

## 8.0 Lubrication

**CAUTION** Do not operate the mill before lubricating the machine fully. Failure to comply may cause damage to the machine.

Refer to *section 11.0* and make sure the machine has been fully lubricated before operating.

## 9.0 Operating instructions

### 9.1 Operating controls

The milling machine is equipped with an automatic lubrication system. Ensure that reservoir has the proper amount of lubricant. The system reservoir is located at rear of machine.

The position of the mill head can be set up to accommodate the workpiece being machined. The mill head can be set up for angles to left or right and for fore and aft angles. The mill head can also be rotated on its turret. The ram can be moved back and forth to reach workpiece locations at fore and aft extremes of worktable travel. Refer to *section 10.0*.

### 9.2 Control panel

The control panel is located on the arm at right side of machine. See Figure 4 for functions.

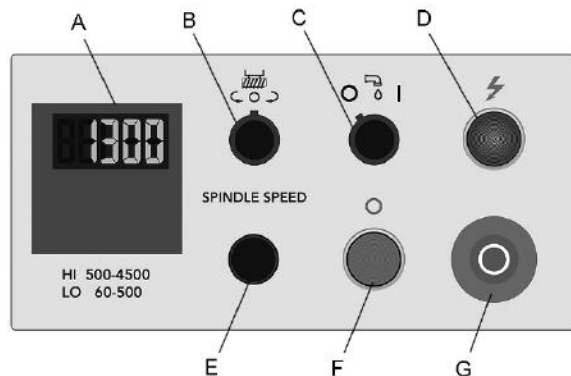


Figure 4

**A – RPM digital readout.**

**B – Motor direction switch:** Has two positions: FWD (forward) and REV (reverse). Setting the switch to FWD will provide clockwise spindle rotation. Use FWD for normal, right-hand tooling.

FWD (clockwise) operation occurs only when gearbox is in low speed position. When gearbox is in high-speed position, the motor switch must be in the REV position to provide right-hand or clockwise rotation. Refer to Table 3 for required switch positions.

The motor switch controls a three-phase motor. The motor can be switched from FWD to REV and back with the motor running, and will reverse direction when the switch setting is changed. At higher speeds, this may put strain on the timing belt but there will be no damage to the motor or gear mechanism.

**C – Coolant switch:** installed for optional coolant pump. The wiring must be connected to U2, V2 and W2 in the terminal strip.

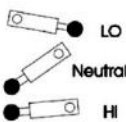
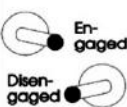
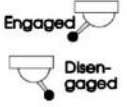

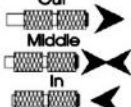

























**D – Power lamp:** indicates electrical power is flowing to machine.

**E – Speed dial:** Sets spindle speed.



**F – Spindle switch:** Engages spindle rotation.

**G – Emergency stop switch:** Shuts down all controls on machine. Rotate switch clockwise to disengage and restart machine.

### 9.3 Control positions for milling and drilling operations

Control Action	High/low lever 	Quill feed lever 	Feed trip cam lever 	Quill feed select lever 	Feed direction control 	Motor switch* 
High spindle speeds						REV
Low spindle speeds						FWD
High spindle speeds with automatic downfeed				Select feed rate		REV
Low spindle speeds with automatic downfeed				Select feed rate		FWD
High spindle speeds with automatic upfeed				Select feed rate		REV
Low spindle speeds with automatic upfeed				Select feed rate		FWD
Lever feed						
Fine feed using handwheel						
Free-turning spindle for positioning or working with tooling						

#### Speeds at Specific Control Settings

Hi/low speed control lever	Range of speeds using control wheel
	60 - 500 RPM
	500 - 4,500 RPM

\* Motor switch position is for right-hand tooling (tooling which requires clockwise rotation of the spindle.) If you are using left-hand tooling, simply change the motor switch to the opposite setting.

Table 3

## 9.4 Electronic variable speed

The dial on the EVS control panel controls the main motor speed. Motor RPM is displayed on the LED screen.

## 9.5 Spindle brake

The spindle brake lever is located on upper left side of mill head (Figure 5). Pull lever downward to apply brake. The spindle brake lever is used only after motor switch has been set to OFF. The spindle will not stop with motor running.

