in 6, 8 and 12 inch diameter sizes. The table is driven by a hardened worm fitted with ball thrust bearings to accommodate axial load in both directions. The worm mechanism is a throw-out type operated by a quick action cam. The hardened centre bush has a $\frac{1}{2}$ inch hole, but this may vary to special requirements.

Fitting the Table.

Before attempting to operate the attachment, ensure that the worm is in complete mesh with the worm wheel. This can be checked by 'feeling' the backlash which should be minimal.

Spindle Bearing Adjustment.

Wear is taken up by the split lock-nut at the rear end of the spindle. Access is gained by removing the rear bearing cover. To adjust the bearings, lightly turn the split lock-nut anti-clockwise until excessive play is removed.

CAUTION : Care must be taken not to overturn the split lock-nut, otherwise over-heating and bearing failure could occur.

Overarm Support Bracket Adjustment.

The overarm support bracket is fitted with a spacer that may be ground down to compensate for wear.

POINTS FOR GUIDANCE
IN OPERATION OF THE "SENIOR" MILLING MACHINES

Bearings.

These are Taper Roller and wear is taken up by the split lock-nut at the rear end of spindle. Access to this is gained by removing the rear bearing cover. When adjustment is necessary, all that is required will probably be a very slight anti-clockwise movement of the nut (this is left-hand thread). Particular care must be taken with this adjustment because, if not, over-heating and chatter could take place.

Periodically the bearings will require re-packing with grease; six monthly periods should suffice for ordinary daily use. To re-pack, it is only necessary to remove the bearing end covers. Use only the highest grade roller bearing grease - as recommended on chart.

Pump.

This is fitted with a ball non-return valve in the bottom of the suction pipe, and after once priming (by detaching the synthetic delivery pipe and inserting a few drops of oil) the pump should require no further attention. When the pump is not in use for any length of time it is advisable to lift off the small vee rope - this is easily done and saves unnecessary wear on the pump.

Use reputable, soluble, or pure cutting oil.

Gear Box.

A dip-stick is provided for the oil level.

Belts.

The outside drive is tensioned by adjusting the four mounting screws under Motor Base. The inside vee rope is then adjusted by the use of the bracket which is clamped round the eccentric bearing bush, and is located with a plunger pin fitting into the bearing mounting. Great care should be taken as it is important this belt should not be too tight, otherwise excessive wear is subjected on the countershaft bearing.

The belts are sent out correctly adjusted and no further adjustment should be necessary, unless a good deal of stretching has taken place or new belts have been fitted. When a replacement inside vee rope is required we recommend the fitting of a "Brammer" Link Belt, which we can supply, of correct length. This avoids the necessity of dismantling the spindle assembly, as the link belt can be placed round the pulleys and easily connected without any disturbance whatsoever to the spindle mounting.

Lubricating Points.

Spindle Cone Pulley - Grub Screw in Rim. It is VITALLY IMPORTANT to ensure that the cone pulley is well supplied with oil at all times, but particularly during the first weeks of use.

Back Gears. Springwell Oiler in Neck.

Countershaft. The Bearings are pre-packed. Check every six months, re-pack if necessary. Use only high grade bearing grease.

Chain Sprockets. Whether your machine is fitted with chain drive or vee rope drive to Gear Box, provision is made for lubricating jockey pulley or sprockets, and though Oilite Bushes are fitted a few drops of oil occasionally are recommended. Lubricators are fitted to the end of the bearing studs.

Worm Feed Wheel. Through front of Saddle.

Knock-off Cam. Springwell Oiler in centre of Shaft.

Feed Worm. Fill Oil Bath through Saddle end Cover.

Table Feed Screw. Springwell Oiler in end brackets.

Raising Screw. Springwell Oiler in side of knee bracket.

Cross Saddle Screw. Springwell Oiler in screw gland.

Raising Screw Shaft. Springwell Oiler in boss.

Universal Joint for Table Feed. Only at very long intervals is it necessary to pack with grease and lubricate the telescopic shafts which the tubes protect. These can be got at by removing the saddle and cover (2 screws) and releasing the inner tube by taking out the bearing screw in boss of worm box.

Overarm Support Bracket. To take up wear in bearing for running bush, remove packing and reduce thickness.

Drive to Gear Box. Chain sprocket or vee pulley studs (whichever is fitted) have Springwell Oilers.

Cutter Arbor. This is fitted with special hardened running bush which is a perfect fit in the overarm support bracket. Always ensure that this running bush is in the bearing, because there is little difference in diameter between this bush and the ordinary spacing collars. Overarm Support Bracket is now fitted with shim block, and when it is necessary to take up wear the block can be removed and a shim "peeled" off. To eject this should release the cutter arbor and make withdrawal easy, after a light tap.

Regular lubrication of all parts, particularly slideways, and cleanliness are essential to efficient, accurate and enduring service.

All slides on the machine are made a perfect fit and locking screws are provided for each machine movement, but if the column face is not kept perfectly clean and oiled, the action of cutting oil and dust can set up a resistance to free movement with troublesome results.

The M1 Miller is a light type machine only and is not intended for rough cutting or quick heavy removal of metal. Nevertheless, with careful set-ups, substantial cuts can be taken with ease. To avoid chatter, always keep the work as close as possible to the table and use a cutter not any larger in diameter than necessary.

OILS AND GREASES RECOMMENDED

	SHELL	CASTROL	BP
Slides, Feedscrews. General Lubrication.	Shell Vitrea Oil 33	Perfecto NN	BP Energol HP30
Gear Box	Shell Vitrea Oil 37	Perfecto RR	BP Energol HP40
Spindle Bearings	Shell Alvania Grease 3	Spheerol A.P. 3	BP Energrease L.S. 3
Vertical Attachment	Shell Alvania Grease 2	Spheerol A.P. 2	BP Energrease L.S. 3
Rotary Table	Shell Alvania Grease 2	Spheerol A.P. 2	BP Energrease L.S. 3

Obtainable from :

Shell Companies throughout the World
 The Power Petroleum Company Ltd. (U.K.)
 BP Companies (Overseas)
 Castrol Companies throughout the World

