

Cutting Mechanics
Strain Forces Power
Machinability

Plastic

Thermal Properties

Cooling may be required

Aluminium

Machinable

BUE (can be avoided)

High thermal expansion

Steel Varies

hardened difficult

Leaded easy

Low carbon BUE

Cast abrasive

Titanium

Low thermal conductivity

High Temperatures

BUE

Superalloys

Nickel based

Inconel

Work Hardening



Composites
Machinable
Abrasive

Graphite
Abrasive

Wood

Art

Cast Iron

Abrasive

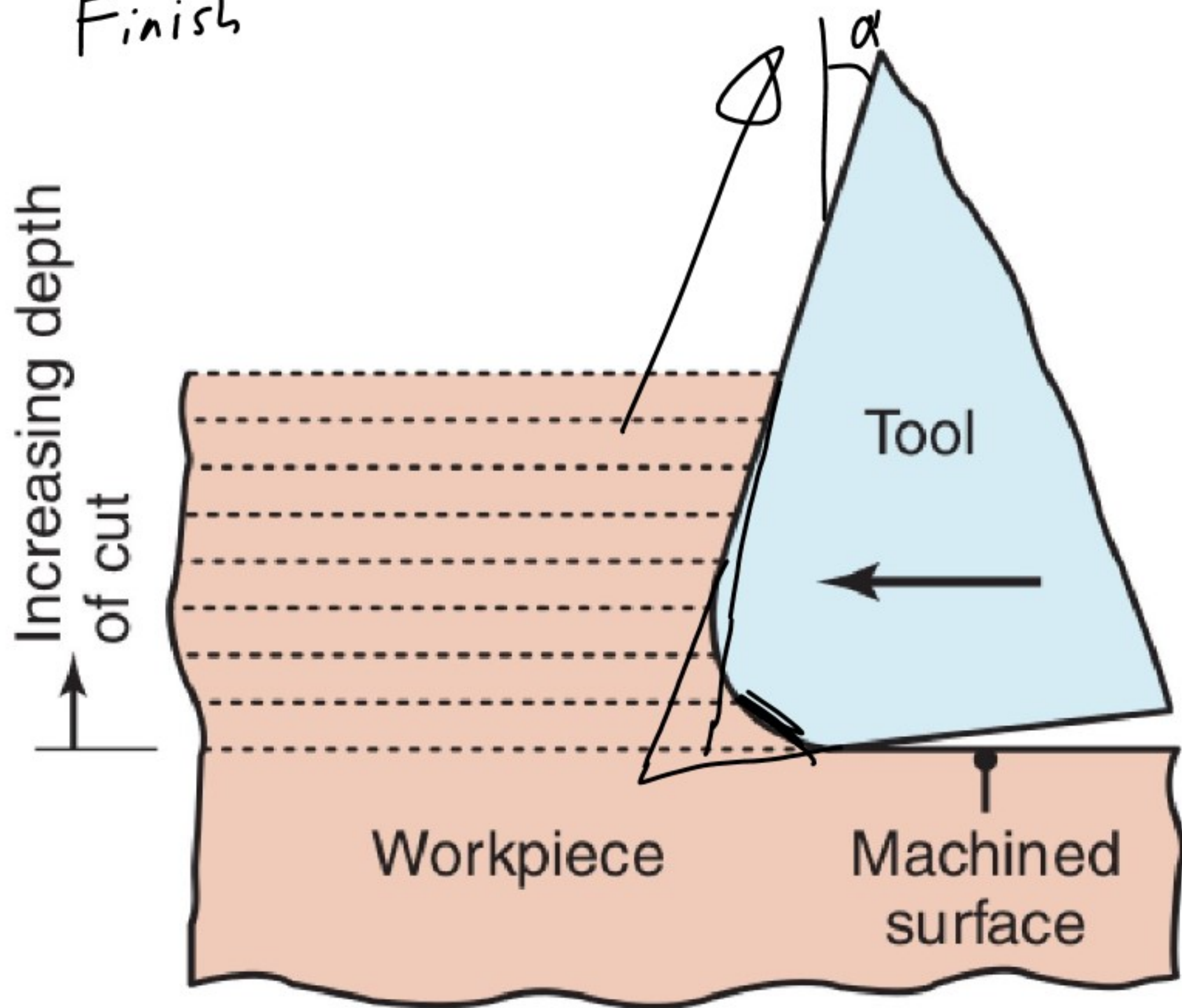
Free Carbides

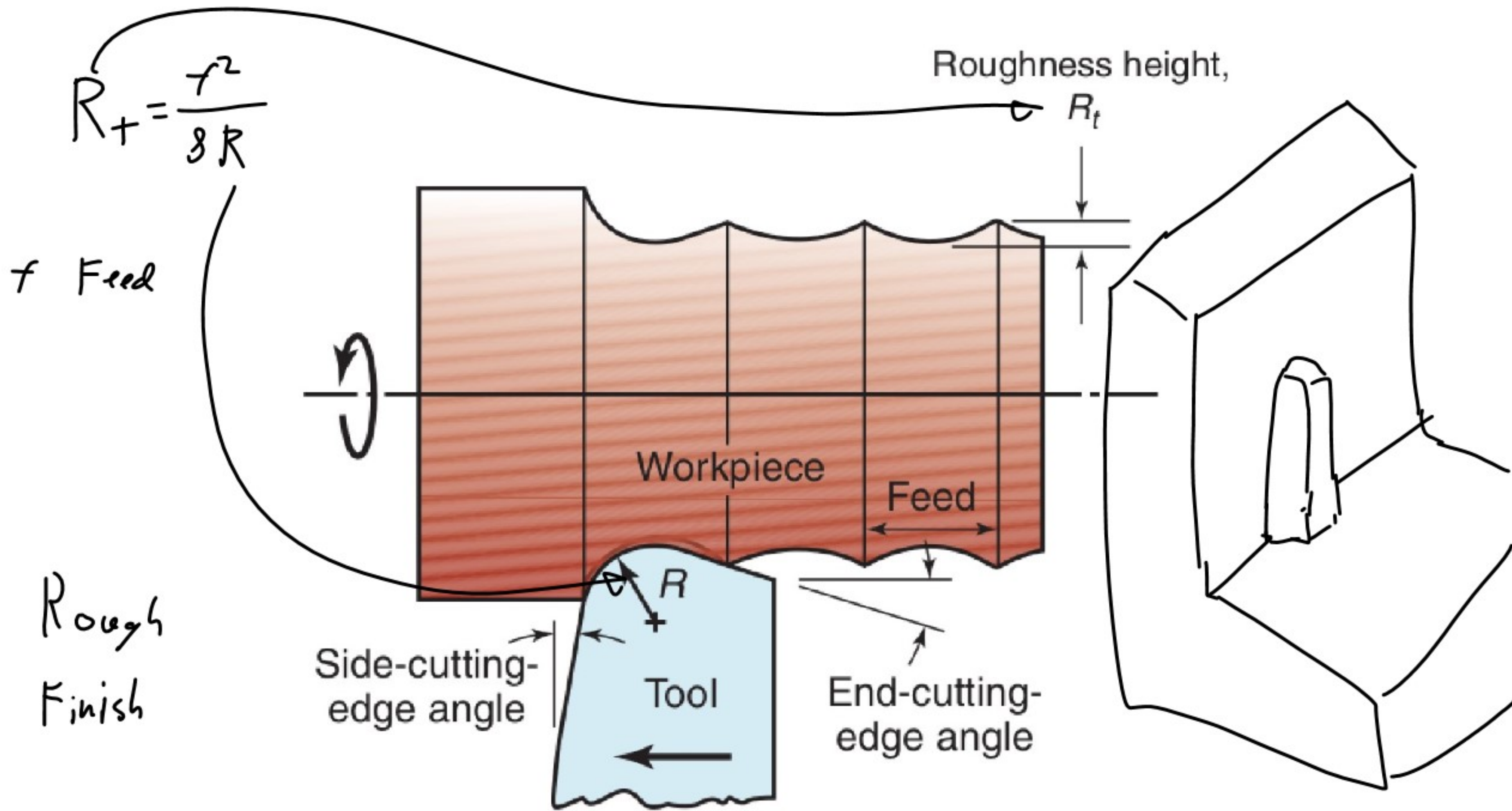
Copper "Gummy"

