# Mechanical Drawing

J.R. Leeman and C. Marone

Techniques of Geoscientific Experimentation
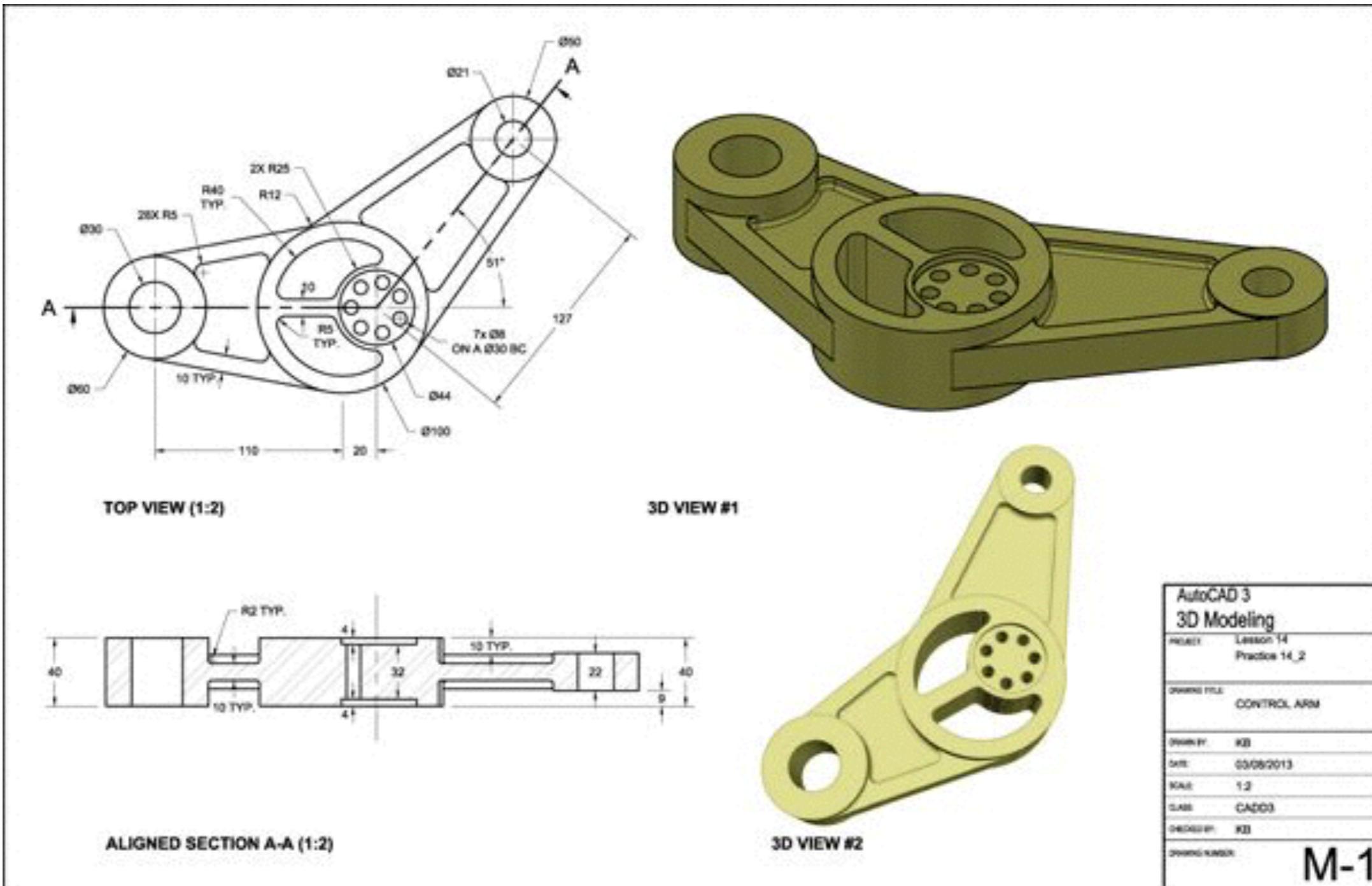
September 22, 2016
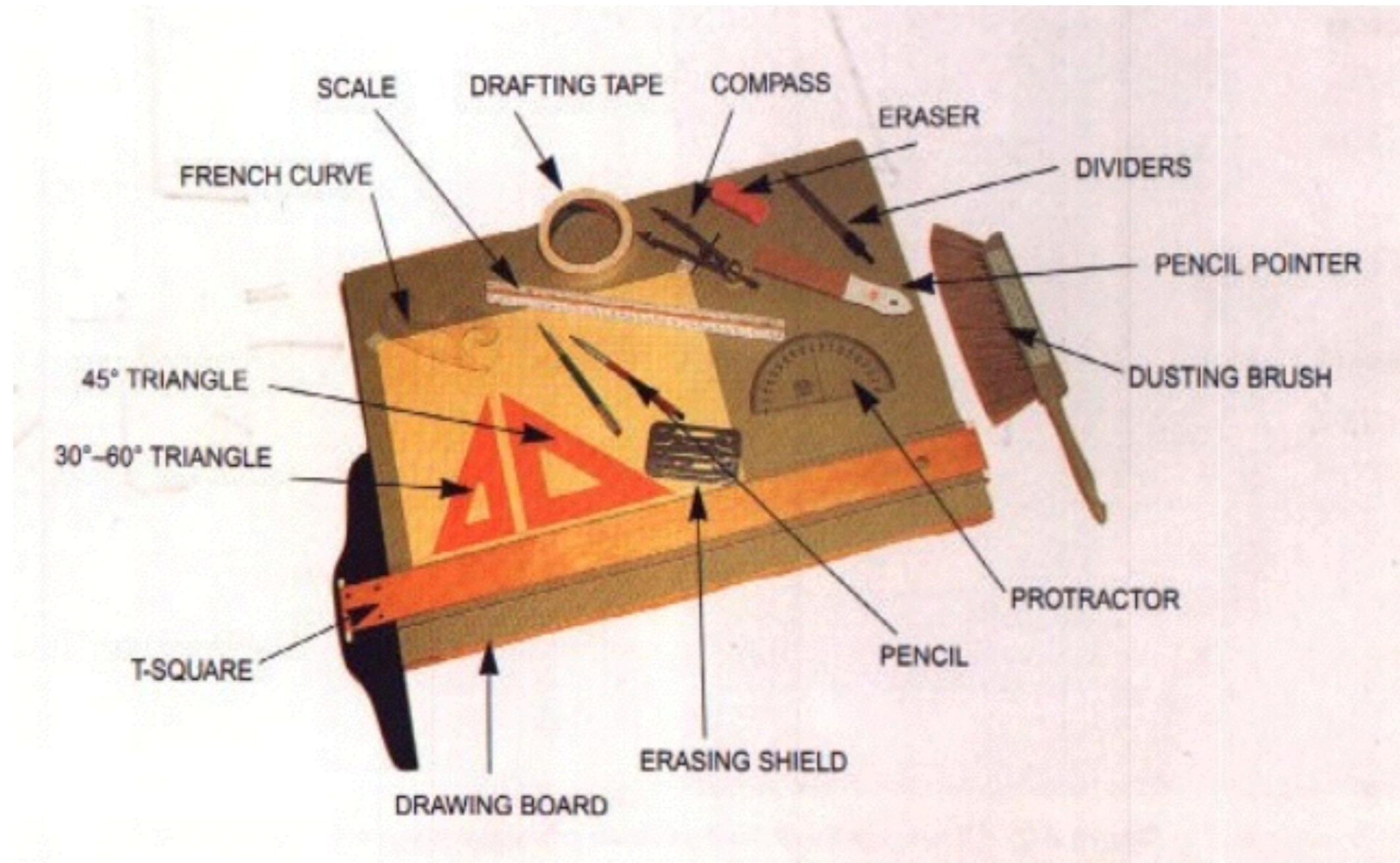
You've got an idea - now you need to tell the shop what to make and communicate your idea to others

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TOP VIEW (1:2)

ALIGNED SECTION A-A (1:2)

3D VIEW #1

3D VIEW #2

AutoCAD 3
3D Modeling

CONTROL ARM

M-1
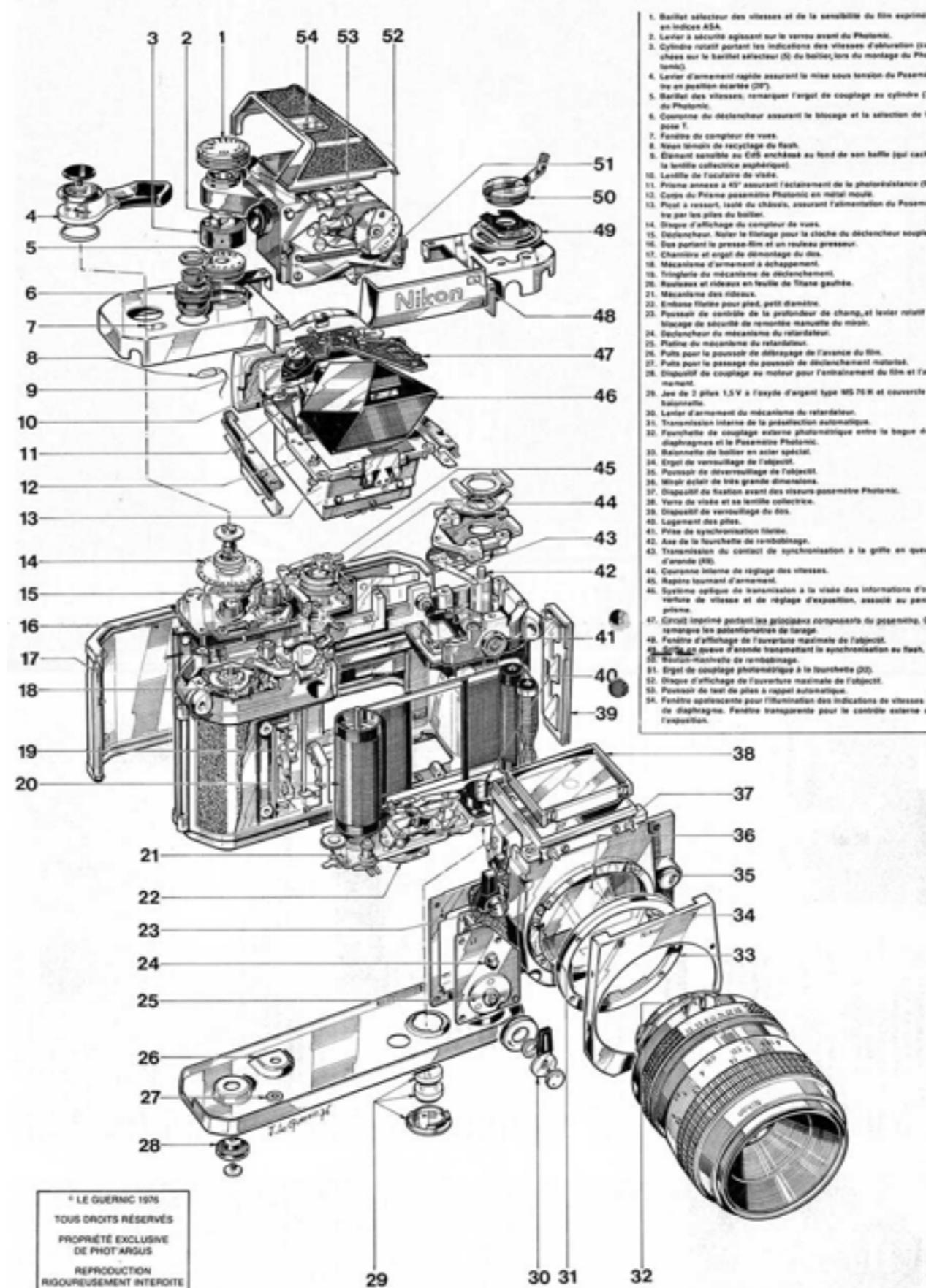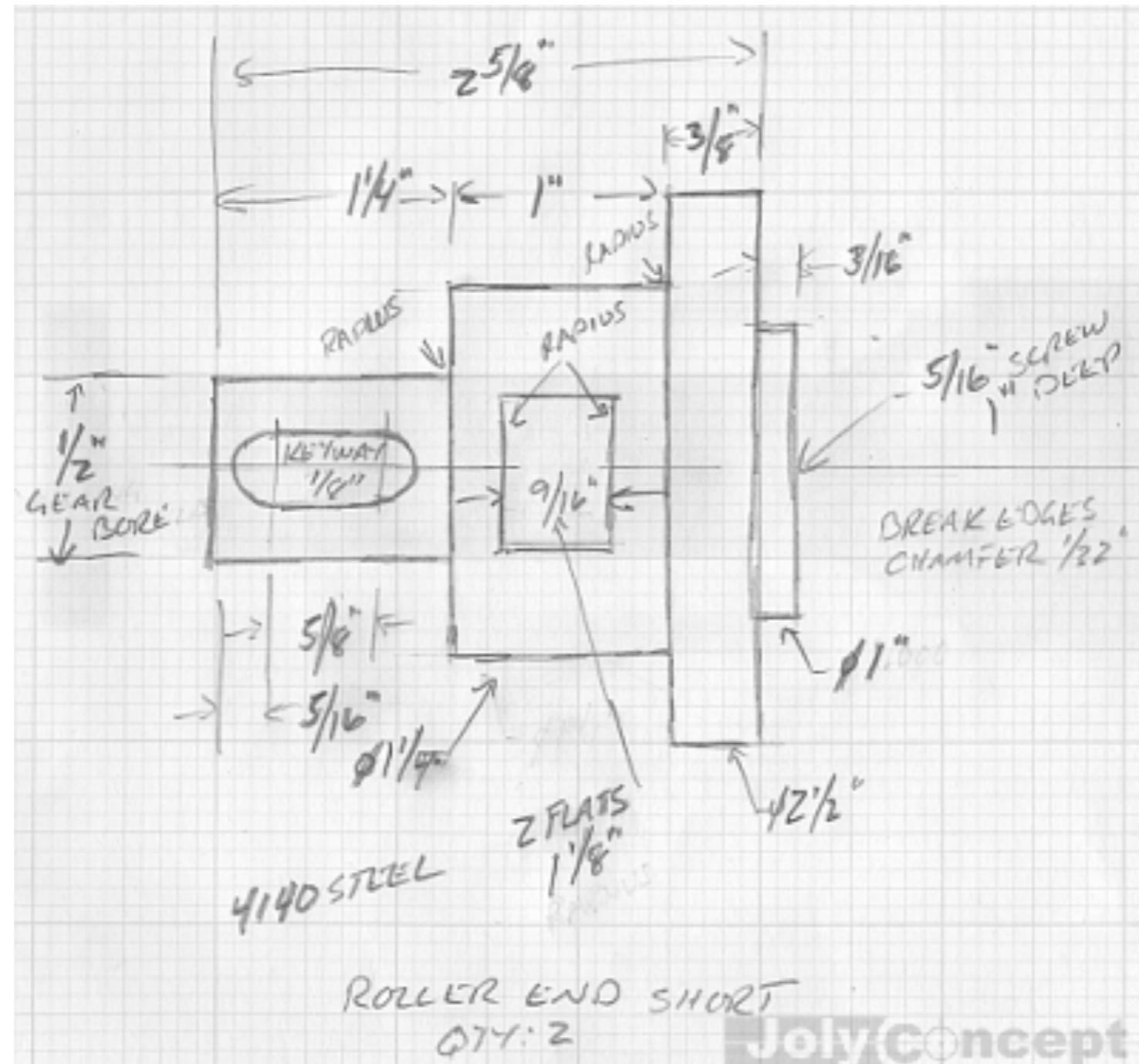
Drawing has been traditionally accomplished with drafting tools
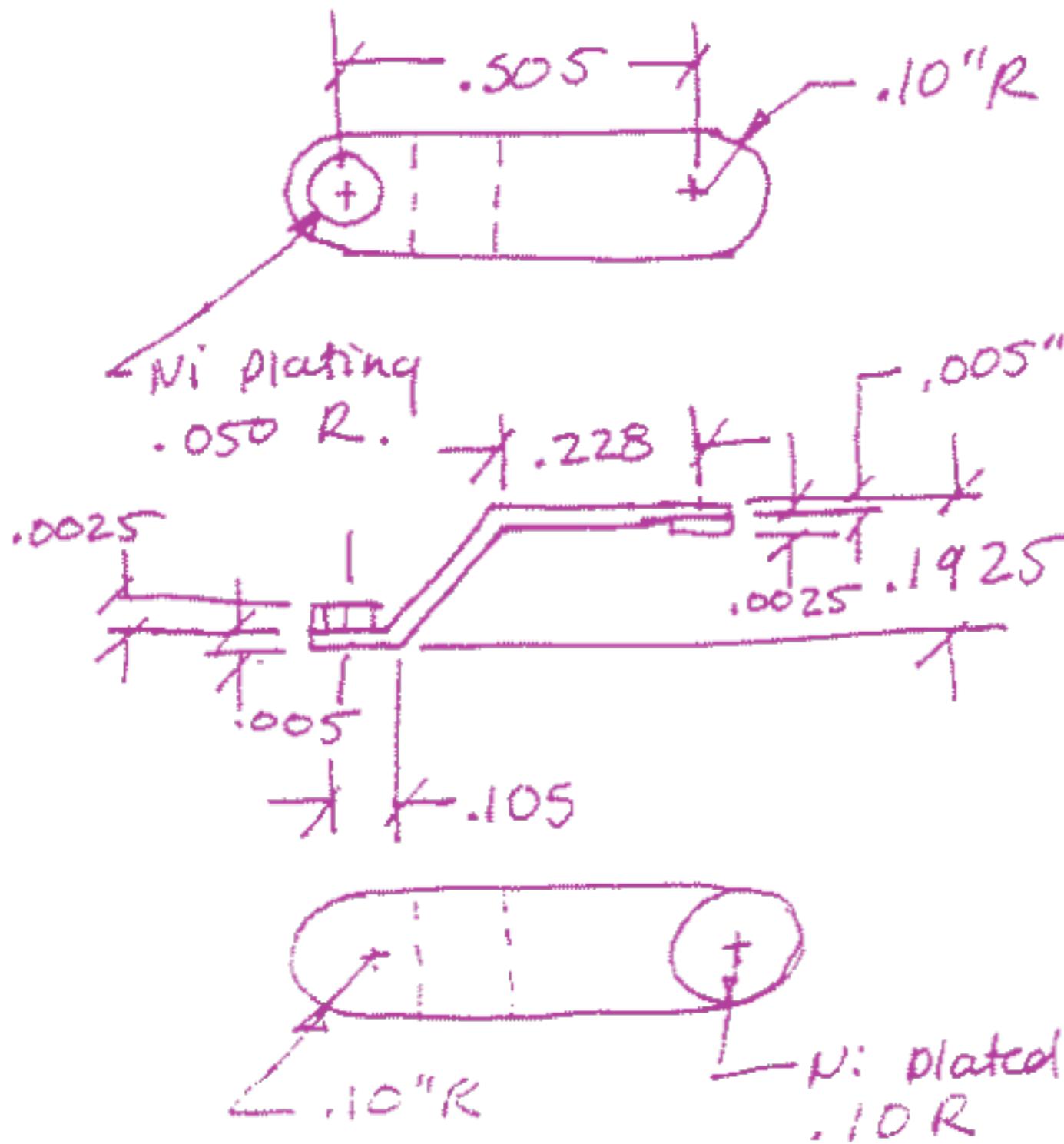
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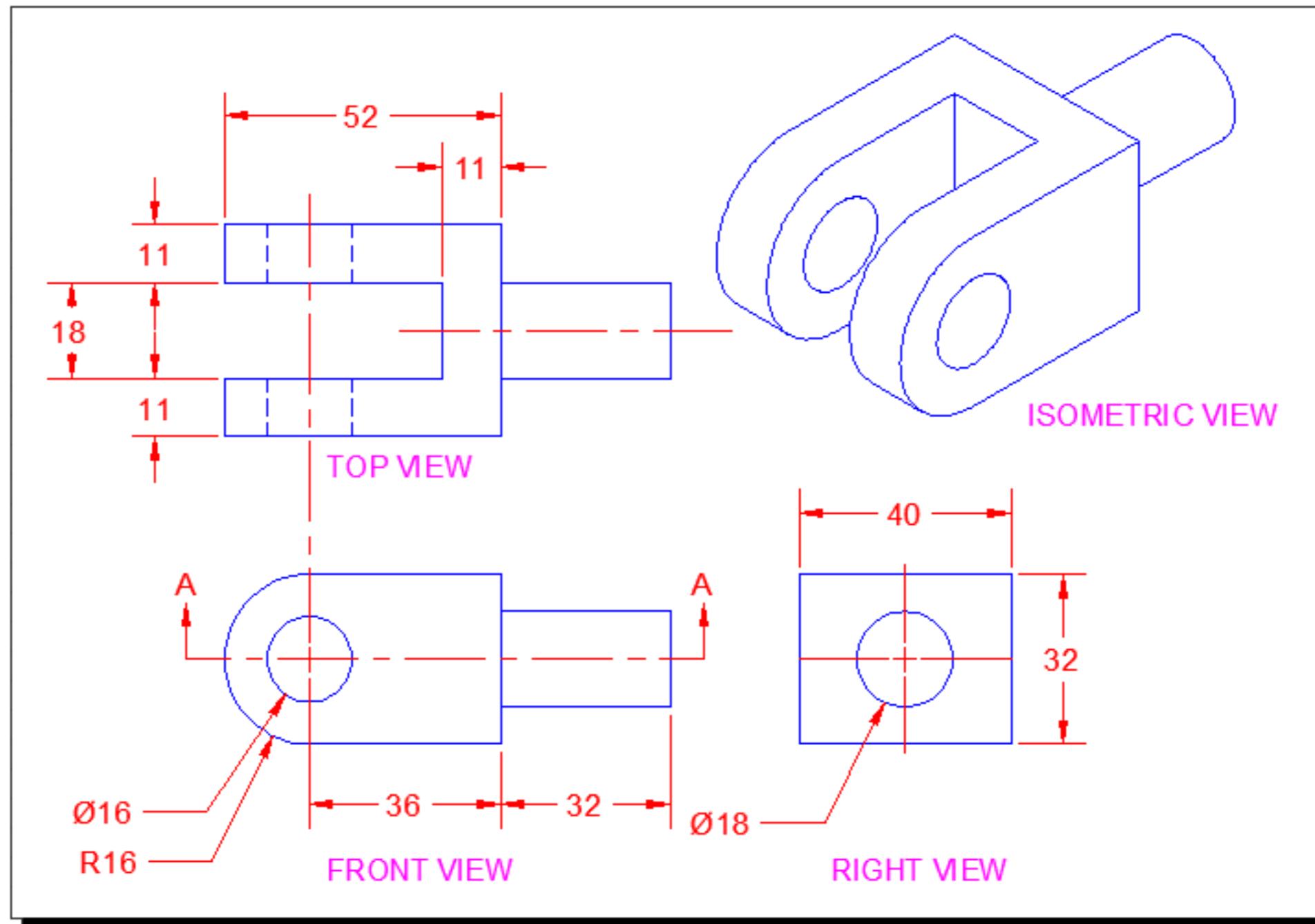
CONTACT #2
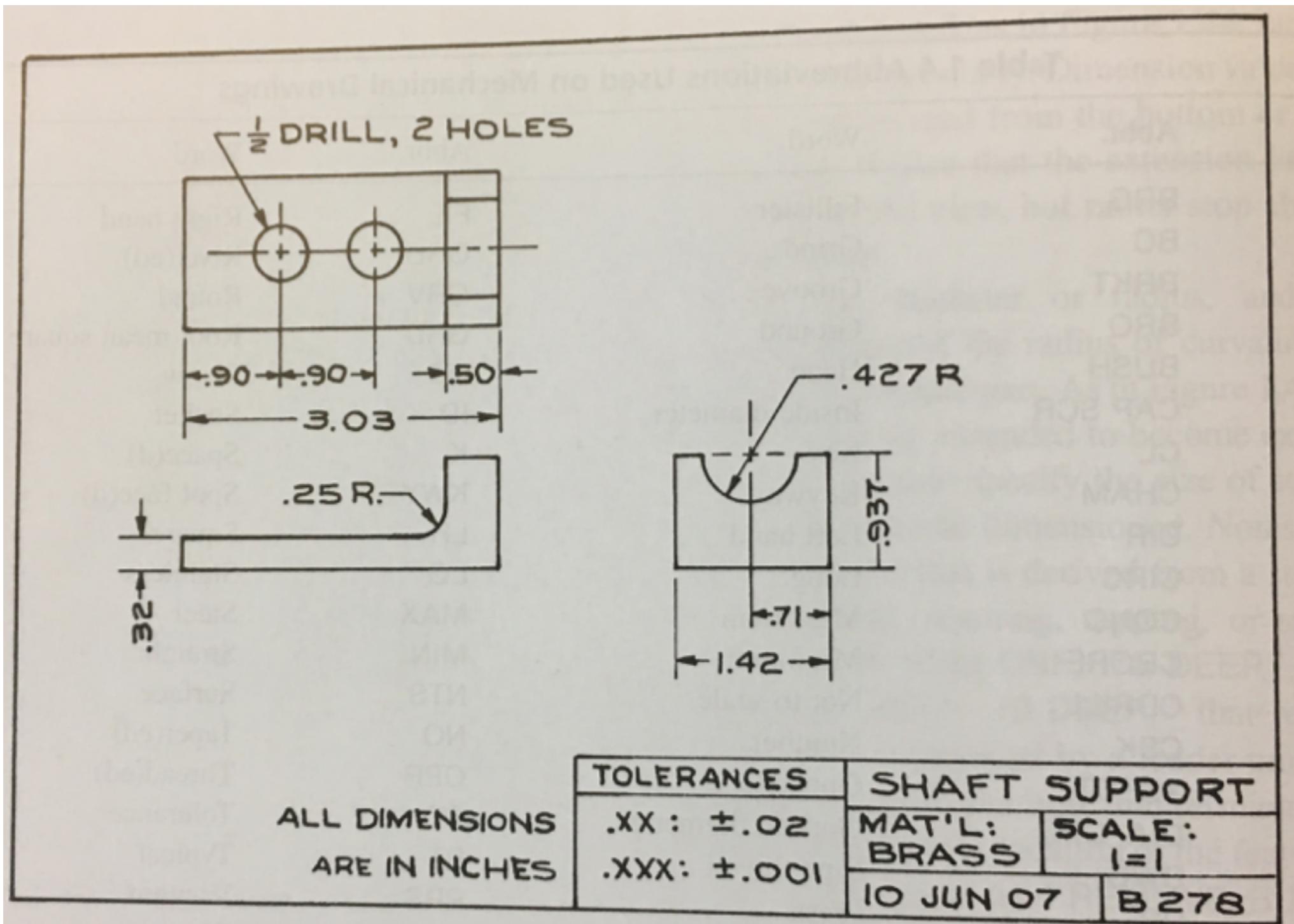
TOP OF ONE BATTERY TO THE NEGATIVE CONTAC ON CIRCUIT BOARD.

