
Process Design and Facility Layout

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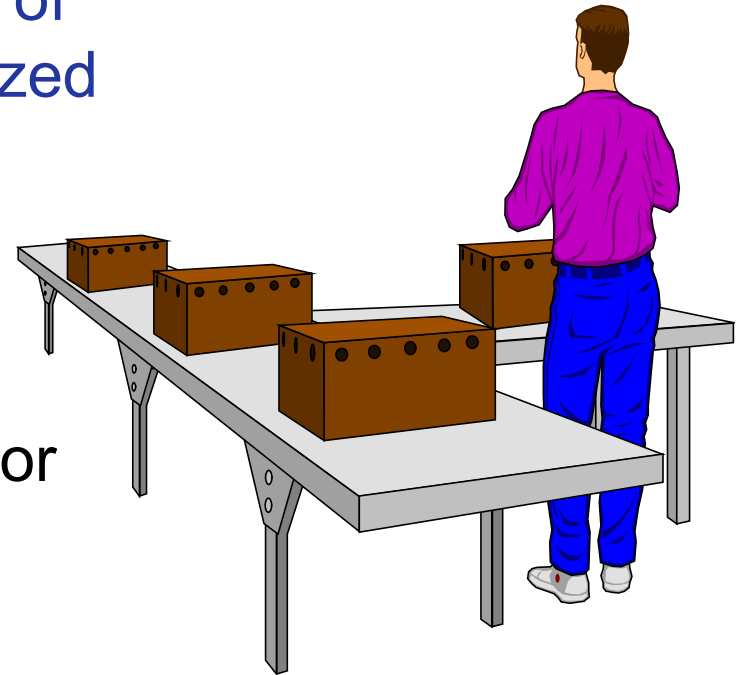
Introduction

- **Make or Buy?**
 - Available capacity, **excess capacity**
 - Expertise, **knowledge**, know-how exists?
 - Quality Consideration, **specialized firms**, **control over quality if in-house**
 - The nature of demand, **aggregation**
 - Cost

Make some components buy remaining

Introduction

- **Process selection**
 - Deciding on the way production of goods or services will be organized
- **Major implications**
 - Capacity planning
 - Layout of facilities
 - Equipment, Capital-equipment or labor intensive
 - Design of work systems
- **New product and service, technological changes, and competitive pressures**



