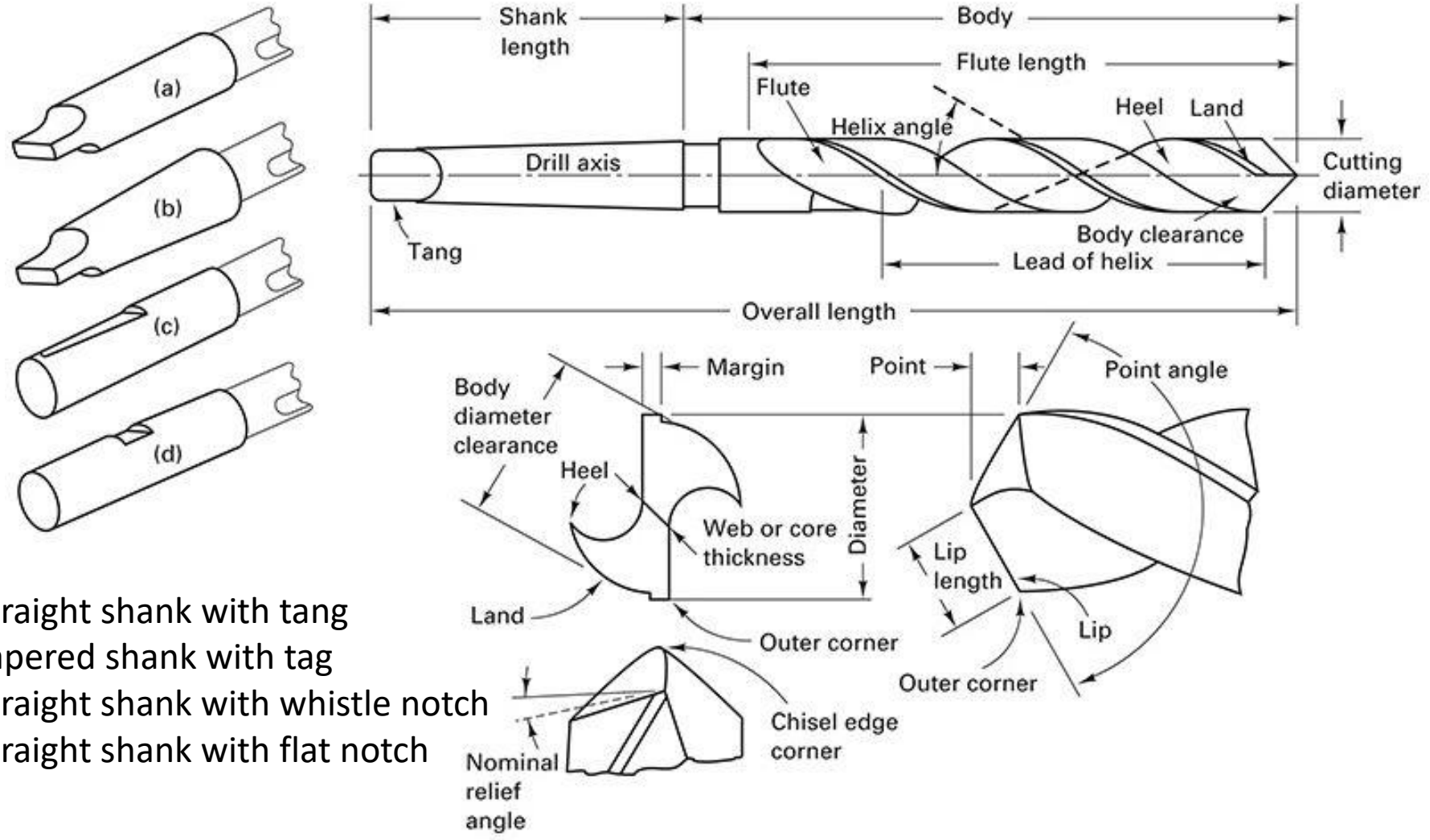
Drilling and Hole Making Processes

Watch Video Here

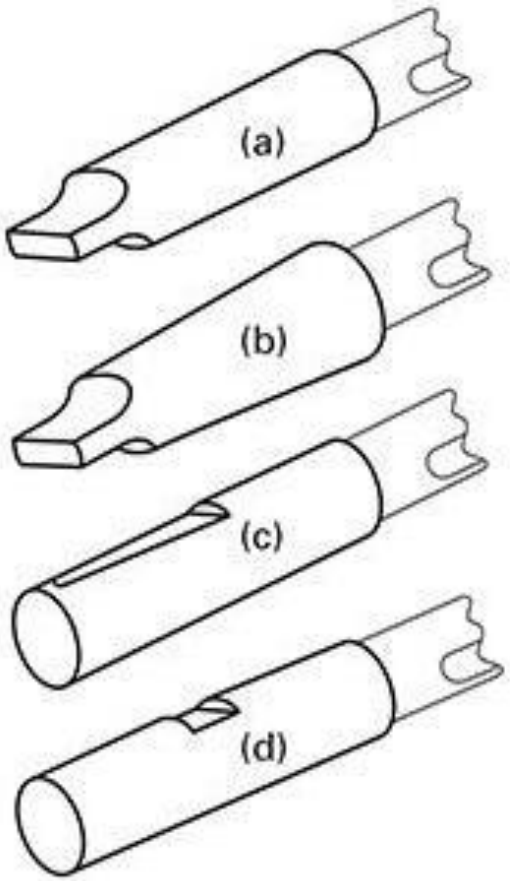
Nomenclature and Geometry of Conventional Twist Drill

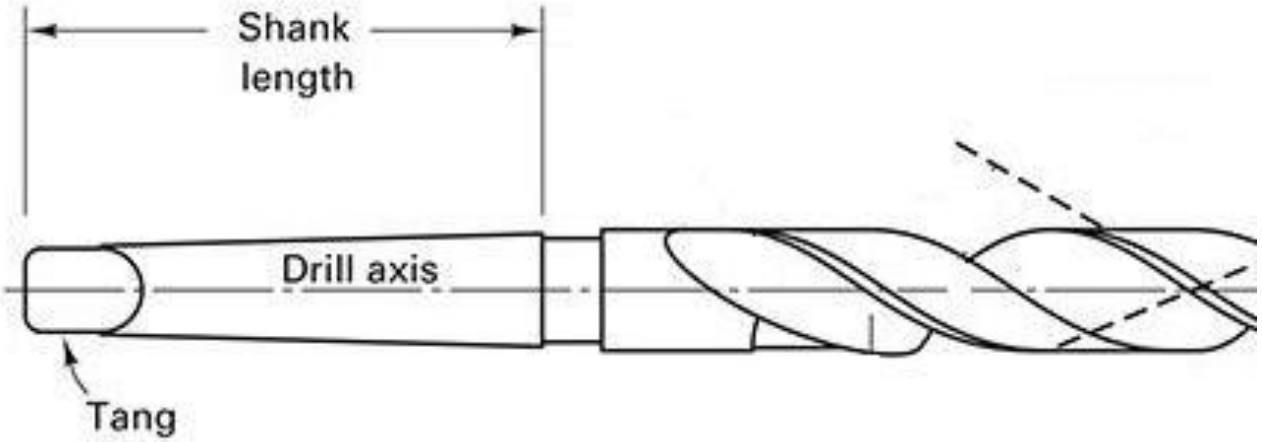


(a) Straight shank with tang
(b) Tapered shank with tag
(c) Straight shank with whistle notch
(d) Straight shank with flat notch