SPINDLE SPEEDS FOR "M.1" and "MAJOR" MACHINES

With Backgear

Without Backgear

50
 86
 104
 136
 169
 267

329
 537
 642
 845
 1050
 1660

SPARE PARTS

<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
1	Base	31	Table End Bracket (Right Hand)
2	Base Suds Drain Cock	32	Table End Bracket (Left Hand)
3	Suds Dish	33	Table Dog (Left Hand)
4	Suds Dish Rings	34	Table Dog (Right Hand)
5	Suds Dish Drain Covers	35	Table Ball Handle
6	Suds Drain Cover Knobs	36	Table Index Collar
7	Screws for holding Suds Dish to Base	37	Table Leadscrew
8	Bright Turned Washers for above	38	Table Screw Lock Nuts
9	Column	39	Table Screw Gunmetal Nut
10	Screws for clamping Column to Base	40	Table Screw Thrust Washers
11	Brt. Engineers Washers for above	41	Screws for fastening End Brackets to Table
12	Knee	42	Motor Platform
13	Knee Adjusting Gib for Column	43	Motor Platform Adjusting Screws
14	Screws for above	44	5/16" Whit. Hex. Nuts for above
15	Brt. Engineers Washers for above	45	5/16" Brt. Washers for above
16	Sq. Head Adjusting Screws for above	46	Rear Door
17	Lock Nuts for above	47	Rear Door Hinges
18	5/16" Springwell Oilers for Knee Bracket	48	Screws for fastening Hinges to door
19	Saddle	49	Washers for above
20	Saddle End Cover	50	Rear Door Latch
21	Saddle Adjusting Gib to Knee Bracket	51	Knob for Rear Door Latch
22	Holding Screws for above	52	Stud for Rear Door Latch
23	Adjusting Screws for above	53	Swivel Screw for Latch
24	Lock Nuts for above	54	Washers for above
25	Saddle Cam	55	Swivel Bush for above
26	5/16" Springwell Oiler for above	56	Fender
27	Saddle Cam Lever	57	Hex. Head Set Screws for clamping Fender to Dish
28	Saddle Cam Lever Knob	58	Washers for above
29	Saddle Knock-off Plunger	59	Overarm Bracket
30	Table	60	Overarm Bush
		61	Overarm Bush stop Screw
		62	Overarm Bracket Bolt
		63	Nut for Overarm Bracket Bolt
		64	Lever for above
		65	Bakelite Knob for above

<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
66	Overarm	99	Screws for fastening Gear Box to Column
67	Overarm Locking Bolts	100	Screws for fastening Lid to Gear Box
68	Nuts for above	101	Screws for fastening Gear Box Lever to Shaft
69	Washers for above	102	Screws for fastening Collars to Gear Box Shaft
70	Overarm Bolt Brass Sleeve	103	Stop Bar
71	Column Door	104	Stud for above
72	Latch for above	105	Knurled Clamping Nut for locking stop bar
73	Knob for Door Latch	106	Inside Knockoff Cam
74	Connecting Stud for Knob and Latch	107	Clamping Screw for above
75	Grub Screws for fastening Knot and Latch to Stud	108	5" Hand Wheel for Cross Saddle Screw
76	Column Door Hinge Blocks	109	Grip for above
77	Studs for above	110	6" Hand Wheel for Raising Screw
78	Washers for above	111	Hand Grip for above
79	Column Hinge Block Swivel Pins	112	Saddle Micrometer Collar
80	Gear Box	113	Raising Screw Micrometer Collar
81	Gear Box Lid	114	Knee Bracket Backplate for above Collar
82(J)	Gear Box Lid Joint	115	Knurled Screws for Collars
82	Gear Box Shaft Driver	116	Raising Screw Bevel Pinion
83	Gear Box Shaft Driven	117	Raising Screw Bevel Wheel
84	Gear Box Gear Driver	118	Cross Slide Gland
85	Gear Box Gear Driven	119	Screws for fastening above to Knee Bracket
86	Gear Box Selector	120	Washers for above
87	Gear Box Selector Fork	121	Raising Screw Bottle
88	Gear Box Oil Seals 1"o/d. 3/8" hole x 1/4"	122	Screws for fastening Bottle to Base
89	Gear Box Oil Seals 1 1/4"o/d x 7/8" hole x 1/4"	123	Washers for above
90	Gear Box Thrust Washer	124	Raising Screw
91	Gear Box Oil Cap	125	Raising Screw Nut
92	Gear Box Oil Sight (Inside)	126	Screws for fastening Nut to Bottle
93	Gear Box Oil Sight (Cover)	127	Raising Screw Bush
94	Gear Box Oil Sight, Perspex Disc	128	Raising Screw Thrust Washer
95	Gear Box Drain Plug	129	Single Phase Electric Motor
96	Gear Box Selector Shaft	130	Three Phase Electric Motor
97	Gear Box Vee Rope Pulley		
98	Screw for fastening Gear Box Shaft		

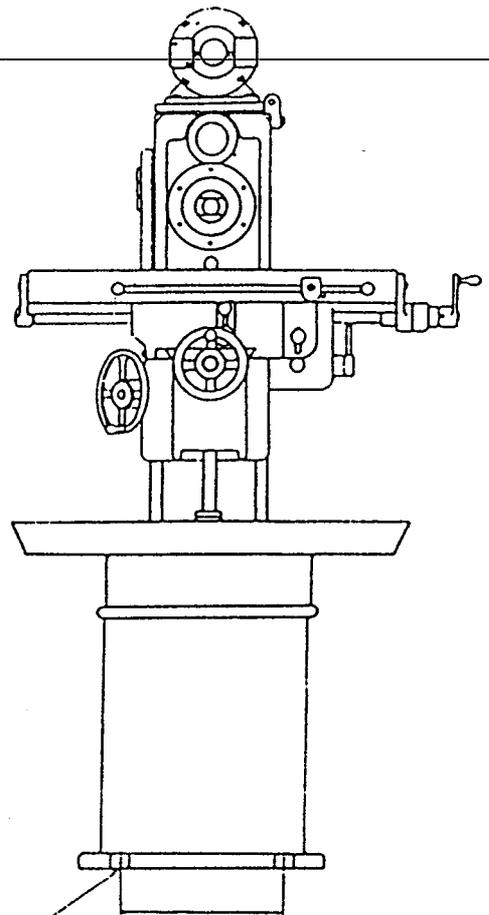
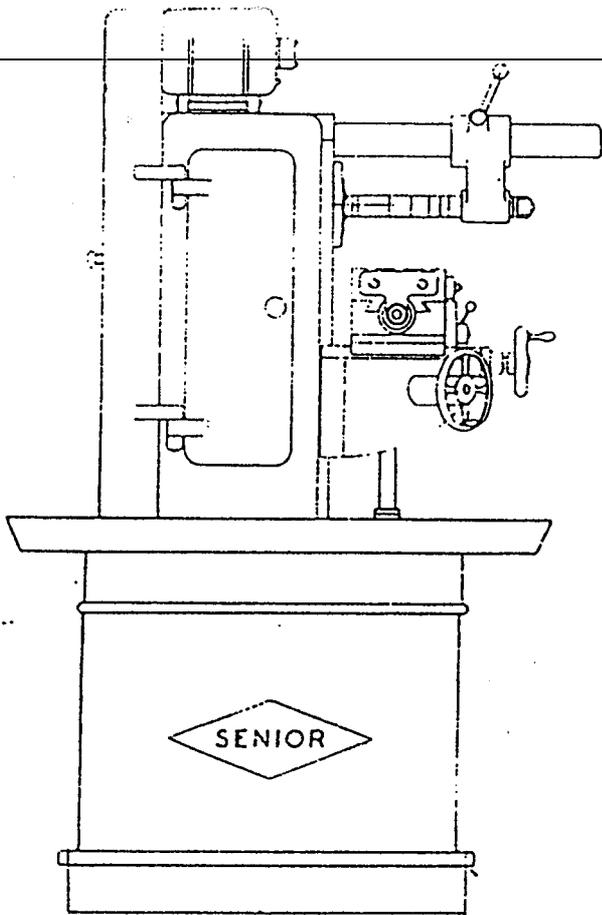
<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
131	Screws for fastening Motor to Base	163	Screw for clamping above to Selector
132	Washers for above	164	Selector Plunger
133	Motor Cone Pulley	165	Plunger Cap
134	Pushbutton Starter	166	Plunger Spring
135	Front Bearing Cover	167	Cover Cap for above
136	Screws for attaching above to Column	168	Screws for fastening same to Selector
137	Rear Bearing Cover	169	Back Gear selector sleeve
138	Screws for attaching above to Column	170	Screw for holding above to Countershaft
139	Front Taper Roller Bearing	171	Back Gear Shaft
140	Rear Taper Roller Bearing	172	Suds Cock
141	Cutter Arbor	173	Universal Suds Joint
142	Cutter Arbor Drawbolt	174	Bolts for above
143	Main Spindle	175	Washers for above
144	Main Spindle Driving Key	176	Suds Pipe - Long
145	Main Spindle Adjusting Nut	177	Suds Pipe - Short
146	Clamping Screw for above	178	Suds Delivery Pipe (Suds Pump to Suds Cock)
147	Spindle Cone Pulley	179	Suds Return Pipe (Table to Sump)
148	Spindle Gear Wheel	180	Suds Pump Body
149	Screw for,locking above to Spindle	181	Pump Cover
150	Driving Pin for engaging Cone Gear	182	Screws for attaching above to Pump Body
151	Locating Spring for above	183	Pump Rotor
152	Screw for attaching above Spring to Gear Wheel	184	Rotor Blades
153	Spring Washer for above	185	Spring for above
154	Spindle Cone Lubrication Tube	186	Pump Vee Pulley Rope
155	Cover Screw for above	187	Screw for above
156	Spindle Collar	188	Pump Suction Pipe
157	Screw for above	189	Valve Container for above
158	Back Gear	190	Ball Valve for above
159	Bronze Bushes for Back Gear	191	Spring for above
160	Back Gear Lubricator	192	Pump Stub Pipe for Release Valve
161	Back Gear Selector	193	Release Valve Connection. (Pump to Sump)
162	Brass U-Plate for above	194	Pump Delivery Outlet Pipe
		195	Pump Swivel Stud
		196	Collars for above
		197	Screws for above