— BE COPPER

— & GLUED to TOP HALF OF ENVELOPE.

— BEND RADII TO BE .05 R

We generally use CAD tools now, but not always for one-offs

A mechanical drawing has several important parts

½ DRILL, 2 HOLES

.90 .90 .50

3.03

.25 R.

.32

.427 R

.937

.71

1.42

TOLERANCES	SHAFT SUPPORT	
ALL DIMENSIONS ARE IN INCHES	.XX : ±.02	
	.XXX: ±.001	MAT'L: BRASS
		SCALE: 1=1
	10 JUN 07	B 278

Image: Building Scientific Apparatus
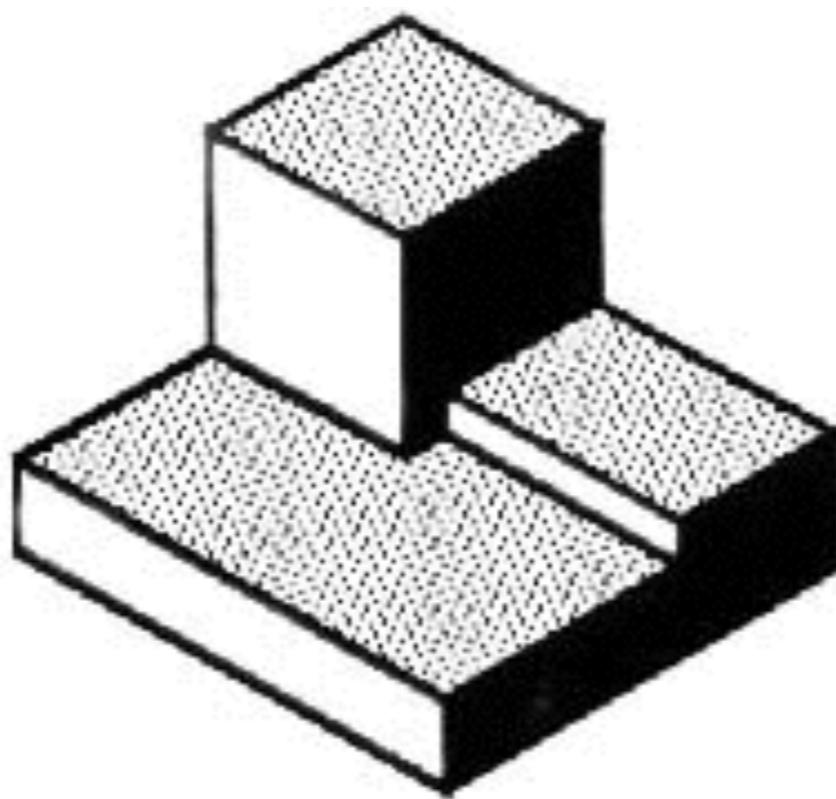
You'll see lots of abbreviations on drawings
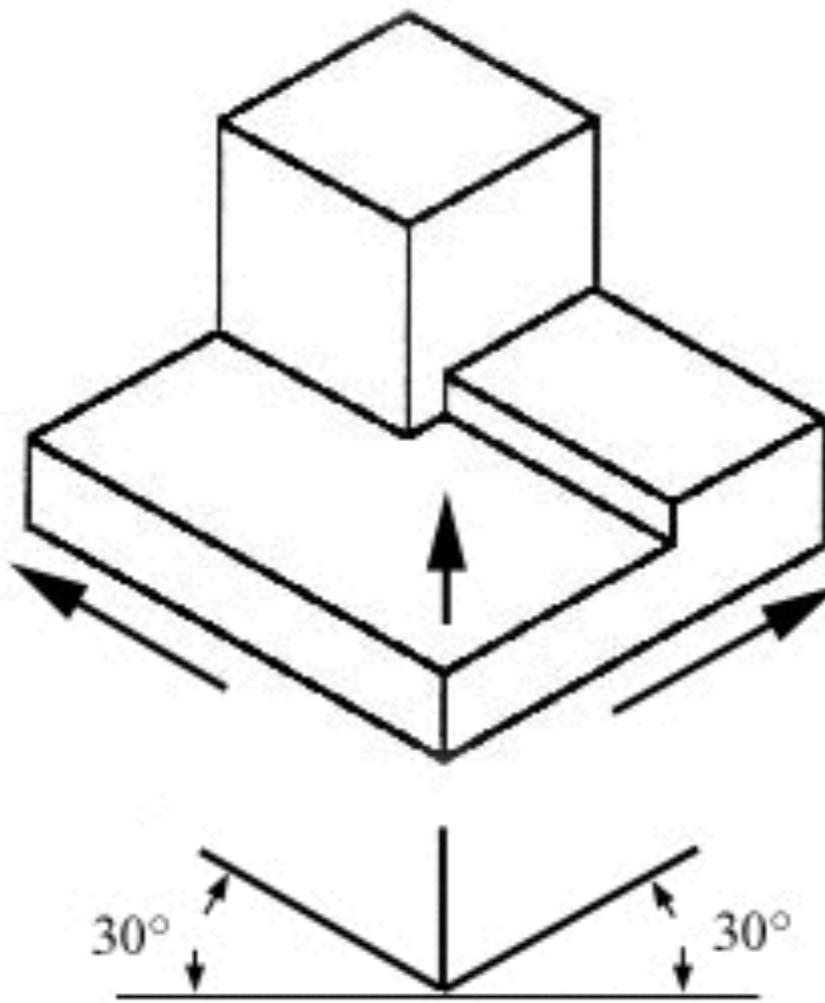
Table 1.4 Abbreviations Used on Mechanical Drawings