Watch Video Here

Shanks





(a) Straight shank with tang
(b) Tapered shank with tag
(c) Straight shank with whistle notch
(d) Straight shank with flat notch

Shanks and Twist Drill Types

Taper Shank, Sub Land

Straight Shank, Straight Flute

Straight Shank High Helix

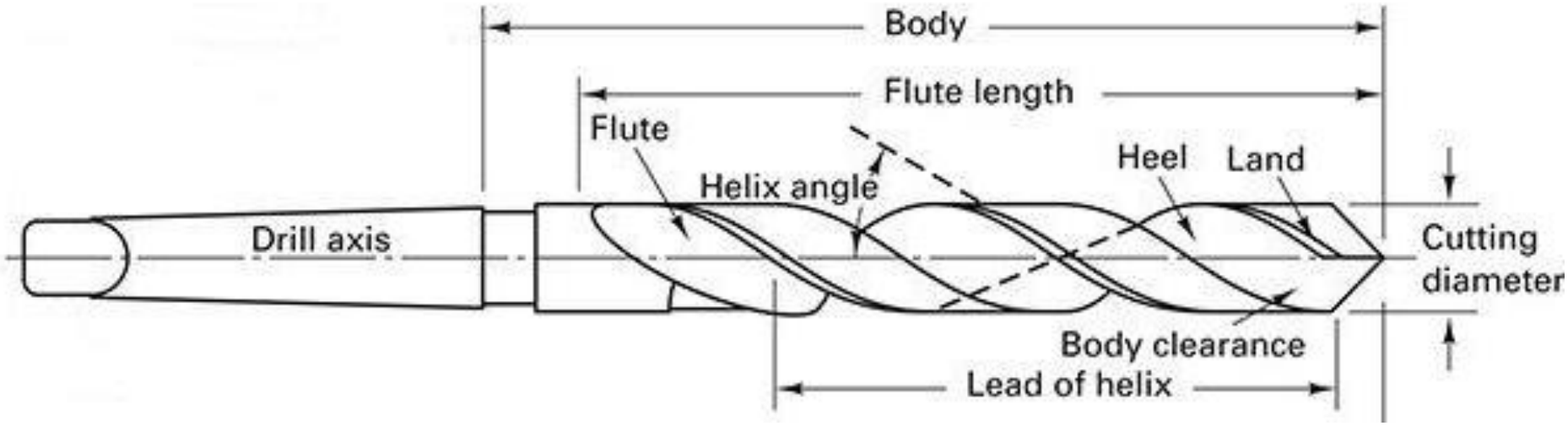
Bit Shank

Straight Shank

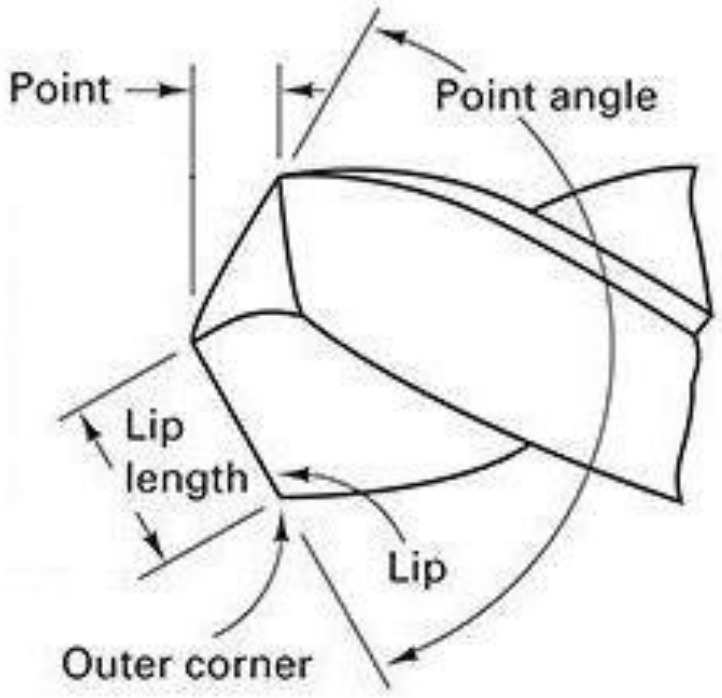
Taper Shank

Straight Shank, three flute

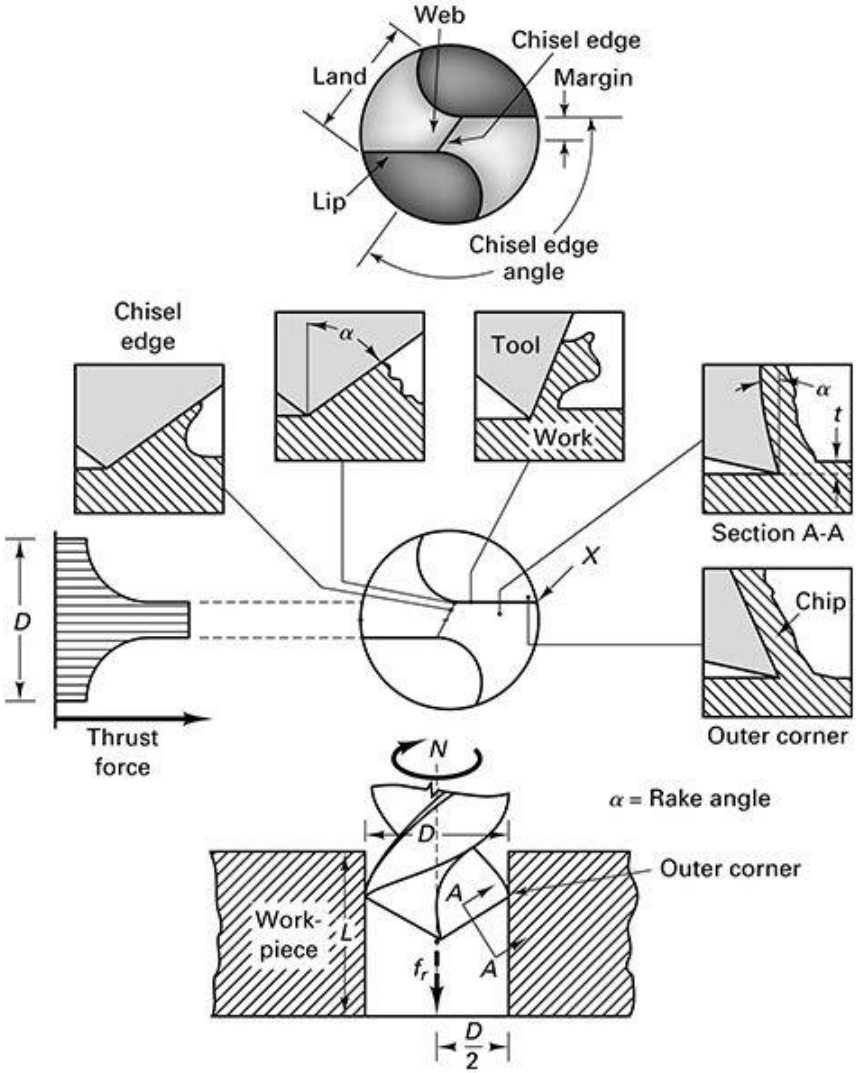
Drill Body


Body
Flute length
Flute
Helix angle
Heel
Land
Drill axis
Cutting diameter
Body clearance
Lead of helix

