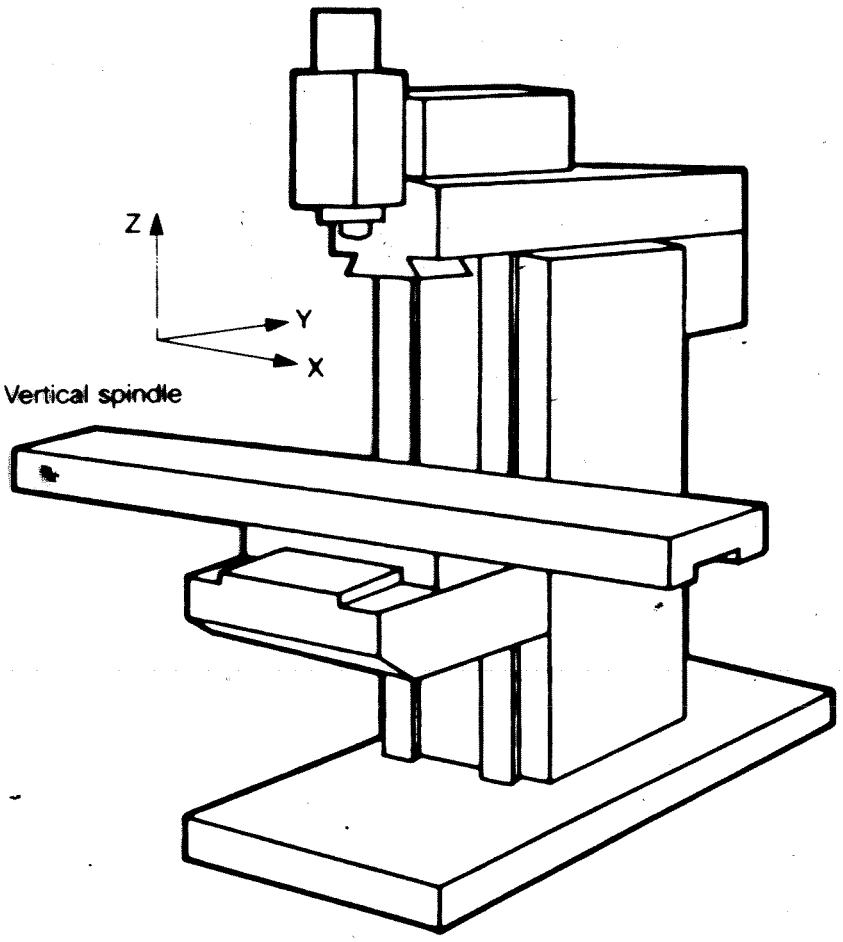
Milling

Machine

Reference

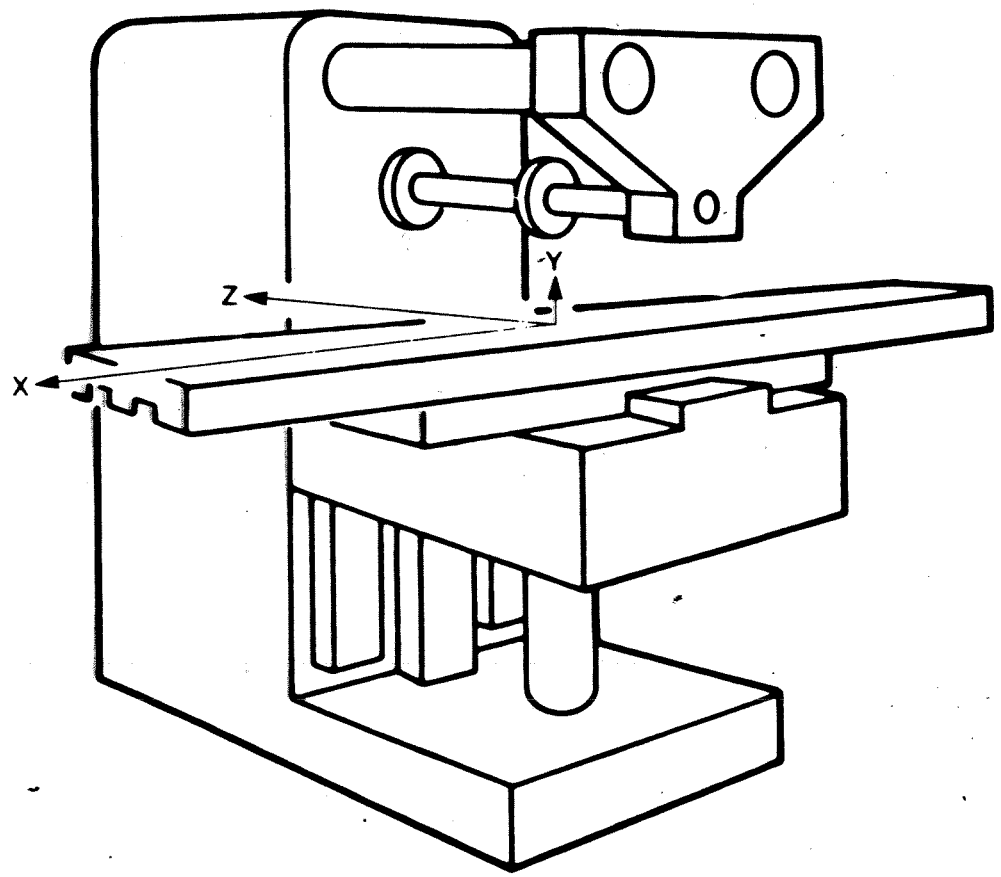