| Word	Abbr.	Word	Abbr.	Word	Abbr.
Bearing	BRG	Fillister	FIL	Right hand	RH
Bolt circle	BC	Grind	GRD	Rivet(ed)	RIV
Bracket	BRKT	Groove	GRV	Round	RD
Broach(ed)	BRO	Ground	GRD	Root mean square	RMS
Bushing	BUSH	Head	HD	Screw	SCR
Cap screw	CAP SCR	Inside diameter	ID	Socket	SOC
Center line	CL	Key	K	Space(d)	SP
Chamfer	CHAM	Keyway	KWY	Spot face(d)	SF
Circle	CIR	Left hand	LH	Square	SQ
Circumference	CIRC	Long	LG	Stainless	STN
Concentric	CONC	Maximum	MAX	Steel	STL
Counterbore	CBORE	Minimum	MIN	Straight	STR
Counterdrill	CDRILL	Not to scale	NTS	Surface	SUR
Countersink	CSK	Number	NO	Taper(ed)	TPR
Cross section	XSECT	Opposite	OPP	Thread(ed)	THD
Diameter	DIA, D, Ø	Outside diameter	OD	Tolerance	TOL
Drawing	DWG	Pipe thread	PT	Typical	TYP
Drill(ed)	DR	Press	PRS	Vacuum	VAC
Each	EA	Punch	PCH	Washer	WASH
Equal(ly)	EQ	Radius	R	With	W/
Fillet	FIL	Reference line	REF	Without	W/O
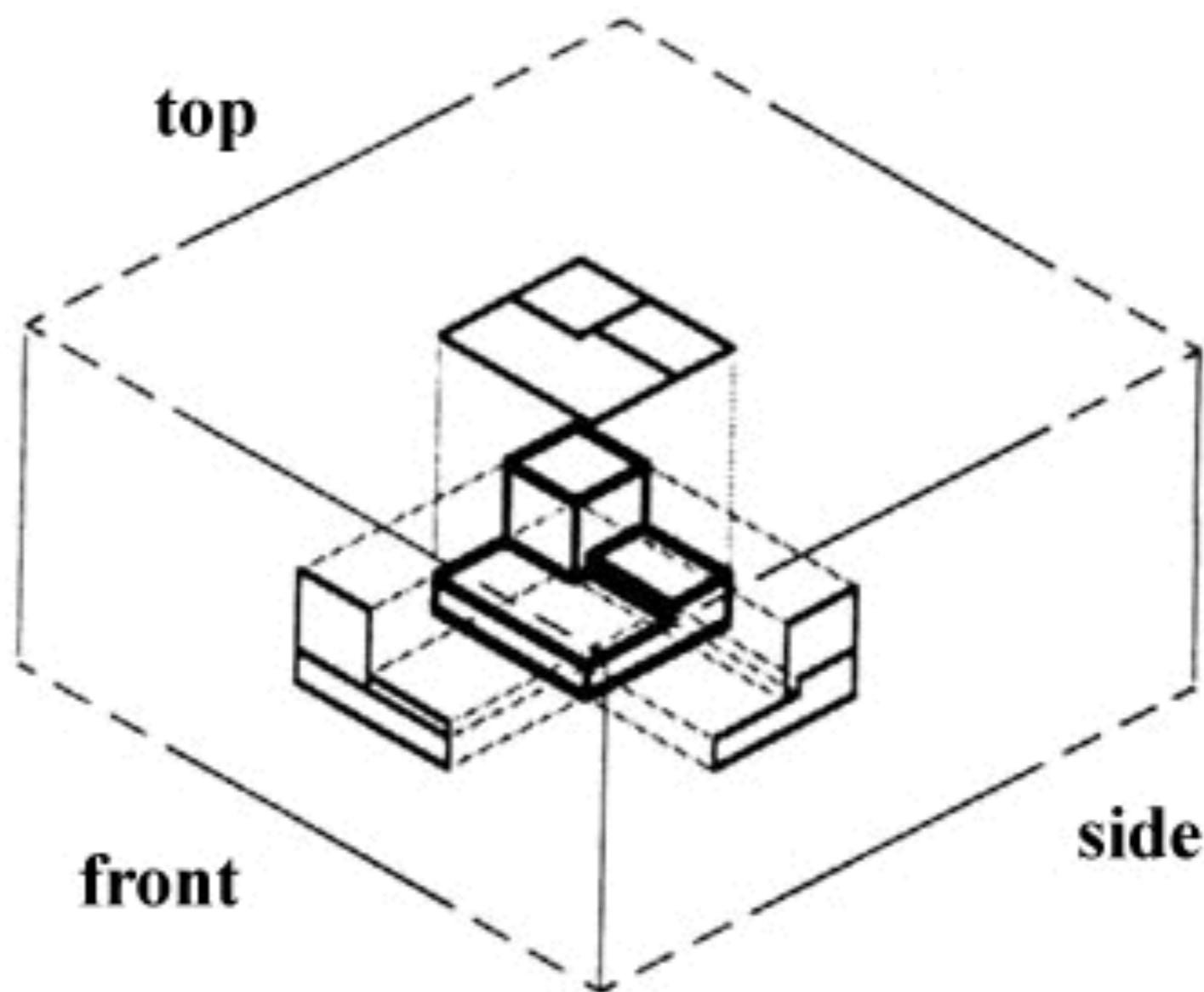
We will use this simple machined part to illustrate how to make a drawing
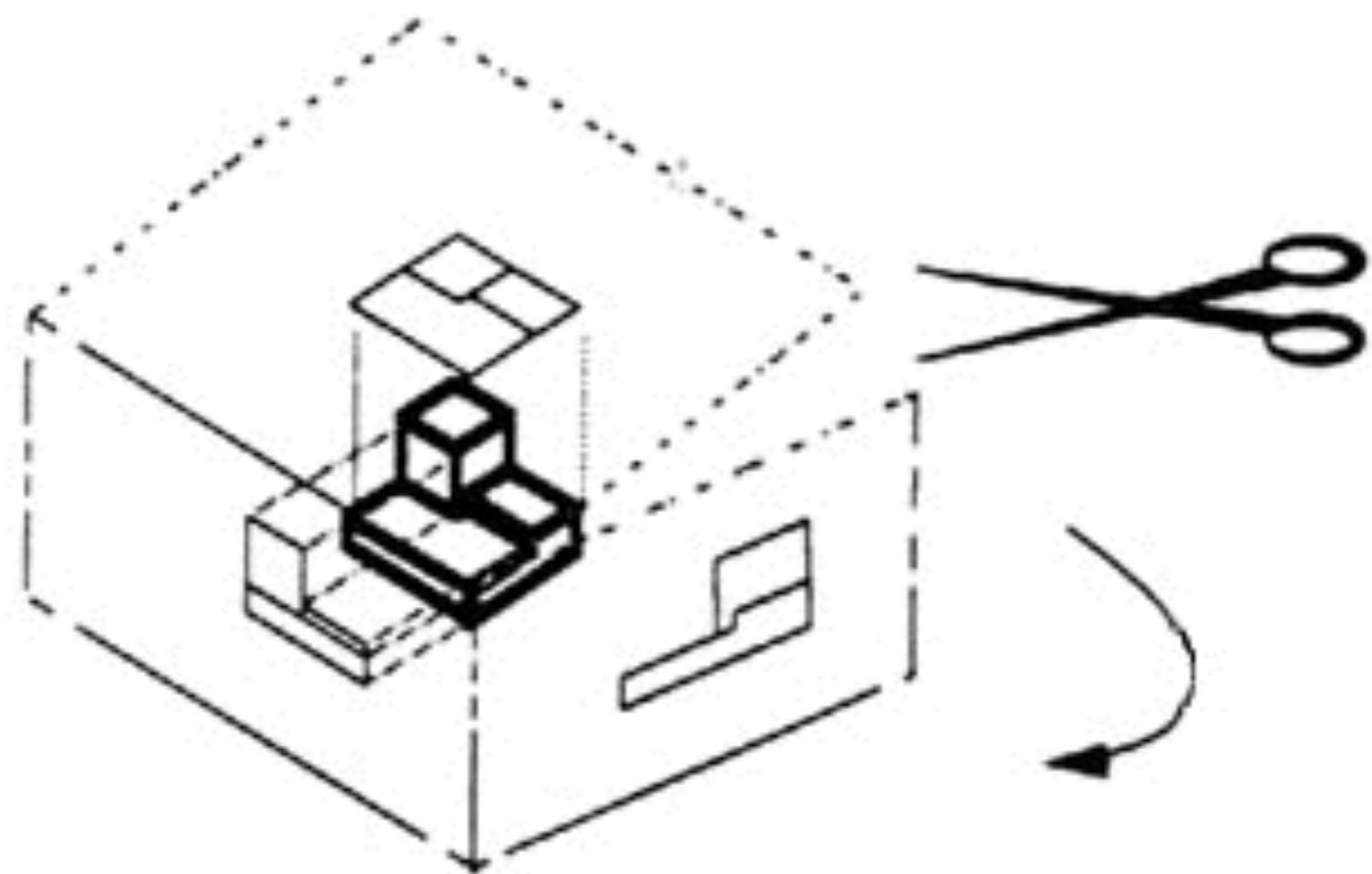
We show parts using isometric and orthogonal drawings
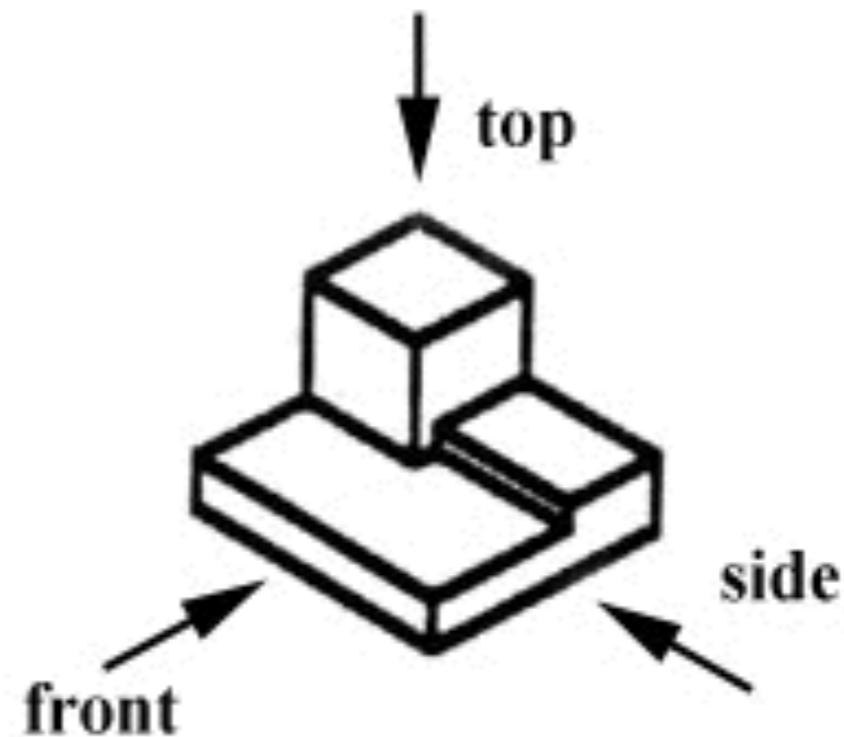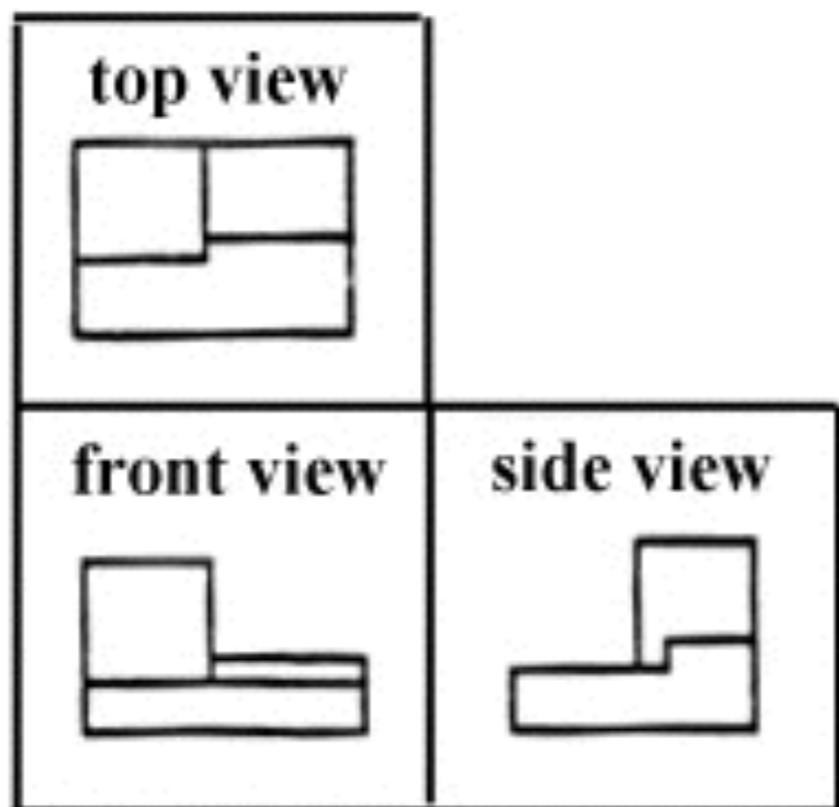
Imagine looking at the object from the fundamental 6 directions