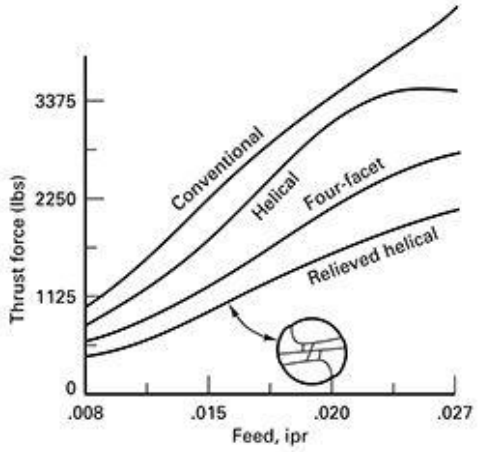
Point (Cone) Angle

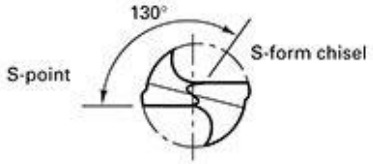


Drill Point

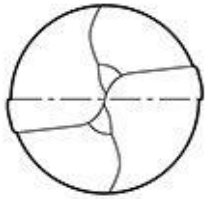

Web
Chisel edge
Land
Margin
Lip
Chisel edge angle
Chisel edge
α
Tool
Work
α
t
Section A-A
X
Chip
D
Thrust force
Outer corner
N
α = Rake angle
D
Outer corner
A
Work-piece
L
A
f_r
$\frac{D}{2}$

Drill Point Variations to Reduce Thrust

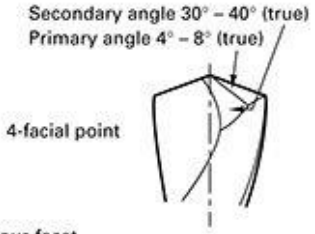




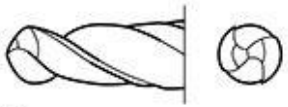
Helical (S-shape chisel point)
Can eliminate center drilling on NC machining centers
Excellent hole geometry
Close relationship between drill size and hole size
Increased tool life
Lower thrust requirements
Leaves burr on breakthrough



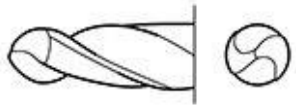
Relieved helical
Reduces thrust force
Eliminates chisel end
Equal, rake angle



Four-facet
Good self-centering ability
Breaks up chips for deep-hole drilling
Can be generated in a single grinding operation: reduces thrust.
Eliminates center drilling in NC

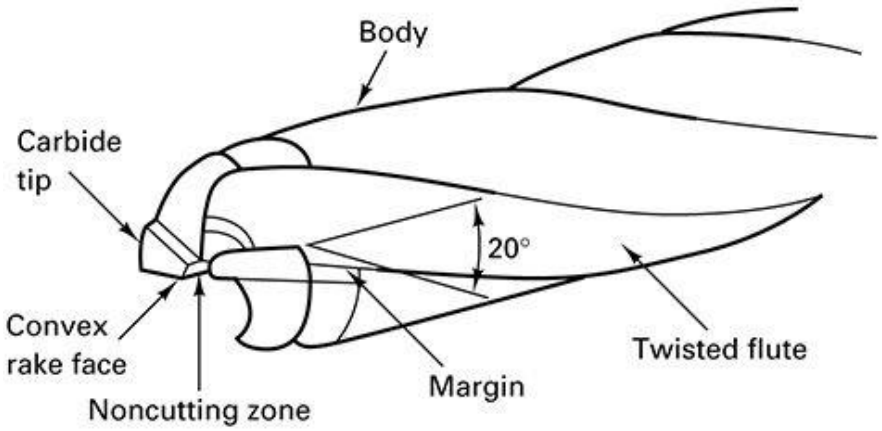


Bickford
Combination of helical and Racon point features
Self-centering and reduced burrs
Excellent hole geometry
Increased tool life

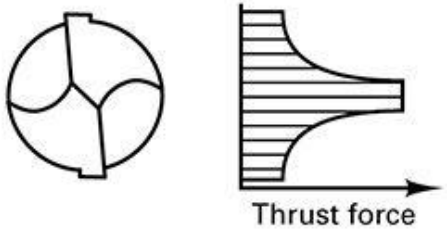


Racon (radiused conventional point)
Increased feed rates
Increased tool life (8–10 times in C.I.)
Reduced burrs at breakthrough
Not self-centering

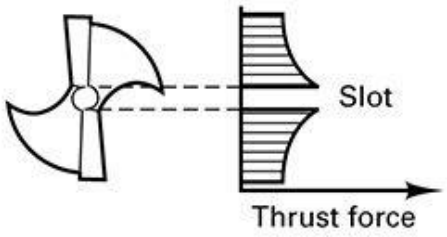
Low Thrust Drill Point



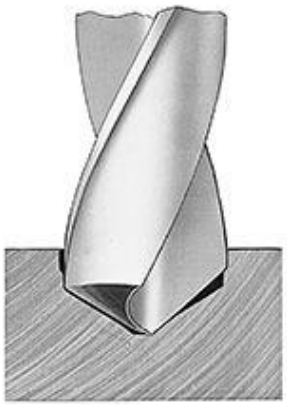
Conventional drill with large thrust force at web.



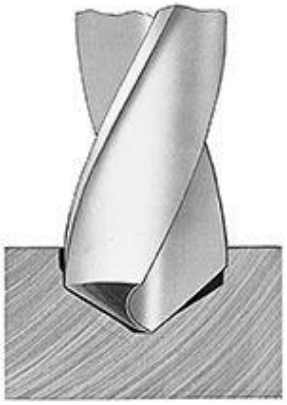
Center core drill or slot point drill with greatly reduced thrust Center core removed by ductile fracture (tension)



Improper Grinding



(a) Angle unequal



(b) Length unequal

Outer corners break down: Cutting speed too high; hard spots in material; no cutting compound at drill point; flutes clogged with chips

Cutting lips chip: Too much feed; lip relief too great

Checks or cracks in cutting lips: Overheated or too quickly cooled while sharpening or drilling

Chipped margin: Oversize jig bushing

Drill breaks: Point improperly ground; feed too heavy; spring or backlash in drill press, fixture, or work; drill is dull; flutes clogged with chips

Tang breaks: Imperfect fit between taper shank and socket caused by dirt or chips or by burred or badly worn sockets

Drill breaks when drilling brass or wood: Wrong type drill; flutes clogged with chips