BUT

Alloys easier

Surface Finish





Property	High-speed steels	Cast-cobalt alloys	WC	TiC	Ceramics	Cubic boron nitride	Single-crystal diamond*
Hardness	83–86 HRA	82–84 HRA 46–62 HRC	90–95 HRA 1800–2400 HK	91–93 HRA 1800–3200 HK	91–95 HRA 2000–3000 HK	4000–5000 HK	7000–8000 HK
Compressive strength, MPa	4100–4500	1500–2300	4100–5850	3100–3850	2750–4500	6900	6900
Transverse rupture strength, MPa	2400–4800	1380–2050	1050–2600	1380–1900	345–950	700	1350
Impact strength, J	1.35–8	0.34–1.25	0.34–1.35	0.79–1.24	< 0.1	< 0.5	< 0.2
Modulus of elasticity, GPa	200	–	520–690	310–450	310–410	850	820–1050
Density, kg/m ³	8600	8000–8700	10,000–15,000	5500–5800	4000–4500	3500	3500
Volume of hard phase, %	7–15	10–20	70–90	–	100	95	95
Melting or decomposition temperature, °C	1300	–	1400	1400	2000	1300	700
Thermal conductivity, W/m K	30–50	–	42–125	17	29	13	500–2000
Coefficient of thermal expansion, × 10⁻⁶/°C	12	–	4–6.5	7.5–9	6–8.5	4.8	1.5–4.8

*The values for polycrystalline diamond are generally lower, except for impact strength, which is higher.

