

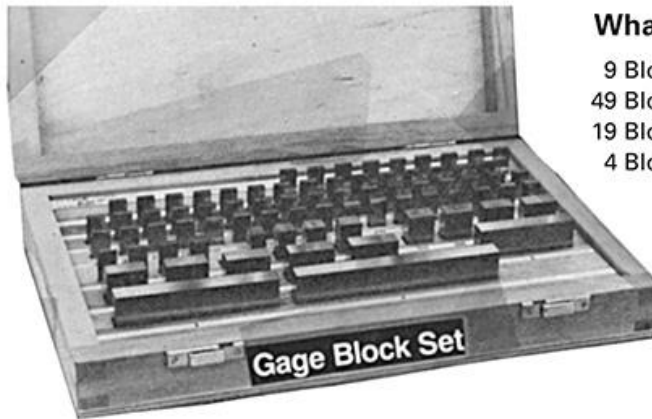
# Measurement, Inspection, and Testing

# Seven Standards of Measurement

❖ Provide the basics for all other units of measurement

- Length
- Time
- Mass
- Temperature
- Ampere
- Candela
- Mole

# Gage Blocks



## What's in the box

9 Blocks	0.1001	through 0.1009 in.	in steps of 0.0001 in.
49 Blocks	0.101	through 0.149 in.	in steps of 0.001 in.
19 Blocks	0.050	through 0.950 in.	in steps of 0.050 in.
4 Blocks	1.000	through 4.000 in.	in steps of 1.000 in.

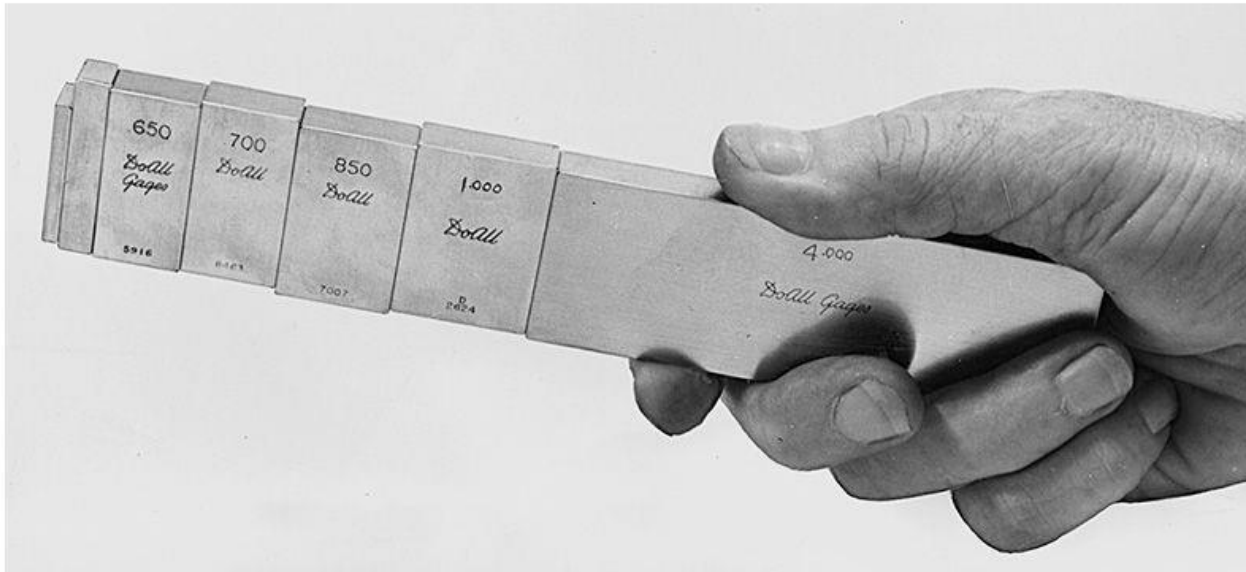


← Lapped and mirror polished to a very low micro-surface finish.