Package

Vertical Milling Machine

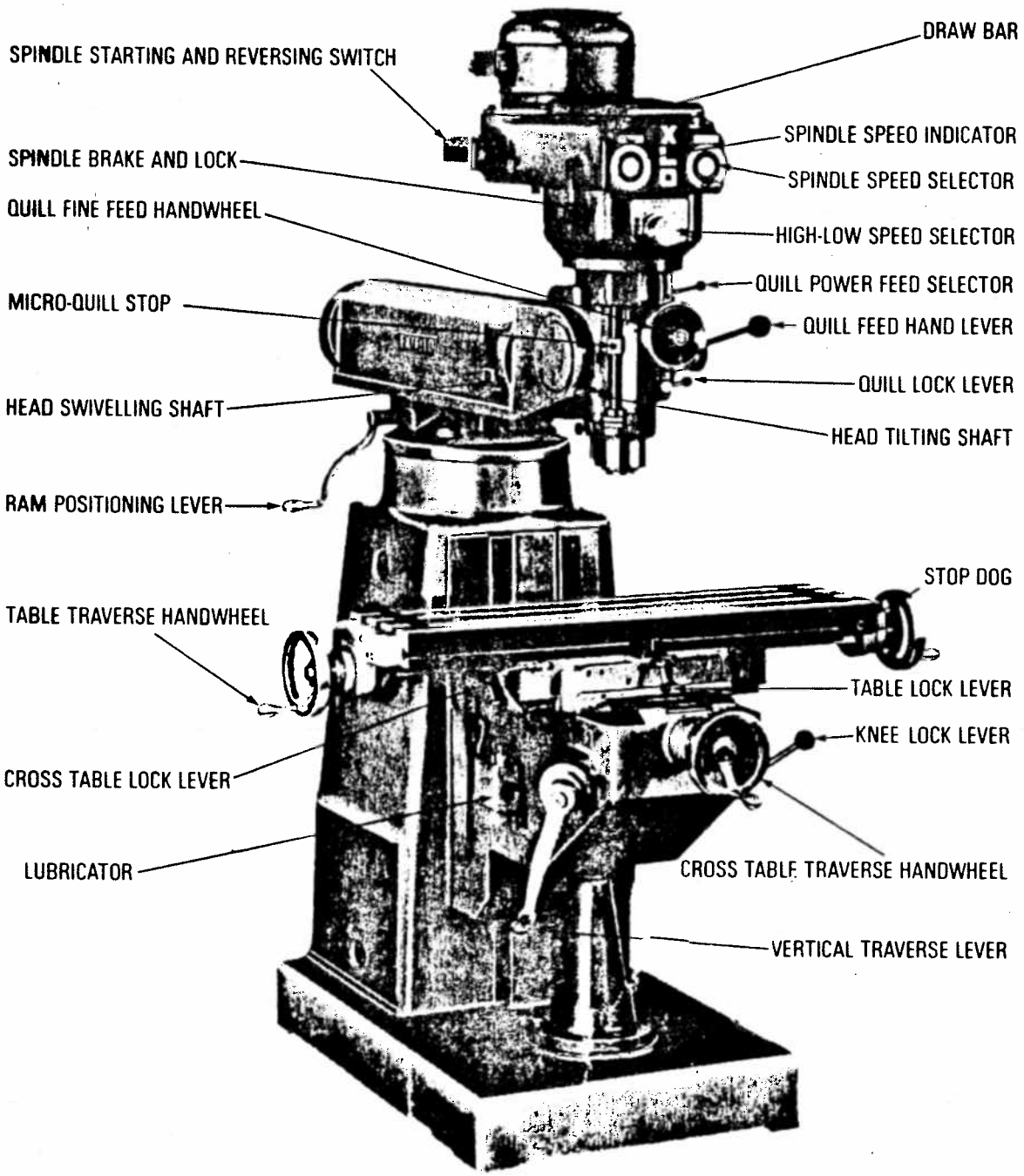


Spindle motion is assigned Z axis.