Drill spilts up center: Lip relief too small; too much feed

Drill will not enter work: Drill is dull; web too heavy; lip relief too small

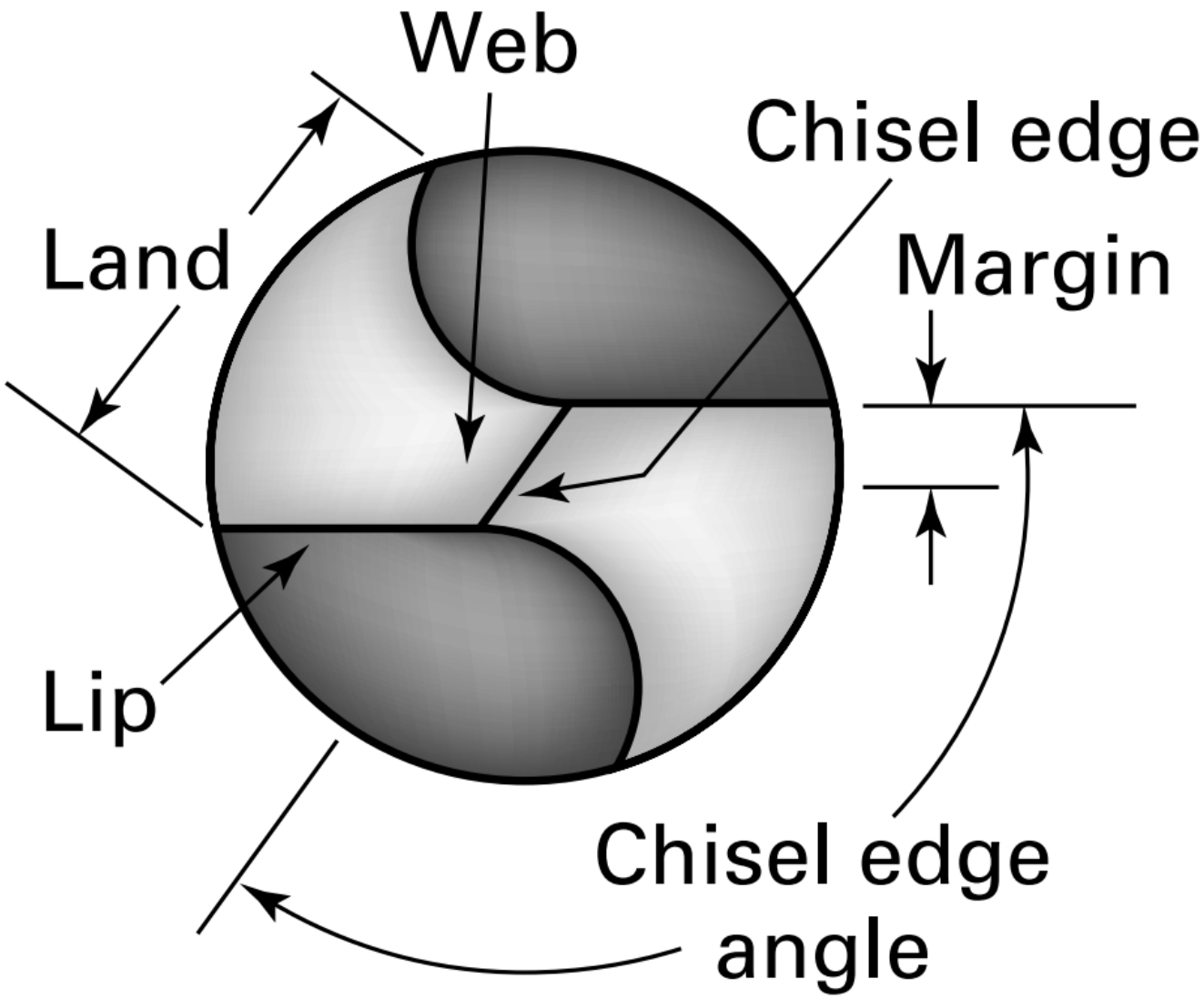
Hole rough: Point improperly ground or dull; no cutting compounds at drill point; improper cutting compound; feed too great; fixture not rigid

Hole oversize: Unequal angle of the cutting edges; unequal length of the cutting edges; see part (a)

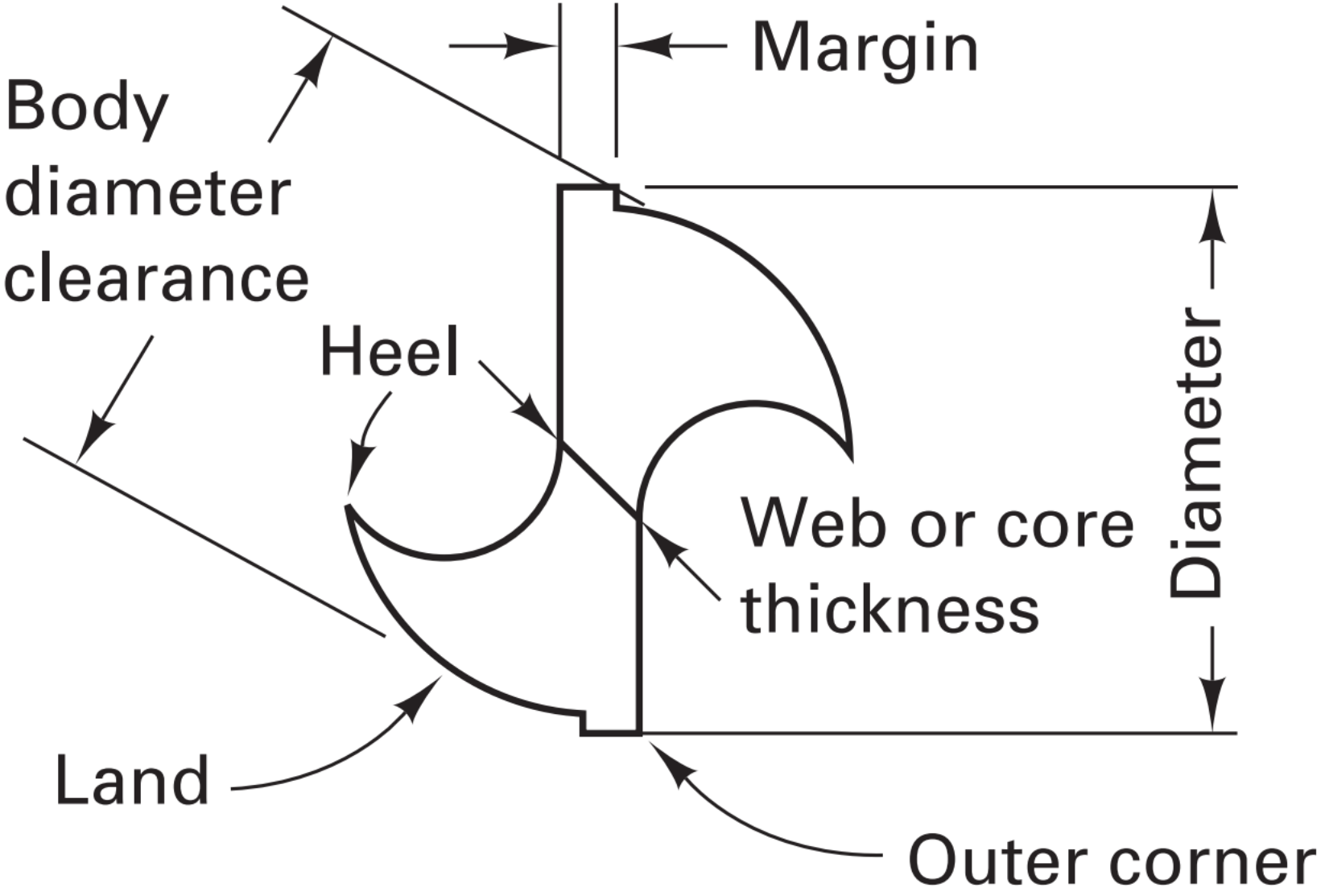
Chip shape changes while drilling: Dull drill or cutting lips chipped

