Mechanical Workshop
AMEW 101

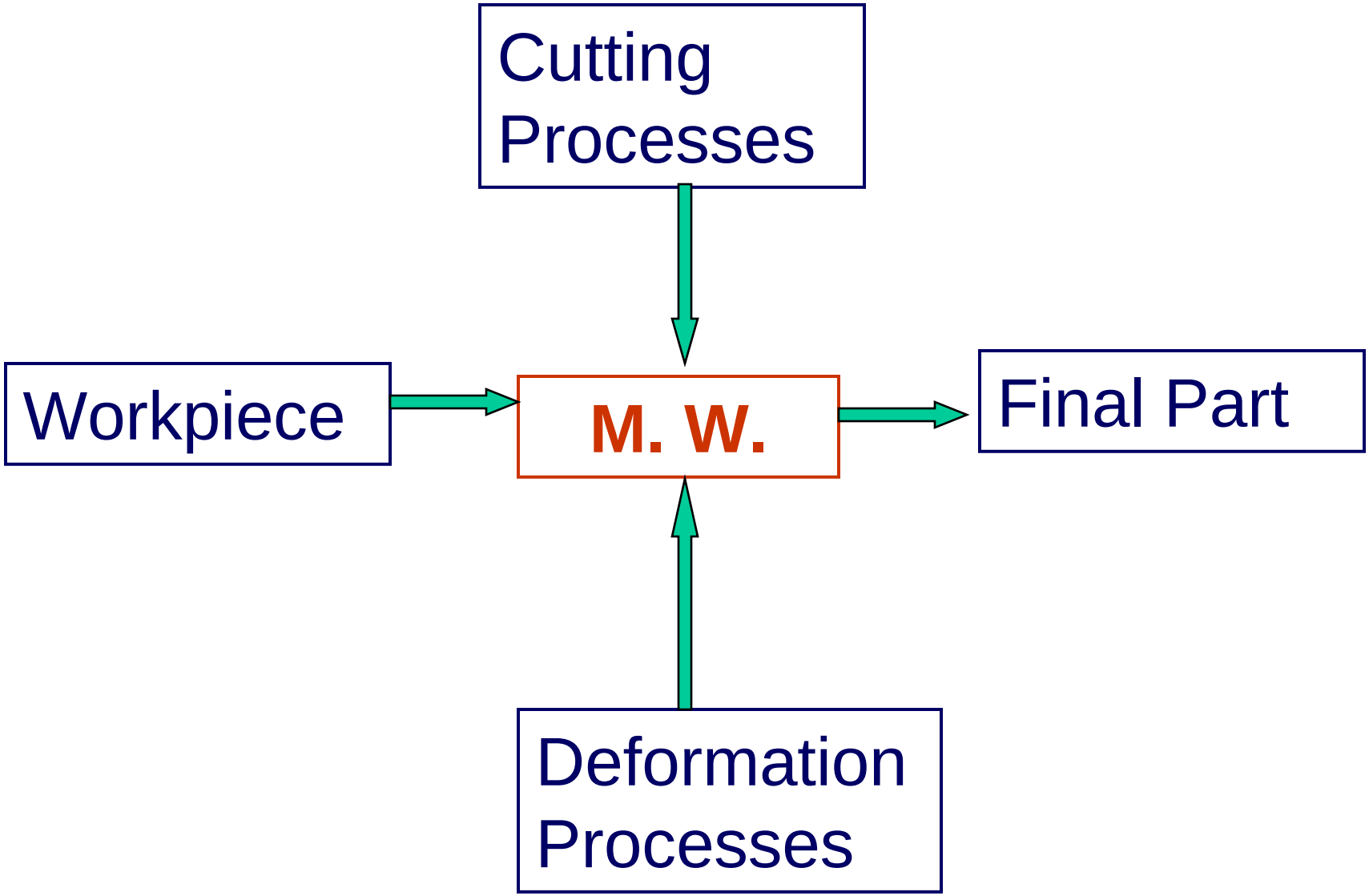
Introductory Lesson

Athanasiou Charalambos

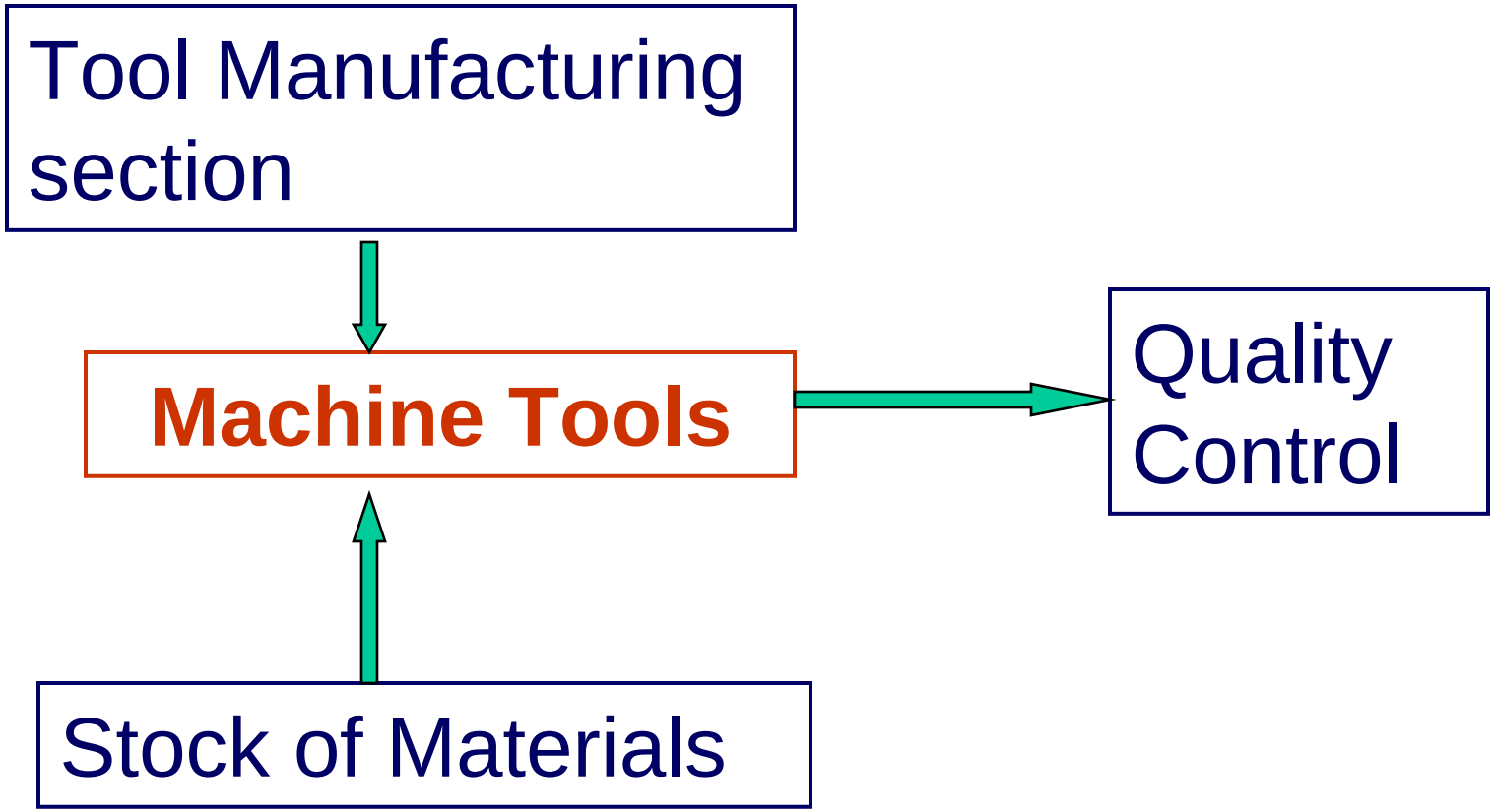
Webpage: http://staff.fit.ac.cy/eng.ca

1. What is a Mechanical Workshop?

- It is a factory place where, metallic materials take a final form (final product) through cutting and/or deformation processes.