Horizontal Milling Machine



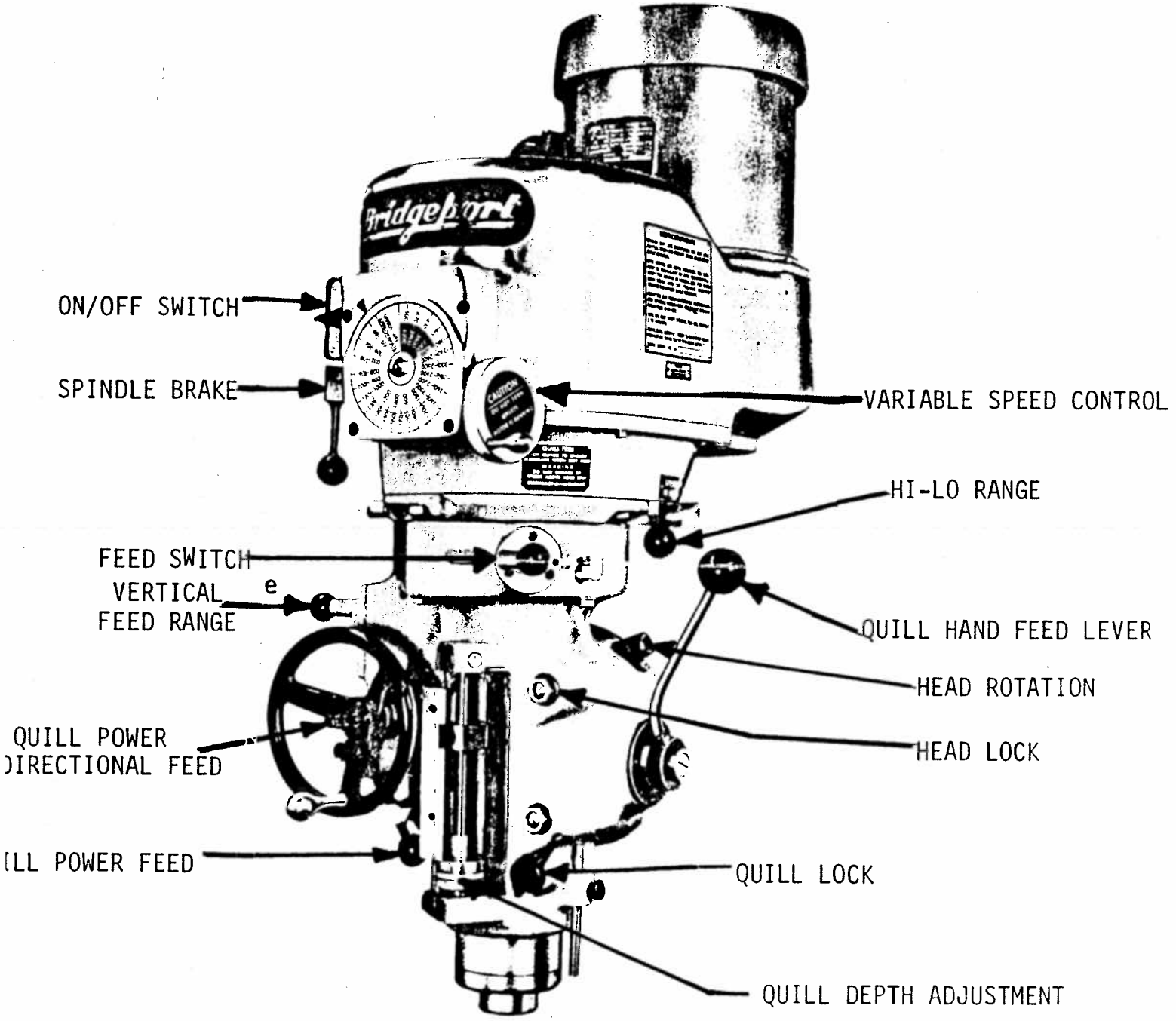
Spindle motion is assigned Z axis.