Large chip coming from one flute, small chip from the other: Point improperly ground, one lip doing all the cutting

Chisel-Edge Angle



Web


Margin
Body
diameter
clearance
Heel
Web or core
thickness
Diameter
Land
Outer corner

Drill Sizes

Millimeter series

increments of 0.01 – 0.5mm in dia. from 0.015mm

Numerical series

No. 80 (0.0135”) to No. 1 (0.228”)

Letter sizes

A (0.234”) to Z (0.413”)

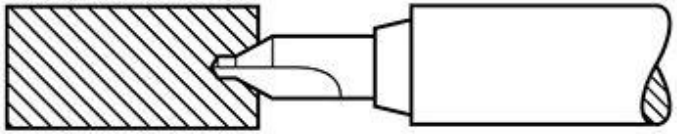
Fractional sizes

by 1/64” up to over 4 inches

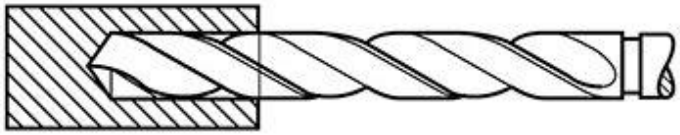
Hole Saw

Center Drill

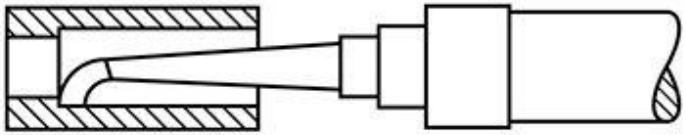
Four Steps to an Accurate Hole



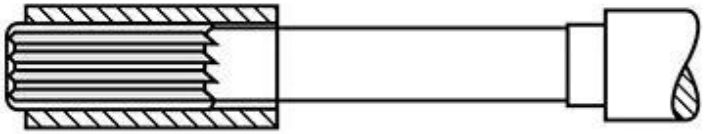
Step 1 Centering and countersinking with a combination center drill and countersink.
(Courtesy of Chicago-Latrobe)



Step 2 Drilling with a standard twist drill.



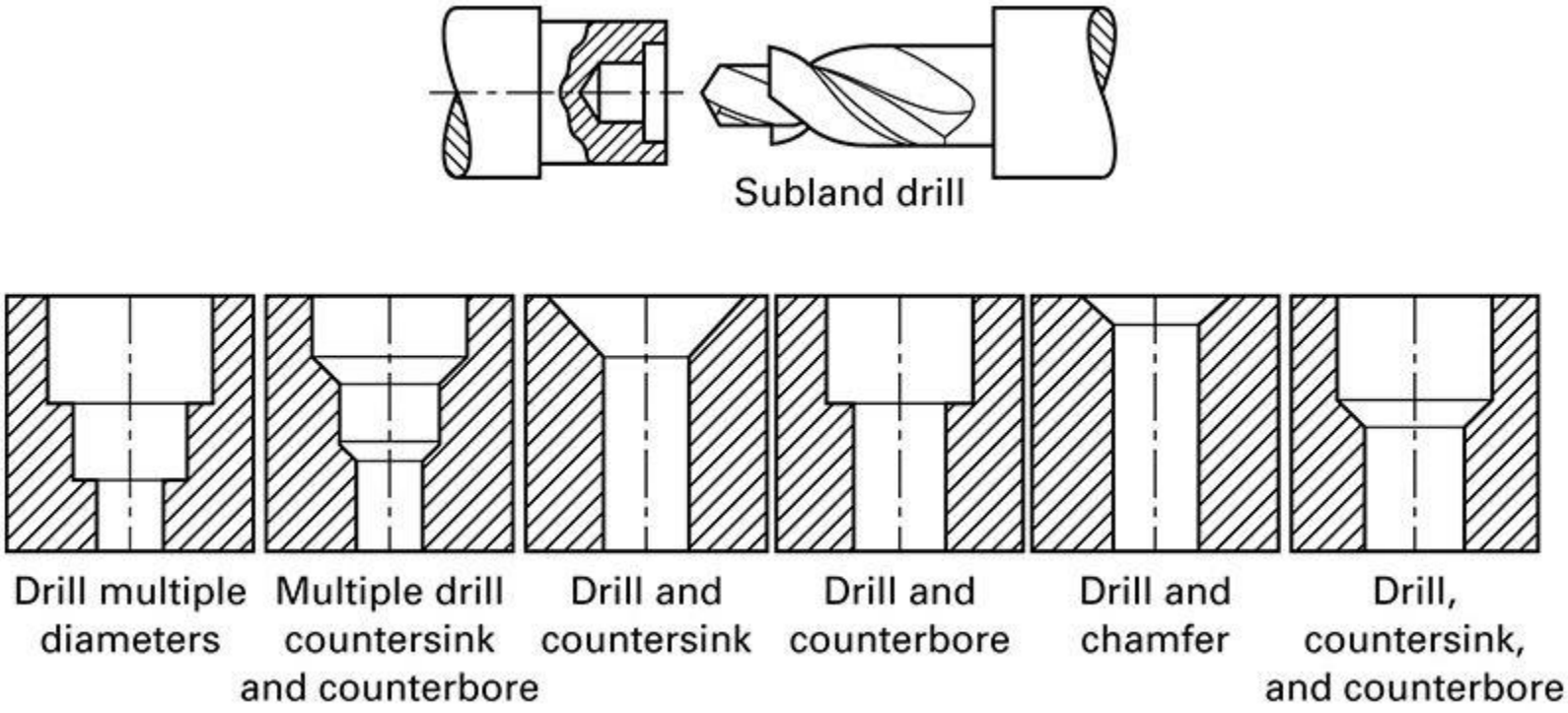
Step 3 Truing hole by boring.



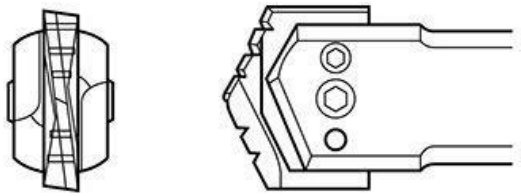
Step 4 Final sizing and finishing with a reamer.