Cutting Processes
Workpiece
M. W.
Final Part
Deformation Processes

2. What are the main sections of a M.W?



Milling

Turning

Grinding

3. What types of machine-tools are used?

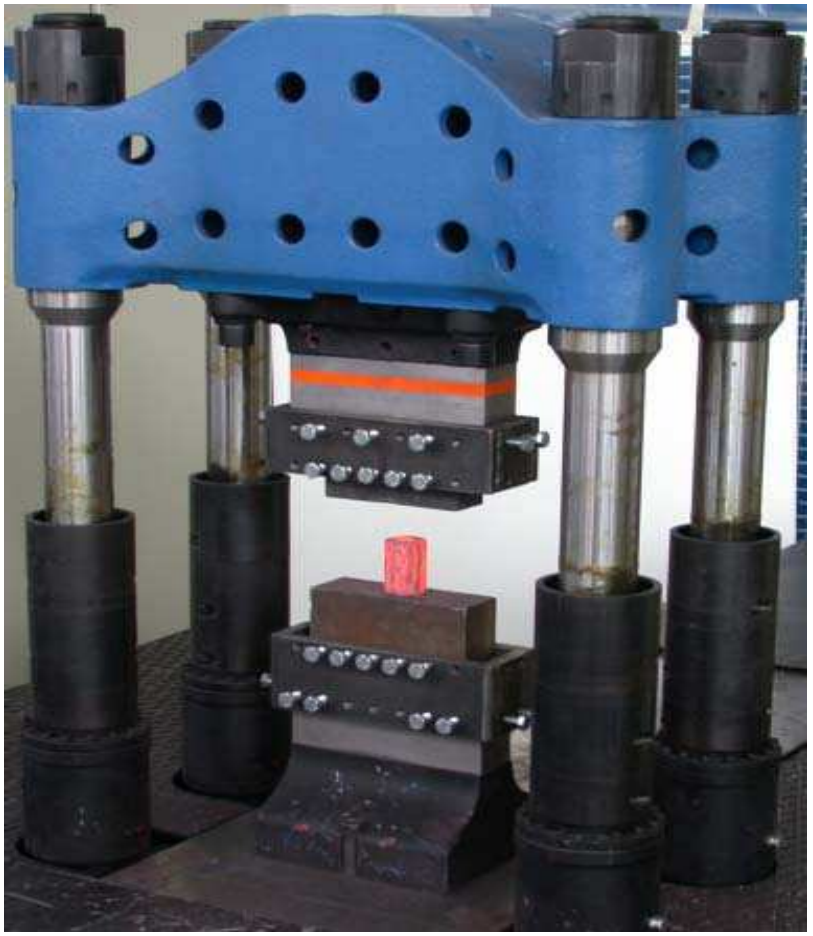
Plastic Deformation

- Hydraulic Presses
- Rollers
- Extrusion

FORGING

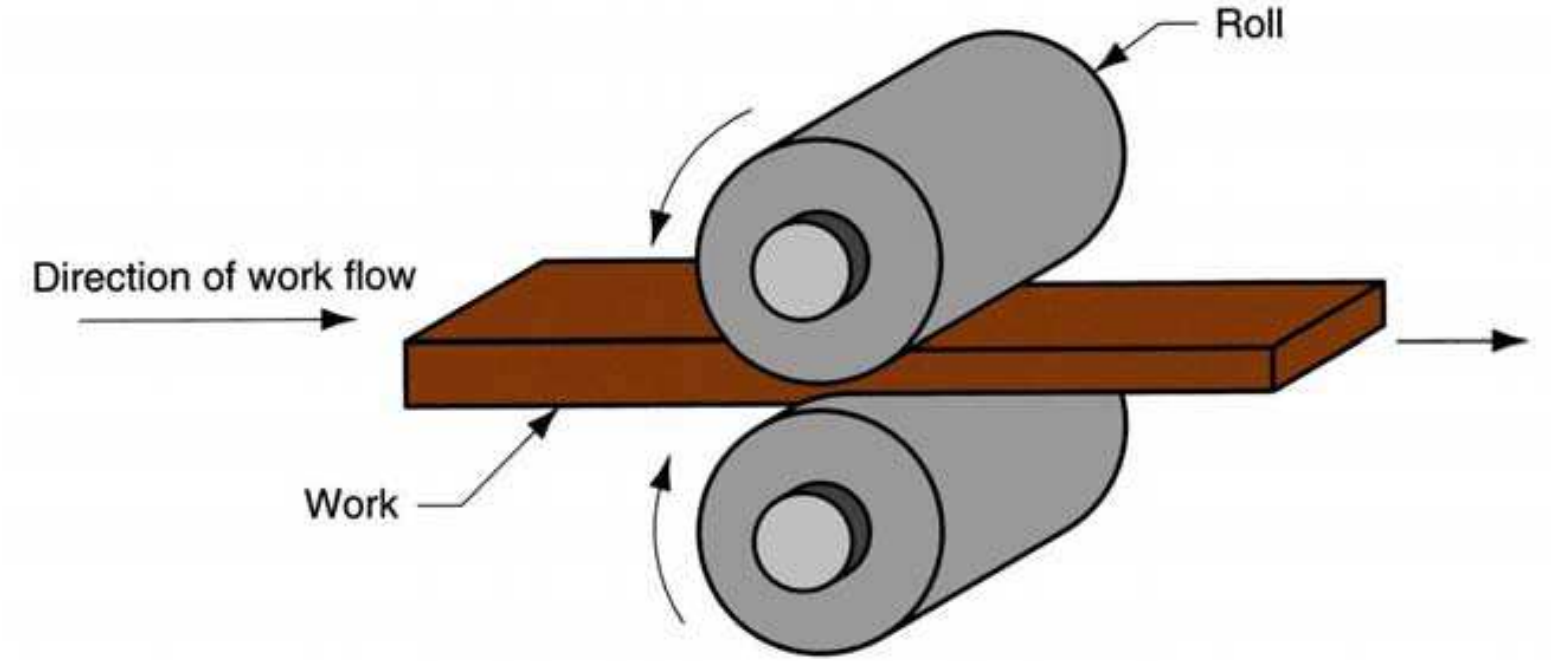
Forging is a compressive metal forming process, involving shaping a metal piece by hammer or press.