top

front

side
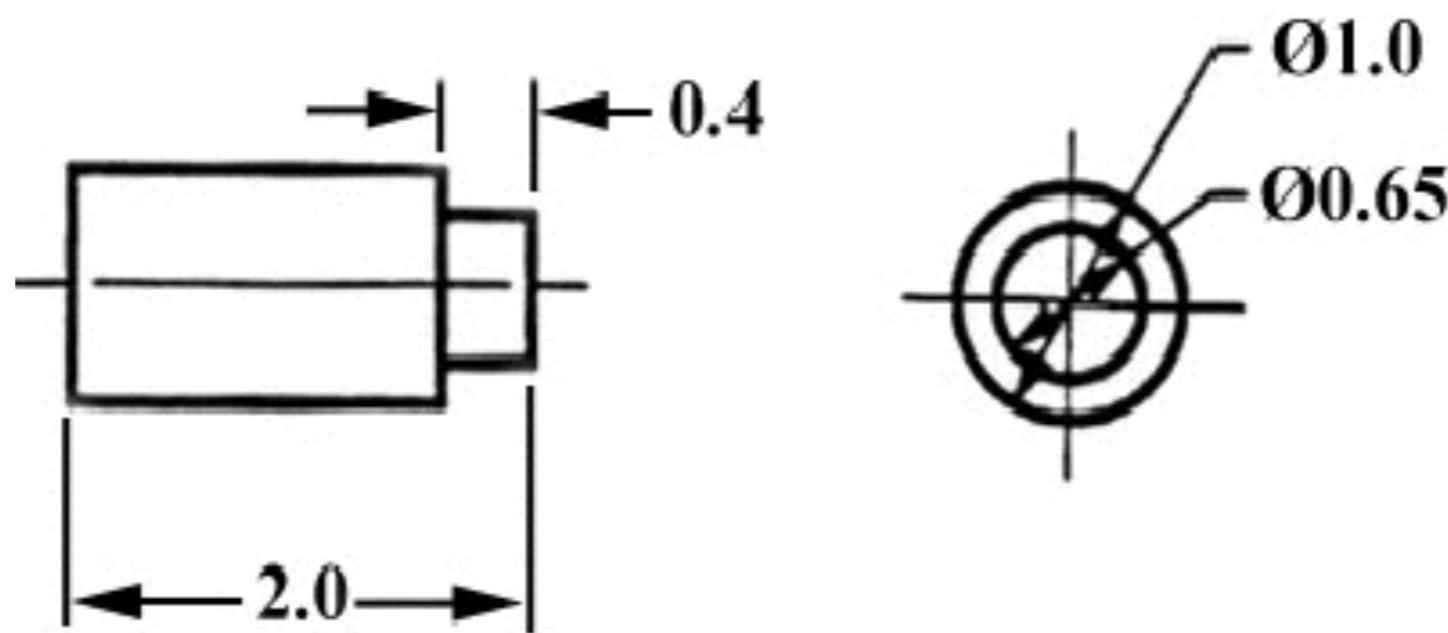
Unfold that view box and you've created an orthogonal drawing
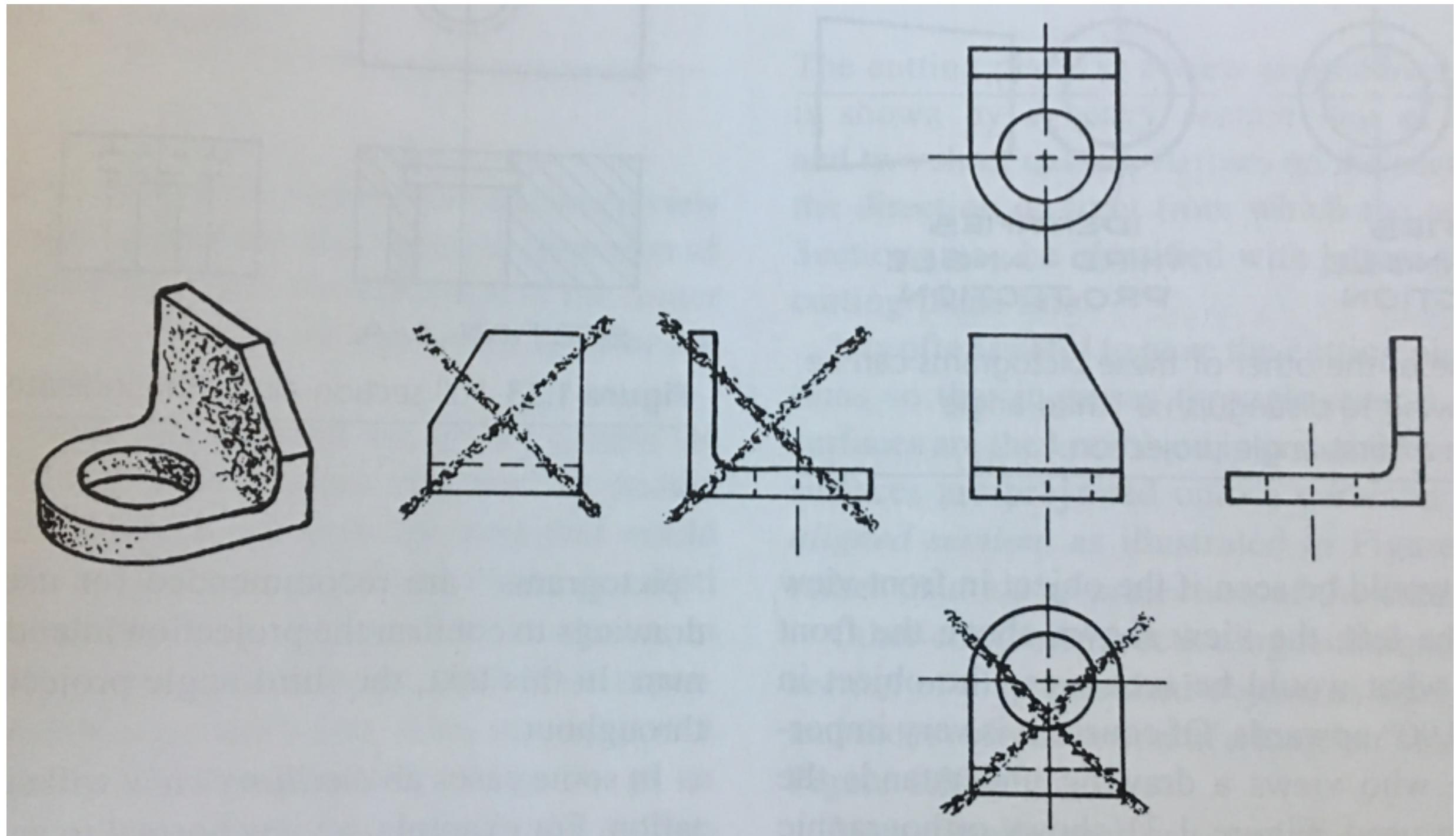
Unfold that view box and you've created an orthogonal drawing
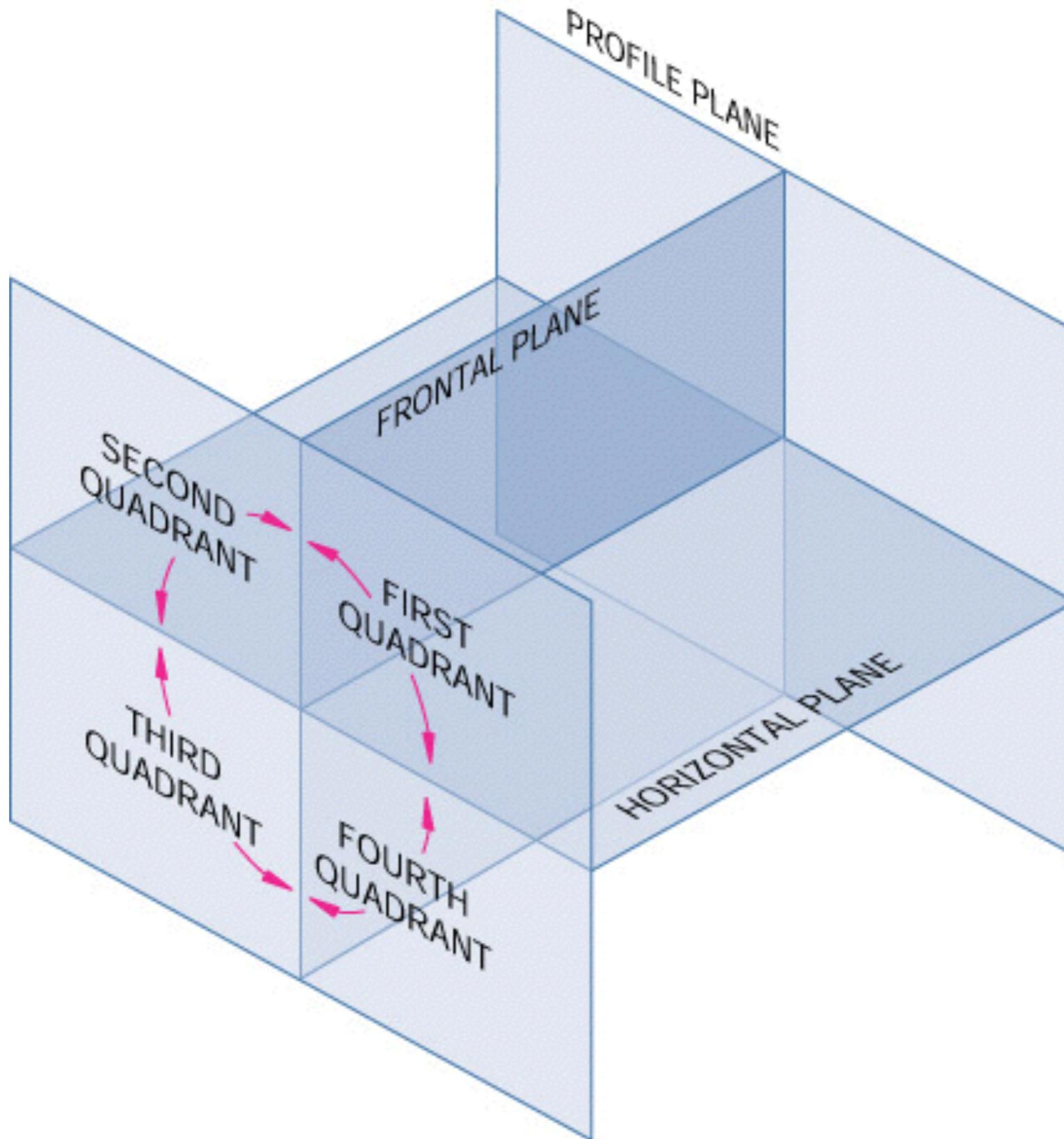
Parts could take only 2 views or many views to describe
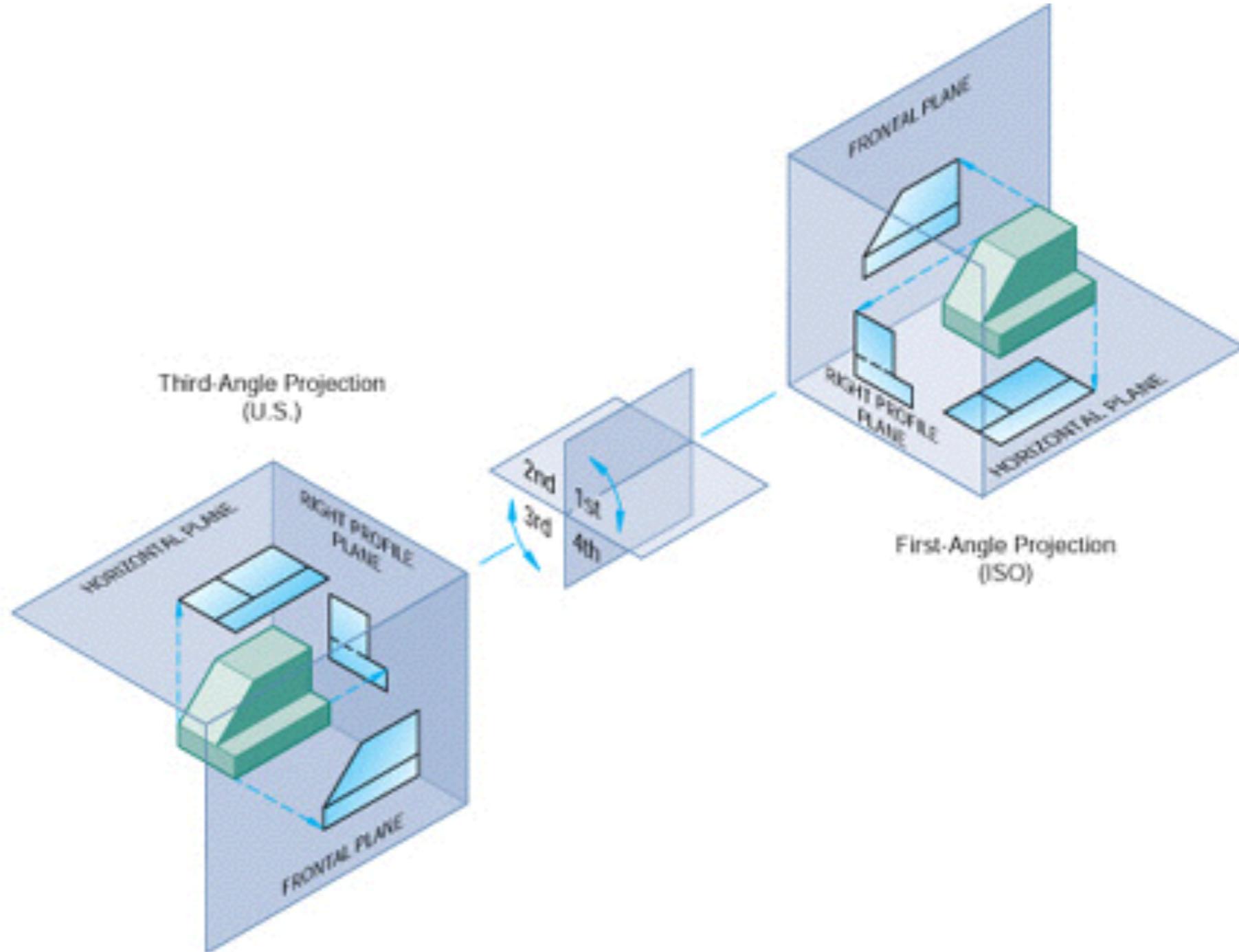
Not all angles will be required for most parts
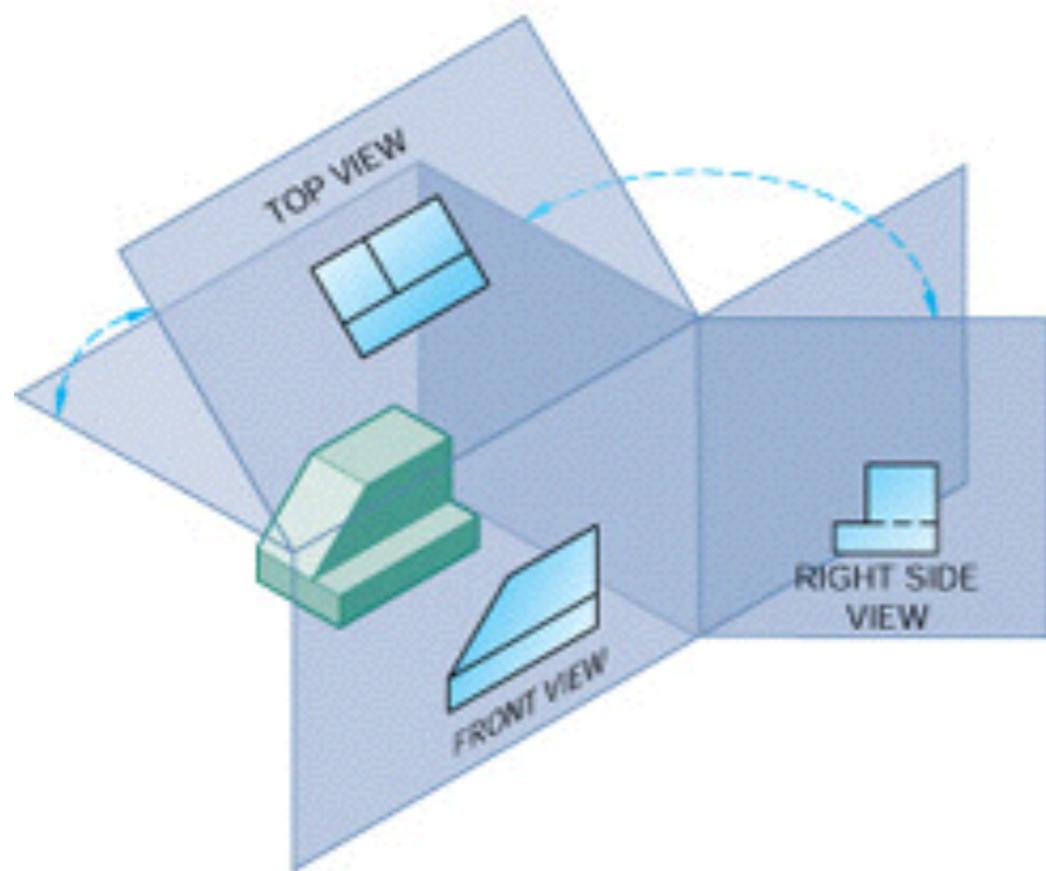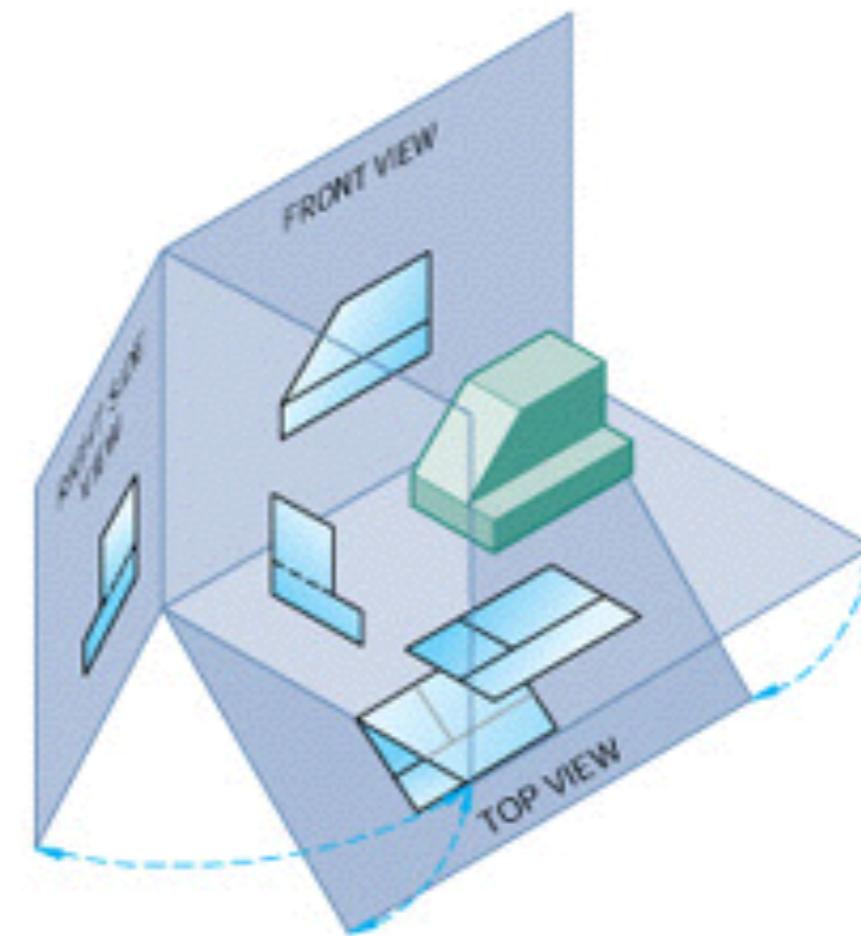
We generally prefer the third-angle projection in the US

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Third-Angle Projection (U.S.)

First-Angle Projection (ISO)

We generally prefer the third-angle projection in the US
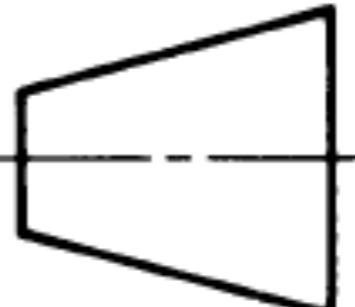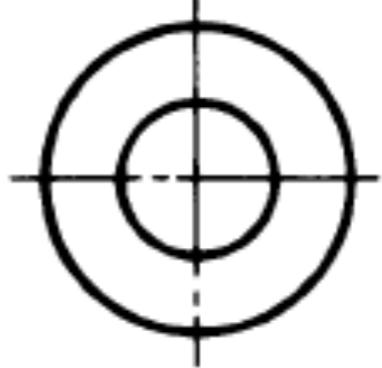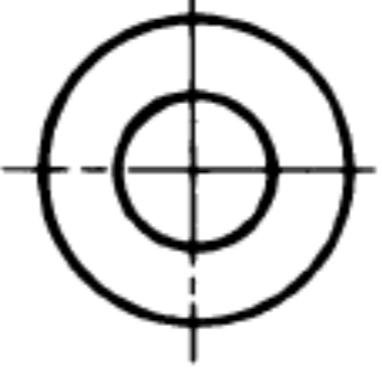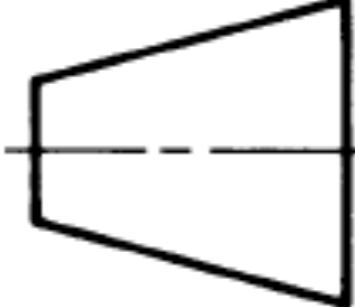
(A) Third-Angle Projection
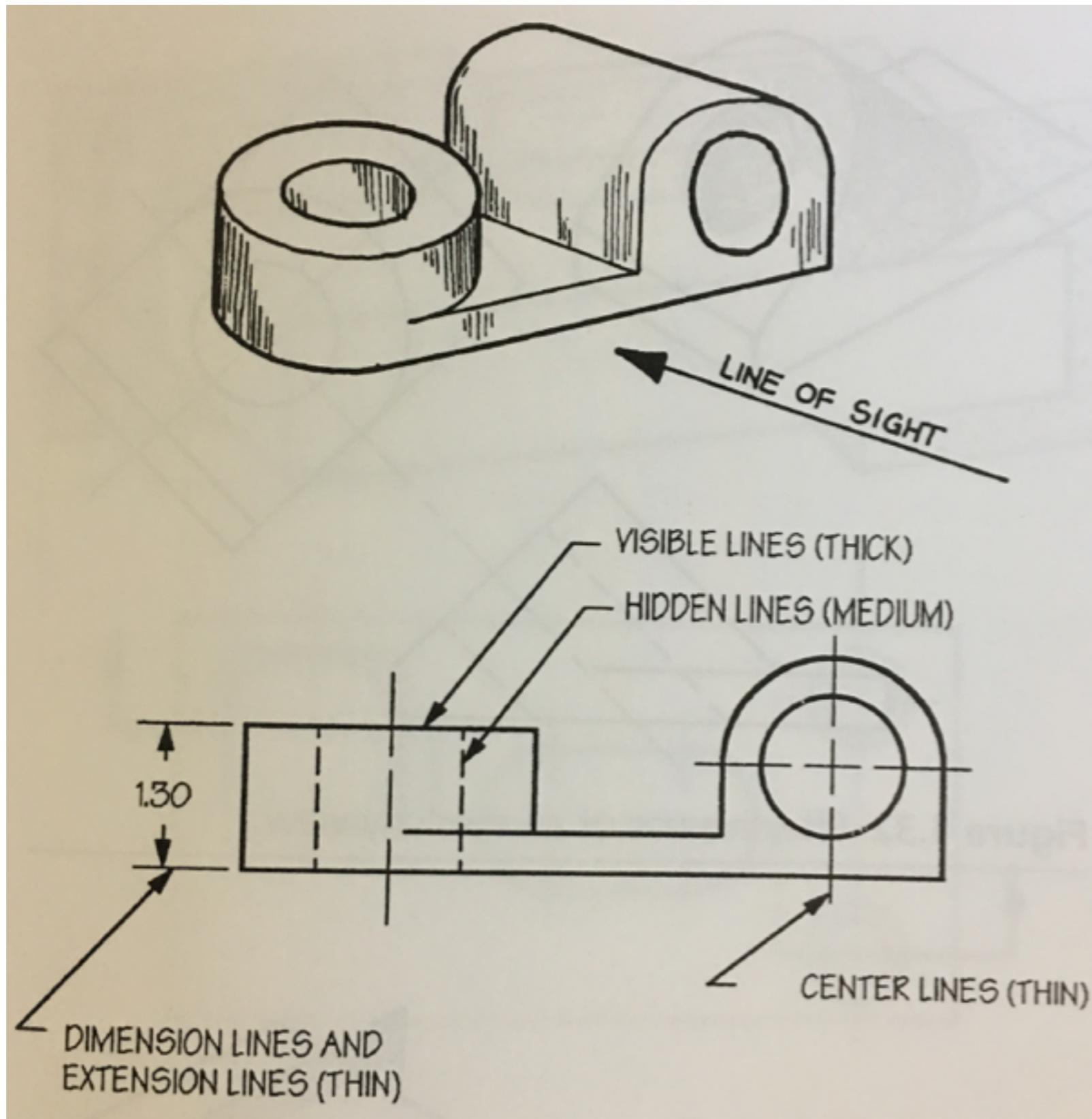
(B) First-Angle Projection
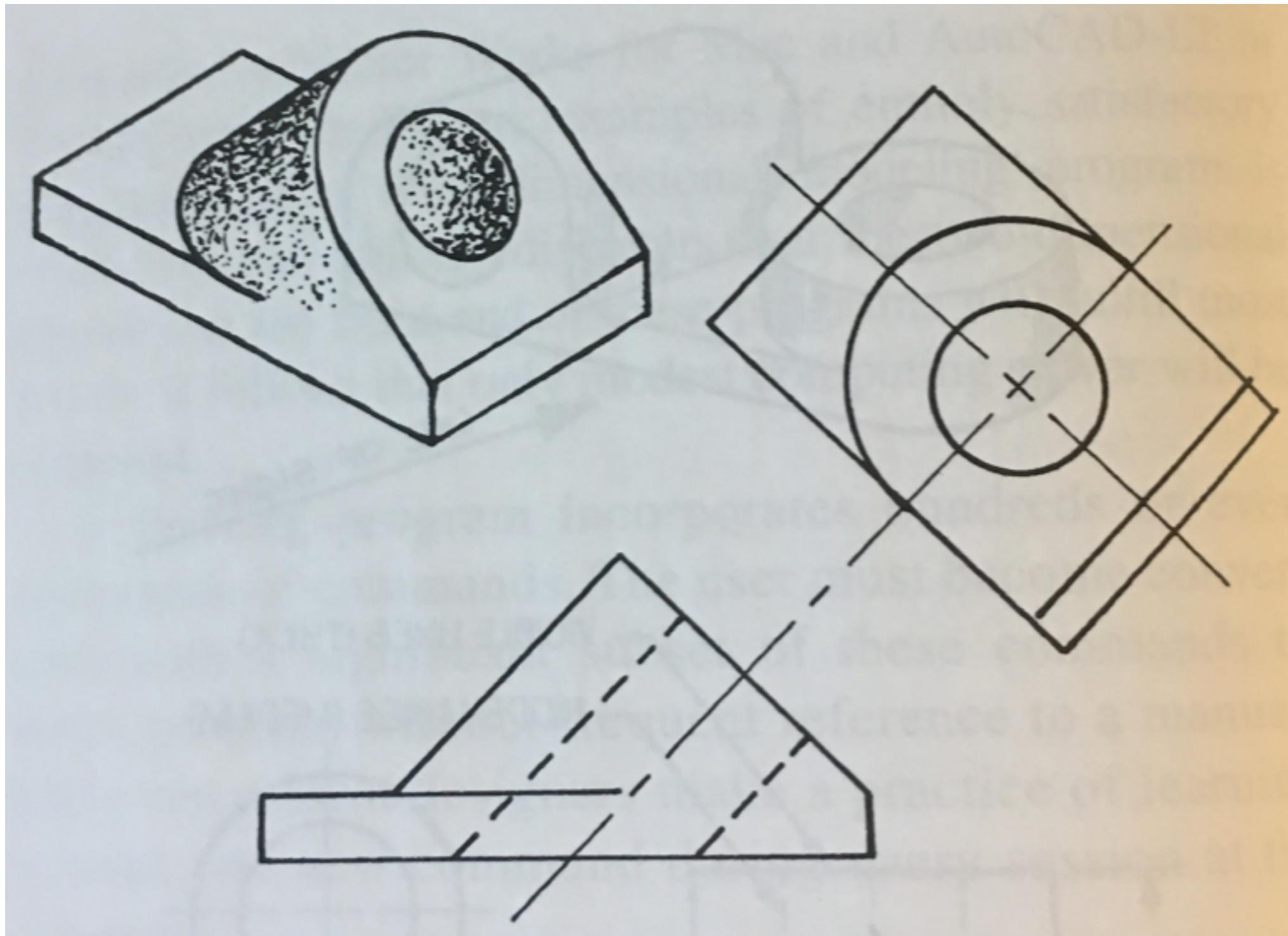
# We generally prefer the third-angle projection in the US