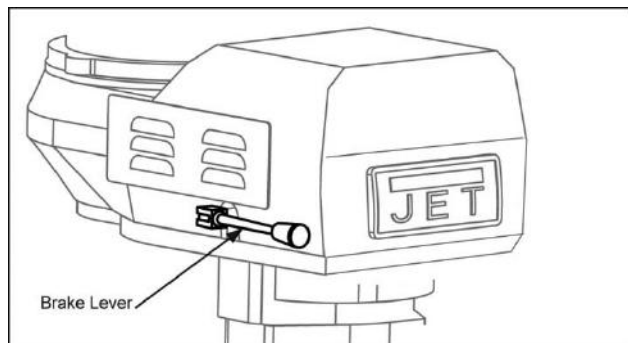


Figure 5

## 9.6 High-neutral-low shift lever

The mill head can be driven directly (High Speed) or through the back gear (Low Speed) in the mill head. The selection is made by changing the position of shift lever.

The *shift lever* is located at lower right side of mill head (Figure 6). The lever position closest to operator is *High* setting. The lever position away from operator is *Low* setting. The middle position is *Neutral* setting.

**CAUTION** Do not shift the High-Low Gear Lever while the motor is running. Rotate the spindle by hand to facilitate changing lever positions.

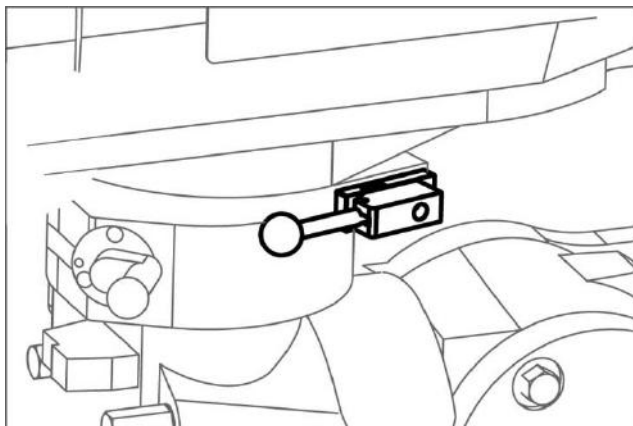


Figure 6

## 9.7 Quill power feed lever

**CAUTION** Do not use power feed at speeds above 3000 R.P.M.

**CAUTION** It is recommended to disengage the power feed worm gear whenever power feed is not required. This avoids unnecessary wear on worm gear.

**CAUTION** Do not move Quill Power Feed Lever unless motor is at a complete stop. When changing lever position, do it gently. If gear does not engage, jog the motor and allow it to stop before attempting to change.

The quill power feed lever is located on right side of mill head (Figure 9). It is used to engage and disengage the quill power feed mechanism.

The power feed is engaged by pulling out the knob and rotating handle to a new locked position. When engaged, the power feed mechanism will drive spindle upward or downward. The power feed mechanism will not drive spindle when handle is in disengaged position.

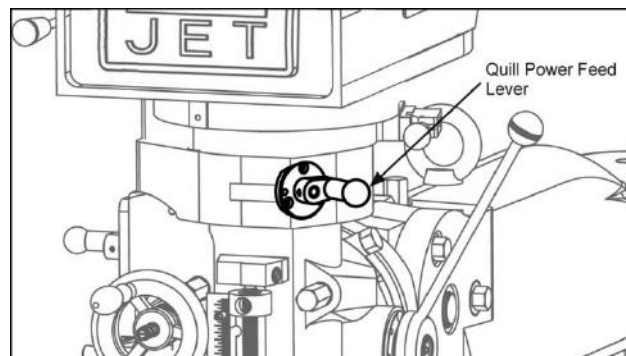


Figure 7

## 9.8 Feed rate lever

The *Feed Rate Lever* (Figure 8) is used to set the per-revolution rate of the power feed mechanism. Three feed rates are available: 0.0015-inch, 0.003-inch, and 0.006-inch per revolution. The positions are shown on an indicator plate under the feed rate lever.