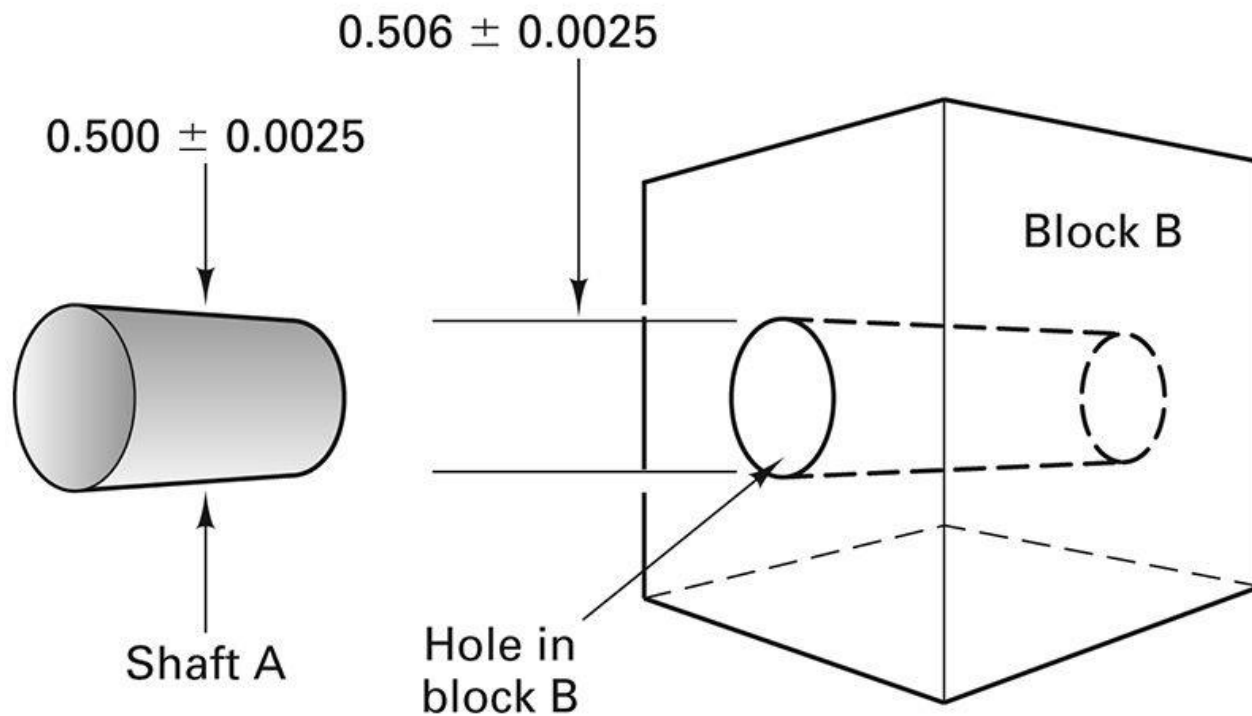


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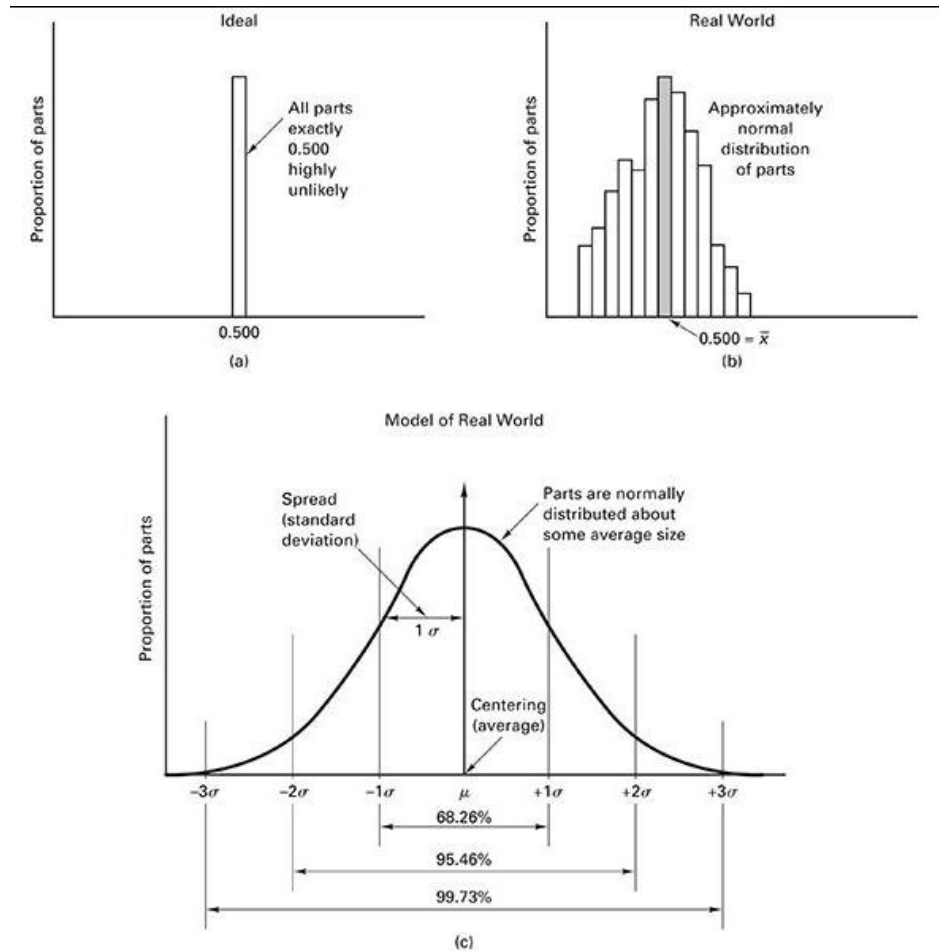
# Gage Blocks wrung together



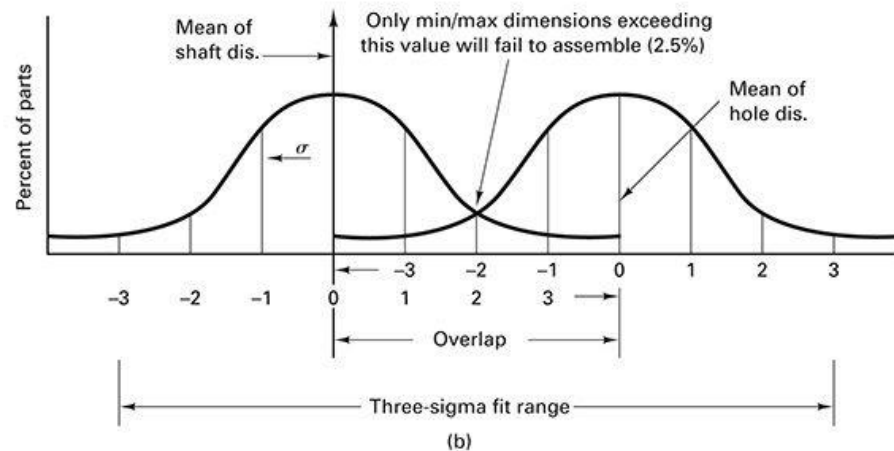
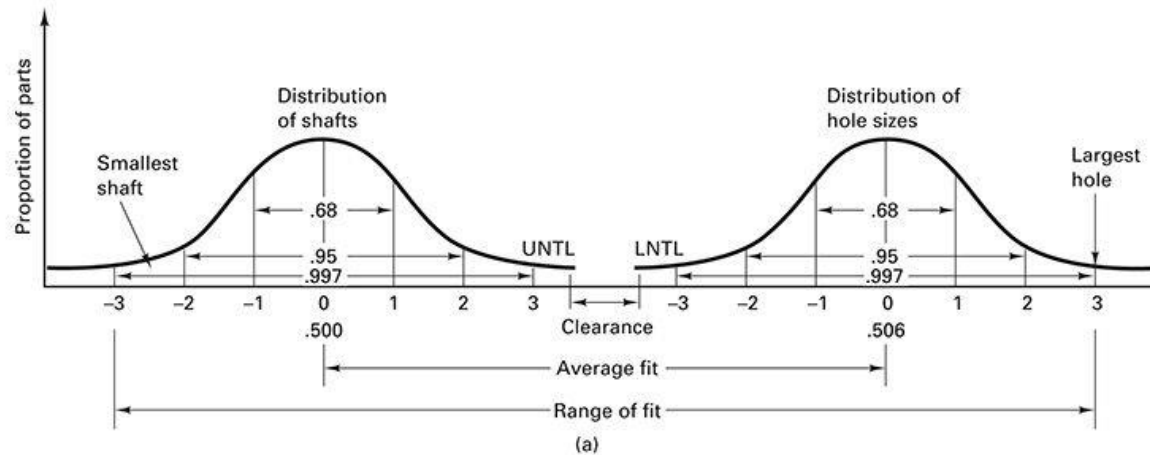
# Mated Parts



# Normal Distribution

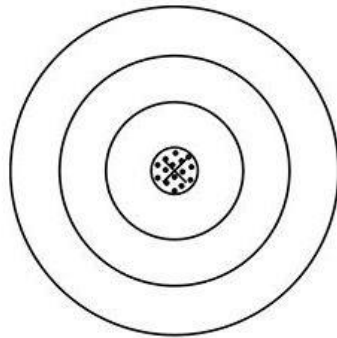


# Distributions of Mating Parts

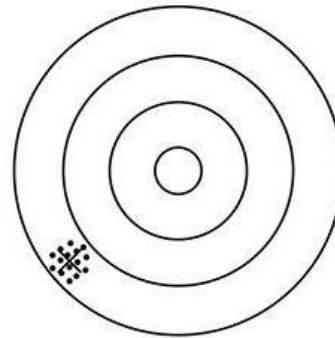




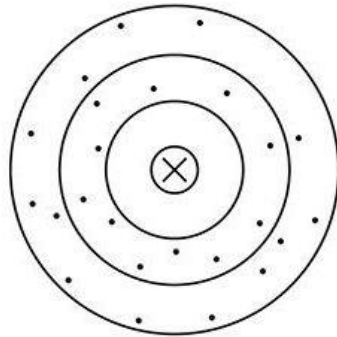
# Accuracy Versus Precision



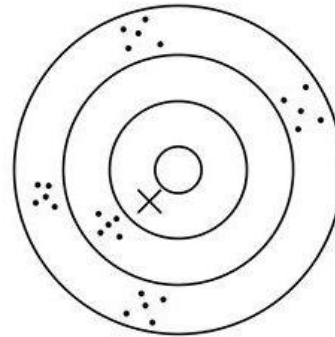
(a) Accurate and precise



(b) Precise, not accurate

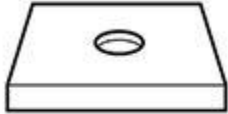
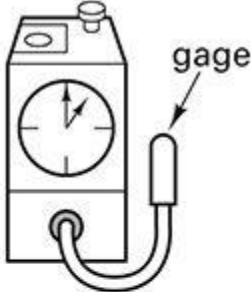

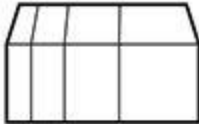


(c) Accurate, not precise

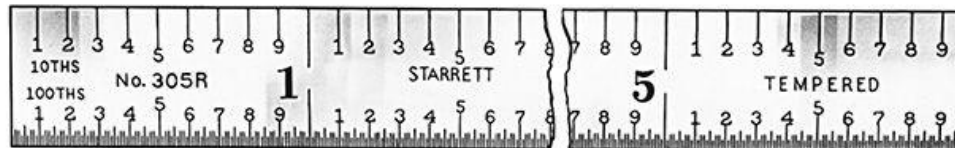


(d) Precise within sample  
Not precise between samples  
Not accurate overall or within sample