Watch Video Here

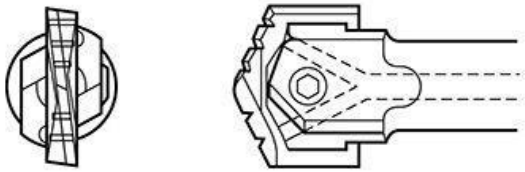
Combination Drills



Spade Drill



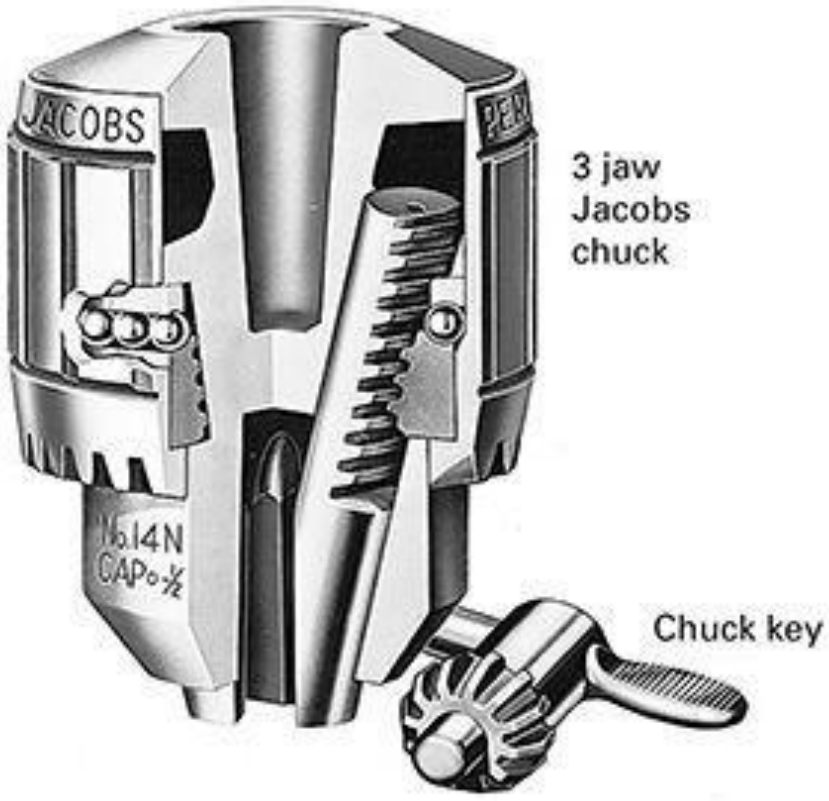
Regular spade drill



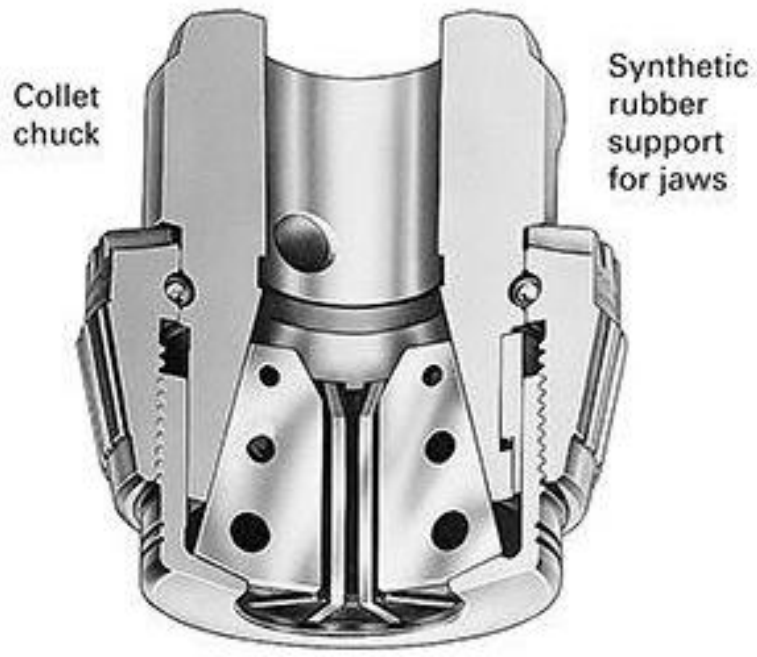
Spade drill with oil holes

Morse Taper

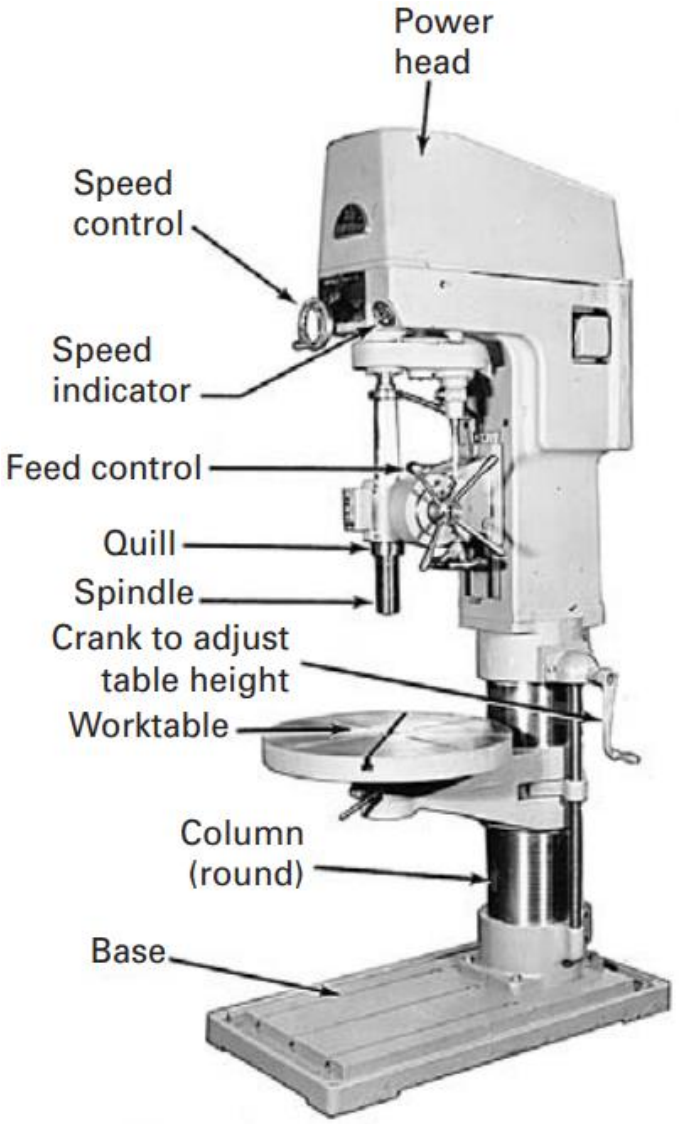