The rate is selected by pulling out knob on feed rate lever and moving handle to the detent of desired feed rate.

**Note:** The knob is spring loaded – pull out to rotate to new position.

Unlike other controls on the machine, the lever shifts into engagement more easily with the motor running, and the quill feed lever engaged.

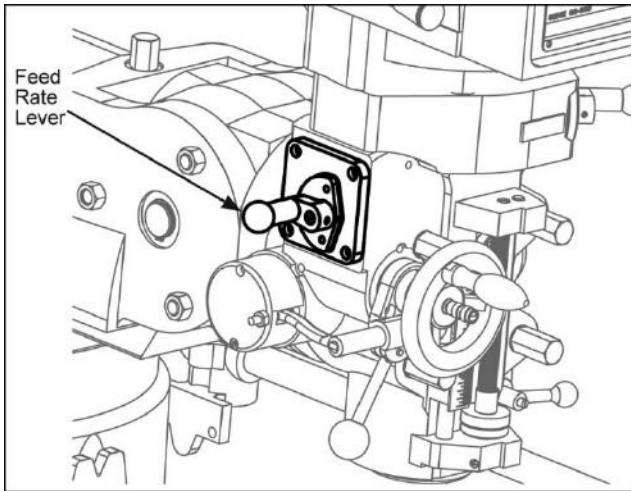


Figure 8

### 9.9 Feed trip cam lever

The *Feed Trip Cam Lever* (A, Figure 9) is located on left side of head behind the *Manual Fine Feed Handwheel* (B, Figure 9). It engages the overload clutch on the pinion shaft when positioned to the left. The *Feed Trip Cam Lever* stays engaged until *Quill Stop* (C, Figure 12) comes in contact with *Micrometer Adjusting Nut* (A, Figure 12) forcing it to drop out automatically, or until it is released manually by engaging the lever to the right.

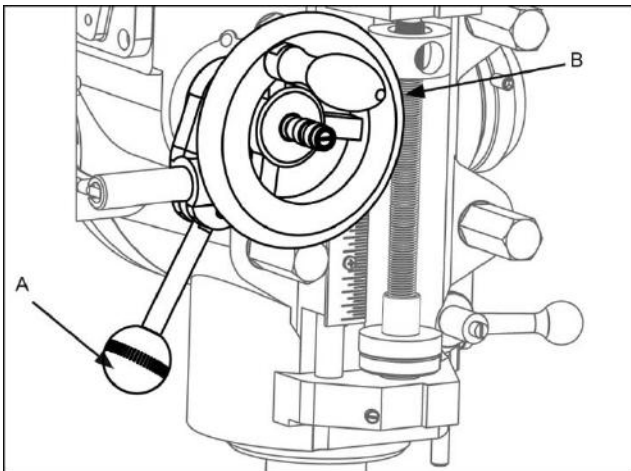


Figure 9

### 9.10 Feed direction control

The *Feed Direction Control* (B, Figure 10) determines whether the power feed will move up, down, or not move at all. The position of knob depends upon direction of spindle rotation (see the *Motor Switch* section). Position of the control may be changed with the system stopped or running. If the control does not engage easily, move fine feed handwheel (A, Figure 10) back and forth to aid engagement.

If spindle is rotating clockwise, *in* is downfeed; *out* is upfeed. If spindle rotation is counterclockwise, *out* is downfeed; *in* is upfeed. Neutral position is between *in* and *out* position.

### CAUTION

It is recommended that *Feed Direction Knob* be left in neutral position when not in use.