Projection	Symbol
First angle	
Third angle	
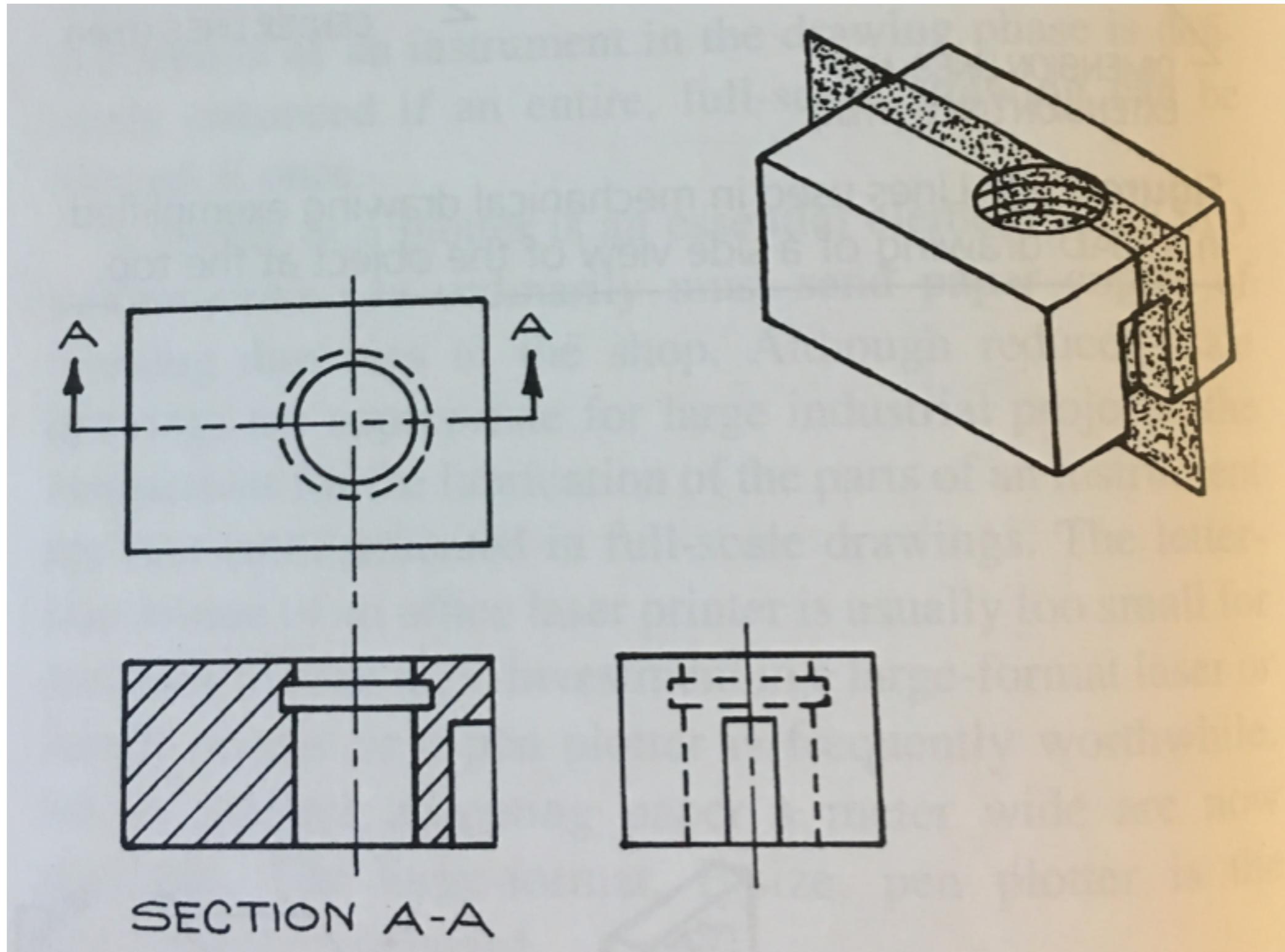
We use different line weights and styles in drawings

LINE OF SIGHT

VISIBLE LINES (THICK)

HIDDEN LINES (MEDIUM)

1.30

CENTER LINES (THIN)

DIMENSION LINES AND
EXTENSION LINES (THIN)
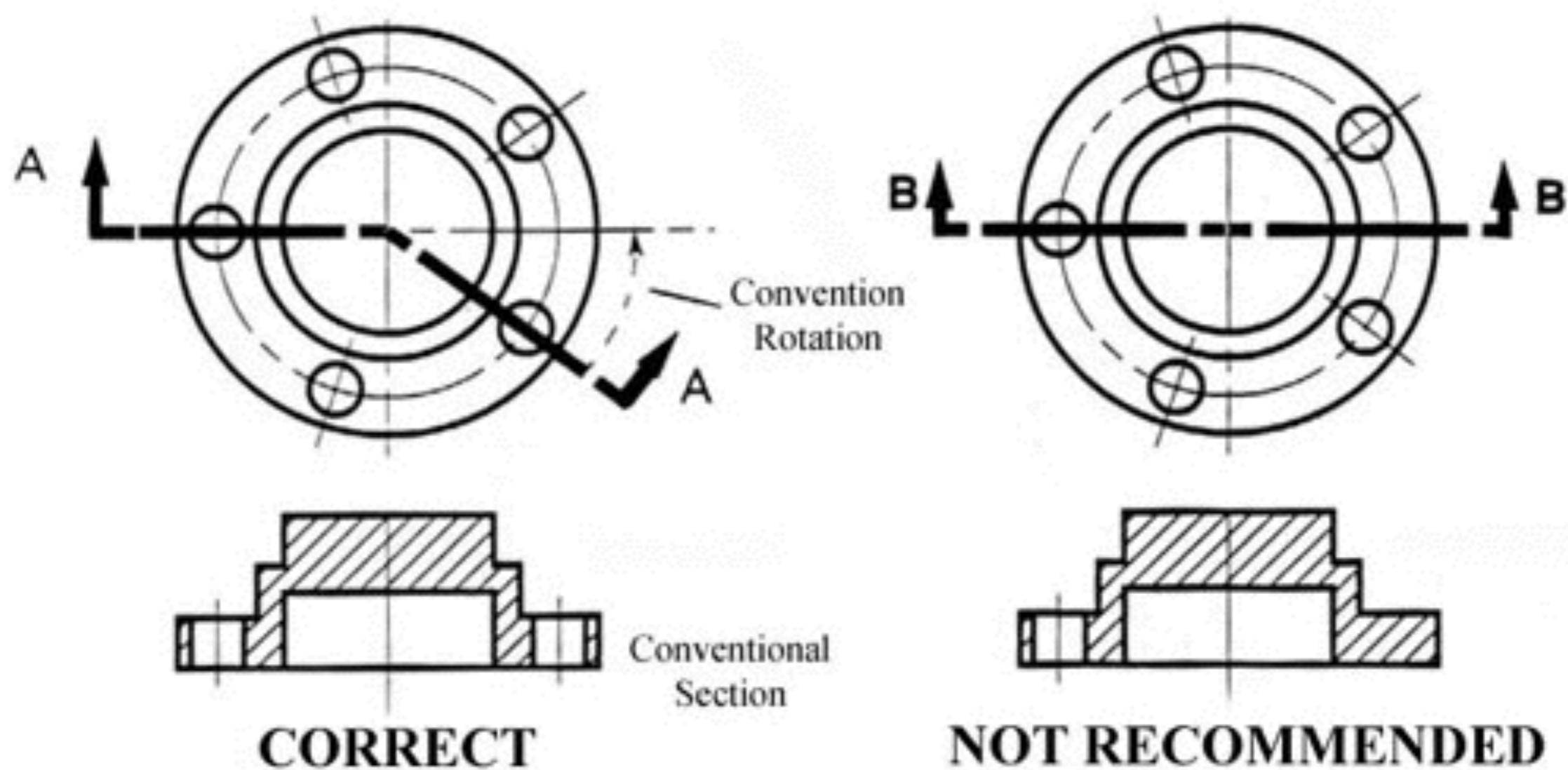
Auxiliary views can be used on strange surfaces/angles
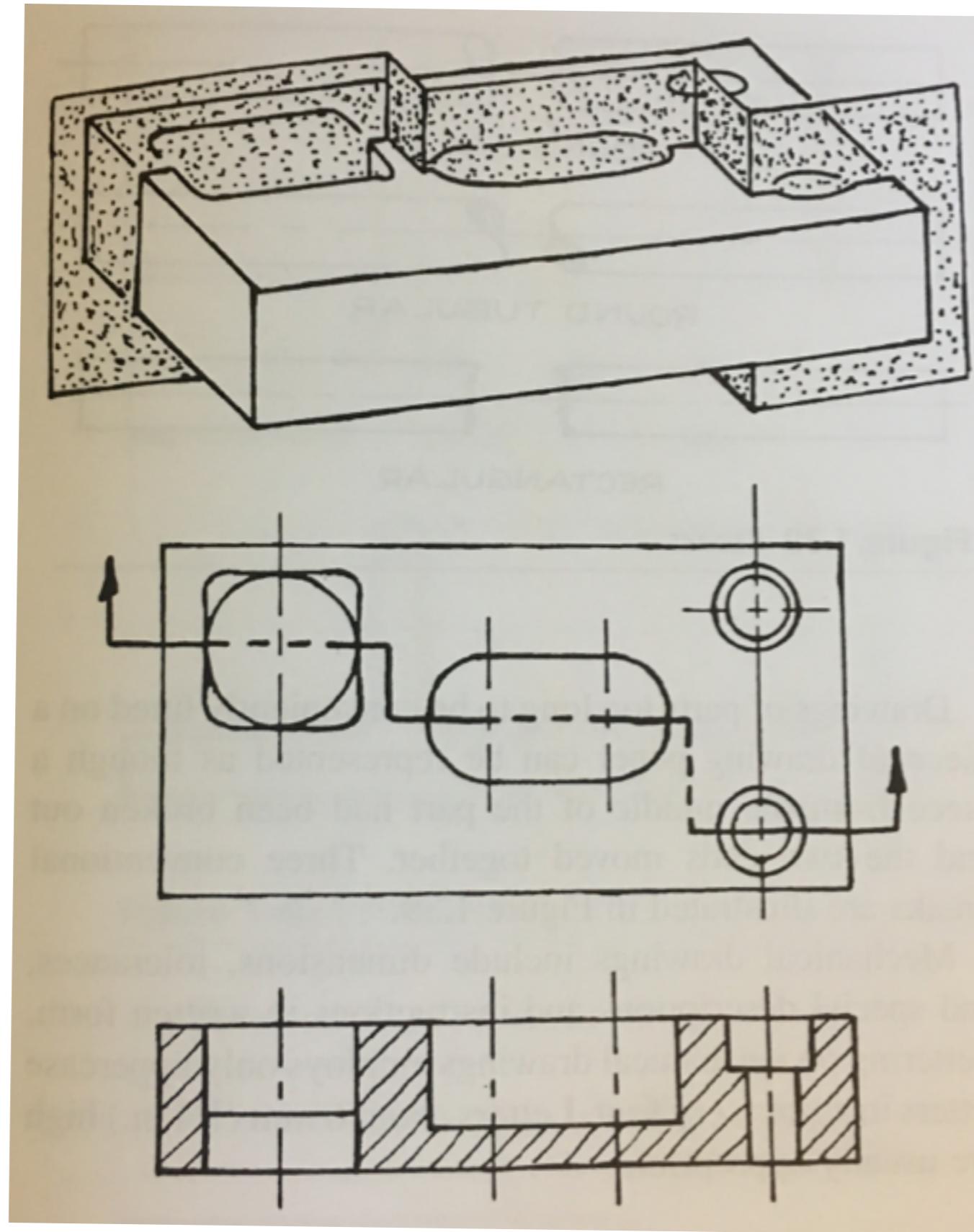
A full section is similar to sawing the part along the section line
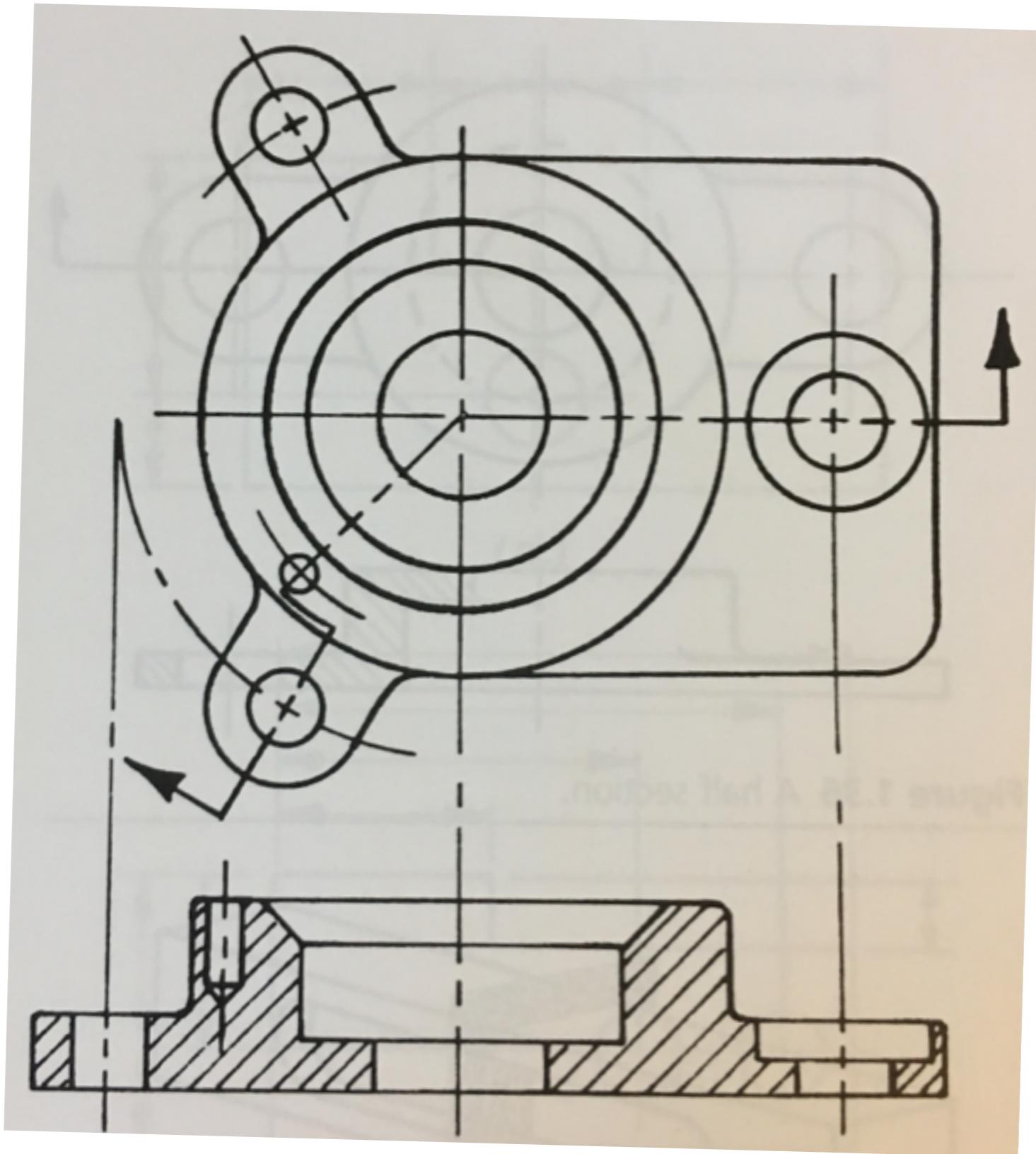
SECTION A-A