Universal (Jacobs) Chuck



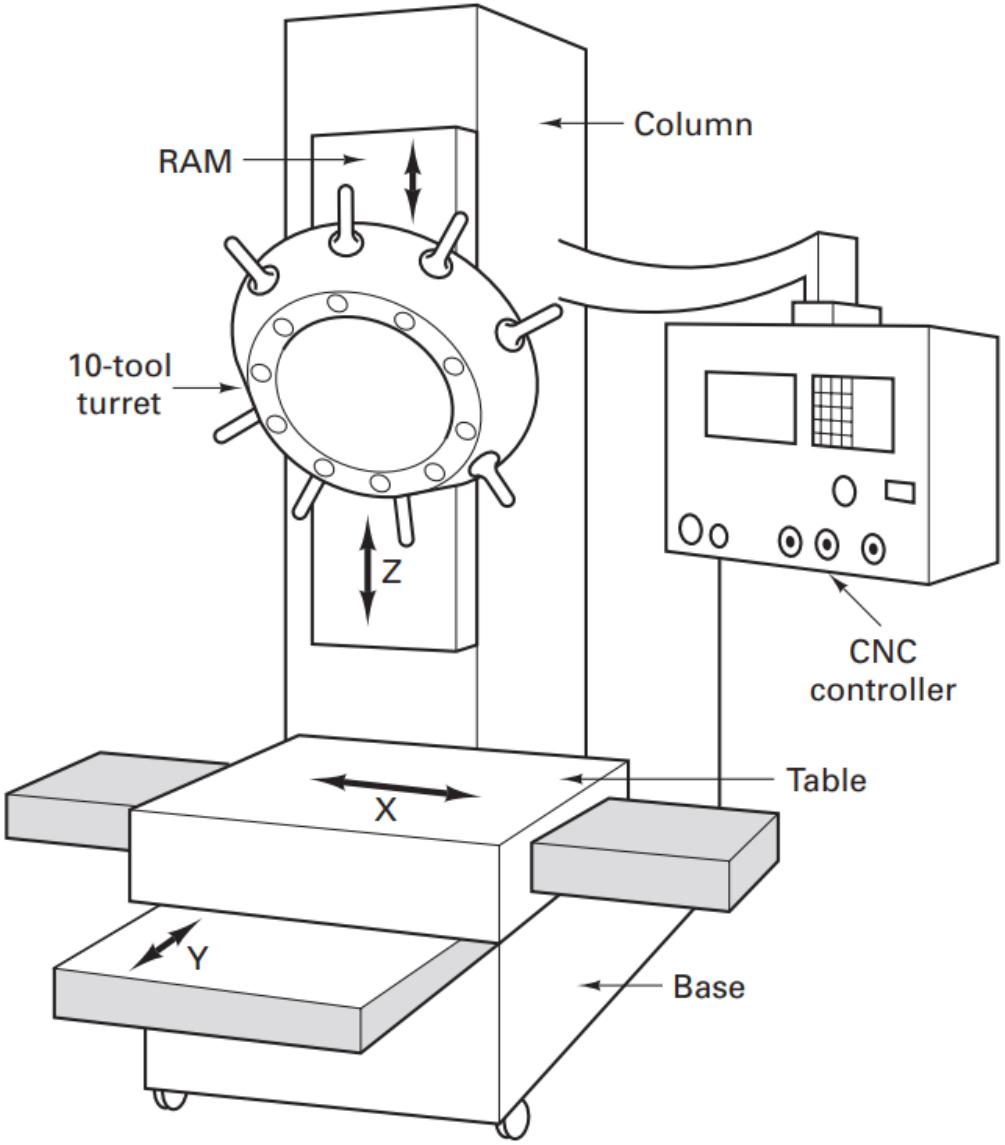
Collet Chuck



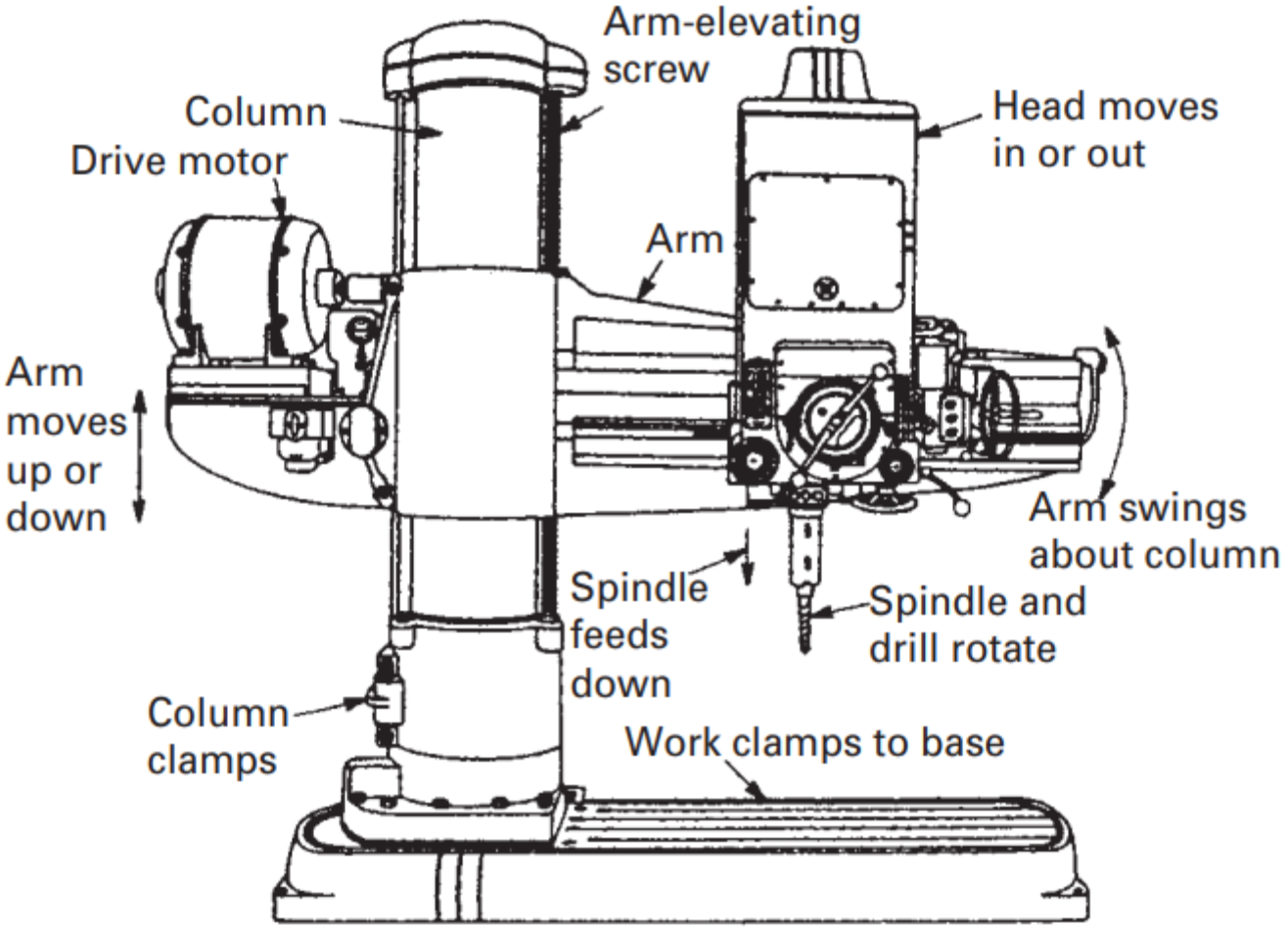
Upright Column Drilling Machine



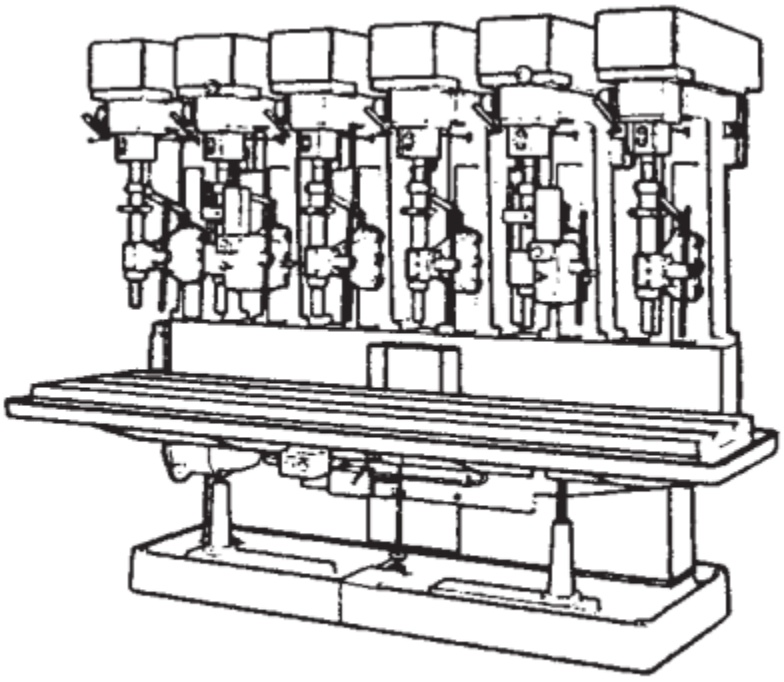
CNC Turret Drilling Machine



Radial Drill Press

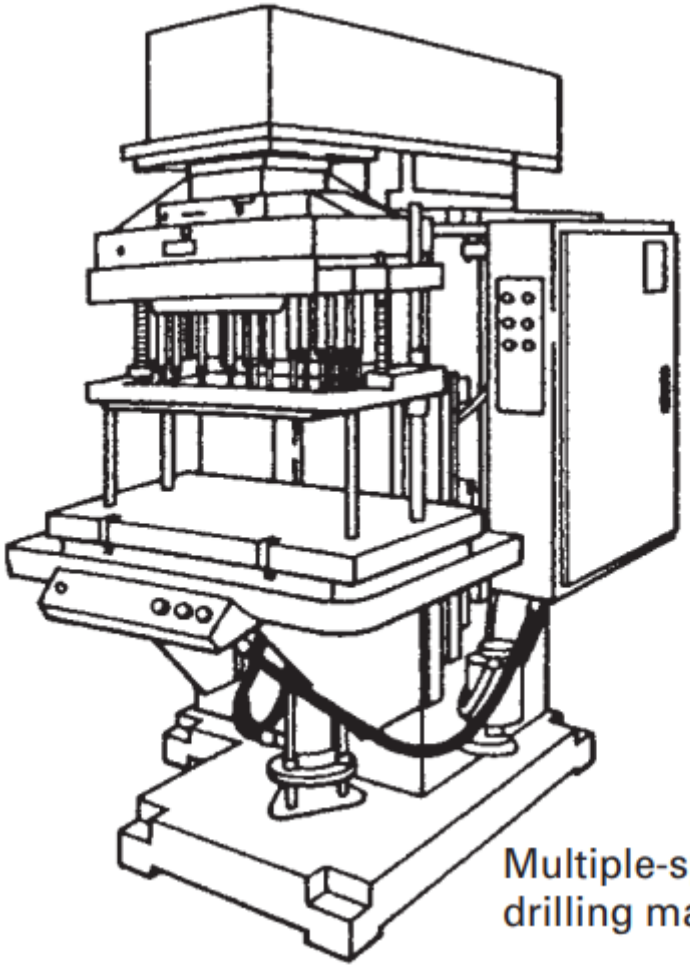