Process Selection and System Design

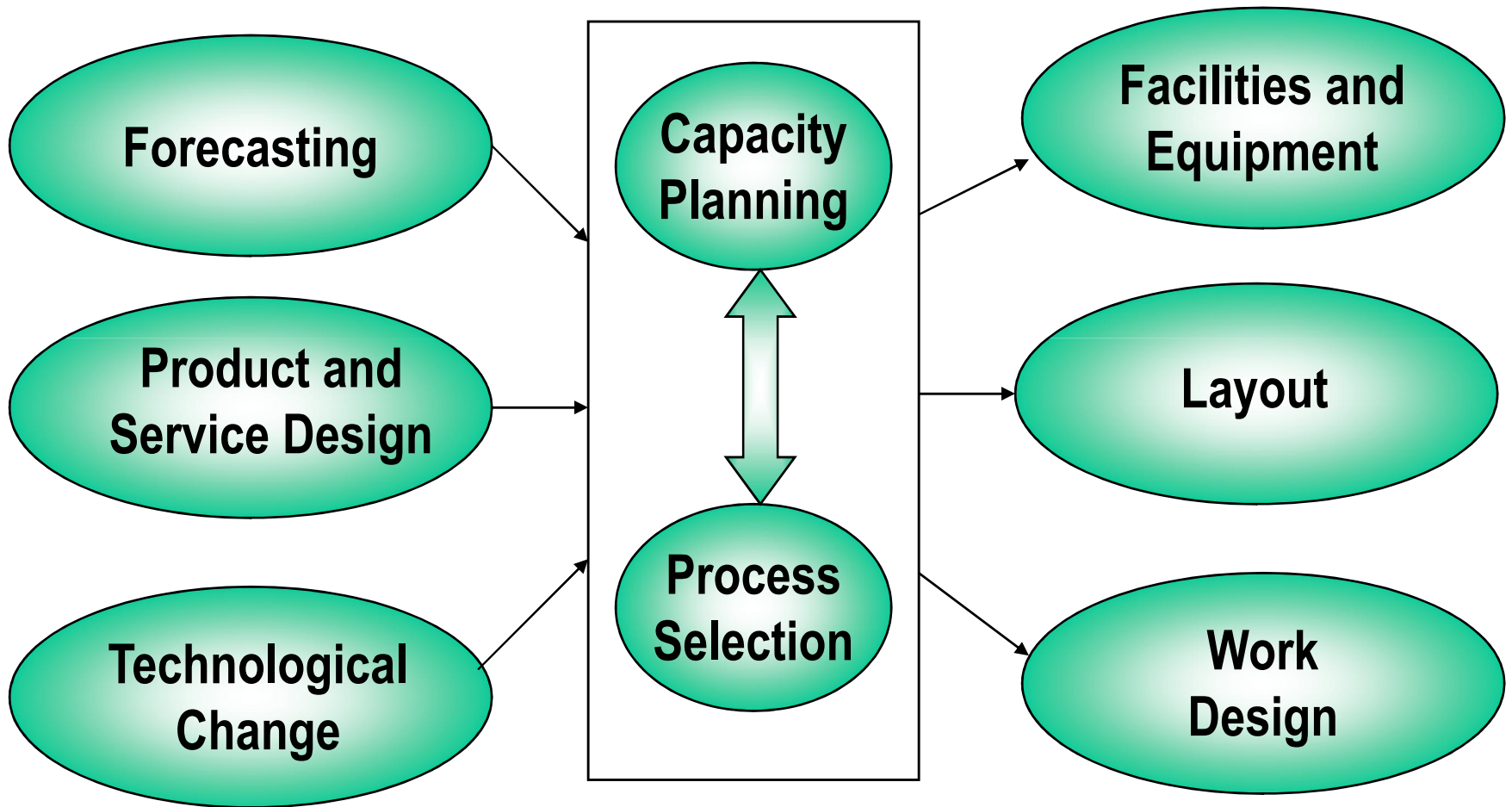


Figure 6.1

Process Types

- **Job Shops:** Small lots, low volume, general equipment, skilled workers, high-variety. Ex: tool and die shop, veterinarian's office
- **Batch Processing:** Moderate volume and variety. Variety among batches but not inside. Ex: paint production , BA3352 sections
- **Repetitive/Assembly:** Semi-continuous, high volume of standardized items, limited variety. Ex: auto plants, cafeteria
- **Continuous Processing:** Very high volume and no variety. Ex: steel mill, chemical plants
- **Projects:** Non-routine jobs. Ex: making a new plant

Questions Before Selecting A Process

- Variety of products and services
 - How much
- Flexibility of the process; volume, mix, technology and design
 - What type and degree
- Volume
 - Expected output

Product – Process Matrix

Dimension	Job Shop	Batch	Repetitive	Continuous
Job variety	Very High	Moderate	Low	Very low
Process flexibility	Very High	Moderate	Low	Very low
Unit cost	Very High	Moderate	Low	Very low
Volume of output	Very low	Low	High	Very high

Product – Process Matrix (example)

Process Type	High variety			Low variety
Job Shop	Appliance repair Emergency room			
Batch		Commercial bakery Classroom Lecture		
Repetitive			Automotive assembly Automatic carwash	
Continuous (flow)				Oil refinery Water purification

Layout

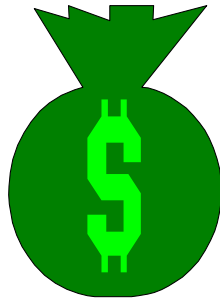
- Layout: the configuration of departments, work centers, and equipment,
 - Whose design involves particular emphasis on movement of work (customers or materials) through the system
- Importance of layout
 - Requires substantial investments of money and effort
 - Involves long-term commitments
 - Has significant impact on cost and efficiency of short-term operations

The Need for Layout Decisions

Inefficient operations

For Example:

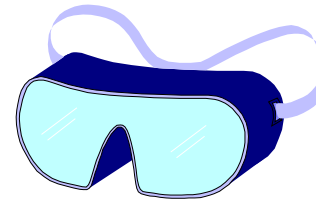
High Cost
Bottlenecks



Changes in the design
of products or services

The introduction of new
products or services

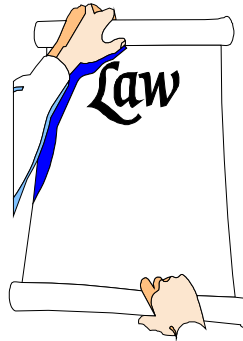
Accidents



Safety hazards

The Need for Layout Design (Cont'd)

Changes in environmental or other legal requirements



Changes in volume of output or mix of products

Changes in methods and equipment

Morale problems

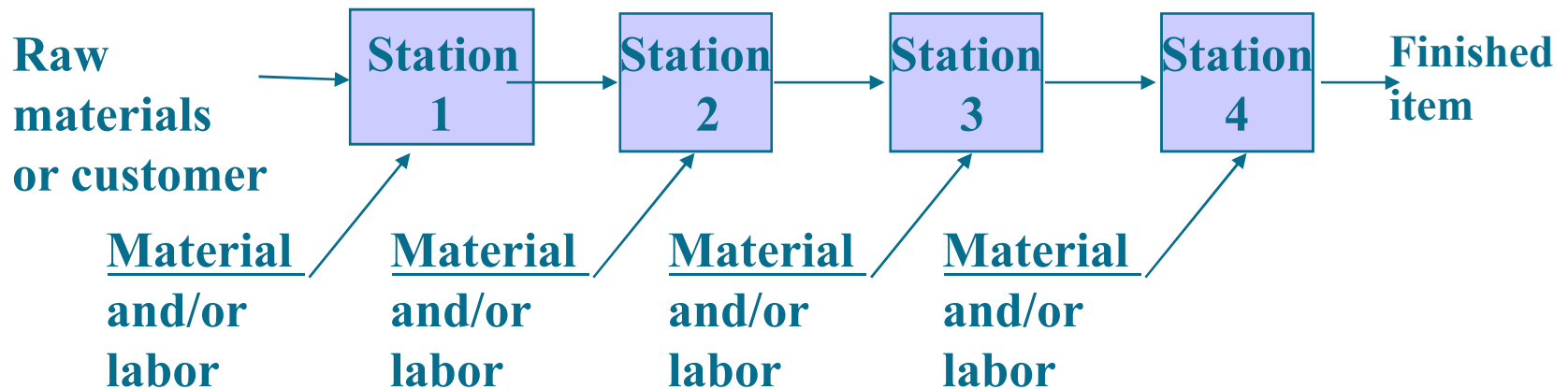


Basic Layout Types (See details from book)