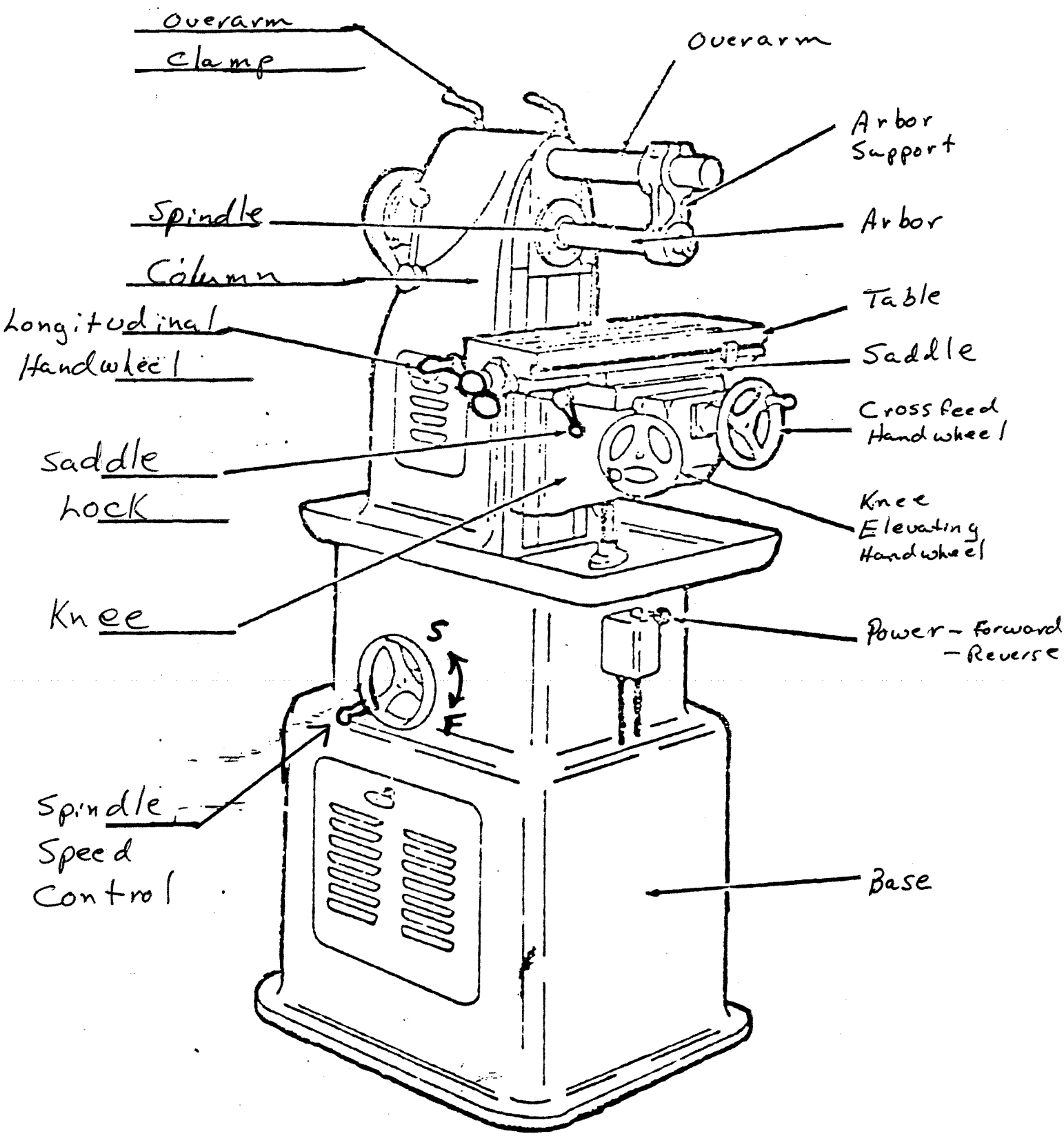
Ram Type Vertical Milling Machine.