Using bent sections is often advised on cylindrical parts

CORRECT

NOT RECOMMENDED
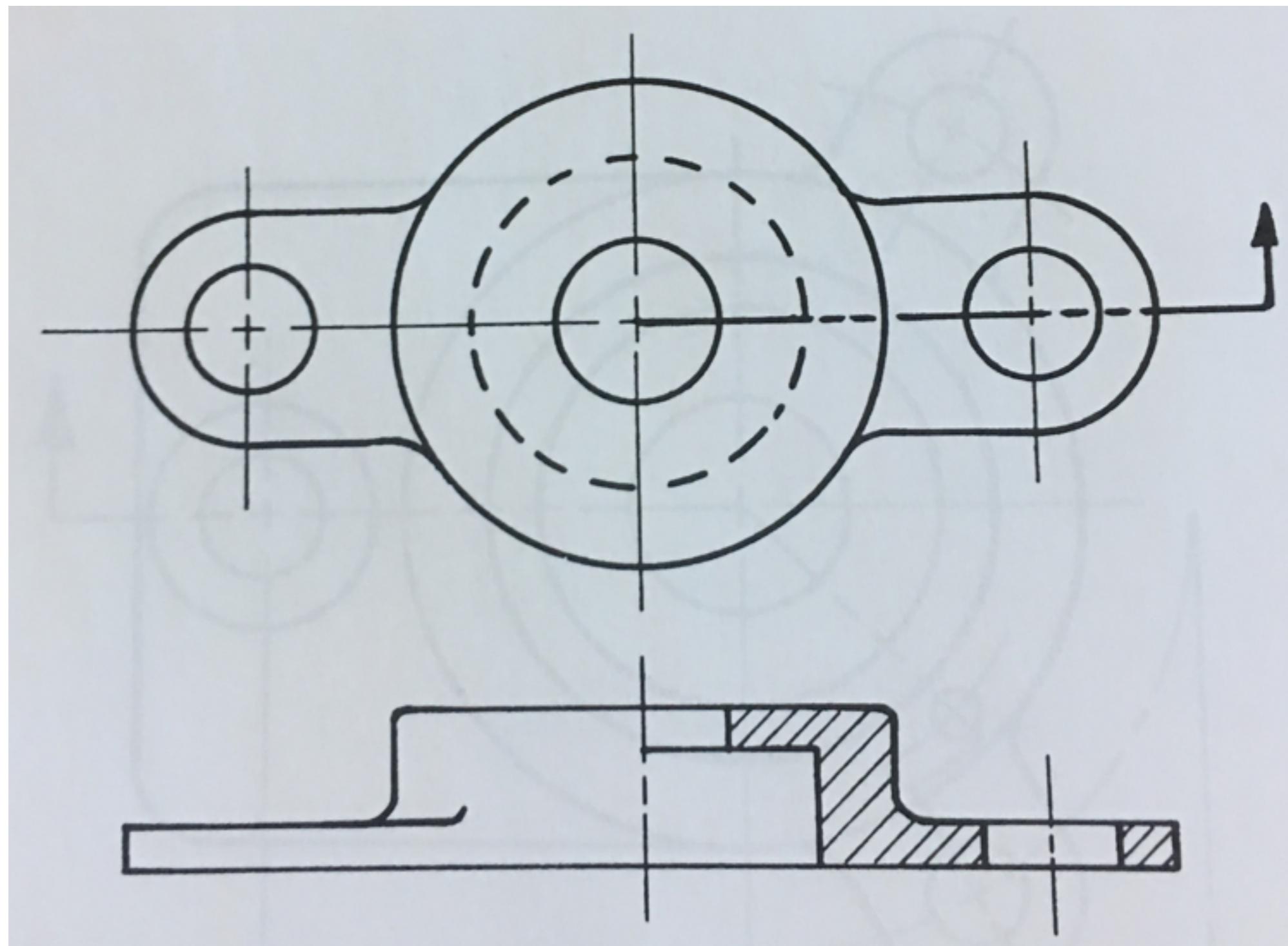
Aligned views/sections reduce the number of sections needed
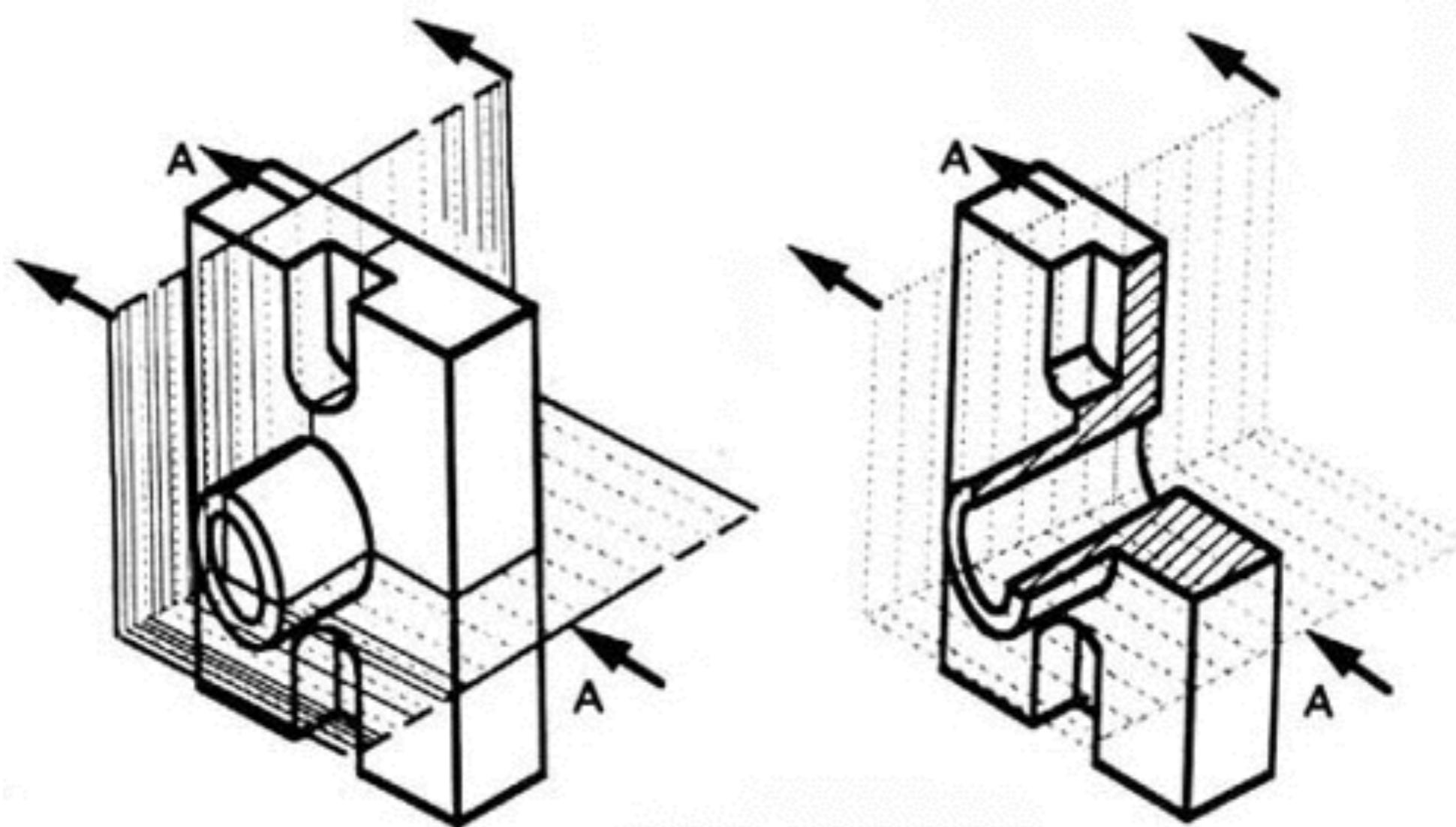
We can also rotate features in aligned sections

Image: Building Scientific Apparatus
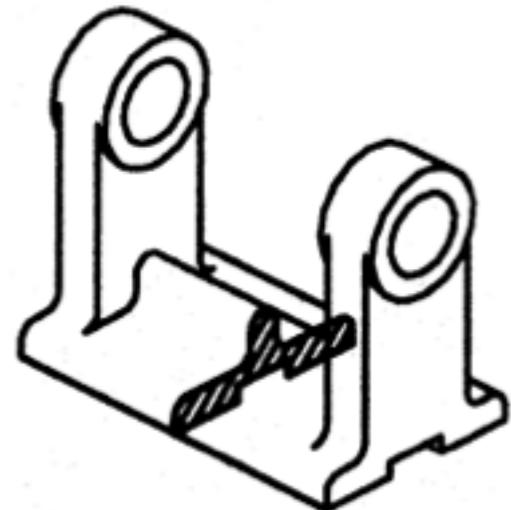
Half sections can show complex geometry easily
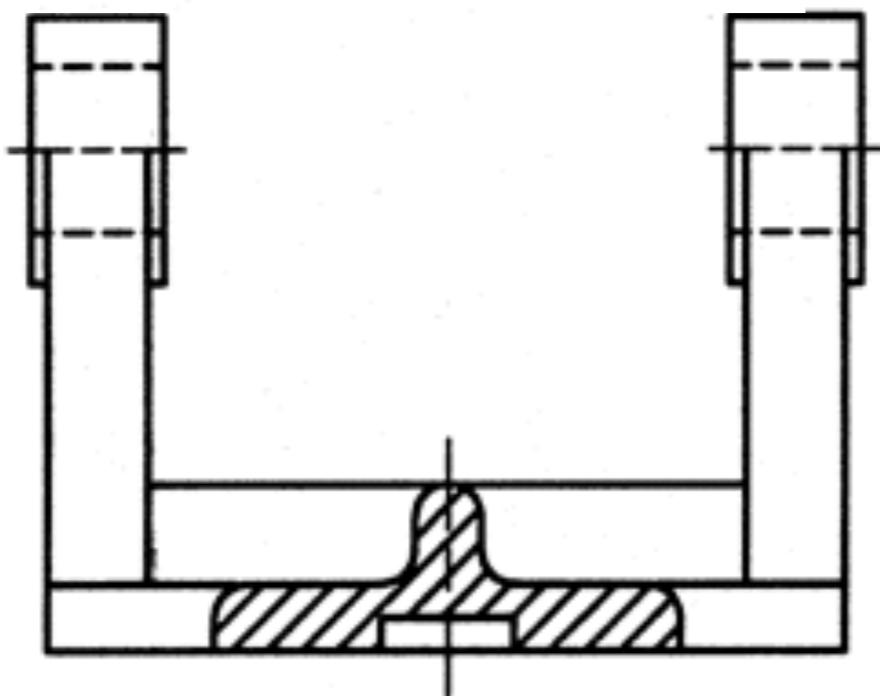
Half sections can show complex geometry easily
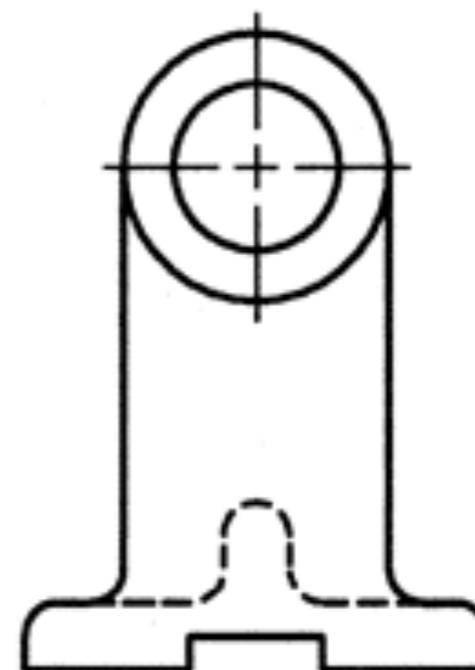
# Revolved sections are in a different plane than the rest of the drawing
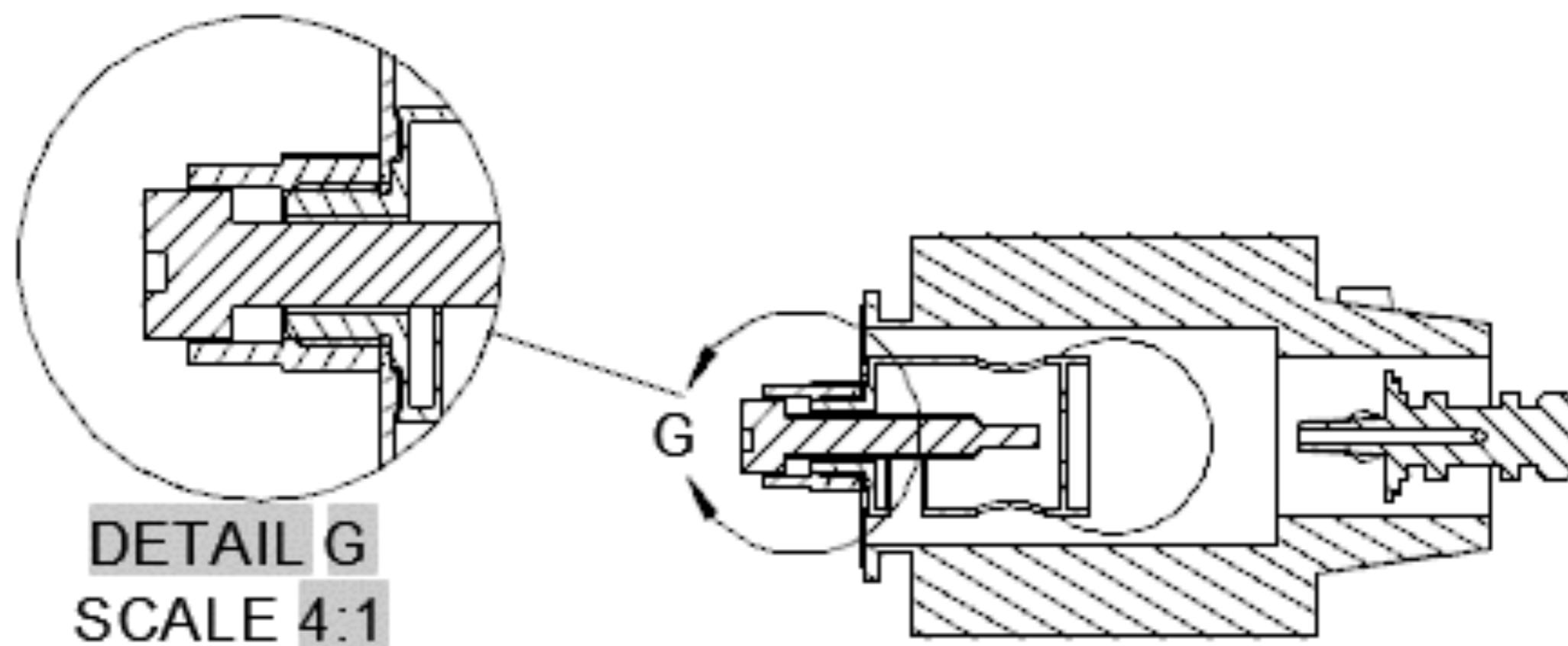