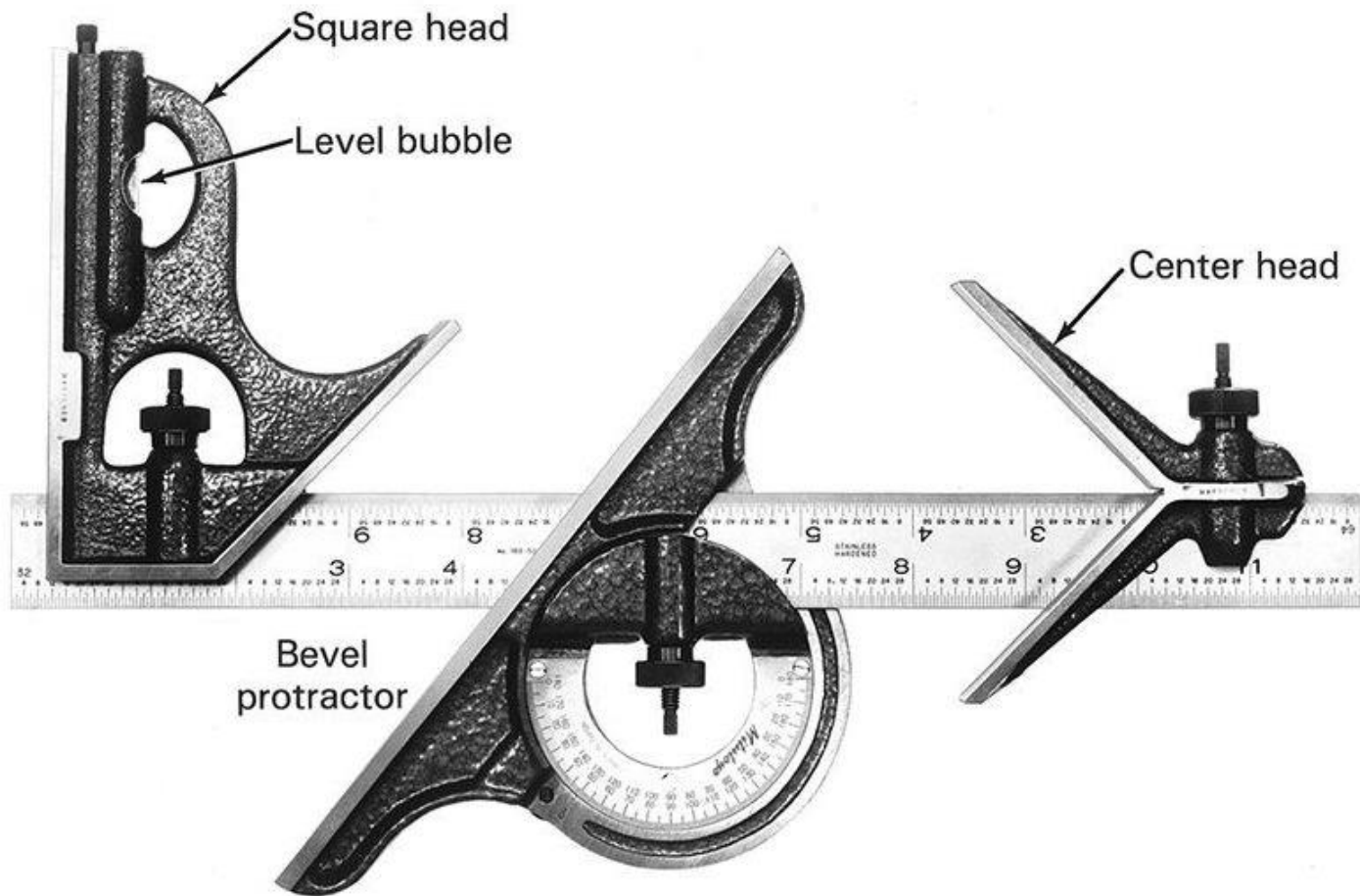
# Rule of 10 for Inspection

 <p>Tolerance needed on part <math>\pm 0.001</math> on hole diameter</p>	 <p>Precision needed on gage <math>\pm 0.0001</math> in.</p>	 <p>To check and set the air gage, needs to be <math>\pm 0.00001</math> in.</p>	 <p>In the manufacture of the master gage, a standard of precision of at least <math>\pm 0.000001</math> in. is needed</p>
Workpiece	Air gage or working gage	Master gage	Reference end standard