Milling Machine Competencies

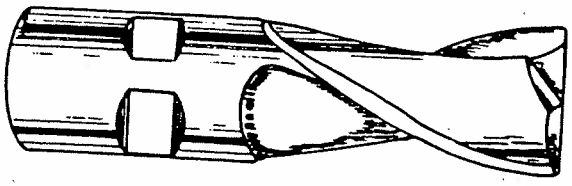
No. 4 - Controls & Operations Information Sheet #2

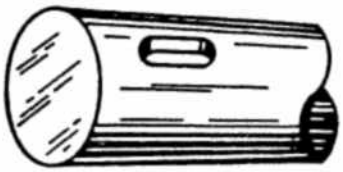


The Horizontal Milling Machine

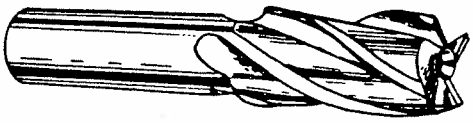


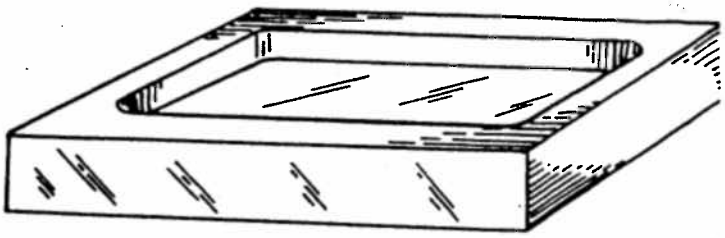
No. 7 - Cutters



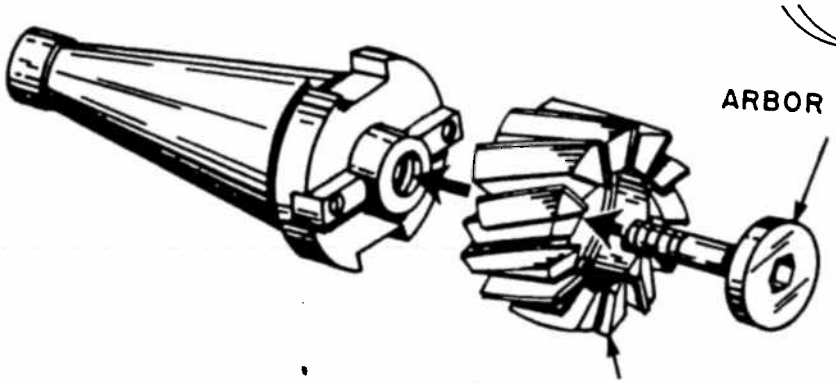


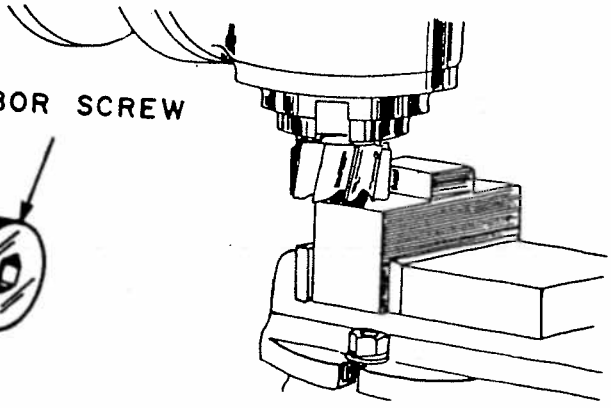
Milling a keyway with a two-fluted end mill. Remember - only a two-fluted mill can plunge straight down into a work piece.