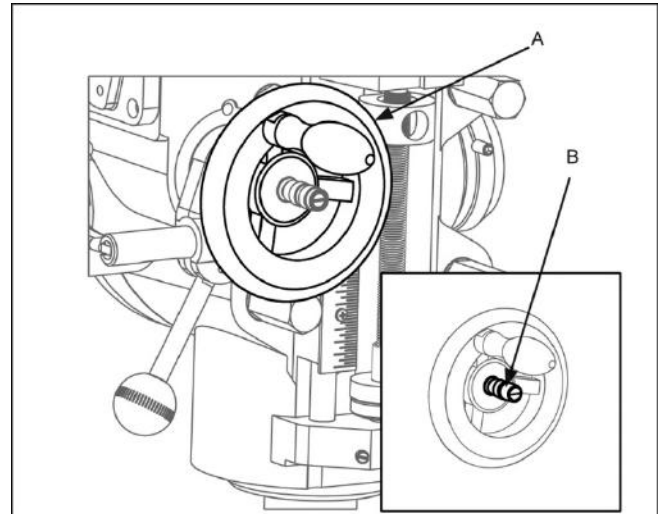


Figure 10

### 9.11 Coarse feed handle

The *Coarse Feed Handle* (A, Figure 11) is located on right side of head. The *Coarse Feed Handle* is used for non-precision drilling operations and for moving quill to a specific depth. A return spring will retract spindle automatically once handle is released.

### 9.12 Quill lock handle

The *Quill Lock Handle* (B, Figure 11) is located on right side of head. Rotate handle clockwise to lock quill in desired position. Rotate handle counter-clockwise to release.

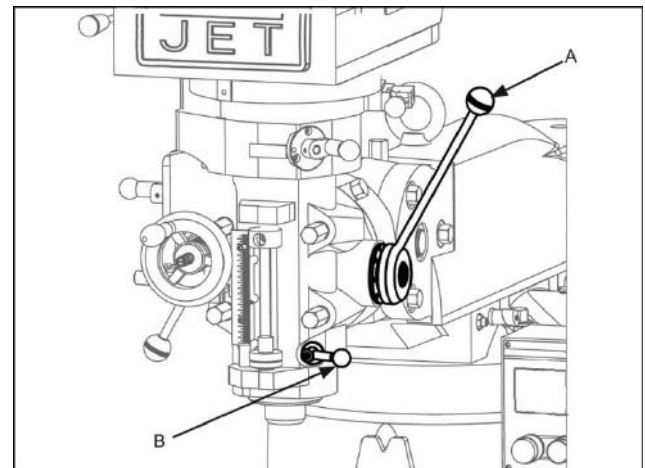


Figure 11

### 9.13 Micrometer adjusting nut

The *Micrometer Adjusting Nut* (A, Figure 12) is located on front of head. Use for setting specific spindle depth. Secure with *lock nut* (B, Figure 12).

## 9.14 Fine feed handwheel

When the controls are set for the *Fine feed using Handwheel* position (see Table 3), the *Fine Feed Handwheel* (A, Figure 10) can be used for manual fine feed control in either upward or downward direction of the quill.

**⚠WARNING** Remove Manual Fine Feed Handwheel when not in use. Failure to comply may cause serious injury.

## 9.15 Depth scale and stop

Referring to Figure 14:

The *Depth Scale and Stop* are used in drilling operations to set the depth of the drilled hole. The depth scale is located on front of mill head. The scale consists of a *Micrometer Adjusting Nut* (A), *Lock Nut* (B), *Quill Stop* (C), *Quill Stop Screw* (D), and *Scale* (E).

The *Micrometer Adjusting Nut* is set to the desired dimension and locked in place using the *Lock Nut*. The quill stop provides a positive stop for quill travel.

The graduations on the micrometer nut are in 0.001-inch increments. Adjustment of quill travel is made by rotating micrometer nut.

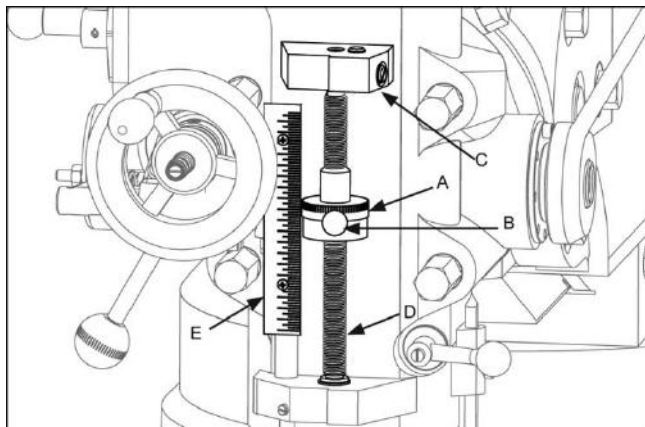


Figure 12

## 9.16 Power feed operation

The *Feed Trip Adjustment* sets the point at which the quill will reset during *Power Feed*.