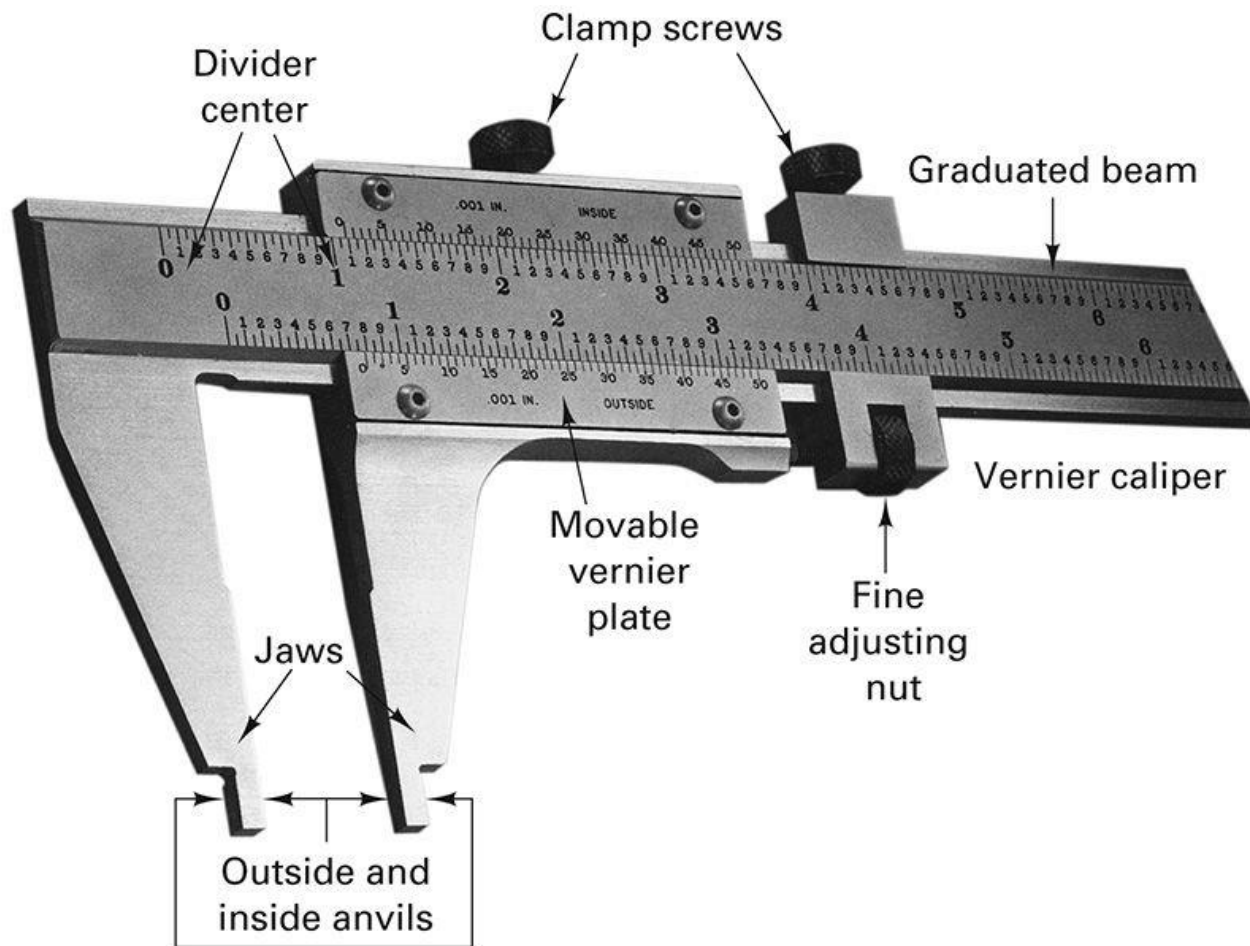
# Machinist's Rules



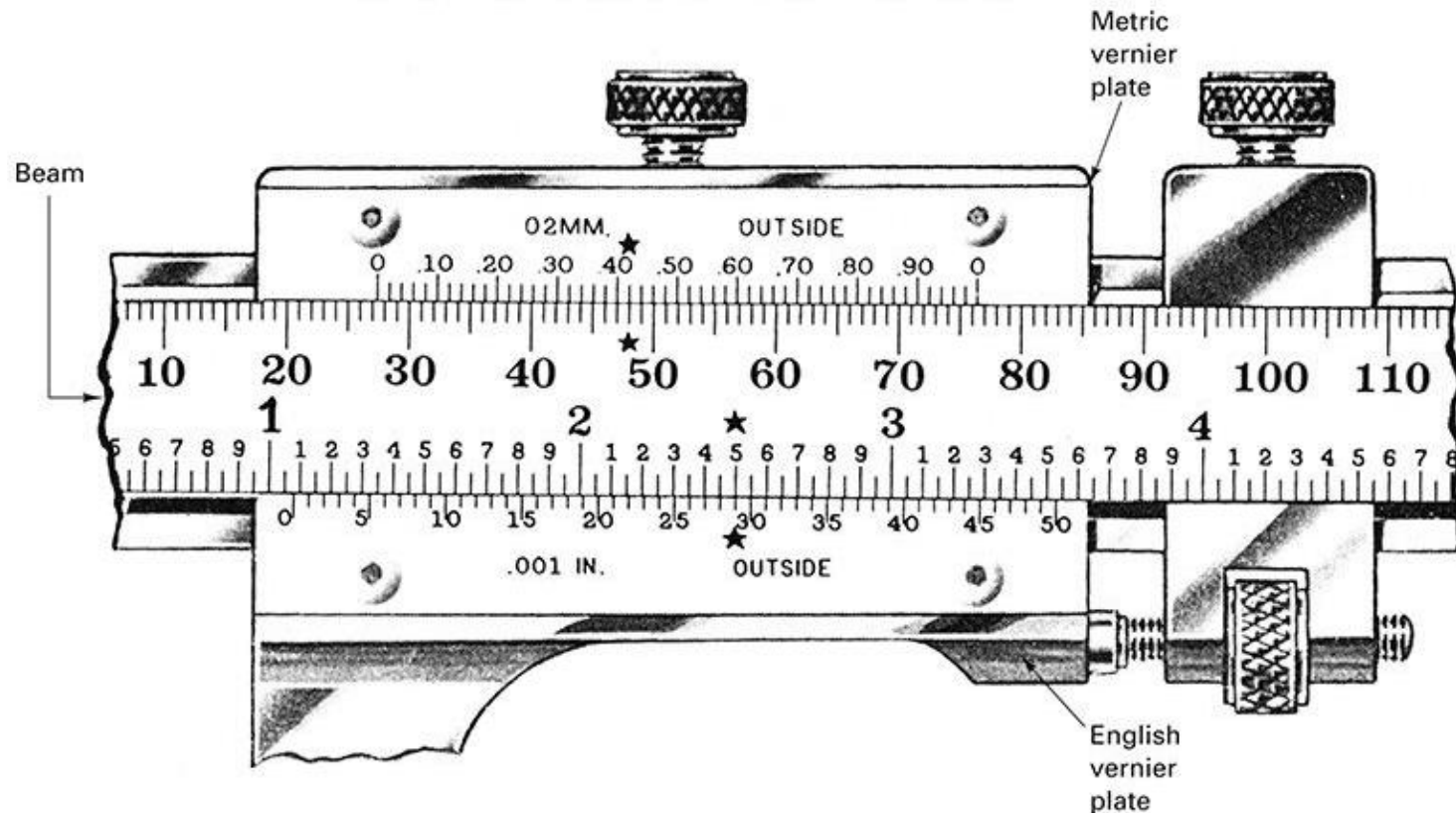
# Combination Set



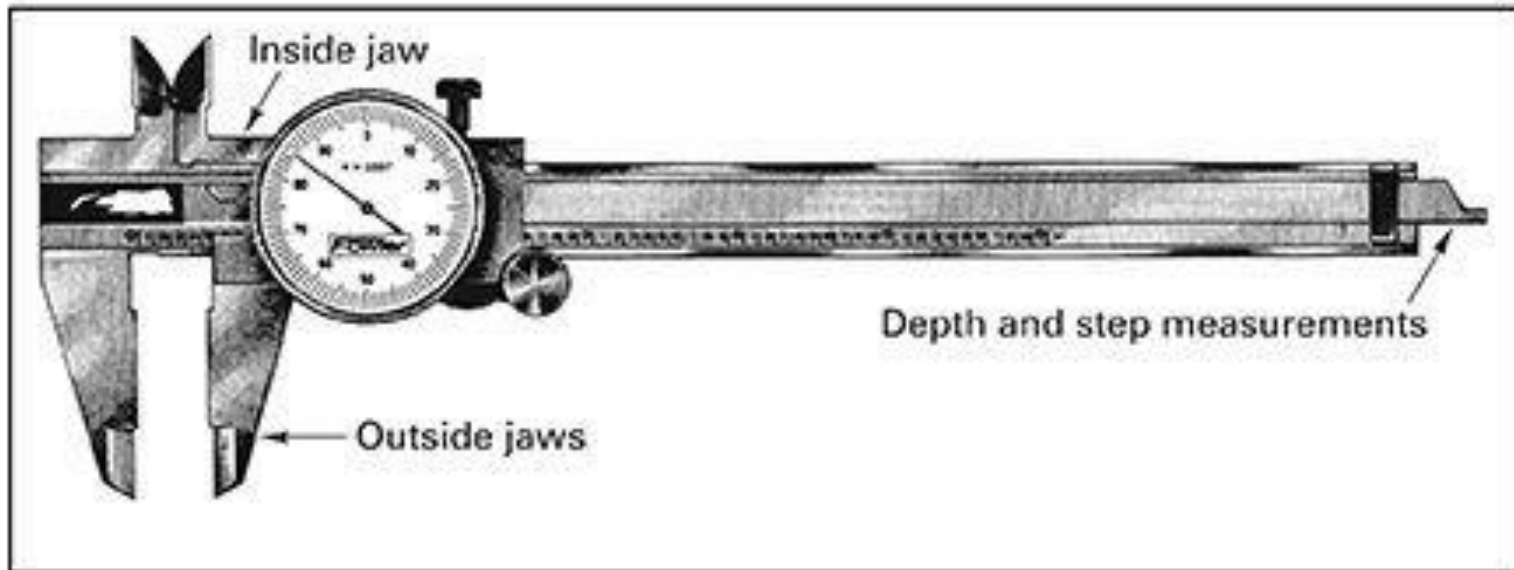
# Vernier Caliper



# Vernier Caliper Scale



# Dial Caliper



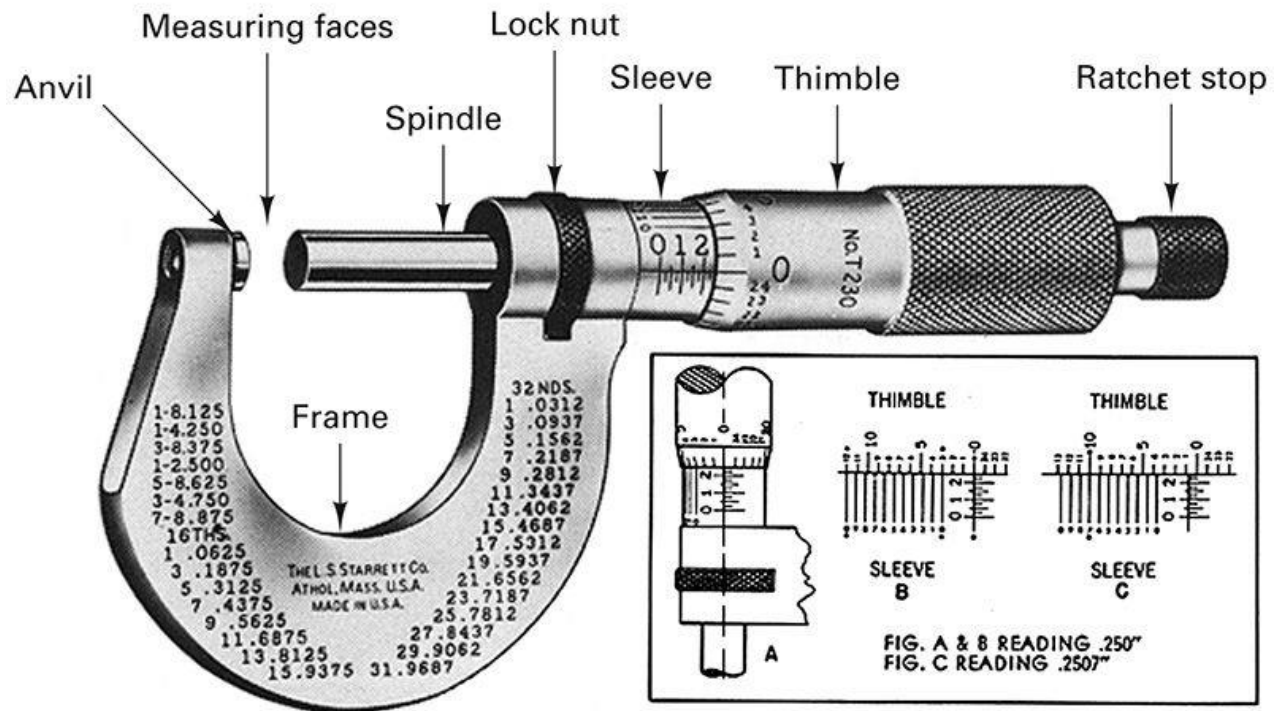