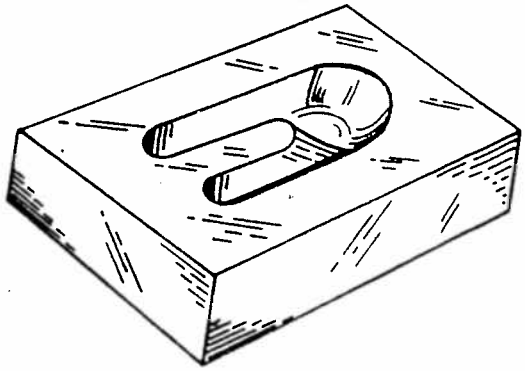


Milling with a four- fluted mill





Shell End Milling

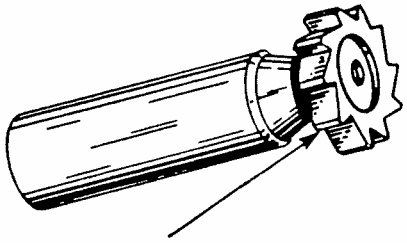


Ball - end Milling

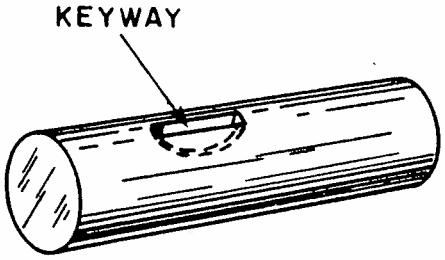
Milling Machine Competencies

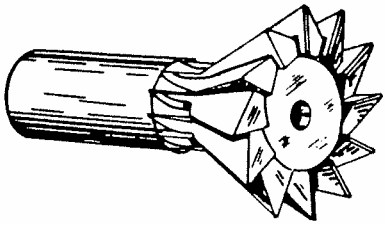
No. 7 - Cutters

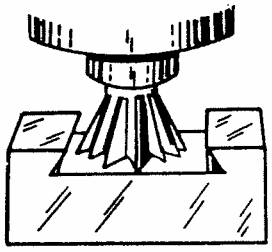
Information Sheet #5



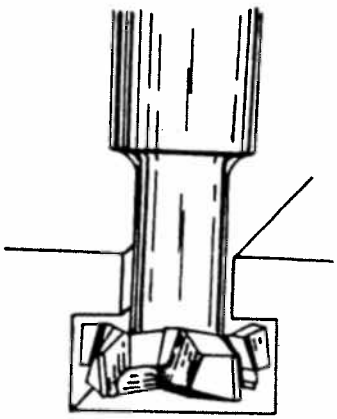
WOODRUFF KEYWAY CUTTER



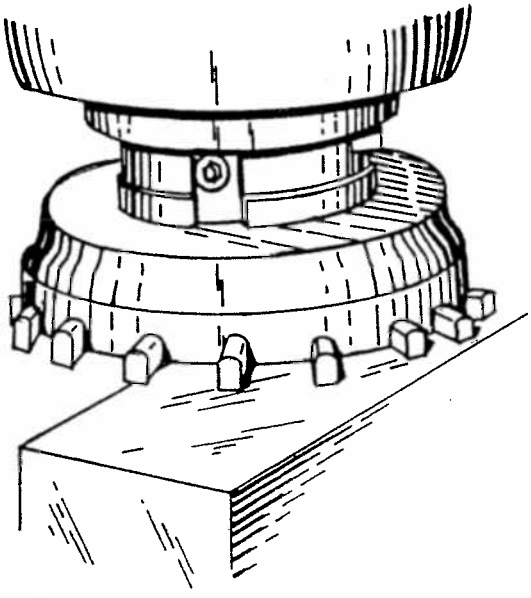




DOVETAIL CUTTER



T-SLOT CUTTER

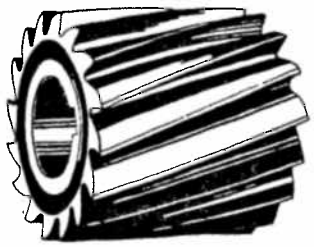


FACE MILLING

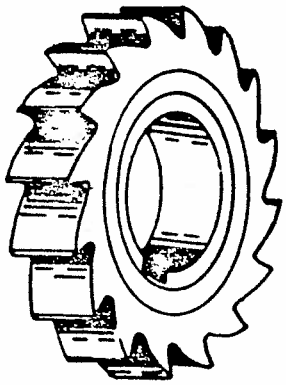
Milling Machine Competencies

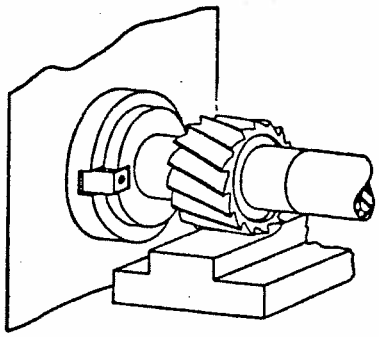
No. 7 - Cutters

Information Sheet #6

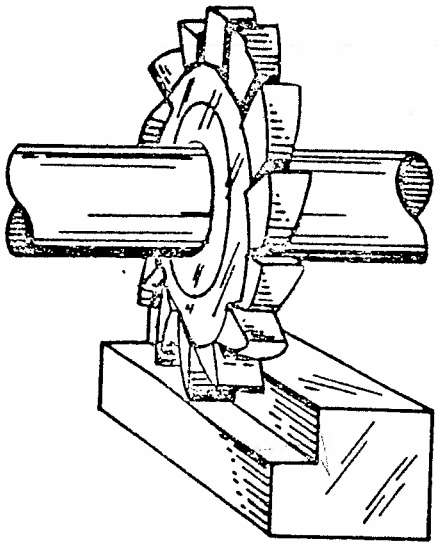


(slab)