Refer to Figure 13.

**⚠WARNING** Be sure that the Manual Fine Feed Handwheel is removed. Failure to comply may cause serious injury.

1. Move adjuster nut to allow for ample spindle travel.
2. With the *Quill Feed Handle* (J), advance the quill to the point where the feed should stop.
3. Engage the *Feed Trip Cam Lever* (D) by pulling away from head assembly.
4. Adjust *Micrometer Adjusting Nut* (H) against *Quill Stop* (G).
5. Continue turning the *Micrometer Adjusting Nut* (H) until the *Feed Trip Cam Lever* (D) trips.

6. Tighten the *Locknut* (I).
7. Ensure *Quill Lock* (K) is disengaged by rotating counter-clockwise.
8. Start spindle (see Table 3):
9. Select feed rate at the control panel.
10. Set *Feed Rate Lever* (B) to feed rate required for the tooling and material.
11. Place *Quill Feed Engagement Lever* (F) in the *Engaged* position.
12. Select feed direction by setting *Feed Direction Knob* (C) position per Table 4:

Spindle Direction	Feed Direction	Knob Position
CW	Down	In
	Up	Out
CCW	Down	Out
	Up	In

Table 4

13. Engage *Feed Trip Cam Lever* (D) by pulling away from head assembly.

**Note:** Due to variables in tool diameter, coatings, coolant, and materials, no specific spindle speed or feed rate recommendations are provided. Use general shop manuals that have data applicable to the milling and drilling operations being performed. Or, contact the supplier of the tooling, coolant, and material for specific recommendations.

**IMPORTANT:** The power feed can be used for drills up to 3/8" in diameter (mild steel). Use manual feed for drills larger than 3/8".

**⚠CAUTION** The overload clutch is factory set to hold up to 200 lbs. downfeed pressure on the quill (accommodates drills up to 3/8"). Do not attempt to adjust clutch pressure.

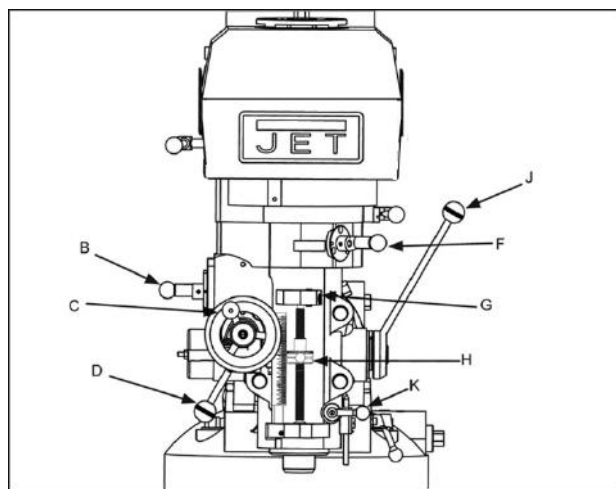


Figure 13

## 9.17 Draw bar operation – changing tooling

1. Using the provided wrench, loosen draw bar two or three turns (turn counterclockwise) using draw bar hex (Figure 14).

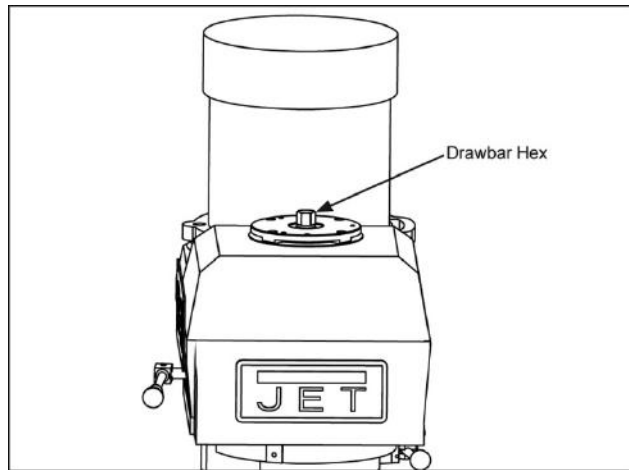


Figure 14

2. Tap the top of draw bar with a soft-faced hammer to loosen collet from taper.
3. Remove tool from collet.
4. Insert new tool into collet.
5. Tighten draw bar firmly using provided wrench. Turn draw bar. The tool is now ready for use.