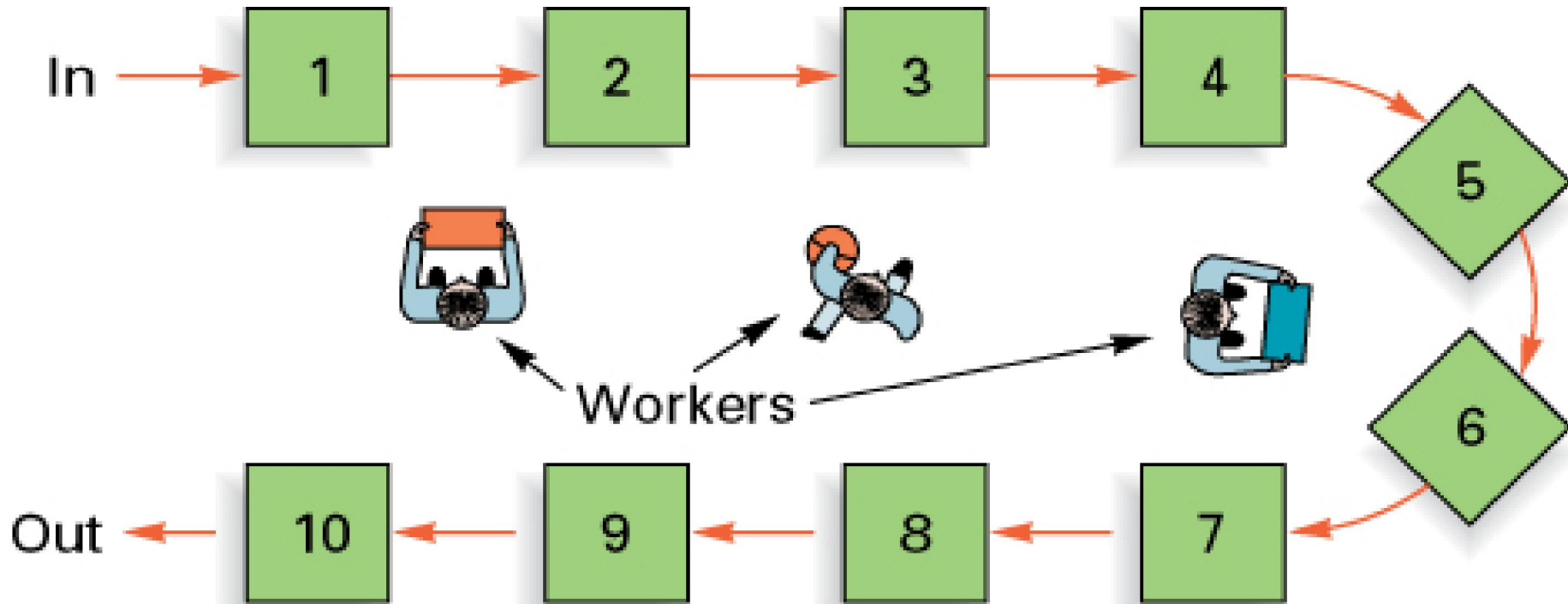
- **Product Layout**
 - Layout that uses standardized processing operations to achieve smooth, rapid, high-volume flow
 - Auto plants, cafeterias
- **Process Layout**
 - Layout that can handle varied processing requirements
 - Tool and die shops, university departments
- **Fixed Position Layout**
 - Layout in which the product or project remains stationary, and workers, materials, and equipment are moved as needed
 - Building projects, disabled patients at hospitals
- **Combination Layouts**

A Flow Line for Production or Service

Flow Shop or Assembly Line Work Flow



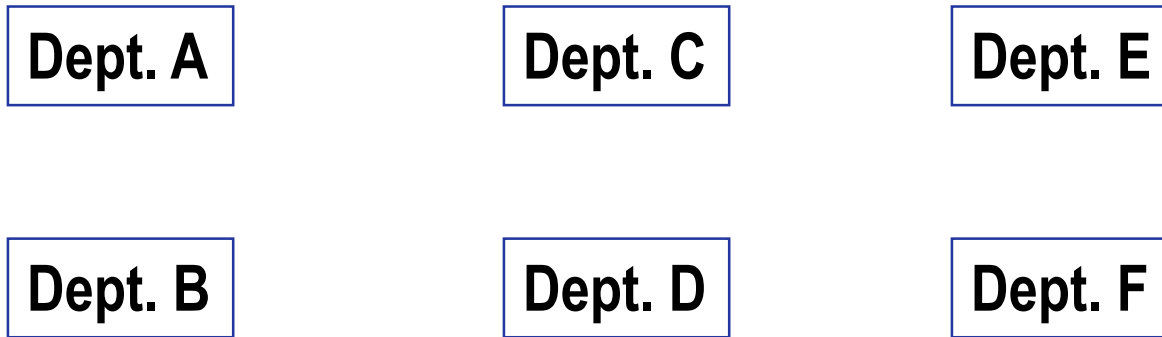
A U-Shaped Production Line



Advantage: more compact, increased communication facilitating team work, minimize the material handling