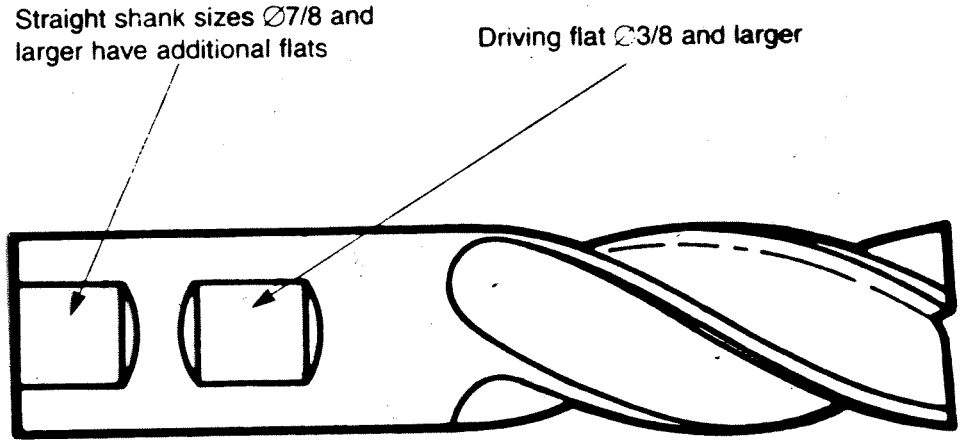


Plain Milling Cutters

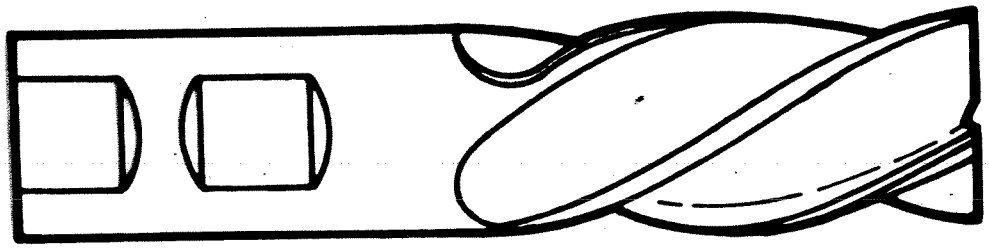


Side Milling Cutter

Cutter Hand



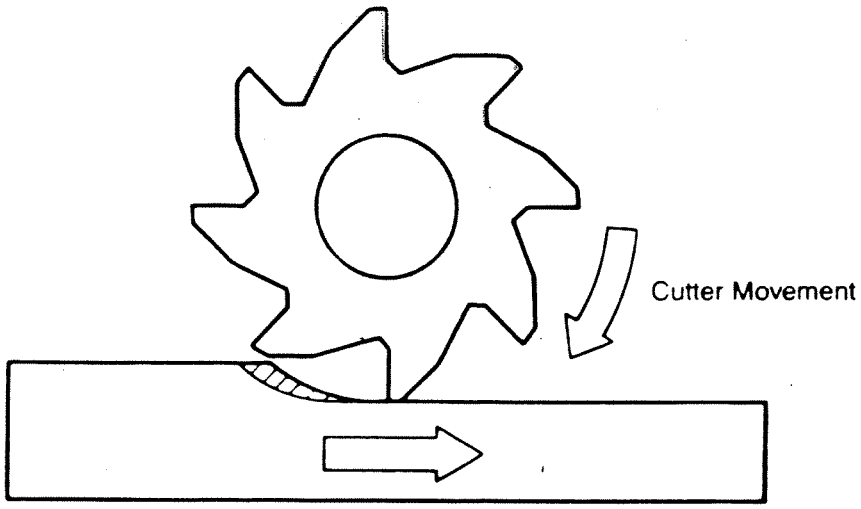
Right-Hand



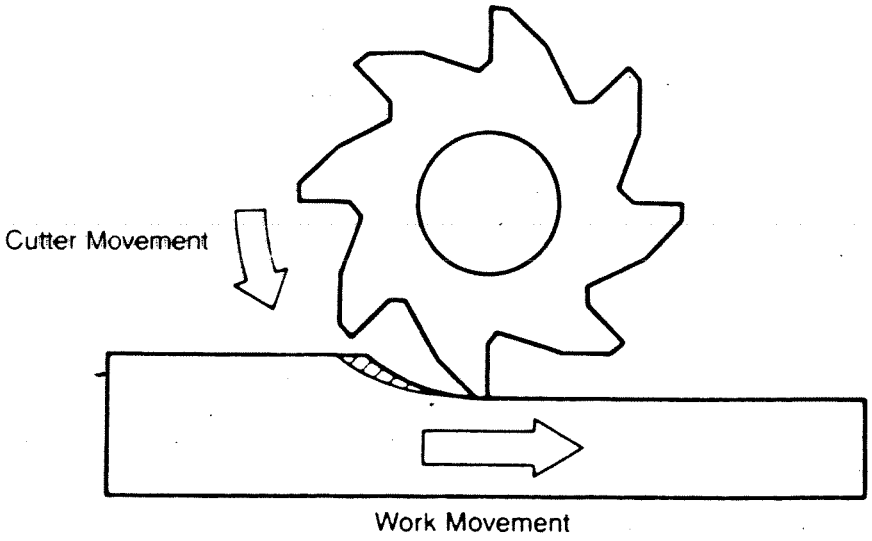
Left-Hand

Cutter is right-hand if it rotates counterclockwise when viewed from cutting end. It is left-hand if rotation is clockwise.

Conventional and Climb Milling



Conventional (up) Milling



Climb (down) Milling

Carbide = H.S.S. X 4

Ceramic = Carbide X 10

Cutting Speeds and Feeds

Material	High-speed steel cutter		Carbide cutter	
	Feet per minute	Meters per minute*	Feet per minute	Meters per minute*
Aluminum	550–1000	170–300	2200–4000	670–1200
Brass	250–650	75–200	1000–2600	300–800
Low carbon steel	100–325	30–100	400–1300	120–400
Free cutting steel	150–250	45–75	600–1000	180–300
Alloy steel	70–175	20–50	280–700	85–210
Cast iron	45–60	15–20	180–240	55–75

Reduce speeds for hard materials, abrasive materials, deep cuts, and high alloy materials. Increase speeds for soft materials, better finishes, light cuts, frail work, and setups. Start at midpoint on the range and increase or decrease speed until best results are obtained.
*Figures rounded off.

Recommended cutting speeds for milling. Speed is given in surface feet per minute (fpm) and in surface meters per minute (mpm).