CUT SECTION OF
SOLID MODEL

REVOLVED SECTION

Image: https://www.me.utexas.edu/~rbarr/draft/Section_Views/Revolved_Section.html
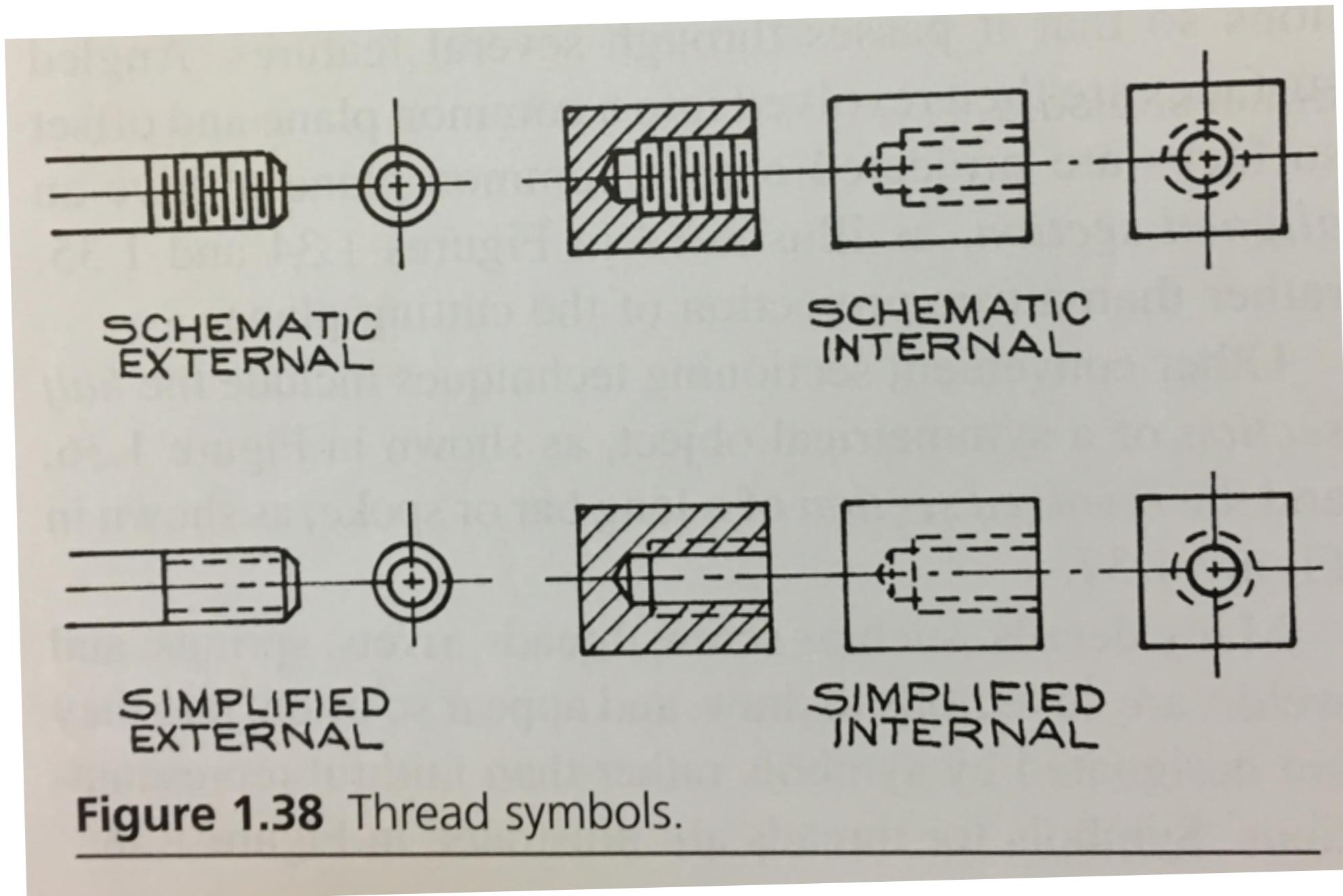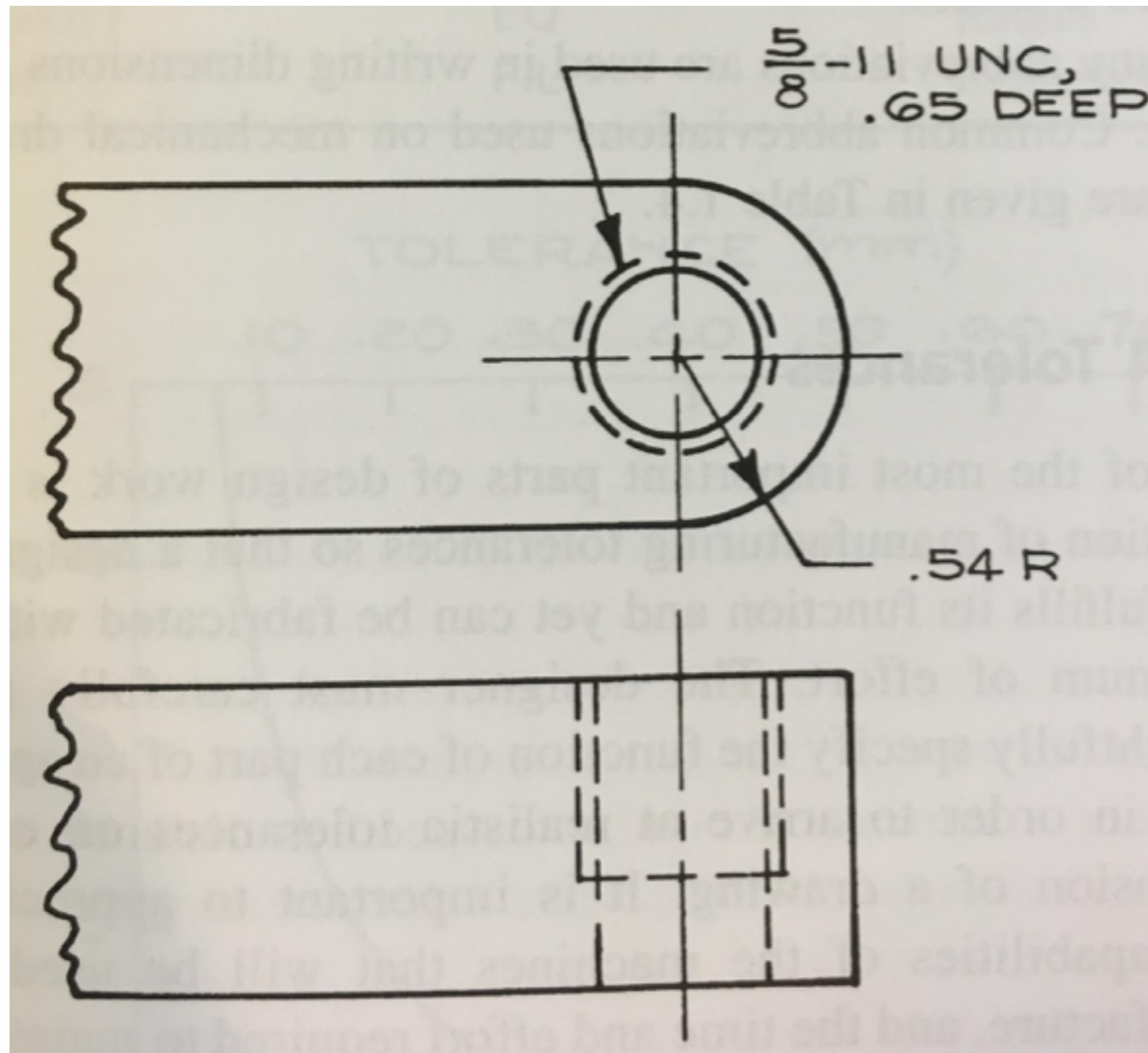
Detail views can show complex areas of parts
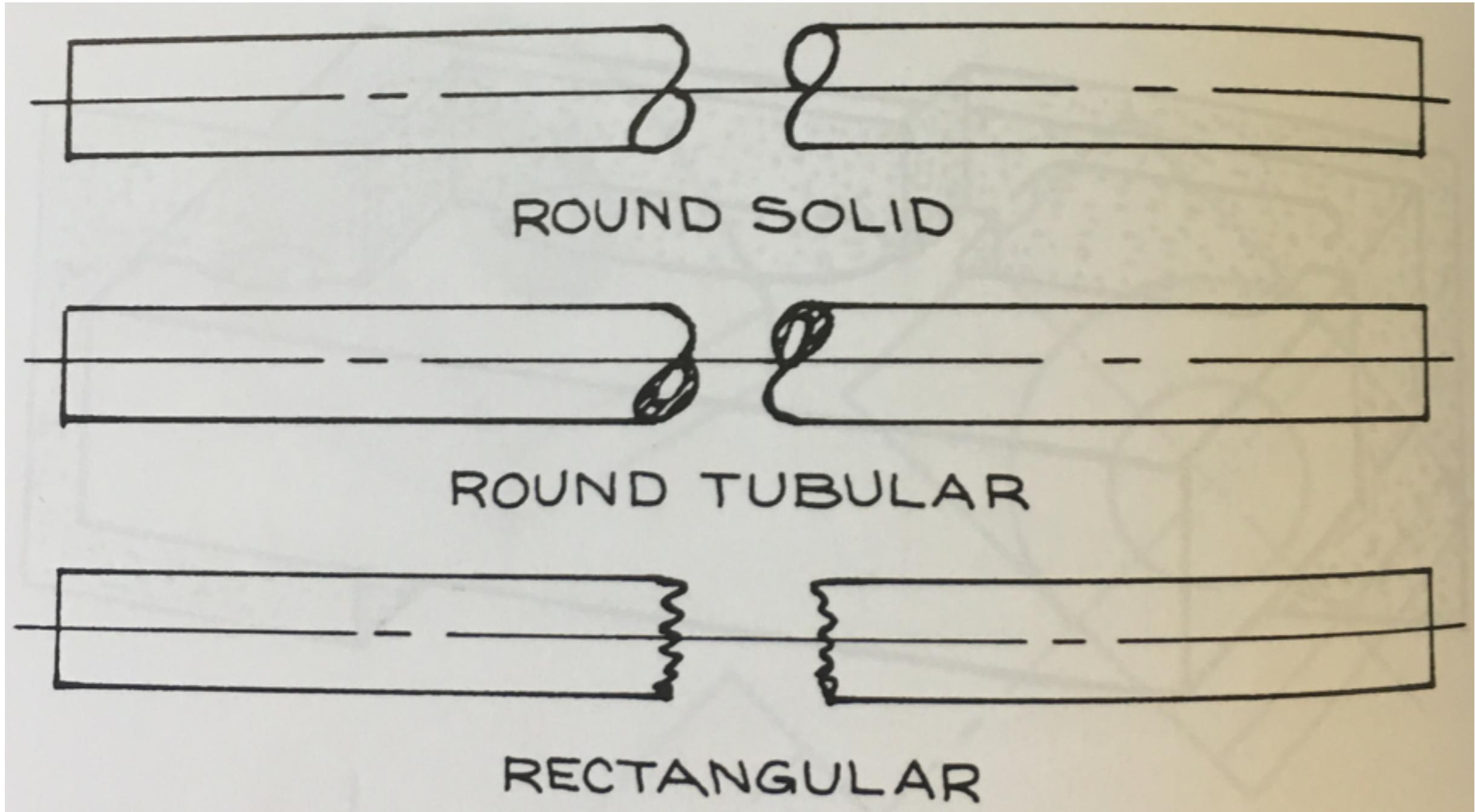
DETAIL G
SCALE 4:1

G

We often don't draw threads accurately, its unnecessary

SCHEMATIC EXTERNAL

SCHEMATIC INTERNAL

SIMPLIFIED EXTERNAL

SIMPLIFIED INTERNAL

Figure 1.38 Thread symbols.
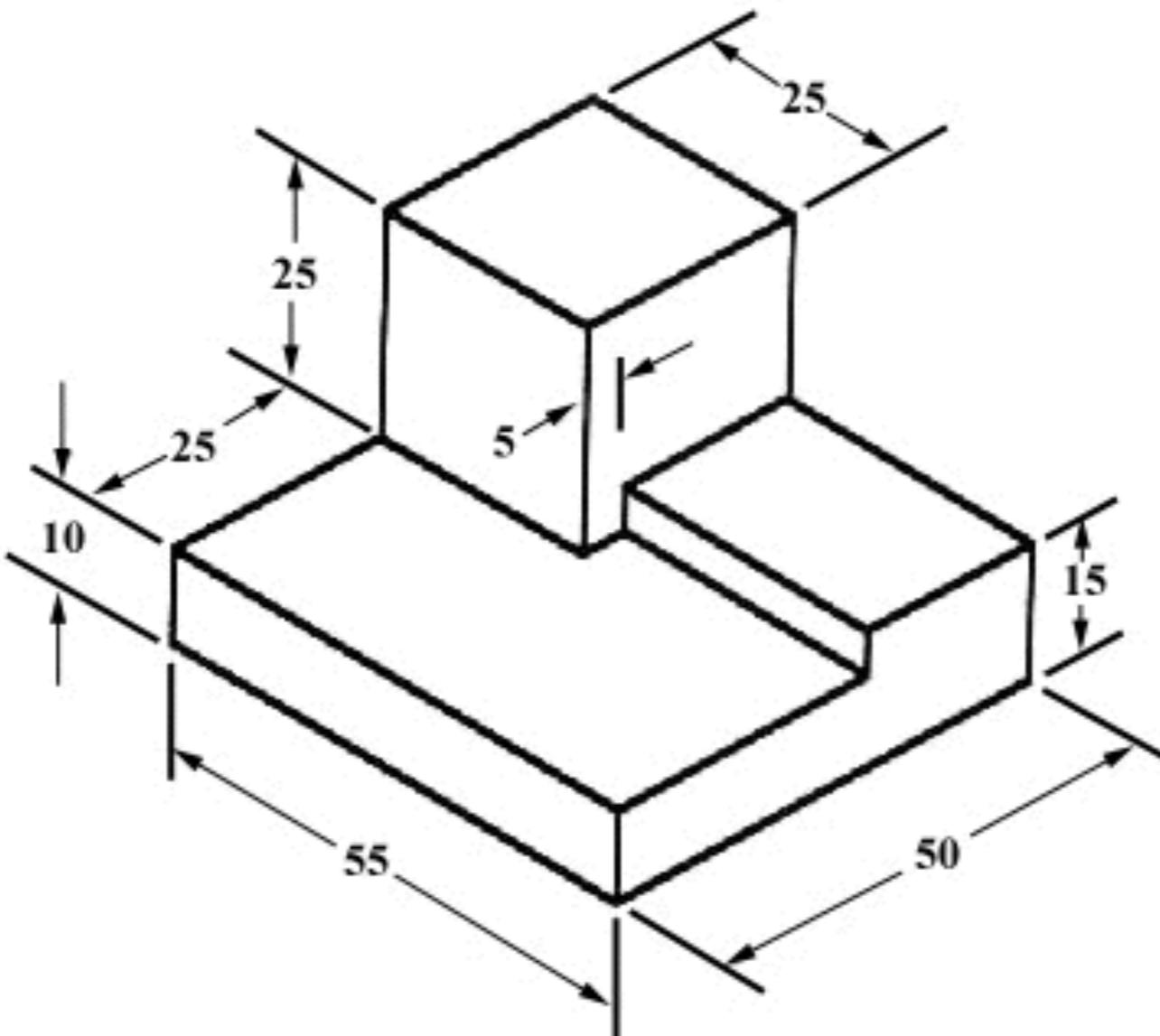
We often don't draw threads accurately, its unnecessary
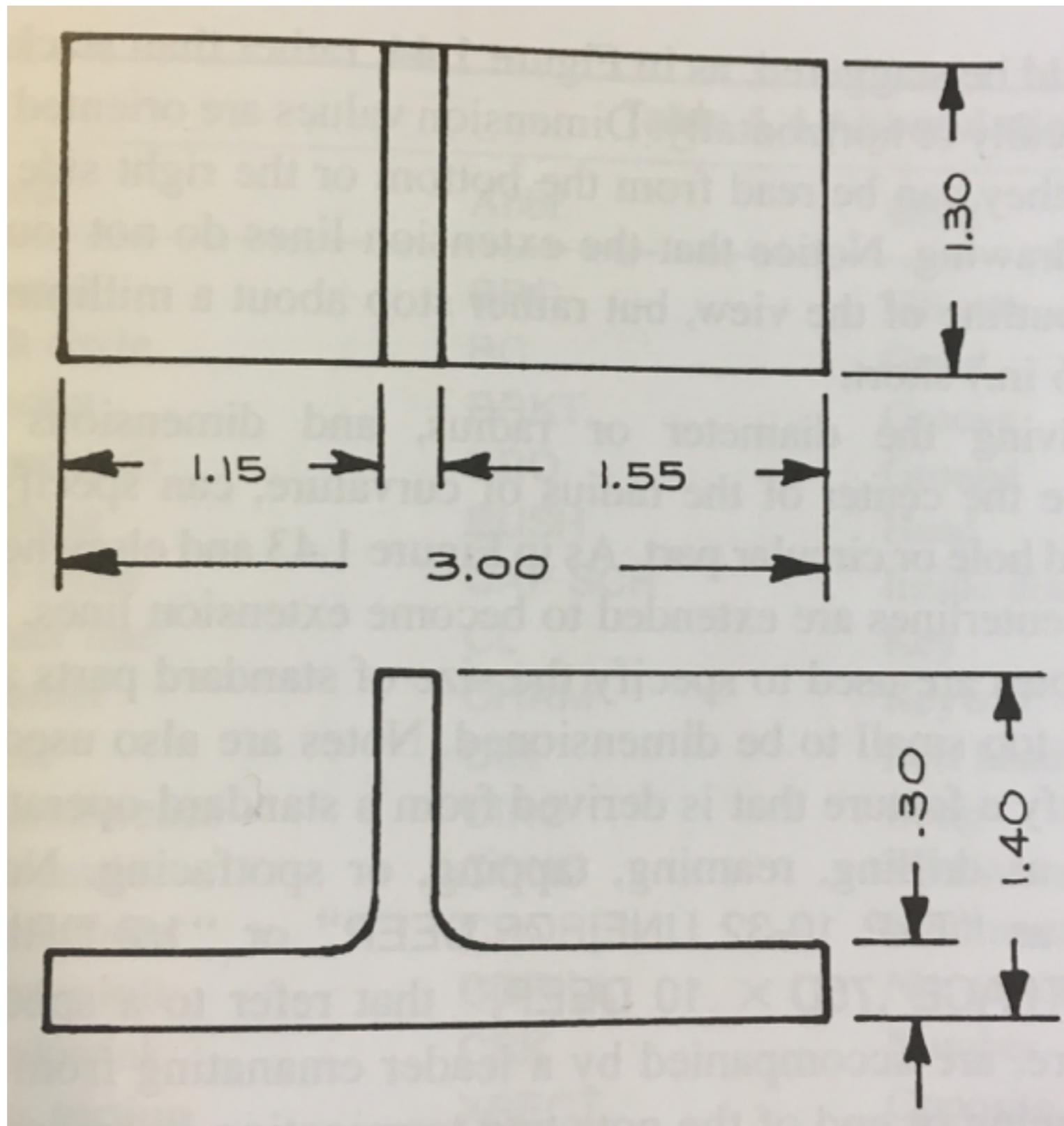
Breaks eliminate large sections of material