Dial caliper with 0.001-in. accuracy



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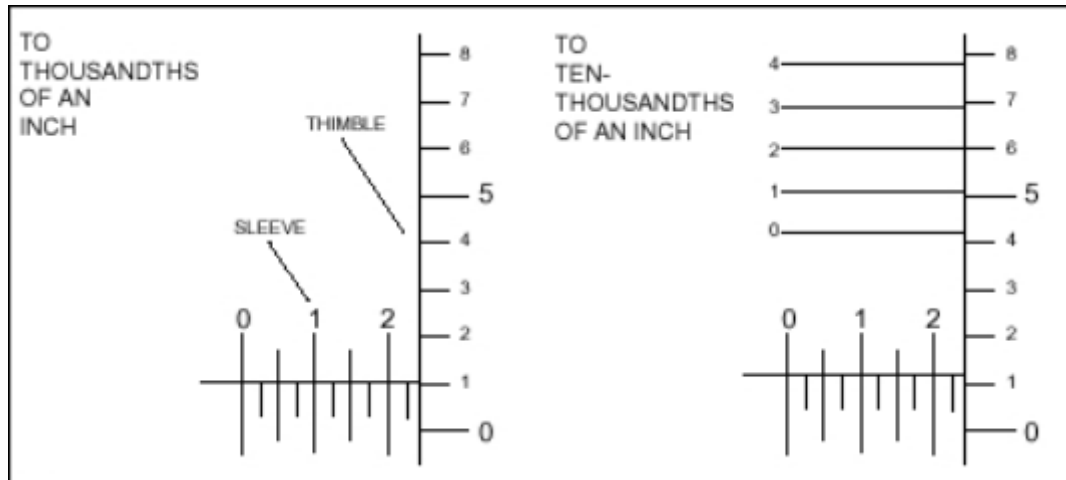
# Micrometer





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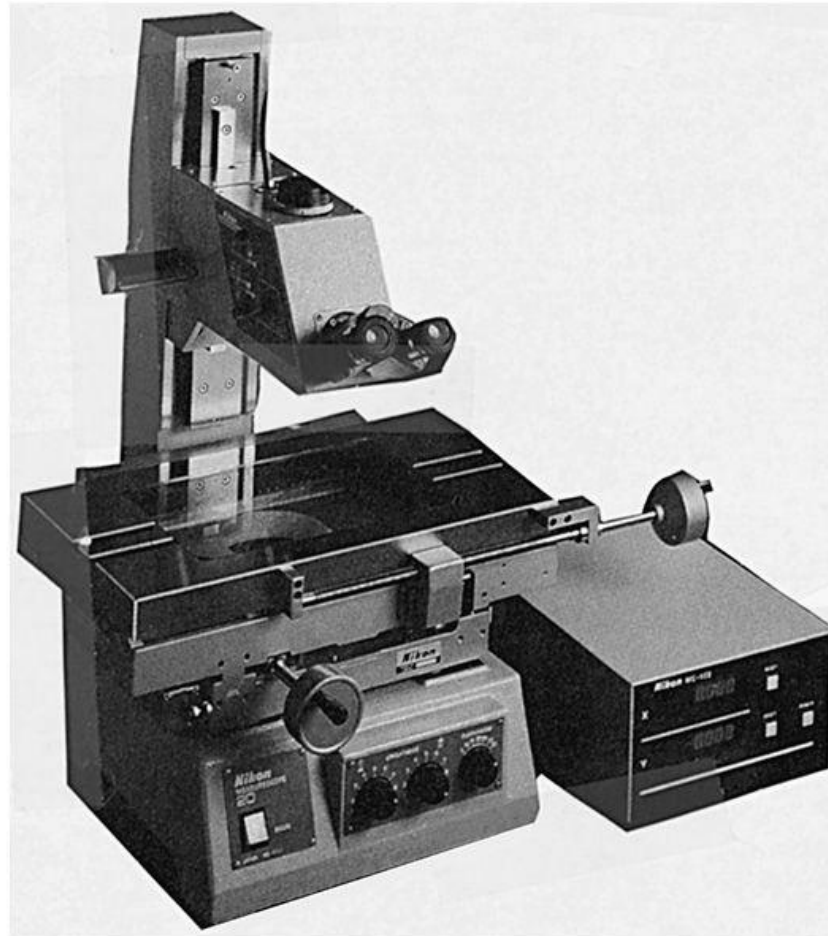
# Micrometer