Type of cutter	Material				
	Aluminum	Brass	Cast Iron	Free cutting steel	Alloy steel
End mill	0.009 (0.22) 0.022 (0.55)	0.007 (0.18) 0.015 (0.38)	0.004 (0.10) 0.009 (0.22)	0.005 (0.13) 0.010 (0.25)	0.003 (0.08) 0.007 (0.18)
Face mill	0.016 (0.40) 0.040 (1.02)	0.012 (0.30) 0.030 (0.75)	0.007 (0.18) 0.018 (0.45)	0.008 (0.20) 0.020 (0.50)	0.005 (0.13) 0.012 (0.30)
Shell end mill	0.012 (0.30) 0.030 (0.75)	0.010 (0.25) 0.022 (0.55)	0.005 (0.13) 0.013 (0.33)	0.007 (0.18) 0.015 (0.38)	0.004 (0.10) 0.009 (0.22)
Slab mill	0.008 (0.20) 0.017 (0.43)	0.006 (0.15) 0.012 (0.30)	0.003 (0.08) 0.007 (0.18)	0.004 (0.10) 0.008 (0.20)	0.001 (0.03) 0.004 (0.10)
Side cutter	0.010 (0.25) 0.020 (0.50)	0.008 (0.20) 0.016 (0.40)	0.004 (0.10) 0.010 (0.25)	0.005 (0.13) 0.011 (0.28)	0.003 (0.08) 0.007 (0.18)
Saw	0.006 (0.15) 0.010 (0.25)	0.004 (0.10) 0.007 (0.18)	0.001 (0.03) 0.003 (0.08)	0.003 (0.08) 0.005 (0.13)	0.001 (0.03) 0.003 (0.08)

Increase or decrease feed until the desired surface finish is obtained.
Feeds may be increased 100 percent or more depending upon the rigity of the machine and the power available, if carbide tipped cutters are used.

Recommended feed rates in inches per tooth and millimeters (shown in parentheses) per tooth for high speed steel (HSS) milling cutters.