Cutting Fluid

Cooling

Lubricant

Reduce friction

Reduce wear

Flushes away chips

Messy

Maintenance

Lathes

1200



Chartres
Cathedral
France



Pole
Lathe

1395



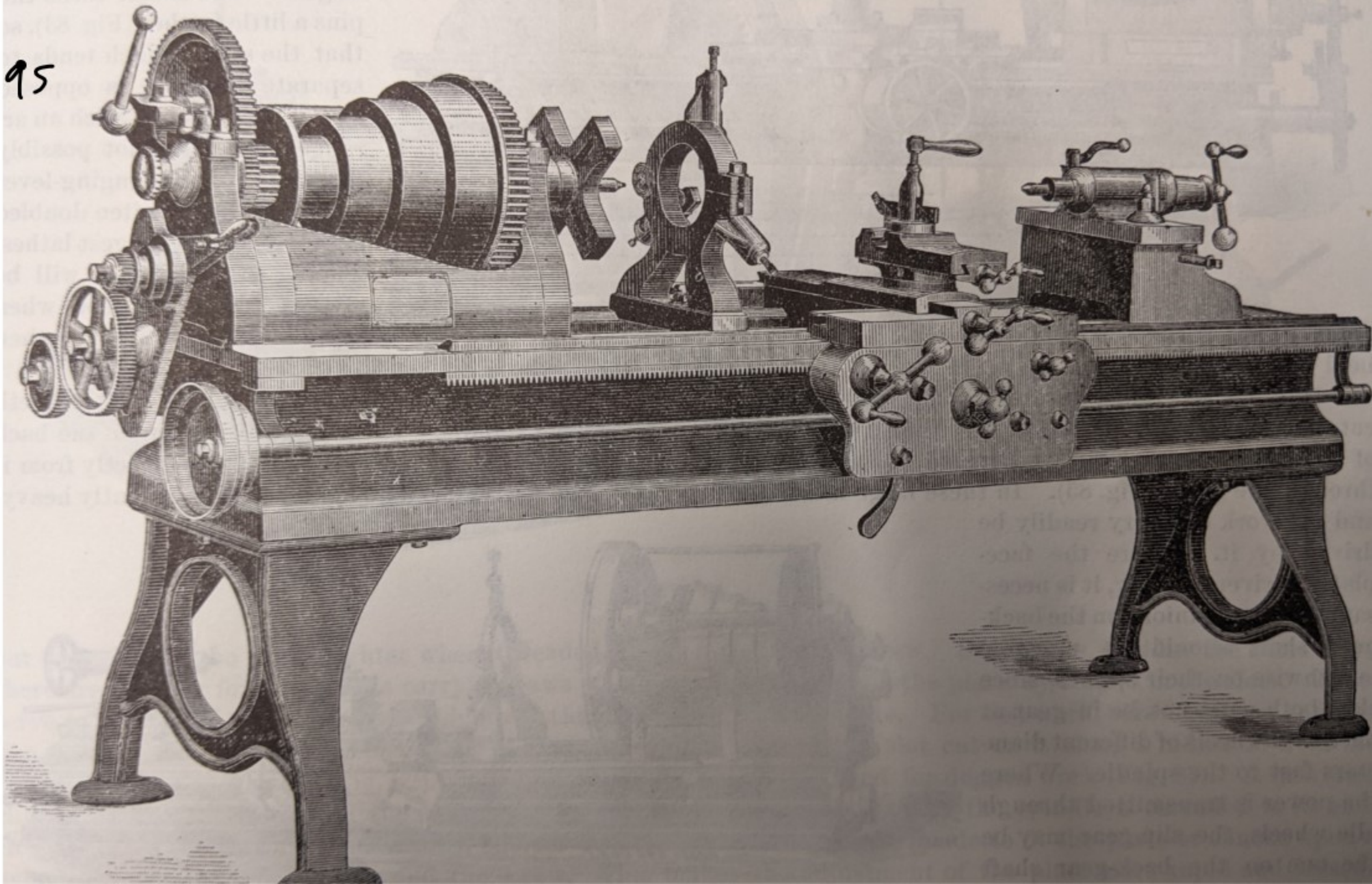
Continuous
Rotation

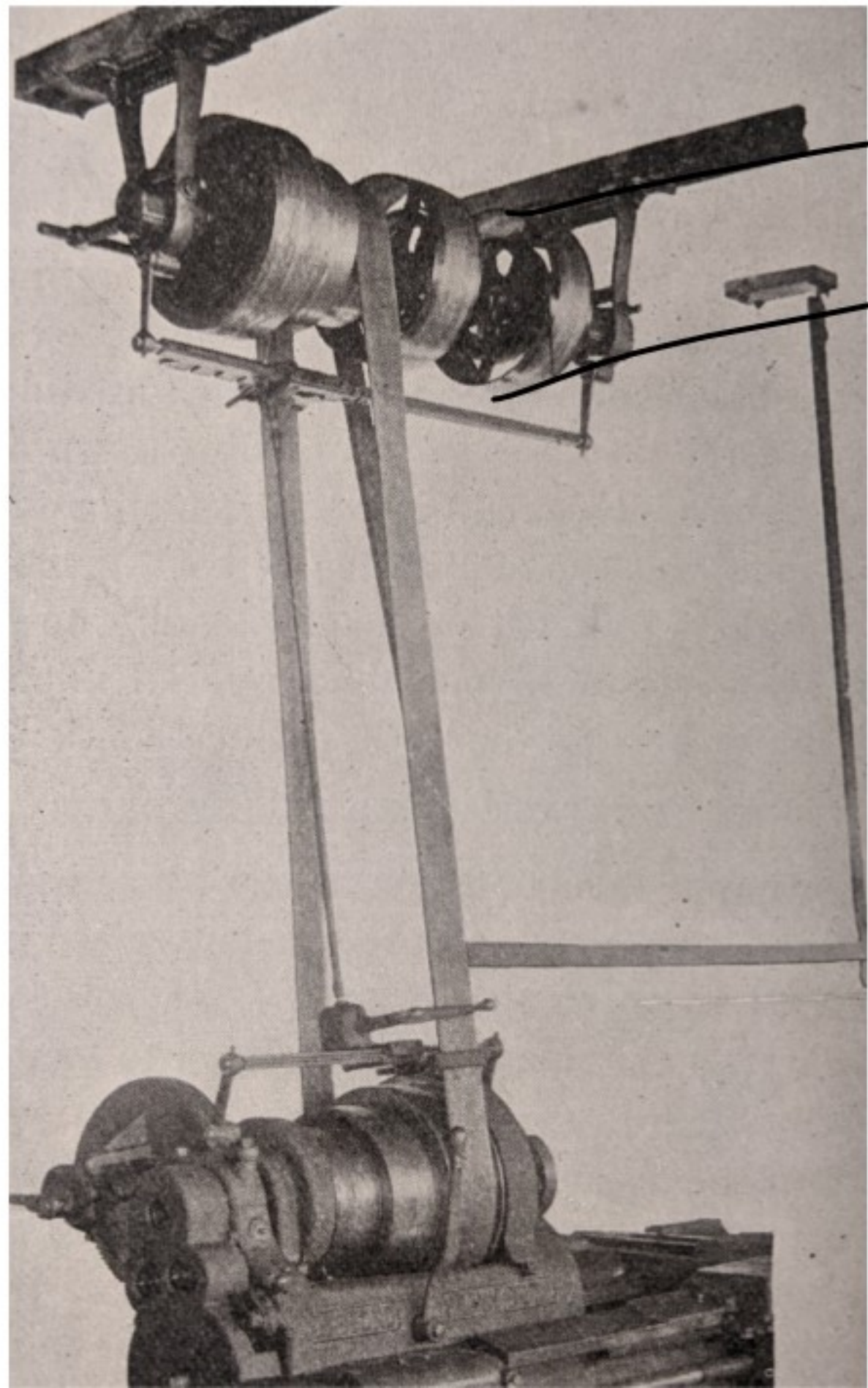
Horse Power
Water Wheels

1568



1895



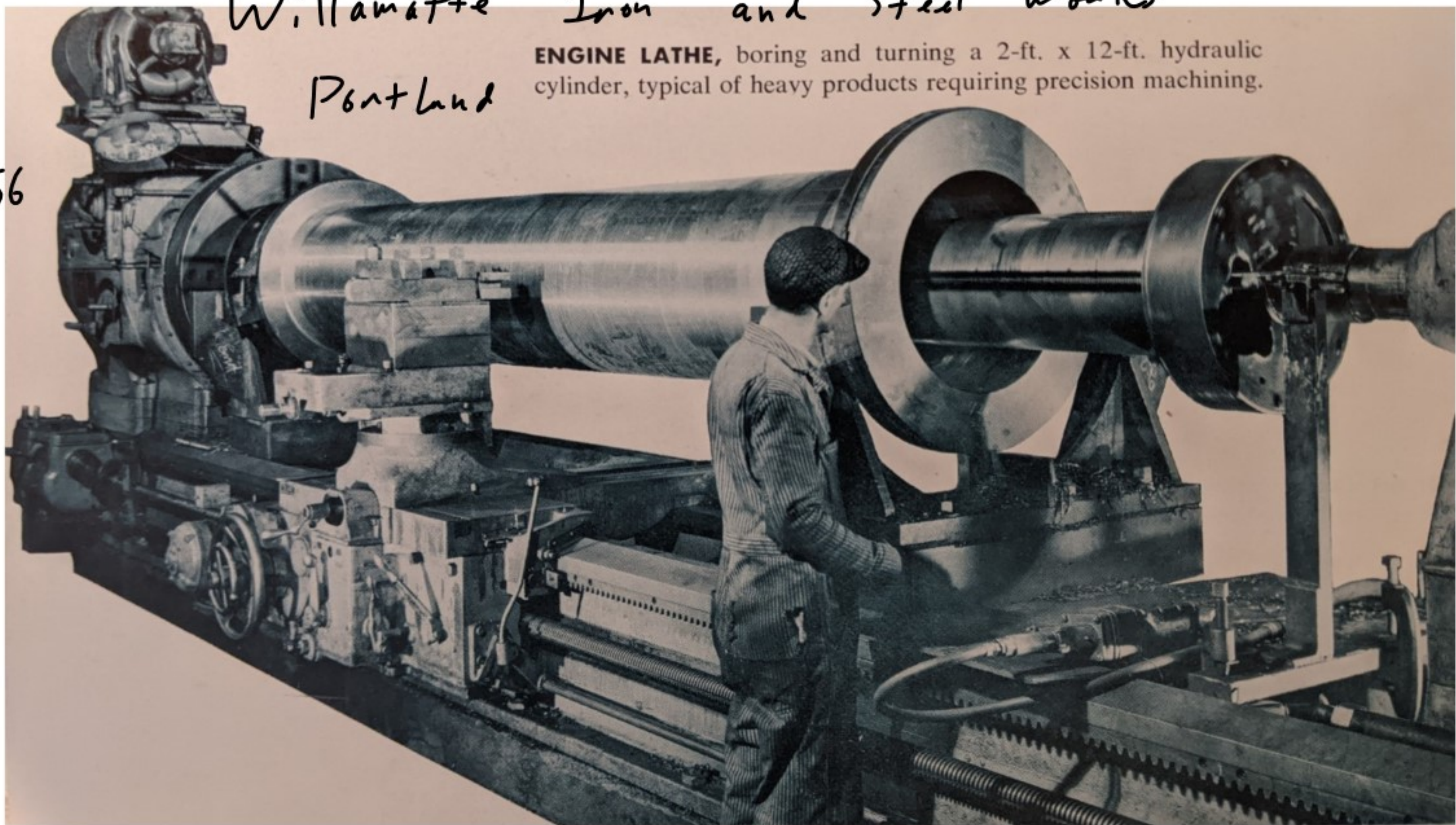