The figure shows an open-die forging process. Note the red hot bar stock in place.



ROLLING

Rolling is a process of reduction of the cross-sectional area or shaping a metal piece through the deformation caused by a pair of rotating in opposite directions metal rolls.



The Rolls

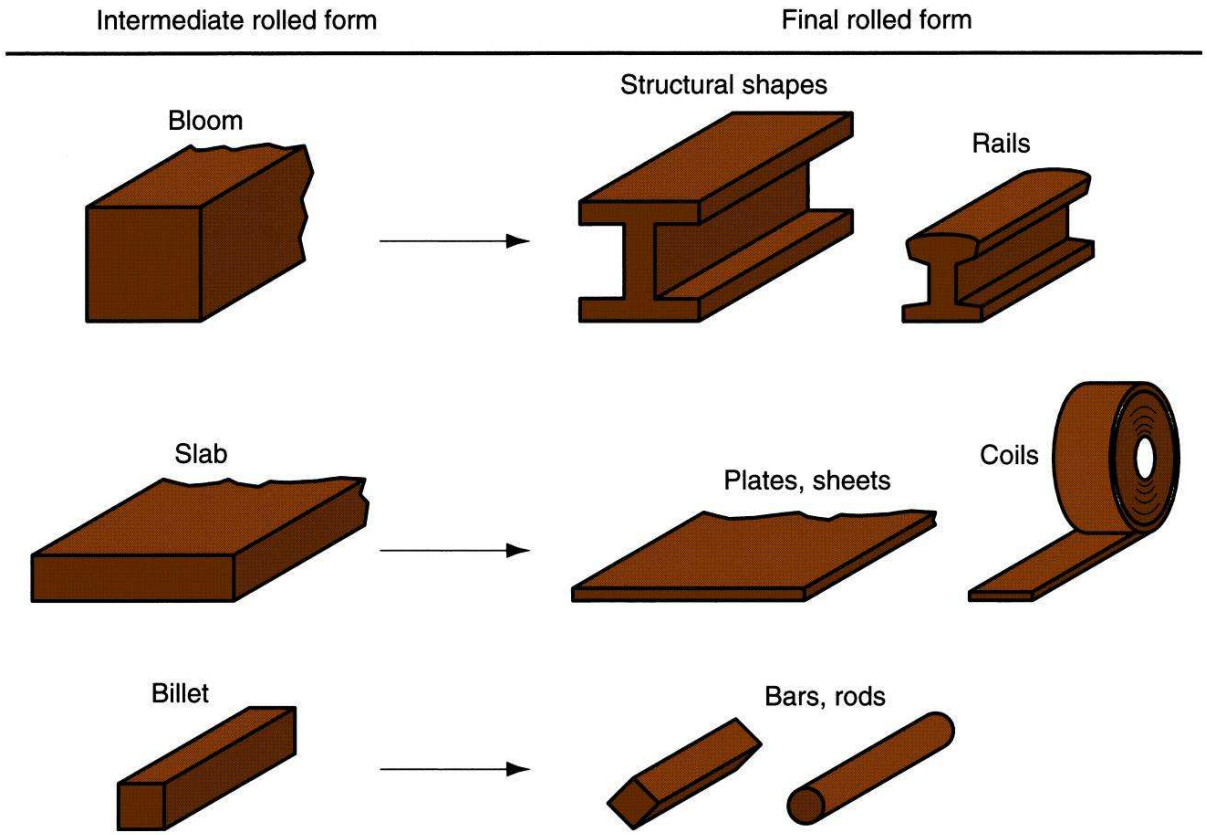
Rotating rolls perform two main functions:

- Pull the work into the gap between them by friction between workpart and rolls.
- Simultaneously squeeze the work to reduce its cross section.

Types of Rolling

- Based on workpiece geometry :
  - Flat rolling - used to reduce thickness of a rectangular cross section.
  - Shape rolling - square cross section is formed into a shape such as an I-beam.
- Based on work temperature :
  - Hot Rolling – most common due to the large amount of deformation required.
  - Cold rolling – produces finished sheet and plate stock.