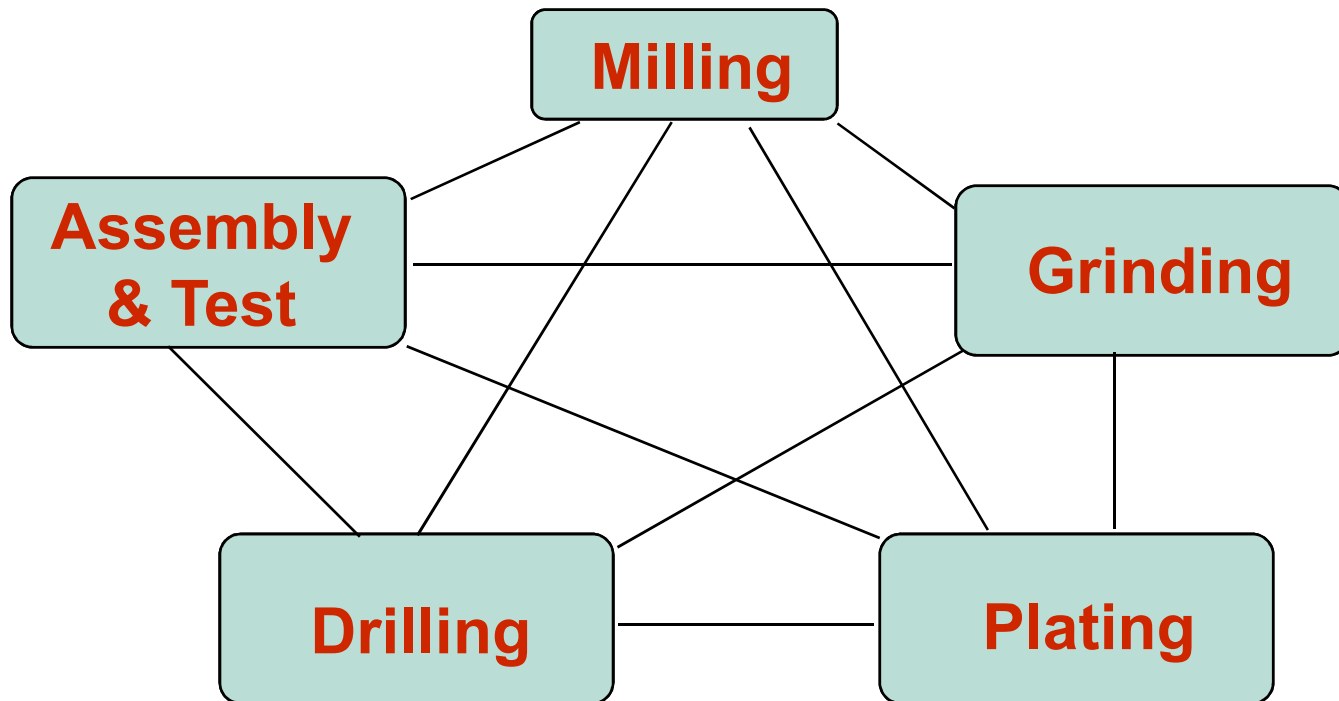
Process Layout

Process Layout (functional)



Used for Intermittent processing

Process Layout



**Process Layout - work travels
to dedicated process centers**

Product layout

Advantages

- High volume
- Low unit cost
- Low labor skill needed
- Low material handling
- High efficiency and utilization
- Simple routing and scheduling
- Simple to track and control