## 9.18 Clamping workpiece to table

The worktable has 5/8-inch T-slots for clamping workpiece to table.

1. Set motor switch to STOP position.
2. Place workpiece on table.
3. Clamp workpiece using T-slot clamps, studs, and step blocks as required (Figure 15).

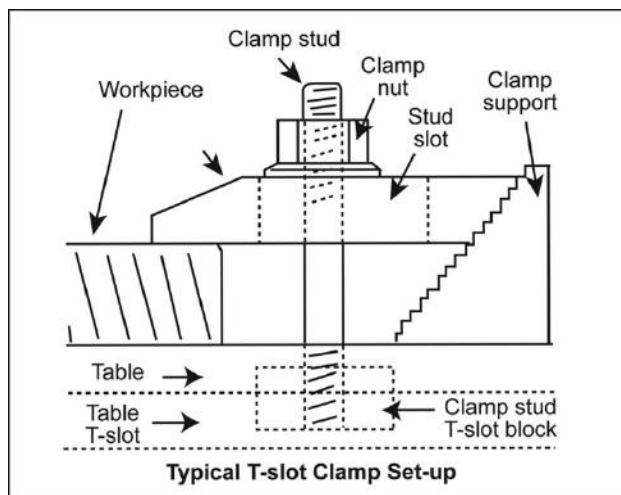


Figure 15

# 10.0 Adjustments

## 10.1 Mill head – left/right adjustment

**⚠WARNING** Make sure machine base is secured to floor before repositioning mill head. The center of gravity can shift enough to cause machine to tip over, resulting in serious injury to operator and damage to machine.

1. Loosen four large hex nuts that secure the mill head to the ram adapter (refer to Figure 16). 1/4 turn should be sufficient to allow head to move.

**NOTE:** For angles greater than 10 degrees, use your free hand to support the mill head, taking some weight off the brass worm gears. Doing so will greatly lengthen the life of the worm gears.

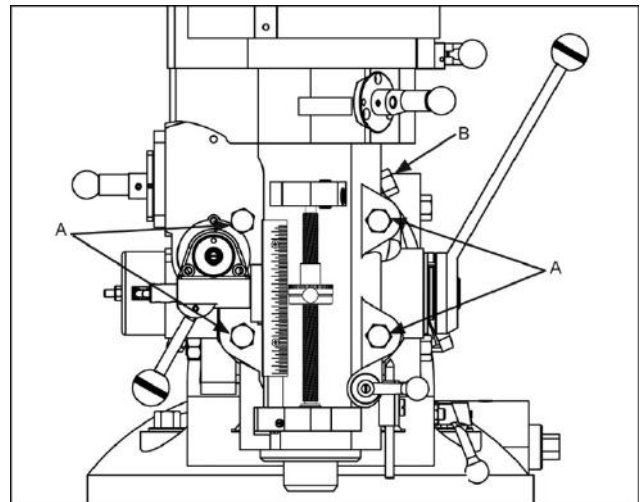


Figure 16

2. Turn worm nut (B, Figure 18) to tilt head left or right as required. Use scale on ram adapter to set desired angle.
3. **Note:** The scales on the ram adapter and for head rotation are guides only. Close tolerance work will require use of a dial indicator to make sure head is 90° to table in X and Y axis. Please note the table is fitted to be slightly higher in front, usually about 0.0005".

**⚠CAUTION** Be sure to apply torque in two steps using a crossing pattern. Failure to do so could distort the face of the ram adapter.

4. Tighten the four hex nuts. Tighten in two steps using a calibrated torque wrench. Use a crossing pattern to tighten the nuts. Tighten initially to 25 foot-pounds.
5. Before applying final torque, check to make sure mill head is perpendicular to work table.
6. Set up a dial indicator in a collet and secure using the draw bar (refer to Figure 18).
7. Put spindle drive in neutral.