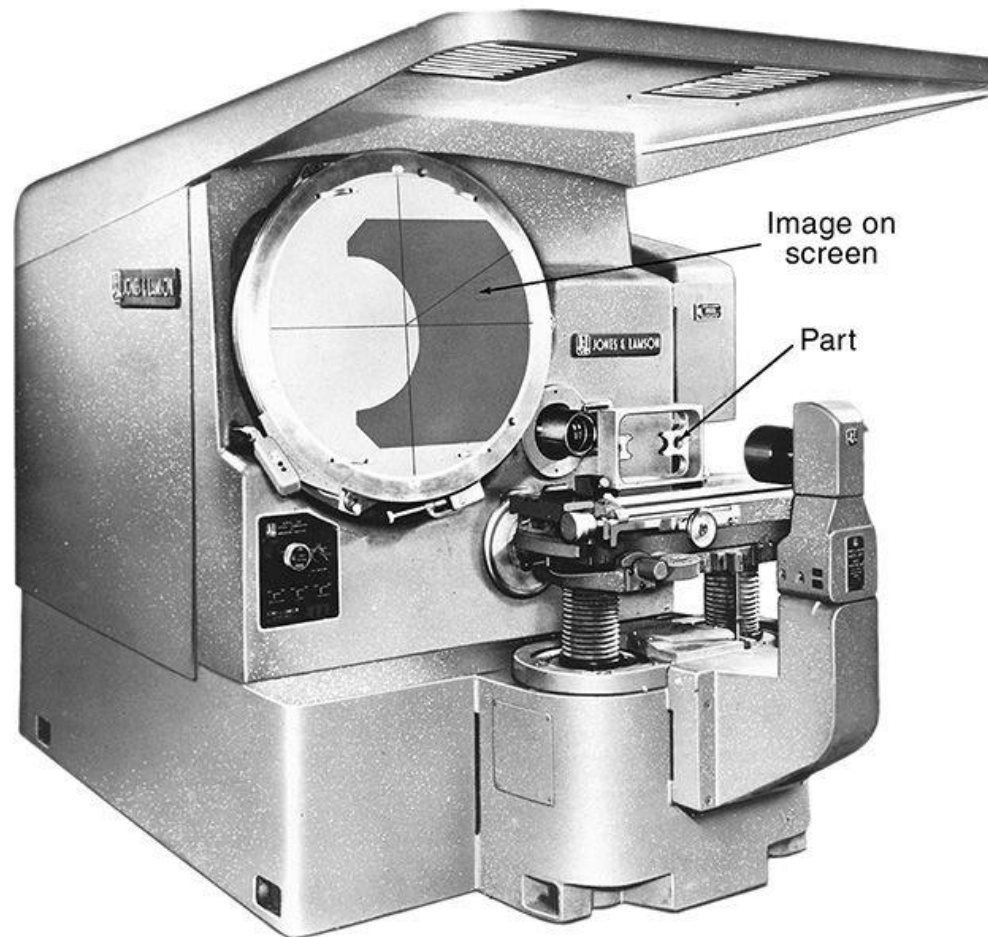
$$\begin{array}{r}
 0.2'' \\
 + 0.025'' \\
 + 0.001'' \\
 \hline
 0.226''
 \end{array}$$

$$\begin{array}{r}
 0.2'' \\
 + 0.025'' \\
 + 0.001'' \\
 + 0.0002'' \\
 \hline
 0.2262''
 \end{array}$$