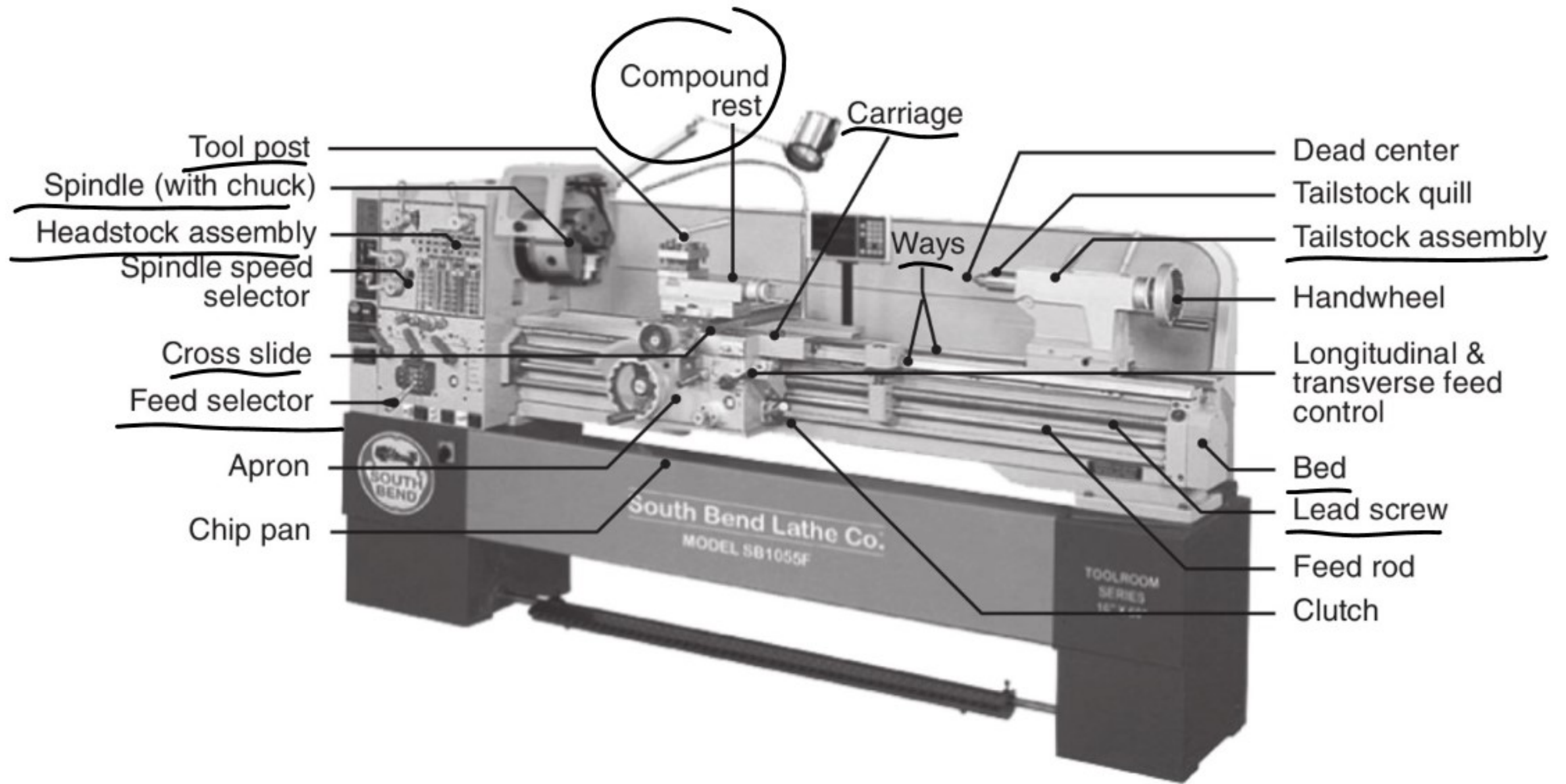
Willamette Iron and Steel Works

ENGINE LATHE, boring and turning a 2-ft. x 12-ft. hydraulic cylinder, typical of heavy products requiring precision machining.