ROUND SOLID

ROUND TUBULAR

RECTANGULAR
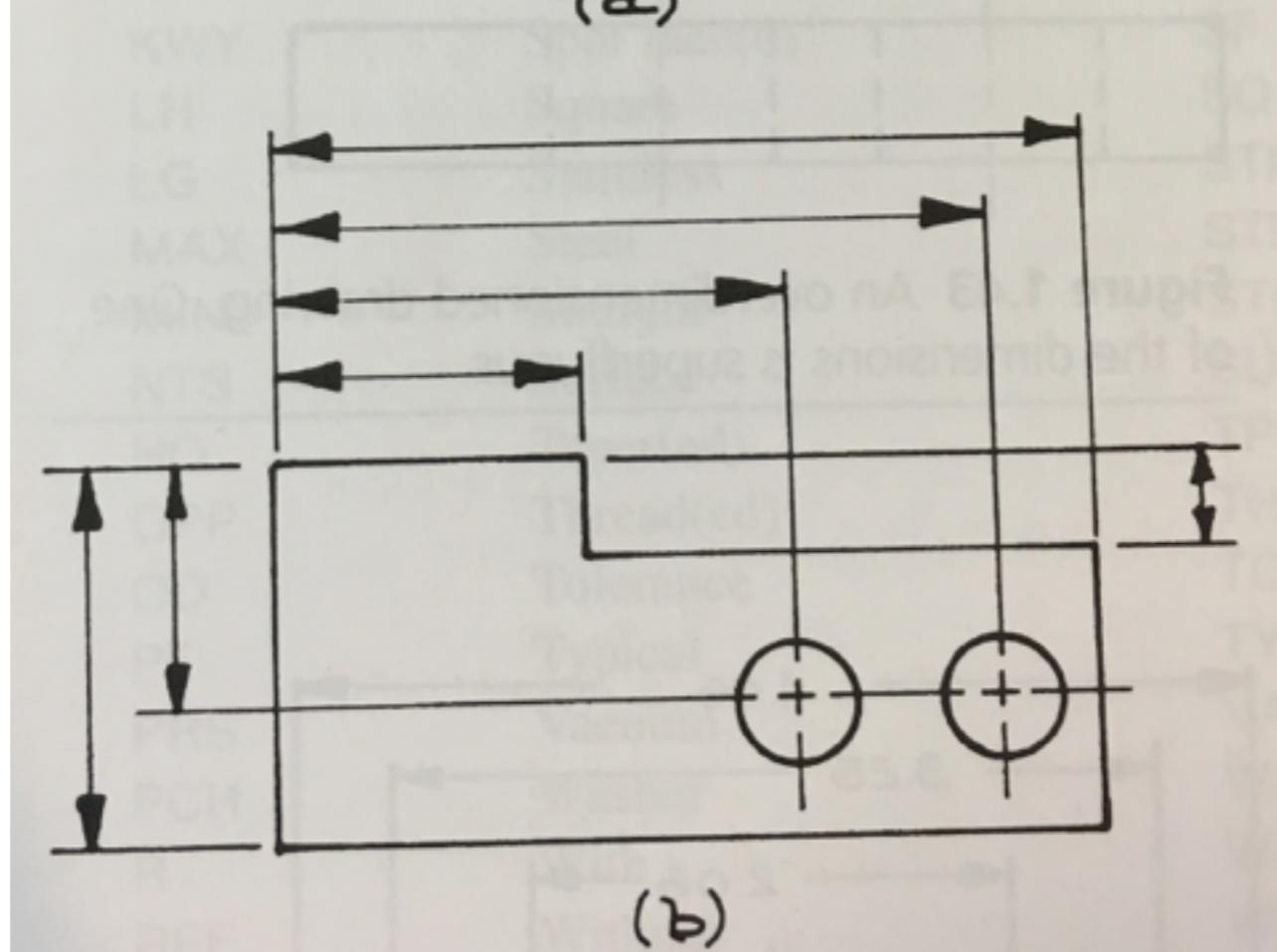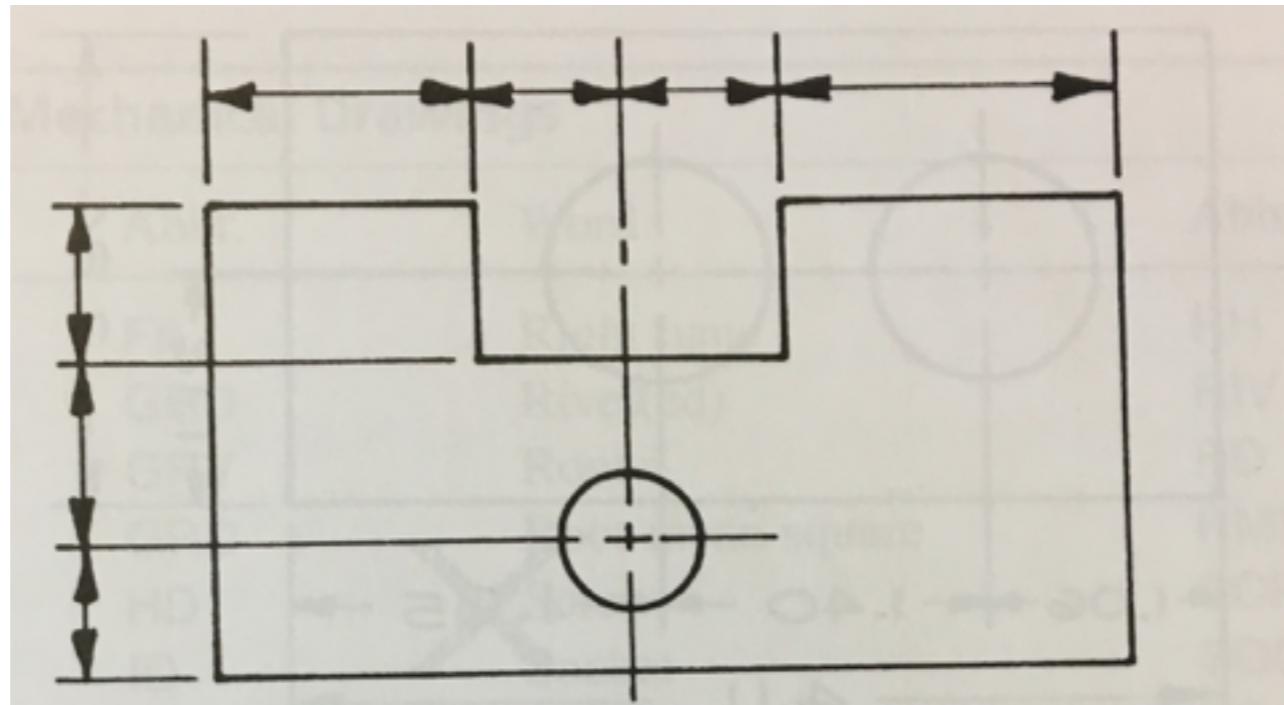
Dimensioning is how we show what size features are
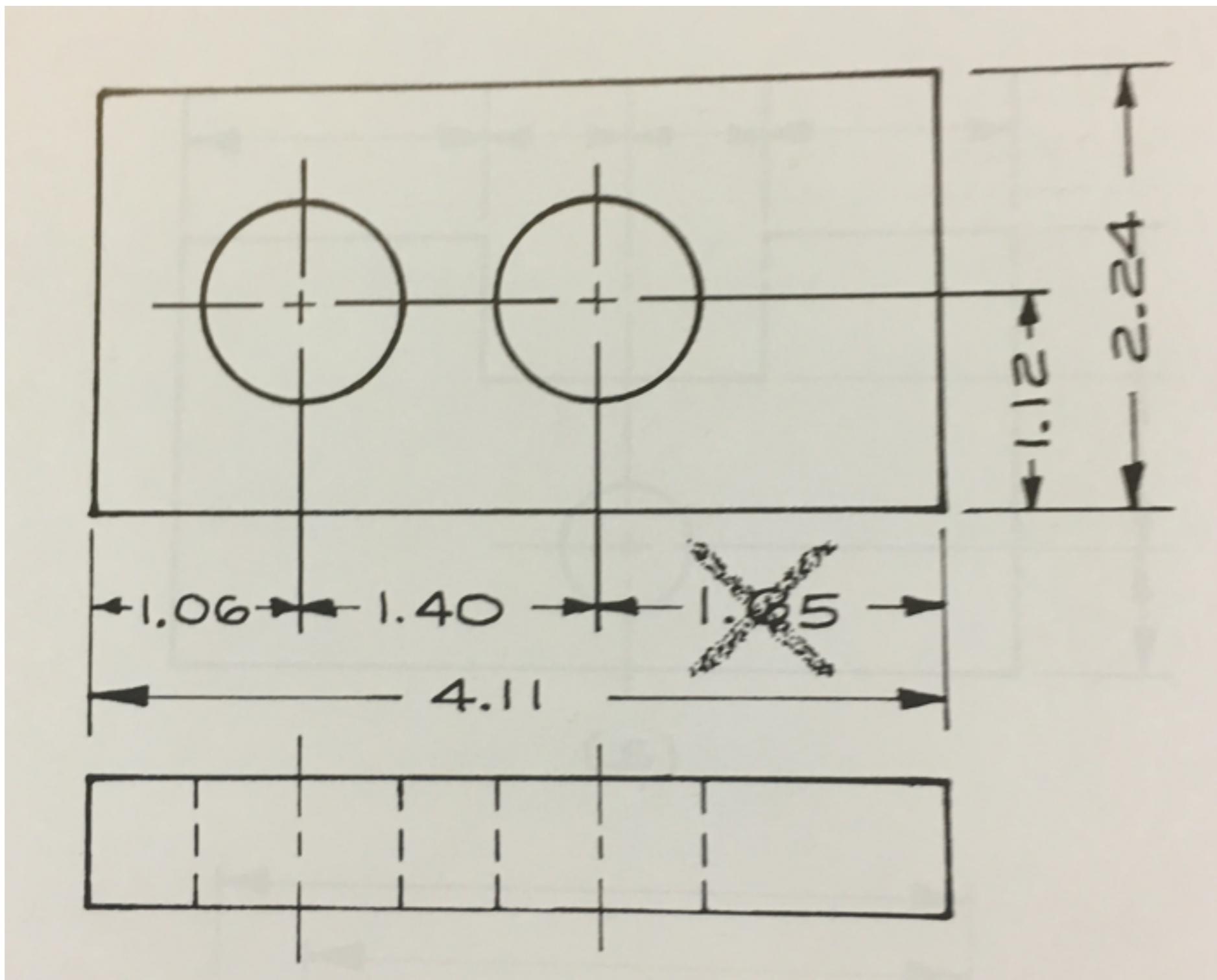
# Dimensions should completely describe the part
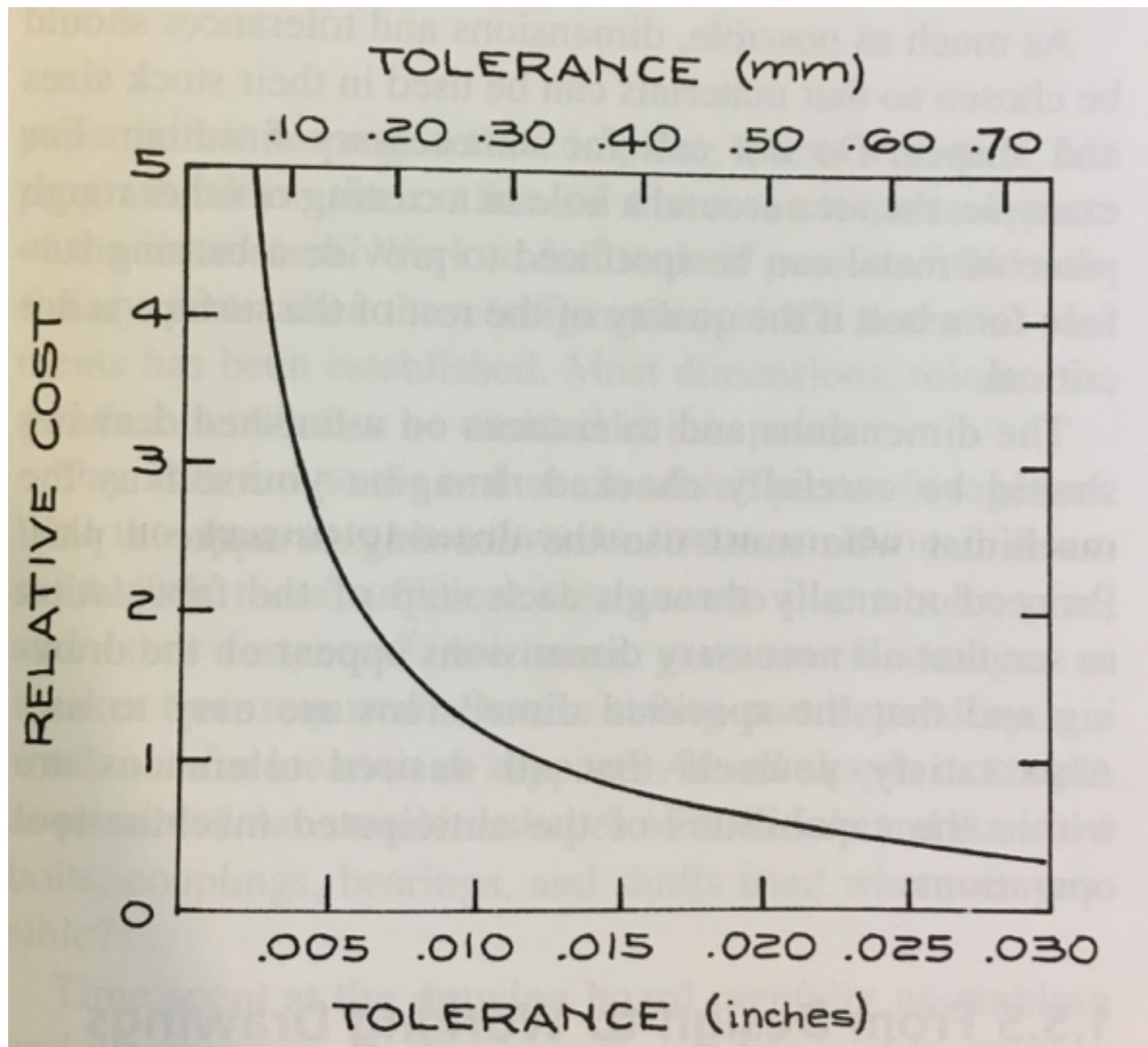
# Dimensioning can be series or parallel depending on your needs
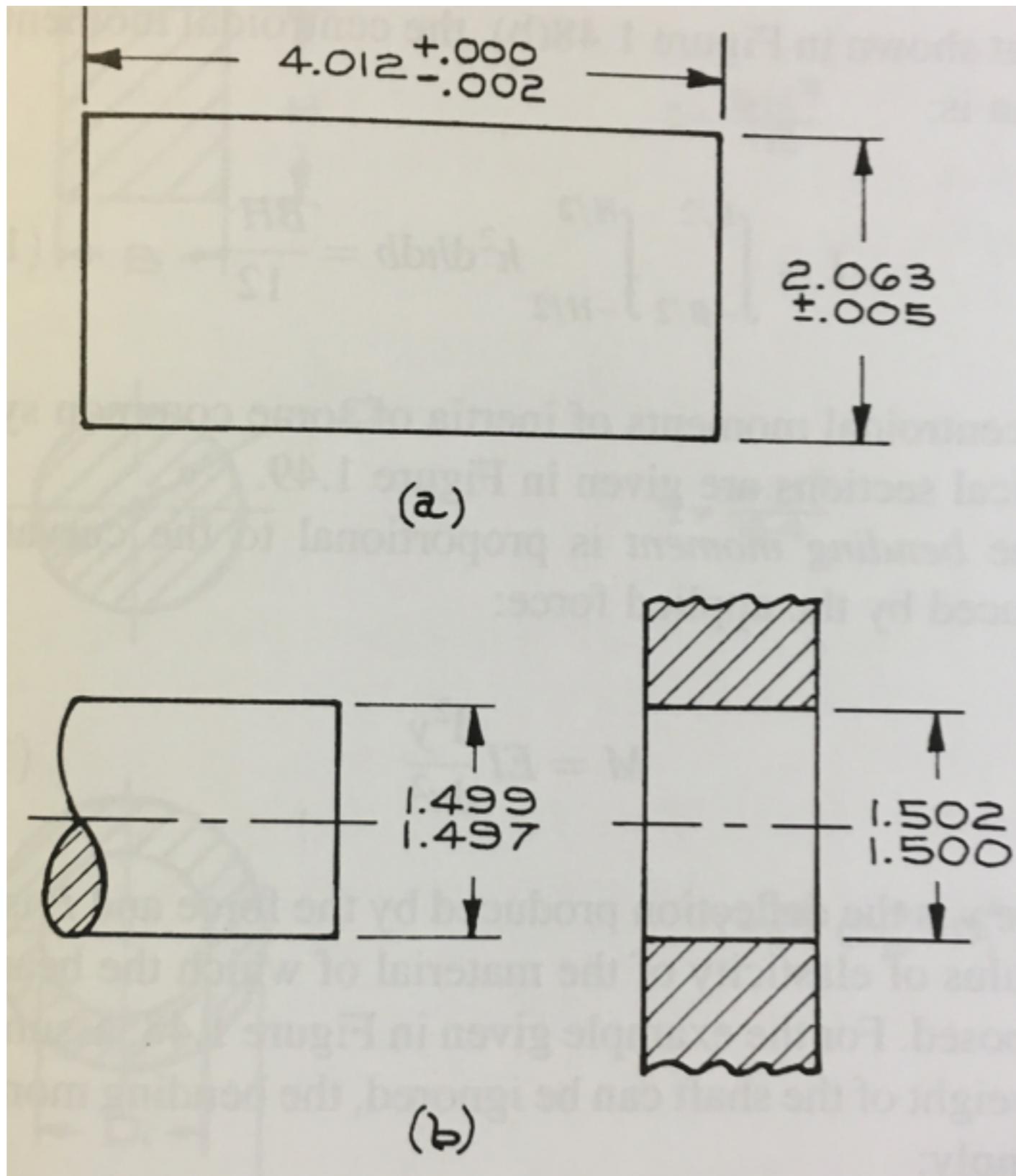
Do not over define parts
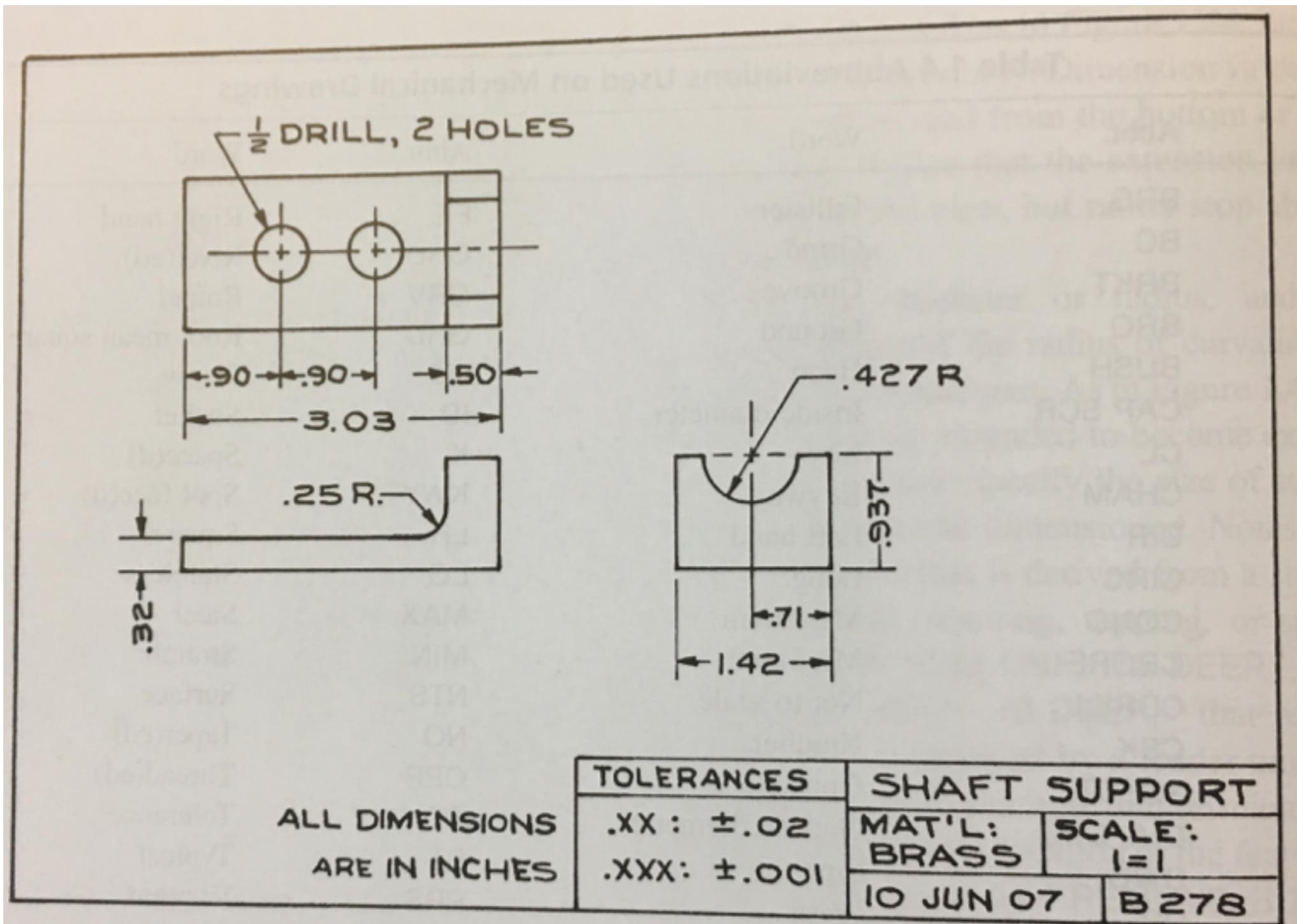
Tolerance can greatly change the price of your part

Tolerance can be specified in three ways

(a)

(b)

Tolerance can be specified in three ways

Assignment: Sign up for OnShape

DUE: 9/27/16

Activity: Make a mechanical drawing

DUE: 9/27/16