# Toolmaker's Microscope



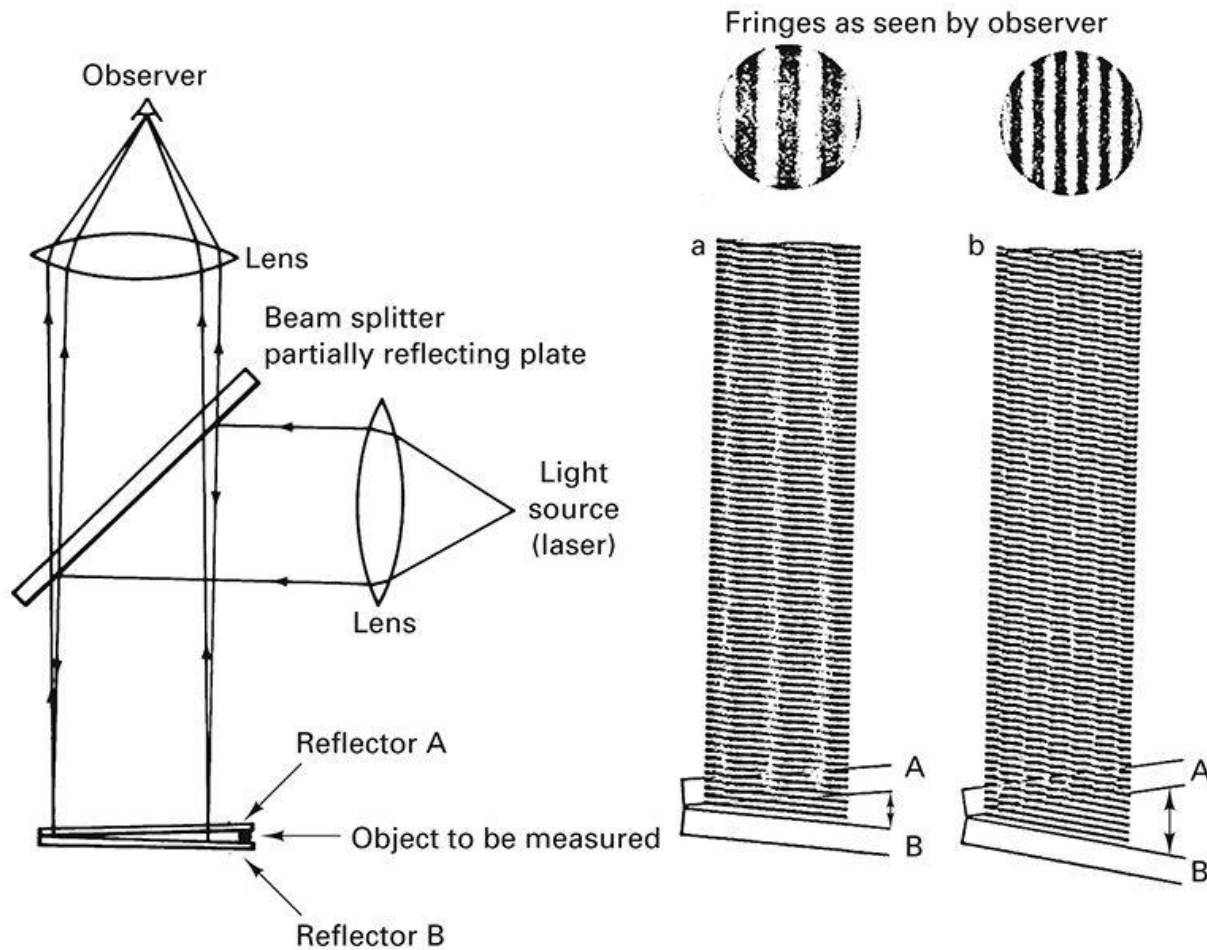
# Optical Comparator



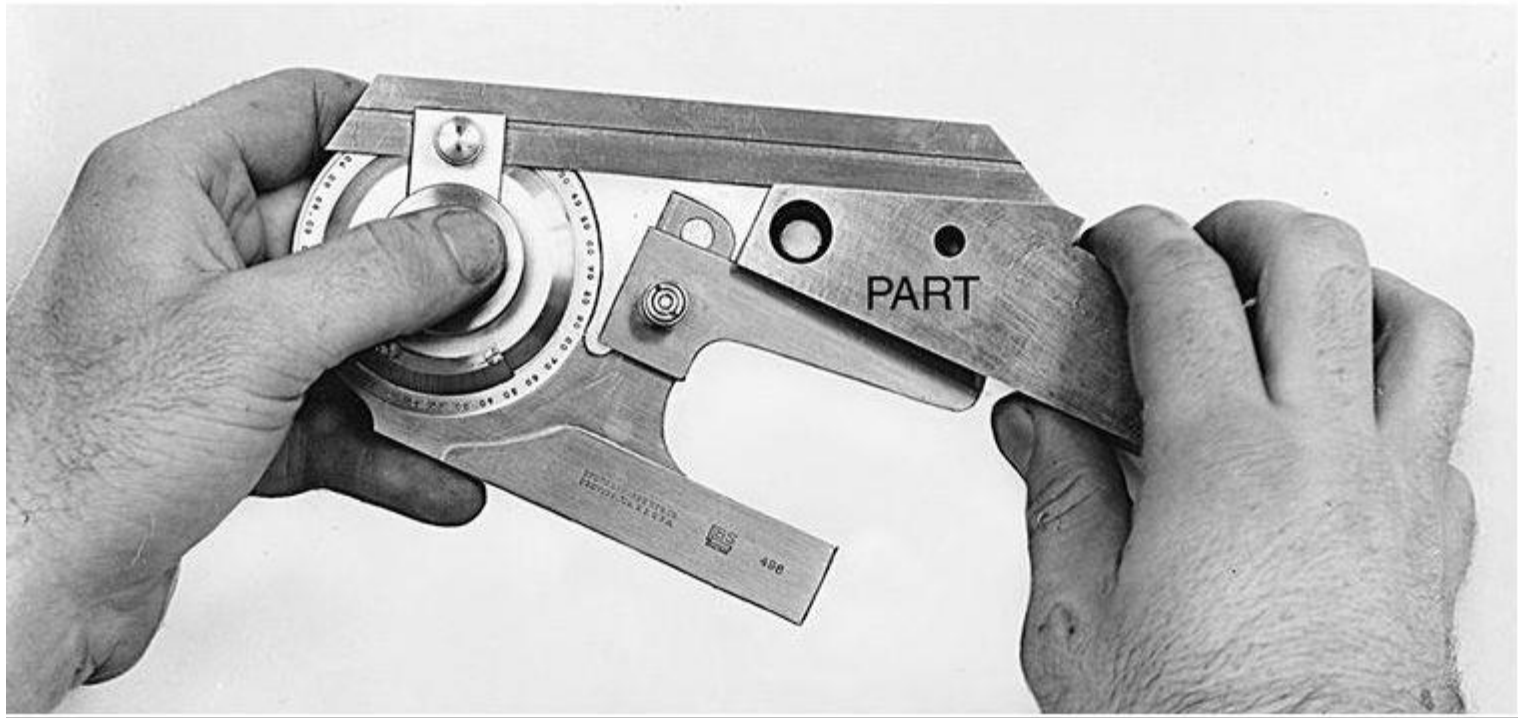


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# Interferometry

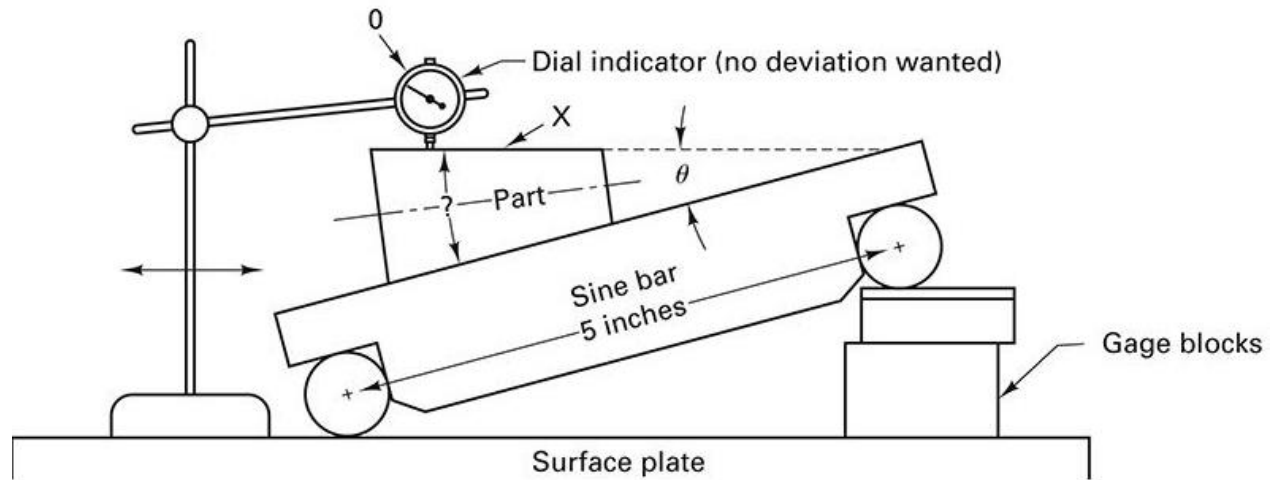


# Bevel Protractor





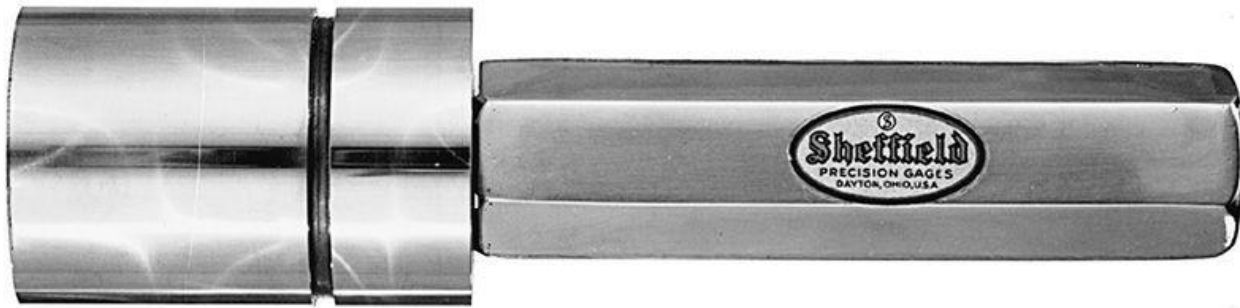
# Sine Bar



# Double-Ended Plug Gage Go/No-Go



# Step-type Plug Gage



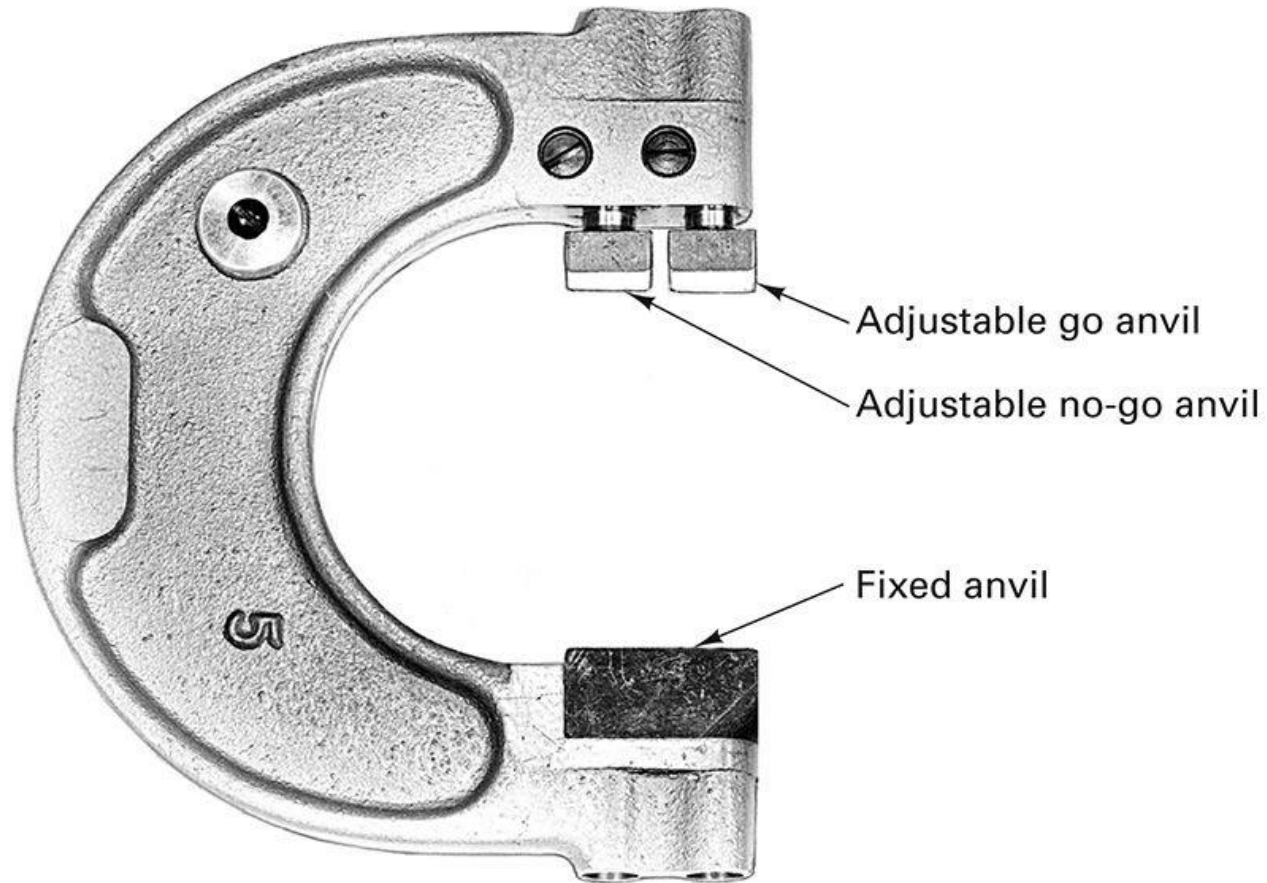
# Ring Gages

No-Go (max) on left, with knurling groove.