<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
198	Suds Drain Cover for Table	226	Feed Worm Wheel
199	Anchor Plate	227	Driving Key for above
200	Screw for clamping Anchor Plate to C/Shaft	228	Screws for fastening Key to Worm Wheel
201	Screw for fastening Anchor Plate to Column	229	Worm Wheel Collar
202	Washer for above	230	Screw for fastening Key to Worm Wheel
203	Countershaft	231	Feed Worm
204	Countershaft outside 4-speed cone pulley	232	Screw to fasten Worm to Shaft
205	Screw for fastening to Countershaft	233	Feed Worm Shaft
206	Countershaft inside 2-speed cone pulley	234	Worm Box
207	Screw for fastening to Countershaft	235	Worm Box lifting lever
208	Countershaft eccentric Bush	236	Knob for above
209	Lubricator for above	237	Worm Box swivel stud
210	Screws for attaching Housing to Column	238	Butting Screw for saddle end cover
211	Countershaft eccentric Bush	239	Locknut for above
212	Bronze Bushes for above	240	Universal Telescopic Shaft Joints
213	Countershaft belt tension bracket	241	Telescopic Shaft (Male)
214	Screw for clamping above to eccentric bush	242	Pin for fastening joint to telescopic shaft
215	Countershaft tension bracket plunger	243	Telescopic Shaft (Female)
216	Knob for above	244	Driving key for above
217	Plunger Spring	245	Screws for fastening key to shaft
218	Ve Rope (Countershaft to Spindle)	246	Worm Box spigot screw for telescopic tube
219	Ve Rope (Motor to Countershaft)	247	Telescopic Tube (Outer)
220	Ve Rope (Countershaft to Pump)	248	Telescopic Tube (Inner)
221	Ve Rope (Spindle to Jockey Pulley for Feed)	249	Telescopic knuckle cover (Male)
222	Ve Rope (Jockey Pulley to Gear Box)	250	Telescopic knuckle cover (Female)
223	Cross Saddle Screw	251	Telescopic knuckle cover pivot screw
224	Cross Saddle Nut	252	Collar for gear box selector shaft
225	Cross Saddle Screw Thrust Washers	253	Lever for above
		254	Lever Knob
		255	Feed Vee Rope Pulley (Spindle end)
		256	Screw for fastening above to spindle
		257	Feed Vee Jockey Pulley
		258	Bronze Bush for above

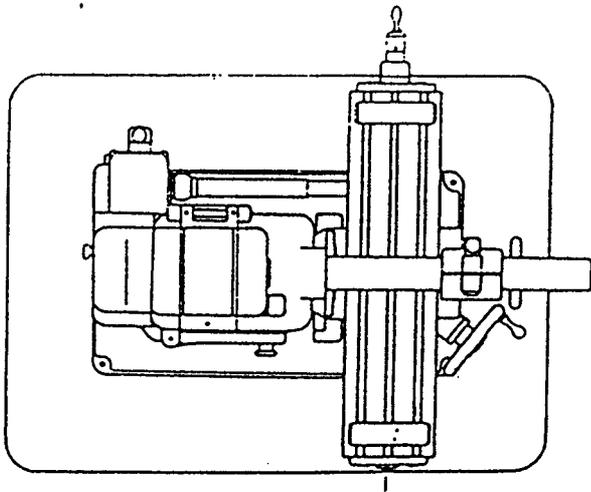
<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
259	Bracket for Jockey Pulley	288	Screws for fastening Table Nut to Saddle
260	Screw for attaching above to Countershaft	289	Screw for fastening Collar to push rod
261	Washer for above	290	Screw for fastening Ball Handle to table screw
262	Jockey Pulley Stud for Bracket	291	Taper Pin for fastening bevel gear to screw
263	Lubricator for above	292	Taper Pin for fastening Collar to raising shaft
264	Nut for fastening Stud to Bracket	293	Taper Pin for fastening Bevel Pinion to raising shaft
265	Washers for above	294	Screw for fastening 6" Hand Wheel to shaft
266	Clip for Suds Drain Pipe from table	295	Taper Pin for fastening Collar to table screw
267	Name Plate	296	Taper Pin for fastening Collar to Cross Slide Screw
268	Studs for fastening above to Base	297	Screw for fastening 5" Hand Wheel to Cross Slide Screw
269	Push Rod	298	Screws for fastening female cup to telescopic tube
270	Push Rod Collar	299	Screws for fastening pegs into door hinges
271	Raising Shaft	300	Screw for adjusting cutter arbor bearing bush
272	Collar for above	301	Washer for above
273	1/4" Gas Elbow for Pump Delivery Pipe	302	Nuts for clamping overarm pads
274	1/4" Gas Nipple	303	Washers for above
275	1/4" Gas Elbow for Table Drain Connection	304	Lubricator for Cutter Arbor Bearing
276	1/4" Gas Nipple for above	305	Screws for fastening push-button starter to column
277	1/4" to 1/8" Gas Reduction Bush for Delivery Pipe Screws for fastening telescopic knuckle cover (Male) to Gear Box.	306	Washers for above
278		307	Screw for clamping spindle adjusting nut
279	Taper Pin for fastening Gear Box Selector to Shaft	308	Oil Nameplate for front of Saddle
280	Warning Plate for Gear Box	309	Rivets for fastening above to saddle
281	Rivets for fastening above to Gear Box	310	Screw Plug for oil-hole in front of Saddle
282	Bolts for table knock-off dogs	311	Lubricator for Table End Bracket
283	Nuts for above	312	Lubricator for Cross Slide Gland
284	Screws for fastening cover to saddle end		
285	Table Strip		
286	Table Strip adjusting screws		
287	Lock Nuts for above		