Gang Drilling Machine



Gang-drilling machine

Multiple Spindle Drilling Machine



Multiple-spindle drilling machine

HOLE FINISHING OPERATIONS

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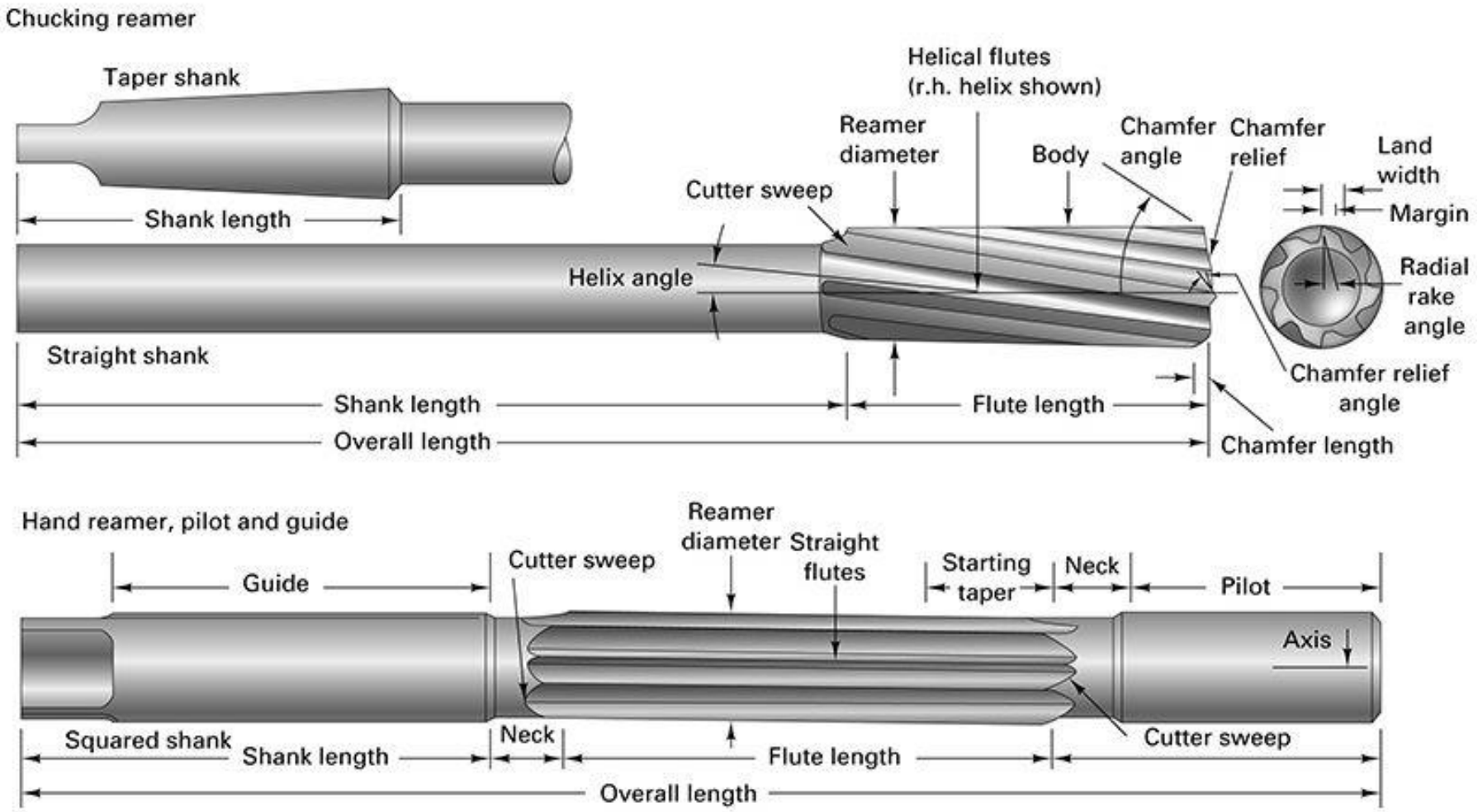
Reamer Nomenclature



Counterbore, Countersink & Spot Face