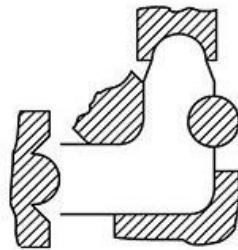
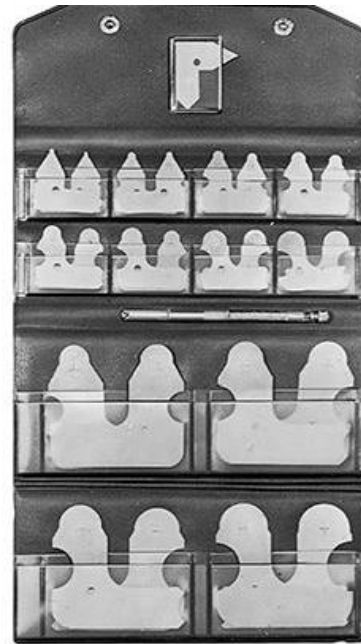
Go (min) on right, without groove



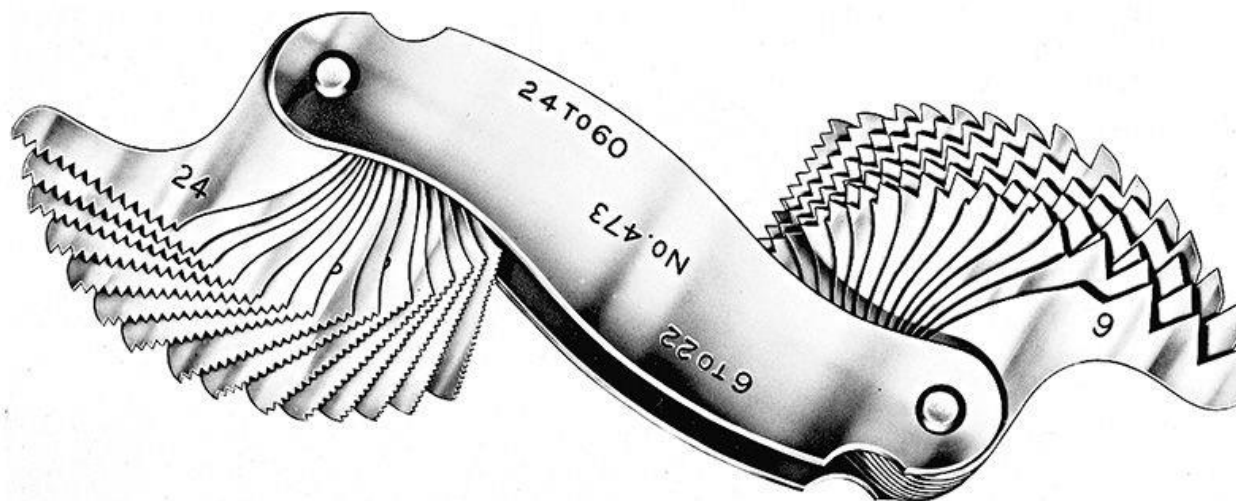
# Adjustable Snap Gage



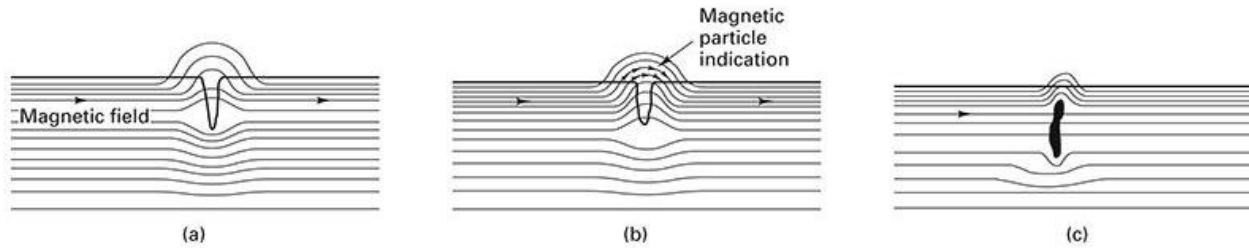
# Radius Gages



# Thread Pitch Gages

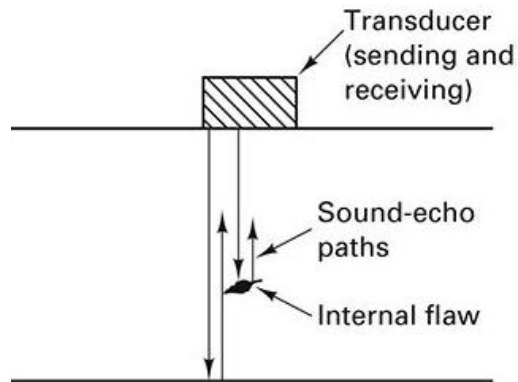


# Magnetic Particle Inspection

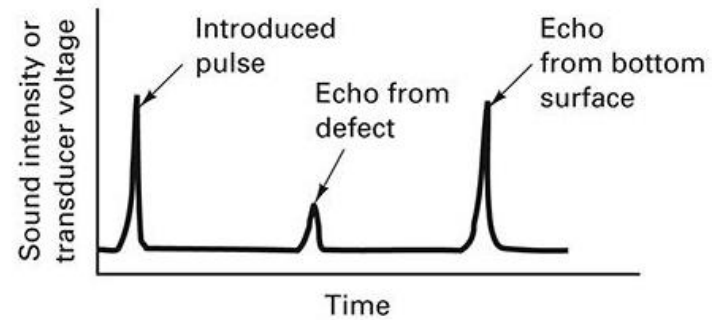




# Ultrasonic Inspection



(a)



(b)

# Radiography X-Ray Inspection