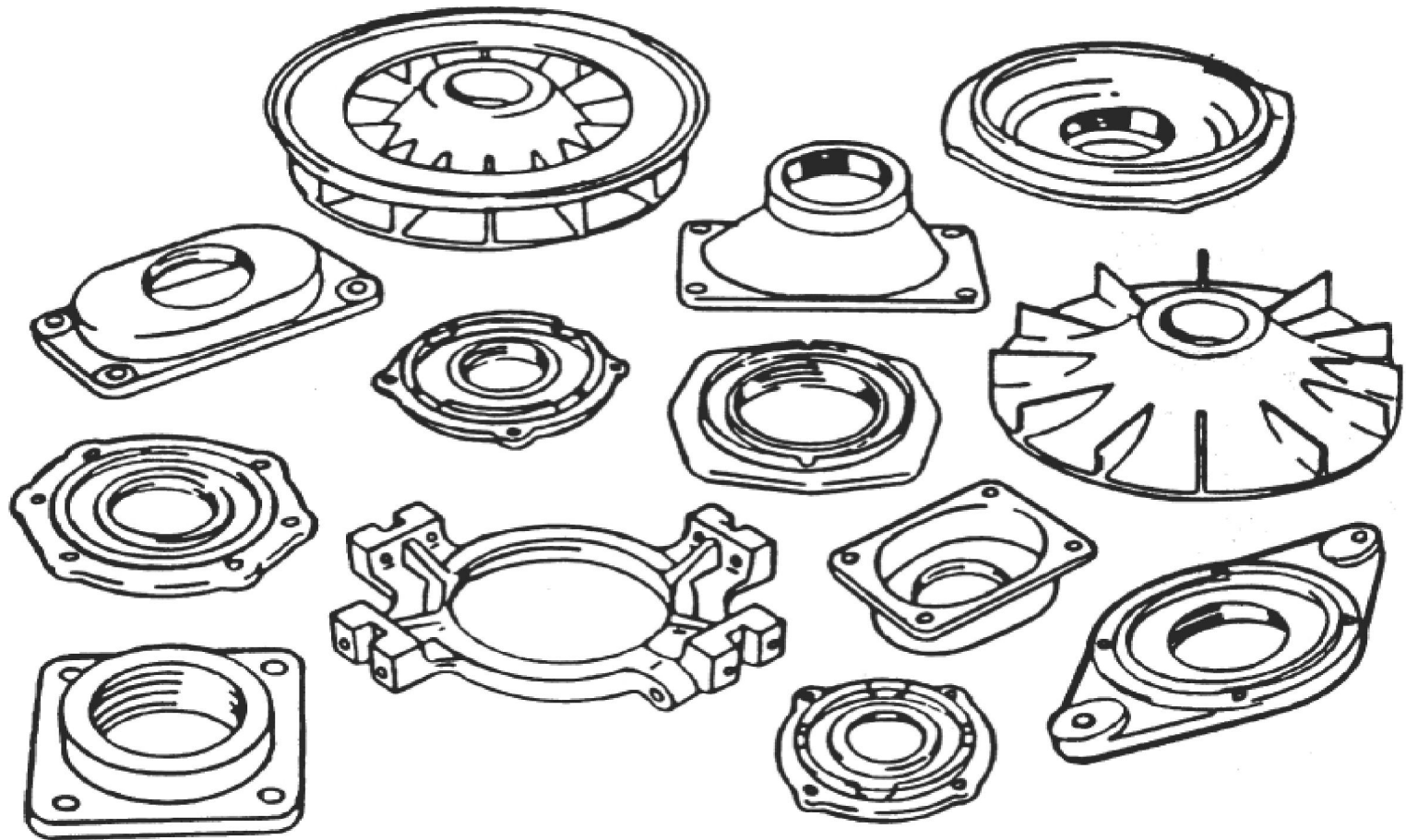
Disadvantages

- Lacks flexibility
 - Volume, design, mix
- Boring for labor
 - Low motivation
 - Low worker enrichment
- Can not accommodate partial shut downs/breakdowns
- Individual incentive plans are not possible

Cellular Layouts

- **Cellular Manufacturing**
 - Layout in which **machines are grouped** into a cell that can process items that have similar processing requirements. A product layout is visible inside each cell.
- **Group Technology**
 - The grouping into **part families of items with similar design or manufacturing characteristics**. Each cell is assigned a family for production. This limits the production variability inside cells, hence allowing for a product layout.