<u>Part No.</u>	<u>Description</u>
313	Glacier Wrapper Bushes
314	1/4" Grub Screw Plunger Knob
315	Plunger Knob
316	Locker Lever Knee Bracket
317	Locking Lever Saddle
318	Hex. Screw for fast. cross slide nut
319	1/4" Washer for above
320	Table Screw Collar
321	Table Locking Lever
324	1/8" c/s for fastening raising bush
326	Plate inside Knee Bracket
327	1" x 3/4" c/s Screw
328	P.B. Retaining Washer
329	Screw for raising bevel gear
330	Bevel Gear Woodruff Key
331	1/2" Oil Seal (Pump)
332	Gear Box Collar
333	3/16" Key Gear Box Shaft
334	Plug for telescopic shaft
335	Taper Pins for joints
339	Screw for fastening selector
340)	
341)	Gear Box Selector
342)	

<u>Part No.</u>	<u>Description</u>
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DETAIL OF "A" OF DRAWING

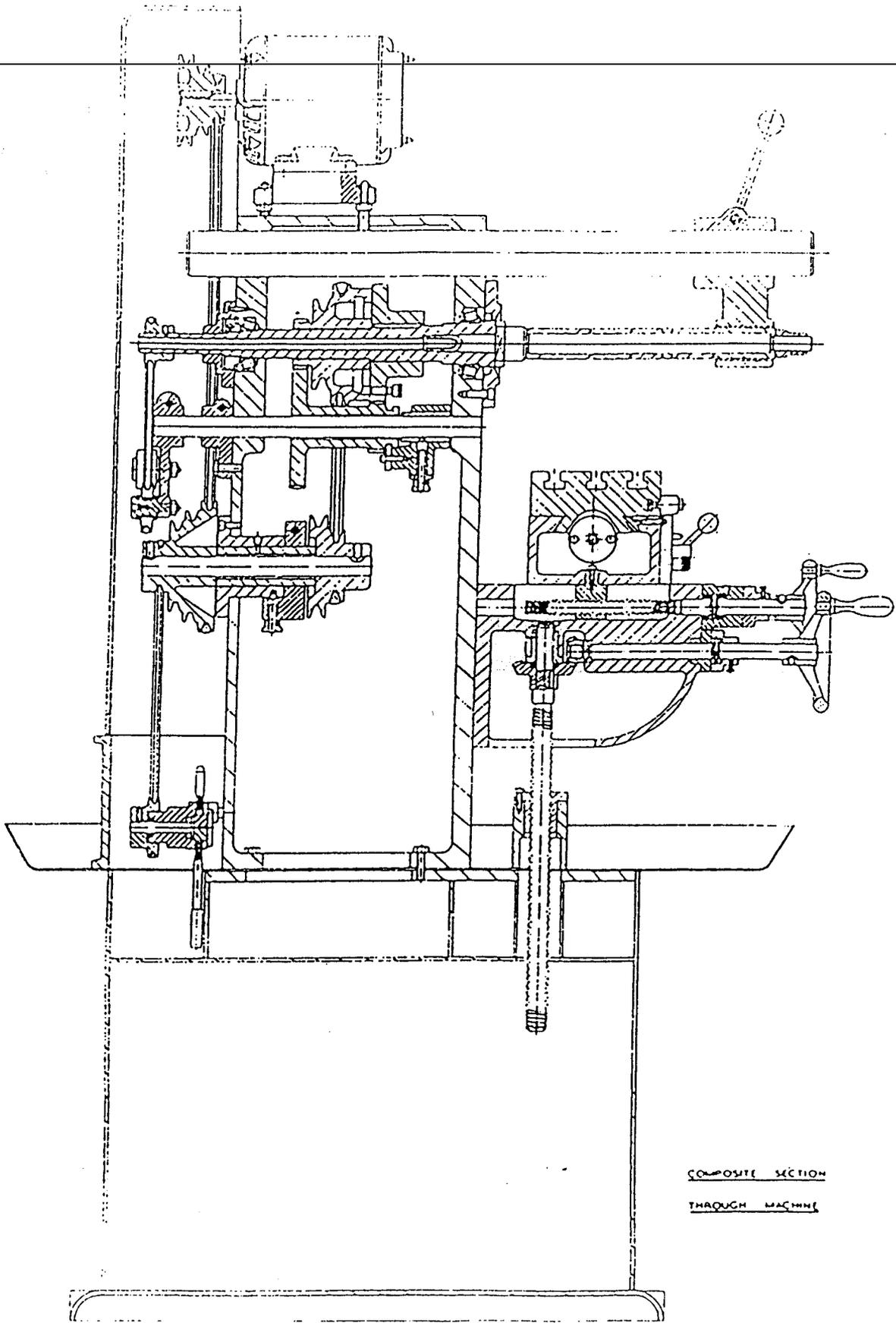


SENIOR M.I. MILLING MACHINE

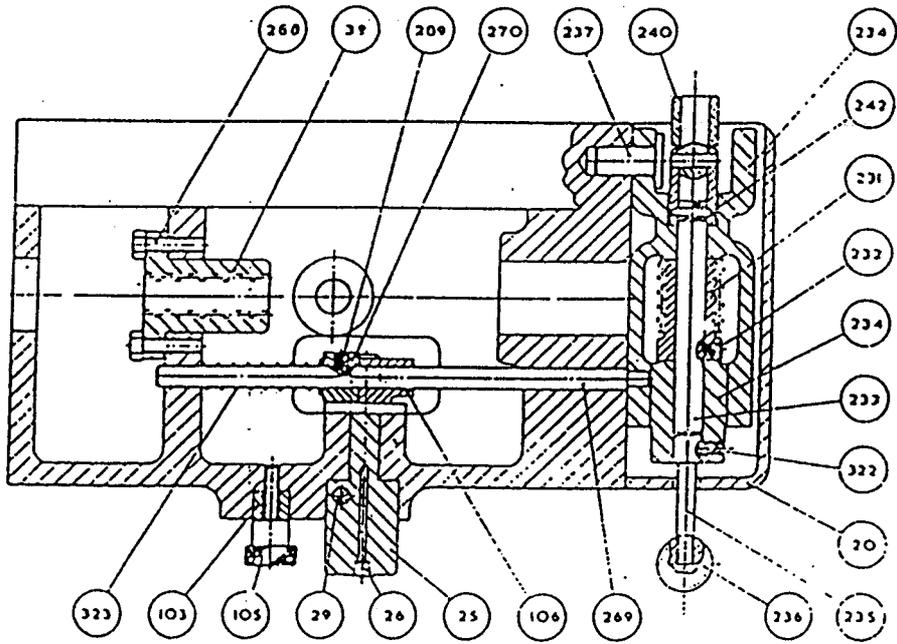
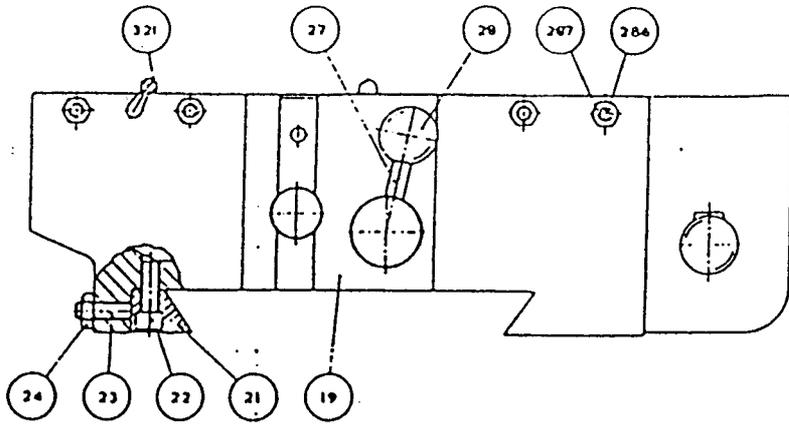
SCALE 3/4 FULL SIZE

DESIGNED BY
 A. J. BOWEN, WYOMING
 DRAWN BY
 J. H. BOWEN

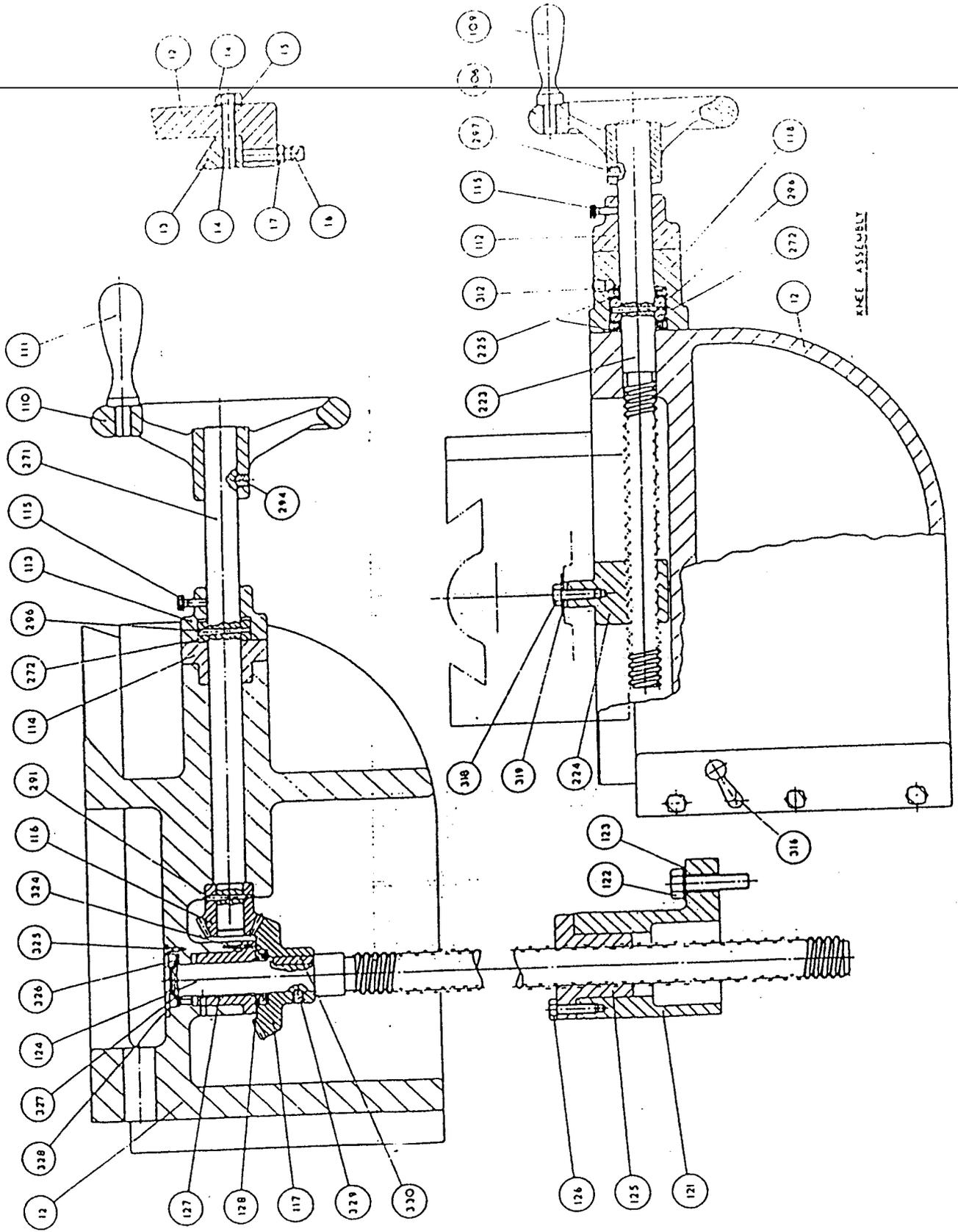
Machine	Foundation Bolt CEN Res.	Nett Weight	Total Height	Suds Tray Dimensions
"M.1"	26½" x 15½"	7½ cwt.	65"	38½" x 28"
"Major"	26½" x 19"	8½ cwt.	65"	38½" x 28"