Portland

1956





Compound rest

Carriage

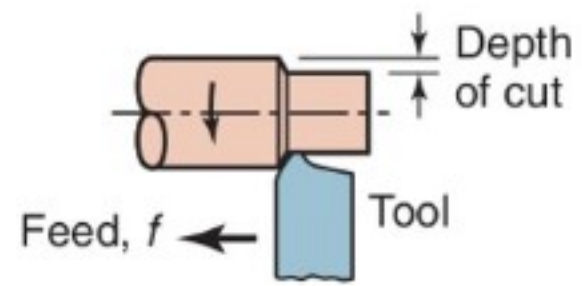
Ways

Dead center
Tailstock quill
Tailstock assembly
Handwheel
Longitudinal & transverse feed control
Bed
Lead screw
Feed rod
Clutch

Tool post
Spindle (with chuck)
Headstock assembly
Spindle speed selector
Cross slide
Feed selector
Apron
Chip pan

South Bend Lathe Co.
MODEL SB1055F

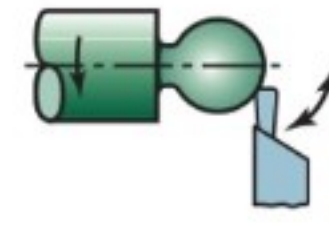
TOOLROOM
SERIES
10\"/>



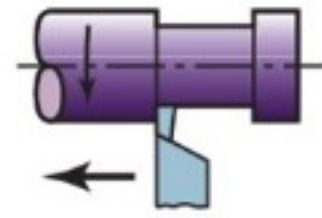
(a) Straight turning



(b) Taper turning



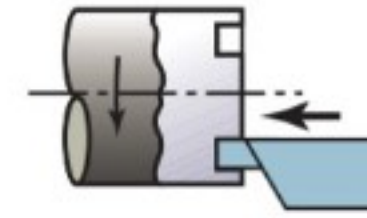
(c) Profiling



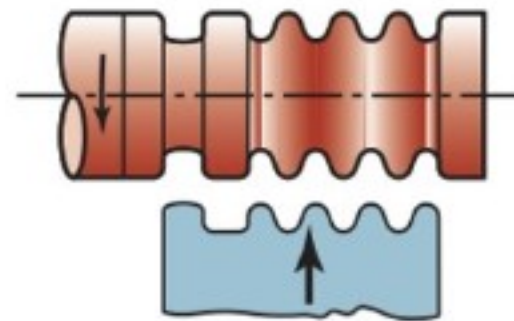
(d) Turning and external grooving



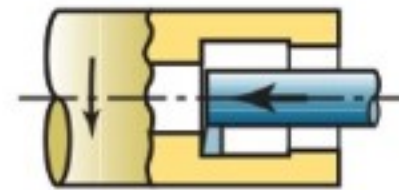
(e) Facing



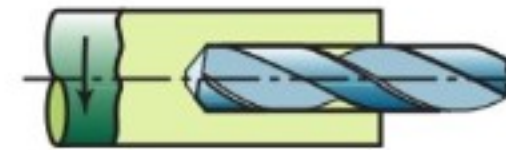
(f) Face grooving



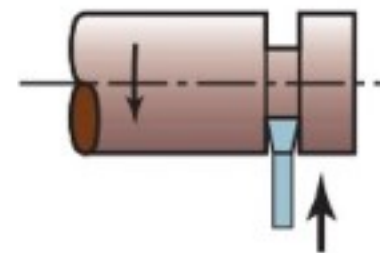
(g) Cutting with a form tool



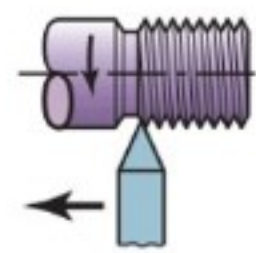
(h) Boring and internal grooving



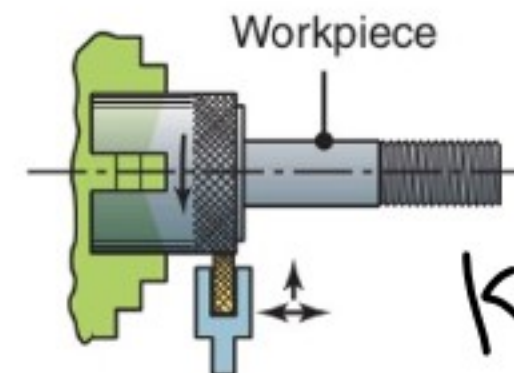
(i) Drilling



(j) Cutting off



(k) Threading



(l) Knurling

Knurling