A Group of Parts

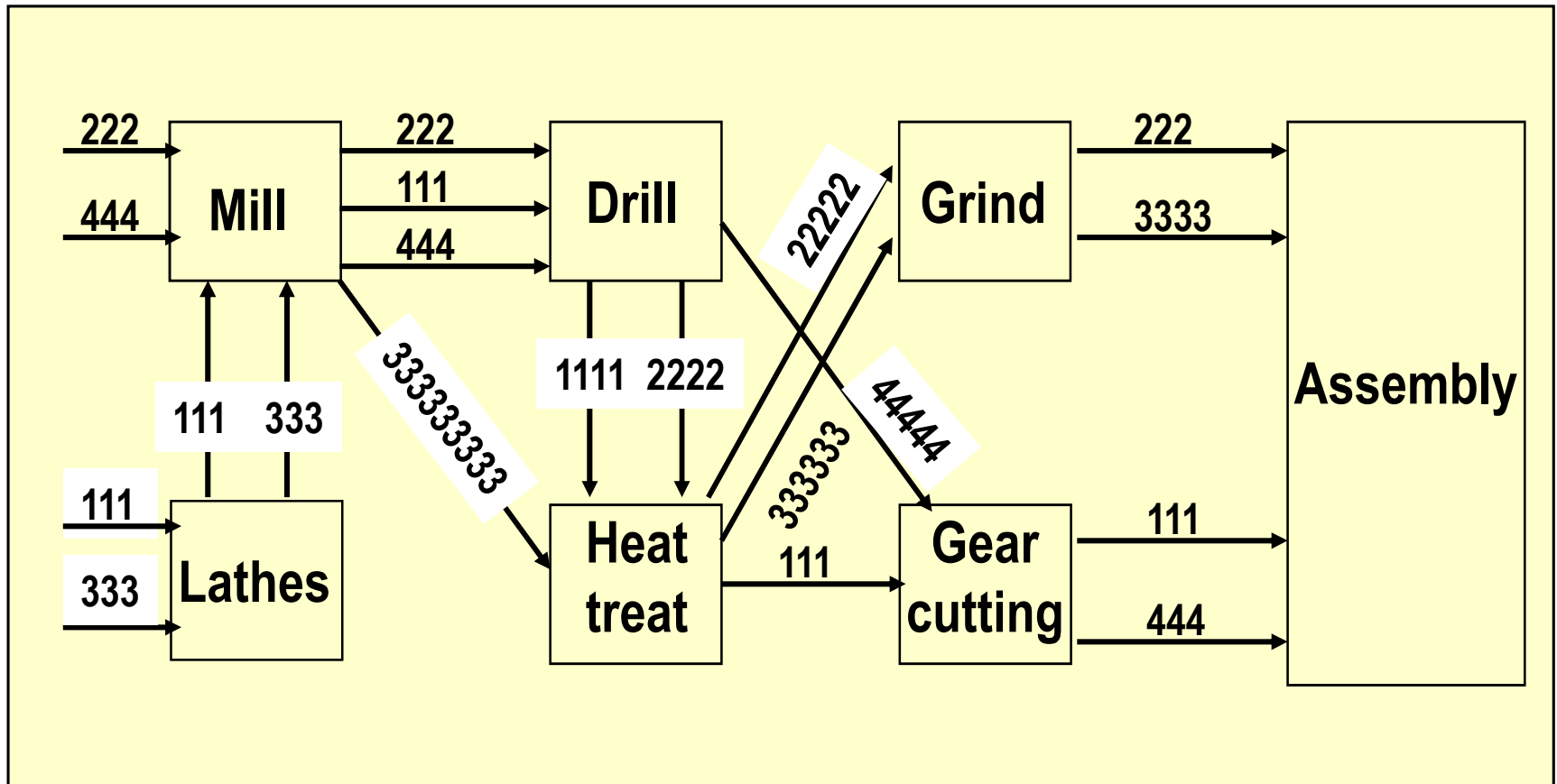


Similar manufacturing characters

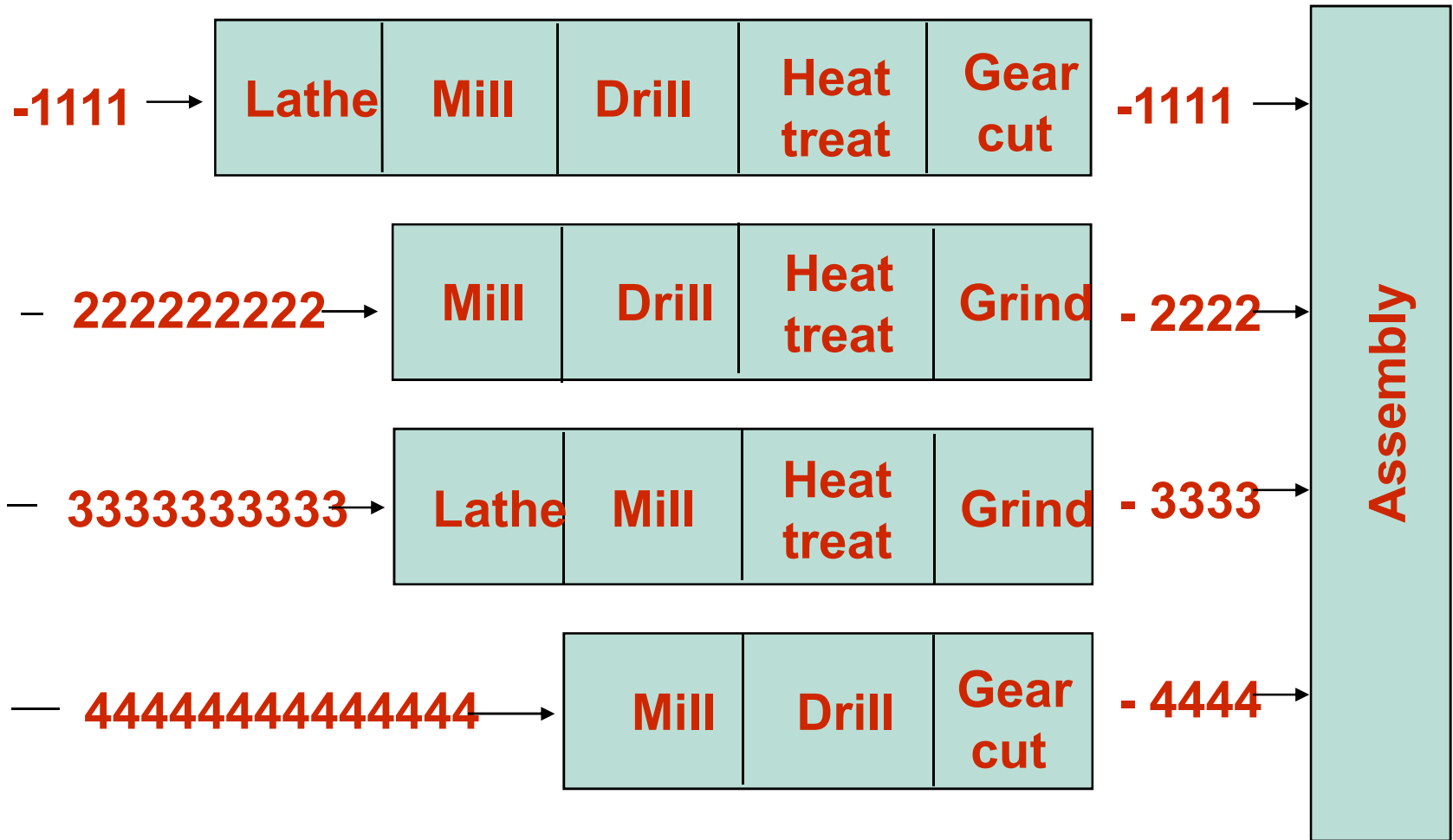
Process vs. Cellular Layouts

Dimension	Process	Cellular
Number of moves between departments	many	few
Travel distances	longer	shorter
Travel paths	variable	fixed
Job waiting times	greater	shorter
Amount of work in process	higher	lower
Supervision difficulty	higher	lower
Scheduling complexity	higher	lower
Equipment utilization	Lower?	Higher?

Process Layout



Cellular Manufacturing Layout



Fixed-Position and combination Layout

- **Fixed-Position Layout:**

Item being worked on remains stationary, and workers, materials and equipment are moved as needed.

Example: buildings, dams, power plants

- **Combination Layouts:**

Combination of three pure layout types.

Example: hospital: process and fixed position.

Service Layouts

- Warehouse and storage layouts

Issue: Frequency of orders

- Retail layouts

Issue: Traffic patterns and traffic flows

- Office layouts

Issue: Information transfer, openness

That's all for now