Rolled Products Made of Steel

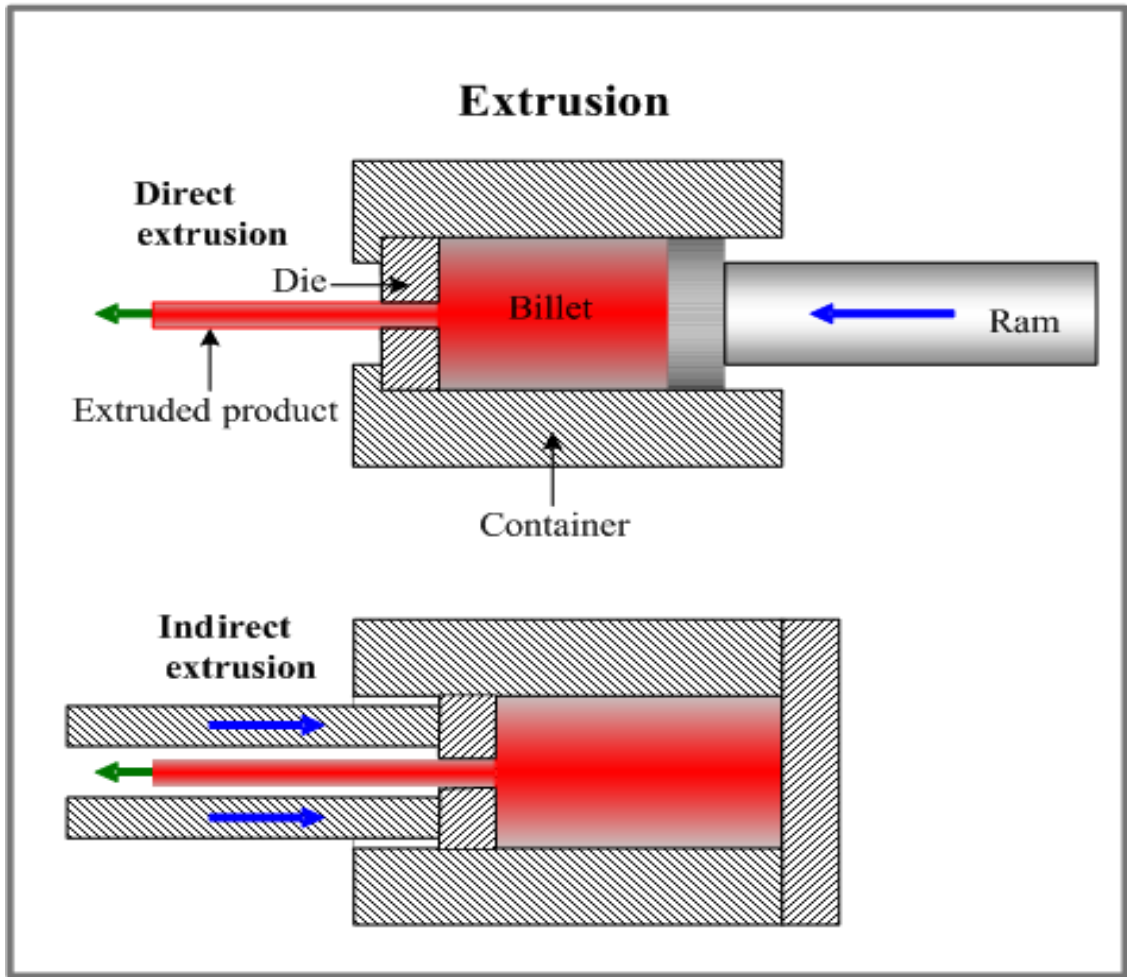


Some of the steel products made in a rolling mill.

EXTRUSION

Extrusion is a metal forming process involving shaping a metal billet (hot or cold) by forcing it through a die with an opening.

The two possible schemes of extrusion are presented in the picture:

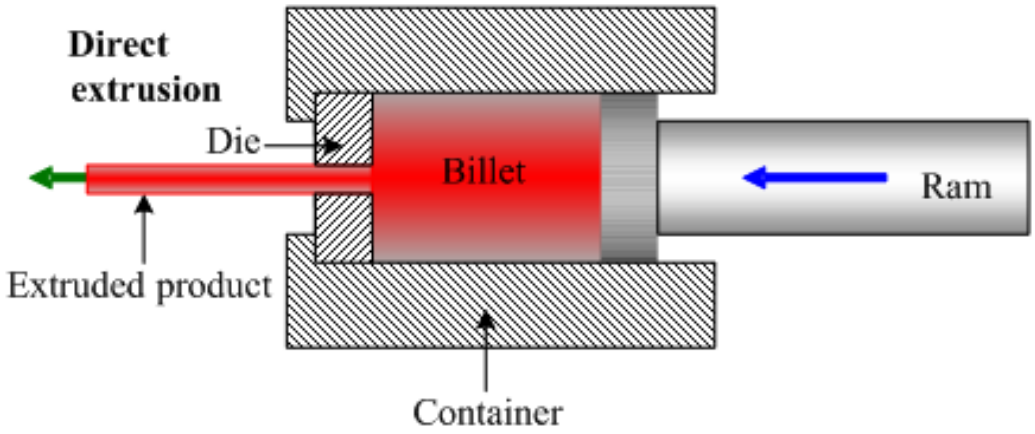


Direct Extrusion

The metal billet is placed to the container of the extrusion press. The die with an opening is mounted at the end of the container.

When the hydraulically driven ram presses the billet, the metal starts to flow through the opening forming the extruded product of the required cross section.