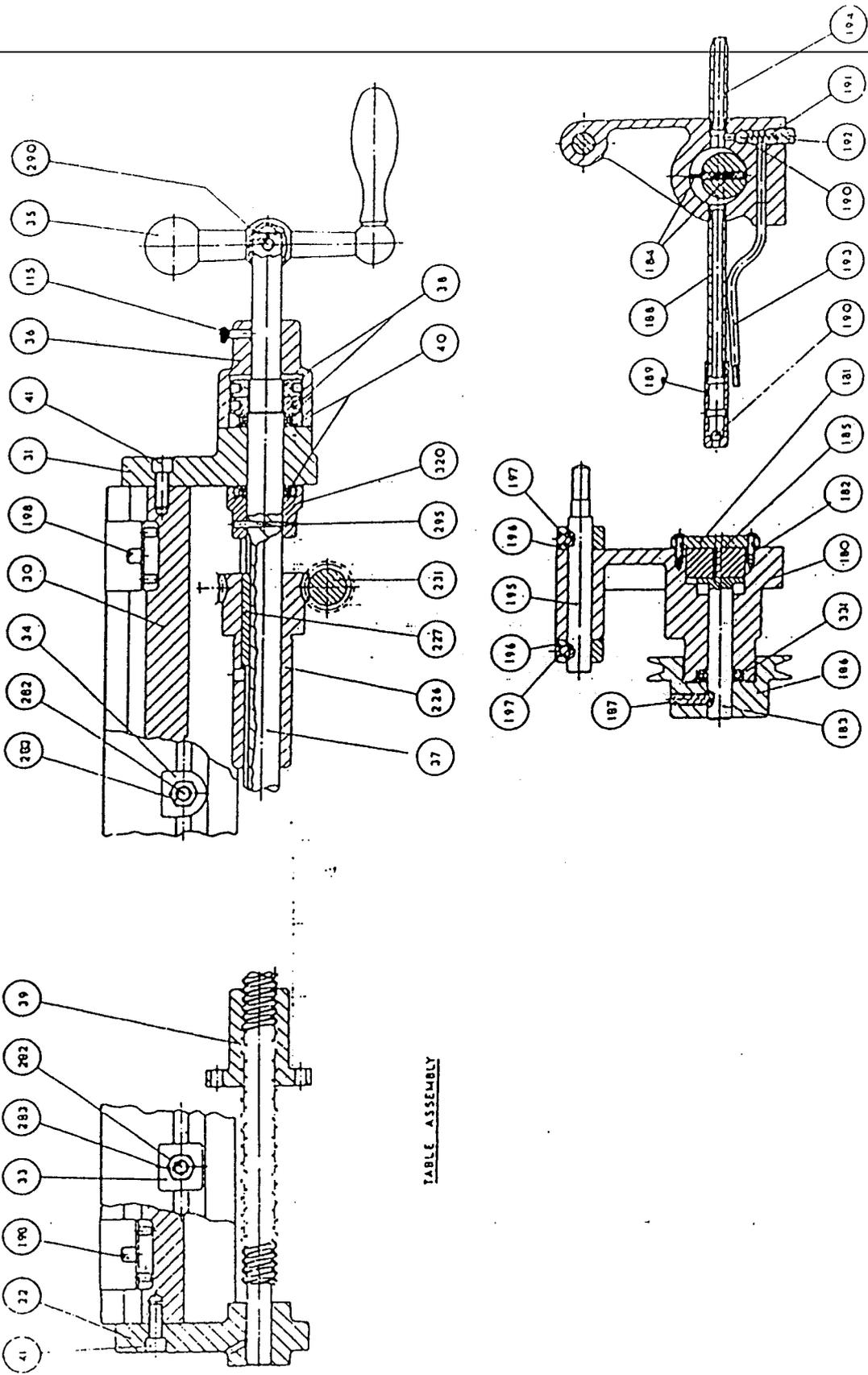


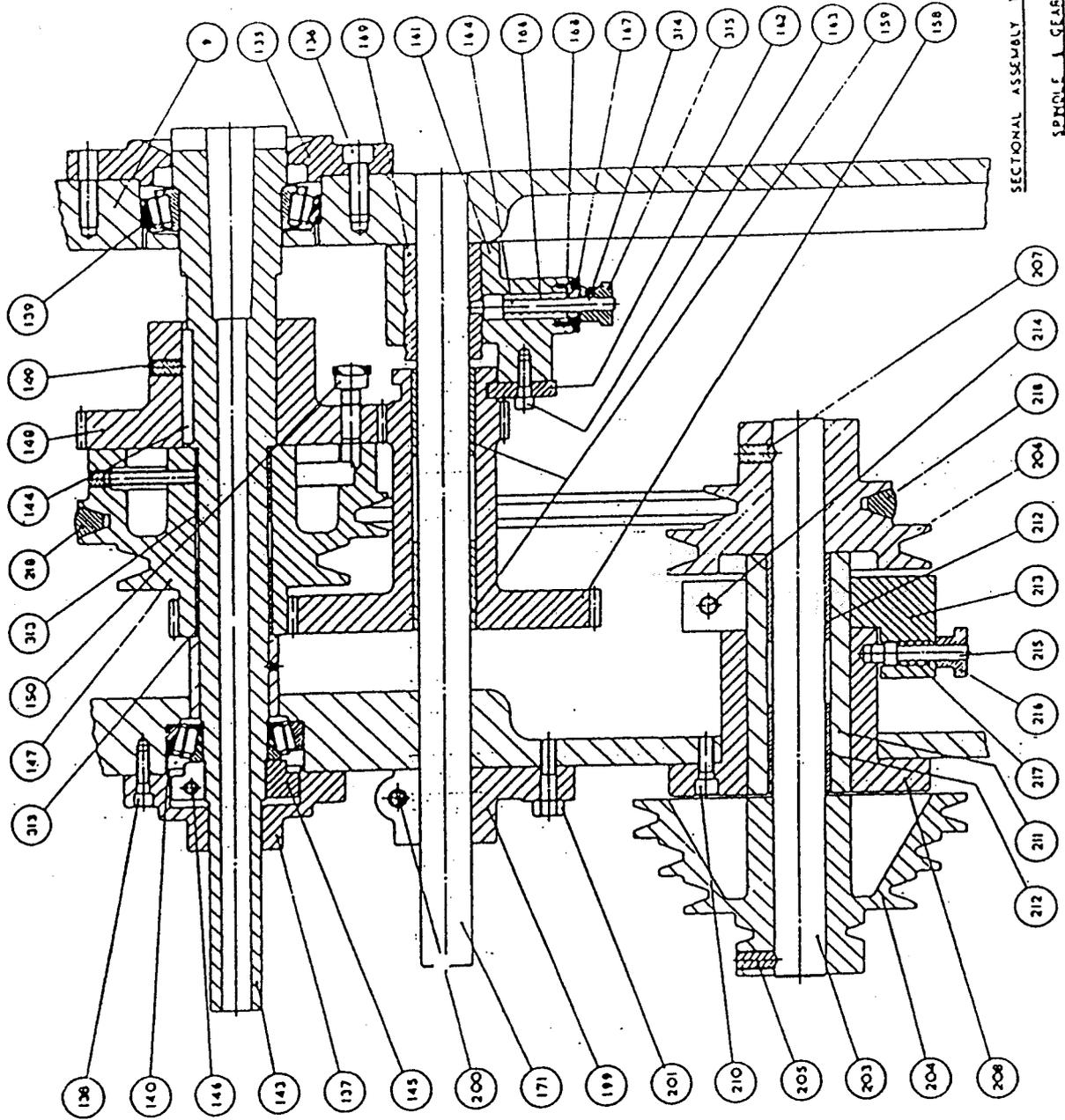
COMPOSITE SECTION
THROUGH MACHINE



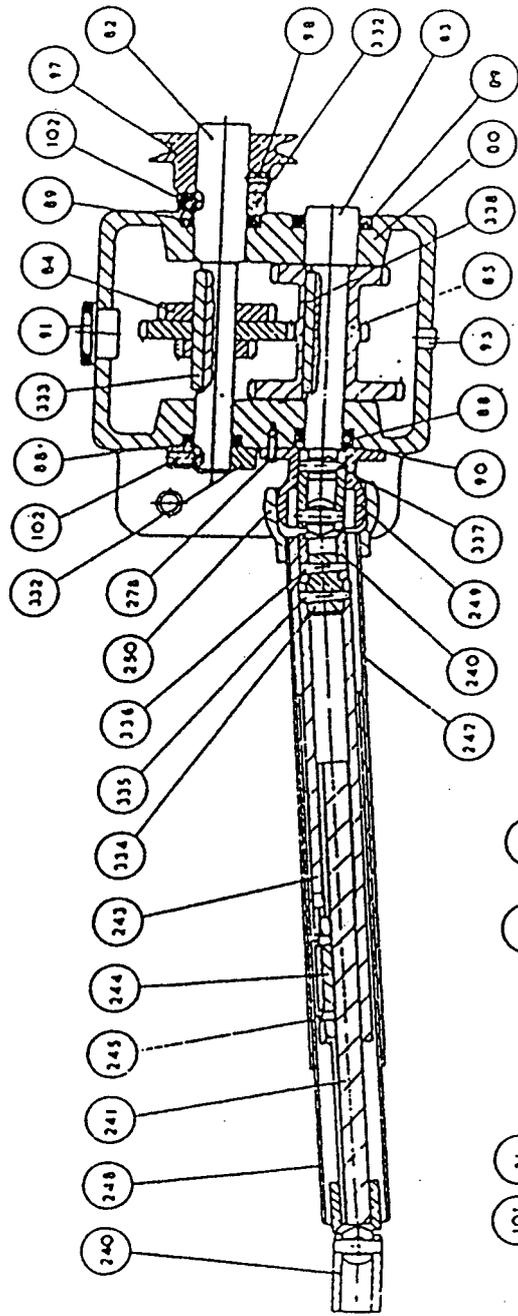
SADDLE ASSEMBLY



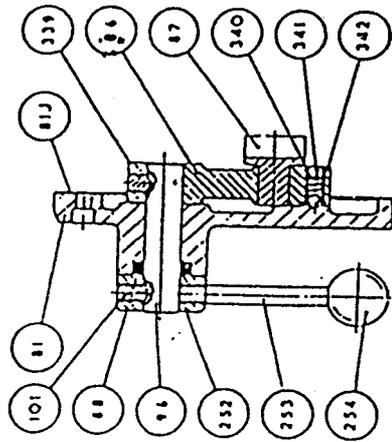




SECTIONAL ASSEMBLY THROUGH
SPINDLE GEAR



GEAR DRIVE ASSEMBLY



GEAR LID ASSEMBLY

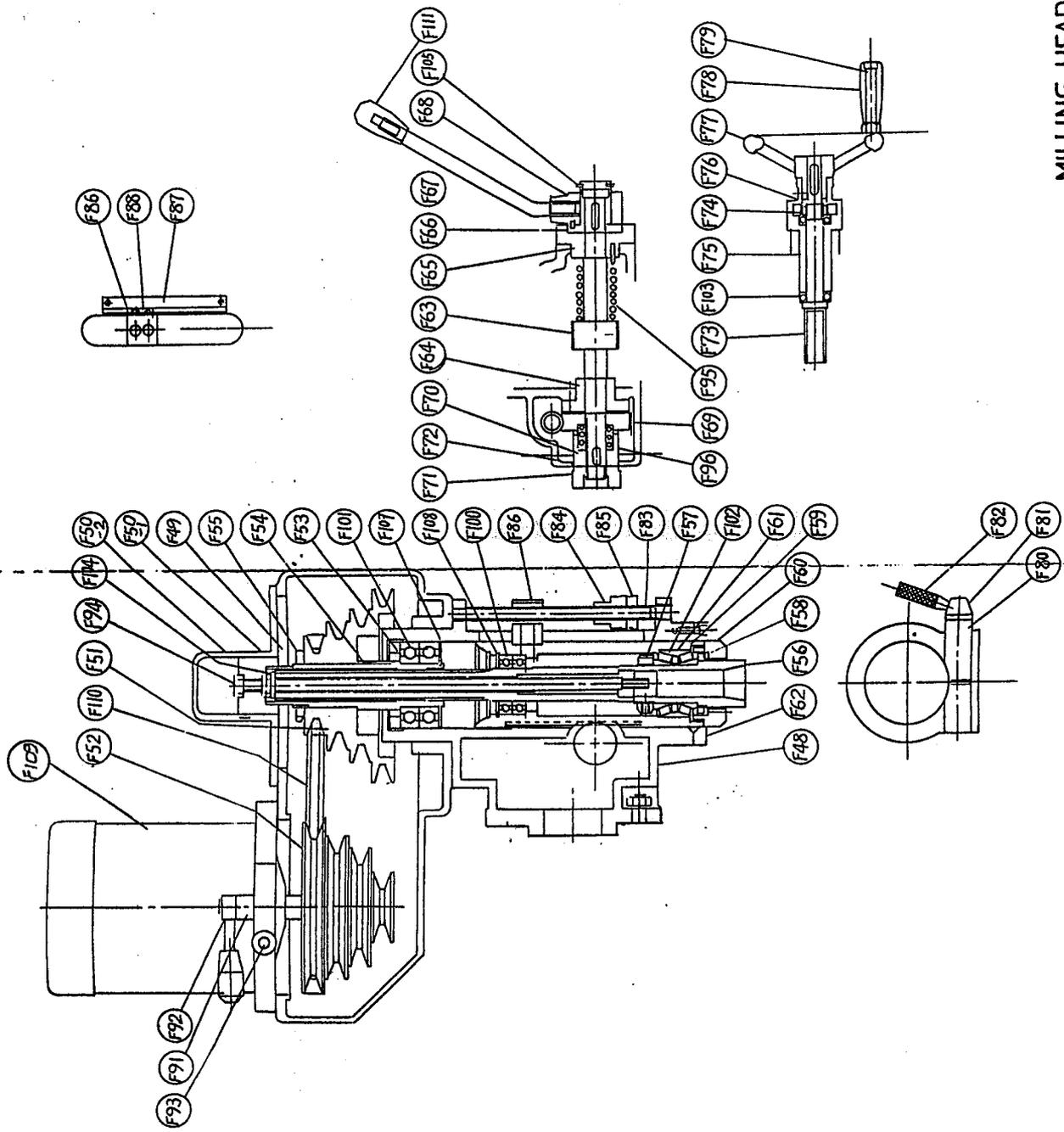
PARTS LIST

'S' TYPE VERTICAL HEAD

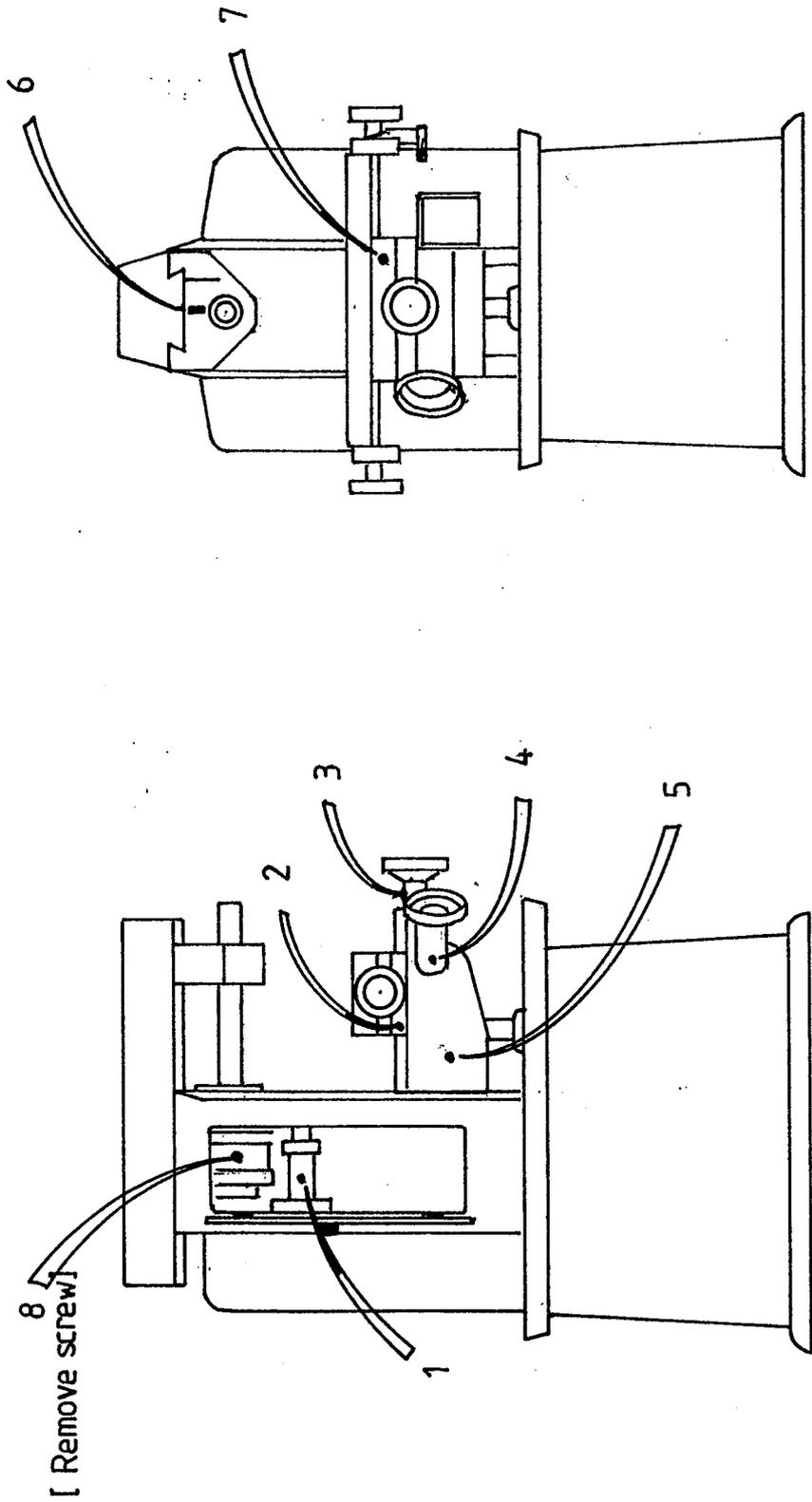
<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>
F 48	Vertical Head	1	F 75	Worm Shaft Sleeve	1
F 49	Belt Housing	1	F 76	Dial	1
F 50	Draw Bar Cover	1	F 77	Handle Wheel	1
F 51	Spindle Pulley	1	F 78	Handle Bar Sleeve	1
F 52	Motor Pulley	1	F 79	Handle Bar	1
F 53	Bearing Locking Nut	1	F 80	Quill Lock Block	1
F 54	Key	1	F 81	Quill Locking Bolt	1
F 55	Pulley Locking Nut	1	F 82	Hand Bar	1
F 56	Vertical Spindle	1	F 83	Quill Stop Micro Screw	1
F 57	Bearing Adjusting Nut	1	F 84	Micrometer Nut	1
F 58	Spindle oilseat	1	F 85	Quill Micro Stop Nut	1
F 59	Quill	1	F 86	Quill Stopper	1
F 60	Locking Nut	1	F 87	Micrometer Scale	1
F 61	Collar	1	F 88	Micrometer Pointer	1