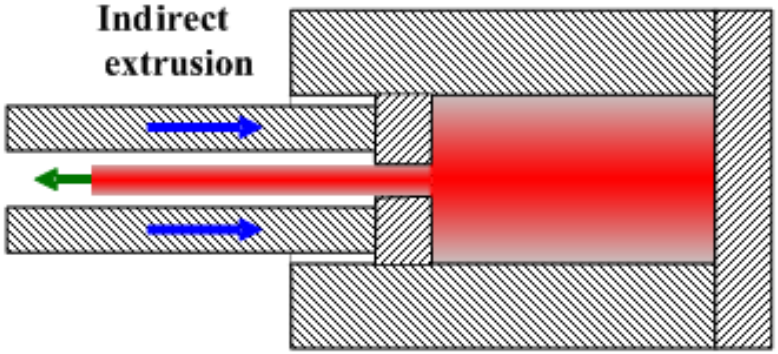
In the direct extrusion the extruded metal flows in the direction of the ram motion.



Indirect Extrusion

In the indirect extrusion the metal flows in the direction opposite to the ram motion.

Indirect extrusion requires a lower force than direct process as there is no friction between the billet and inside walls of the container.



4. How the machine-tools are arranged in a M.W?

a. According to the machine type
(example: milling section)

b. According to the produced part
(arrangement in the order of machining phases)

5. Which are the steps for machining a part in a M.W?

- Manufacturing Drawing
- Process Plan
- Execution
- Inspection / Quality control

6. Measurements & Quality Control

Definitions

7. Errors in measurements

Error: The difference between the real value and the measured value

Classification of Errors

- **Systematic**
- **Random**

Sources of Errors

- Operator
- Instrument
- Environmental conditions
- Method of measurement

8. Systems of units for Length Measurements

- **Metric**
- **Imperial**

Metric

1 m = 100 cm = 1000 mm = 10^6 µm

1 µm = 10^-6 m

1 m = 1.09 yards = 3.28 feet

1 cm = 0.39 inches

Imperial

1 yard = 3 ft = 36 in = 0.9144 m = 914.4 mm

1 in = 0.0254 m = 25,4 mm = 10^6 µin

1 µin = 10^-6 in

1 ft = 12 in = 0.3048 m = 304.8 mm

Exercise 1

Example: Convert a length L = 3.25 in to its equivalent value in millimeters.

Solution: 1 in = 25.4 mm

$$L = 3.25 \text{ in} \times (25.4 \text{ mm/in})$$

$$L = 82.55 \text{ mm}$$

Exercise 2

Example: Convert a length L = 3 ft to its equivalent value in millimeters.

Solution: 1 ft = 12 in = 3 x 12 in = 36 in

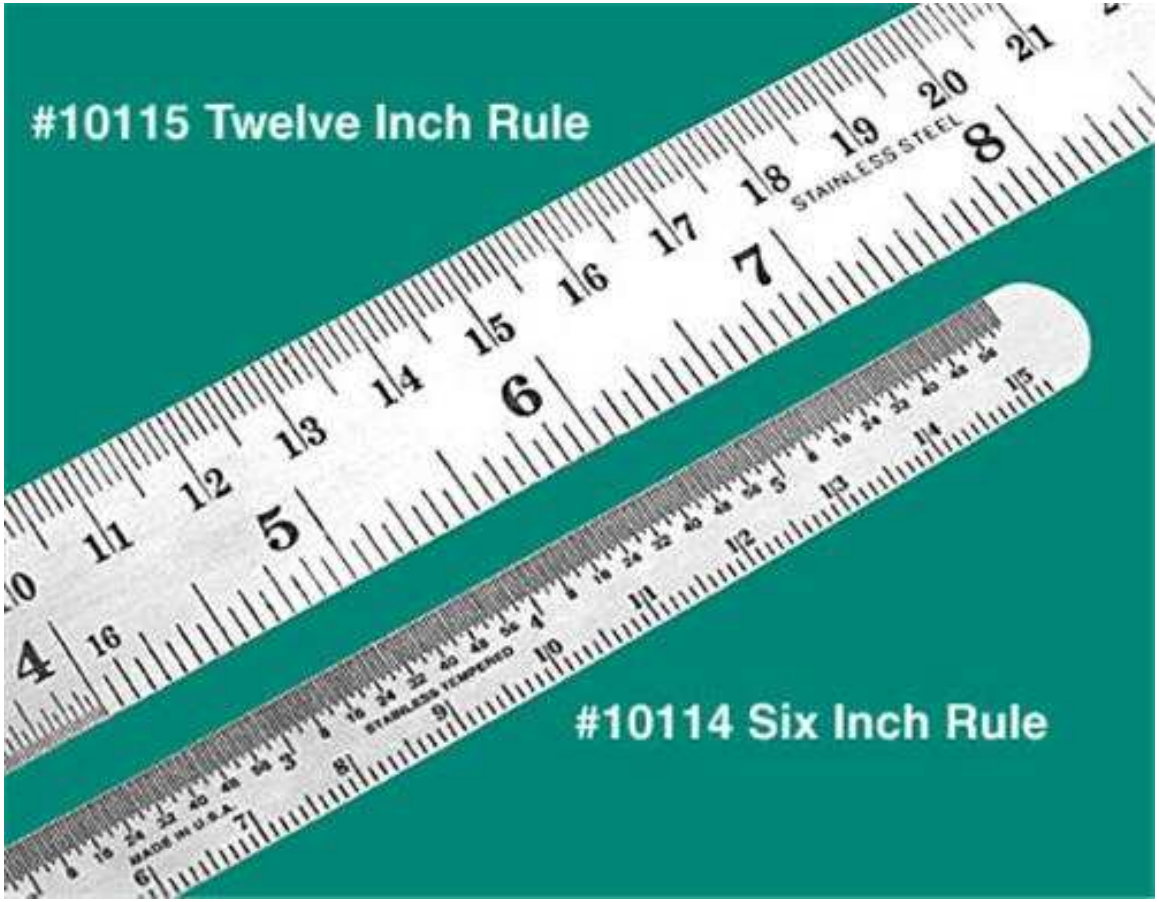
L = 36 in x (25.4 mm/in)

L = 914.41 mm

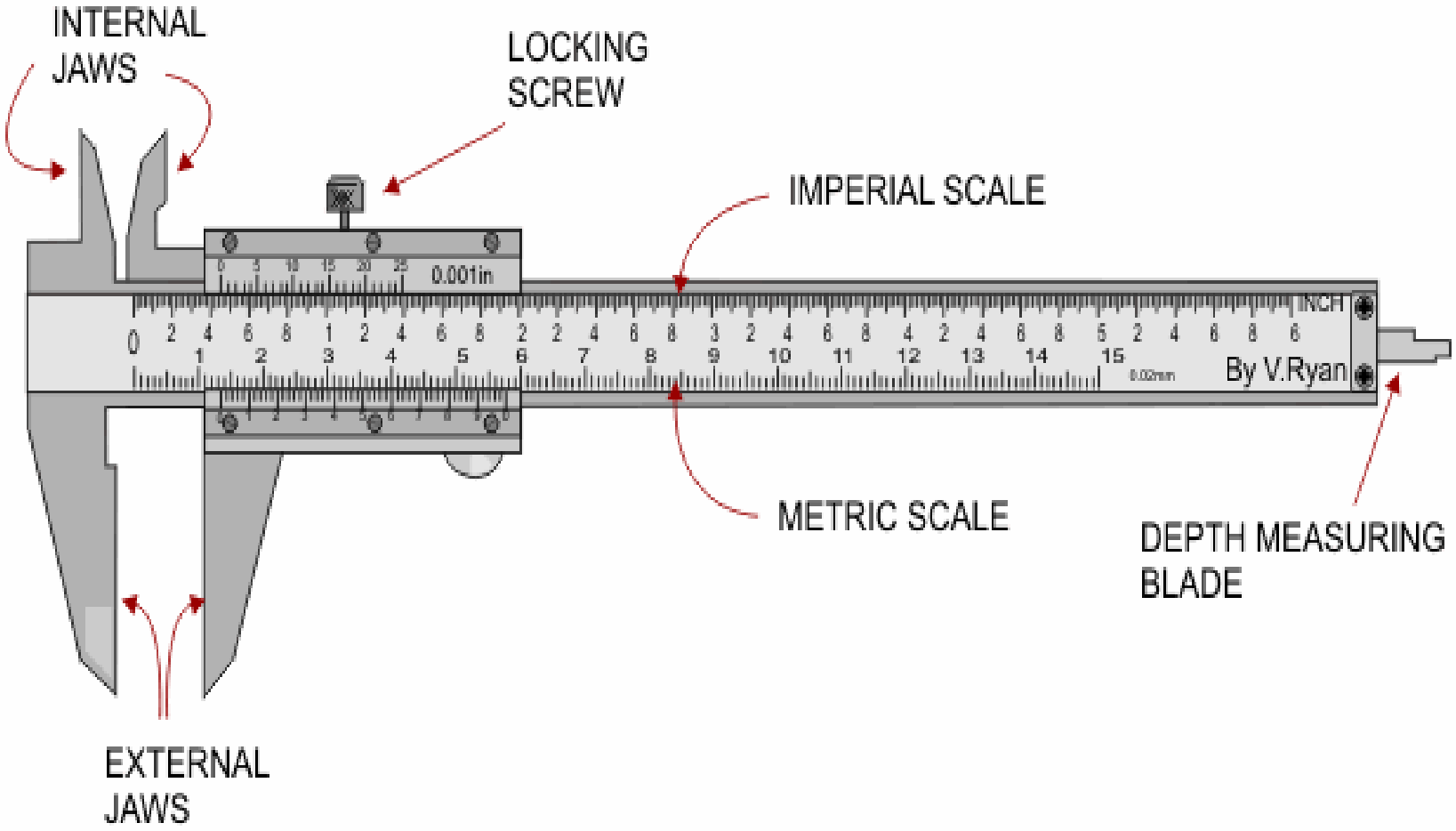
9. Instruments for measuring Length

- **Machinist’s rule**
- **Vernier Caliper**
- **Micrometer**

Machinist's rule

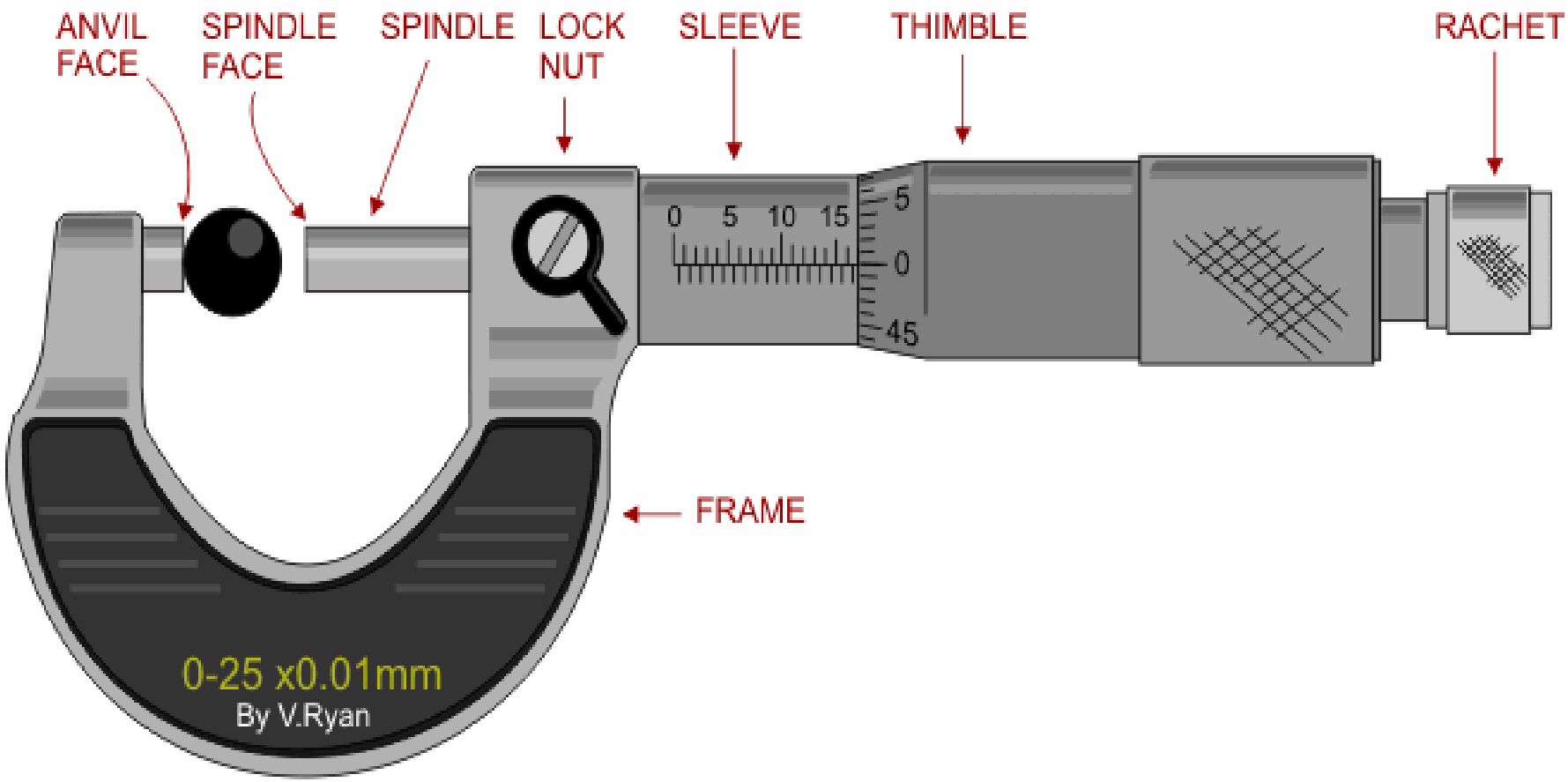


Vernier Caliper



Digital Caliper

Micrometer


ANVIL FACE
SPINDLE FACE
SPINDLE
LOCK NUT
SLEEVE
THIMBLE
RACHET
FRAME
0 5 10 15
5
0
45
0-25 x0.01mm
By V.Ryan

Digital Micrometer