F 62	Felt Ring	1	F 89	Key	1
F 63	Quill Pinion Shaft	1	F 90	Adaptor Bolt Set	6
F 64	Pinion Shaft Seat	1	F 91	Screw for Motor	2
F 65	Pinion Shaft Seat	1	F 92	Screw Bar	2
F 66	Pinion Shaft Sleeve	1	F 93	Bar for Motor	1
F 67	Handle Bar	1	F 94	Draw Bar	1
F 68	Handle Bar Seat	1	F 95	Spring	1
F 69	Pinion Shaft Seat	1	F 96	Spring	1
F 70	Clutch	1	F 97	Ball Bearing 6204 Z	6
F 71	Clutch Adjusting Nut	1	F 98	Ball Bearing 6303 Z	1
F 72	Clutch Cover	1	F 99	Ball Bearing 6004 Z	2
F 73	Fine Feed Worm Shaft	1	F 100	Ball Bearing 6006	2
F 74	Washer for Bearing	2			

PARTS LIST - 'S' TYPE VERTICAL HEAD - CONT'D.

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>
F101	Ball Bearing 6208	2			
F102	Taper Roller Bearing 32007	2			
F103	Taper Roller Bearing 51102	2			
F104	Bearing 6007	1			
F105	Rings E-40	1			
F106	Rings E-25	1			
F107	Rings C-62	1			
F108	Rings C-80	1			
F109	Motor	1			
F110	Belt	1			
F111	Hand Bar Sleeve (Plastic)	4			



MILLING HEAD



LUBRICATION POINTS : 1 to 8 by oil can

FREQUENCY : Weekly

GRADE : General purpose oil

ie SHELL VITREA 68

CASTROL PREFECTO NN

MOBIL DTE 26

ADDITIONAL INFORMATION

'S' TYPE VERTICAL HEAD

To obtain the speeds on the Vertical Head, as shown on the Speed Chart, select the correct belt ratio on the pulley arrangement in the head pulley housing and then select the high or low with the switch on the push button control panel (top left). Having done this, now press the start button (top right).

The Spindle Taper is R.8

The Draw Bolt Thread is 7/16" UNF.

COOLANT PUMP

Coolant is by means of an electric pump.

To Start and Stop pump, press On-Off push button (bottom left) on push button control panel.

TABLE POWER FEED UNIT

This is standard on "Universal" and "VS" Models, and optional on all other models.

To operate unit. Lever on front of unit should be in an upright position, press start button (top left) on push button control panel, now by means of moving lever select the direction required to travel and select required feed speed with control knob on front of unit. For rapid feed override, press rubber covered button alongside of neon light. Adjustable stops are provided on front of table.