

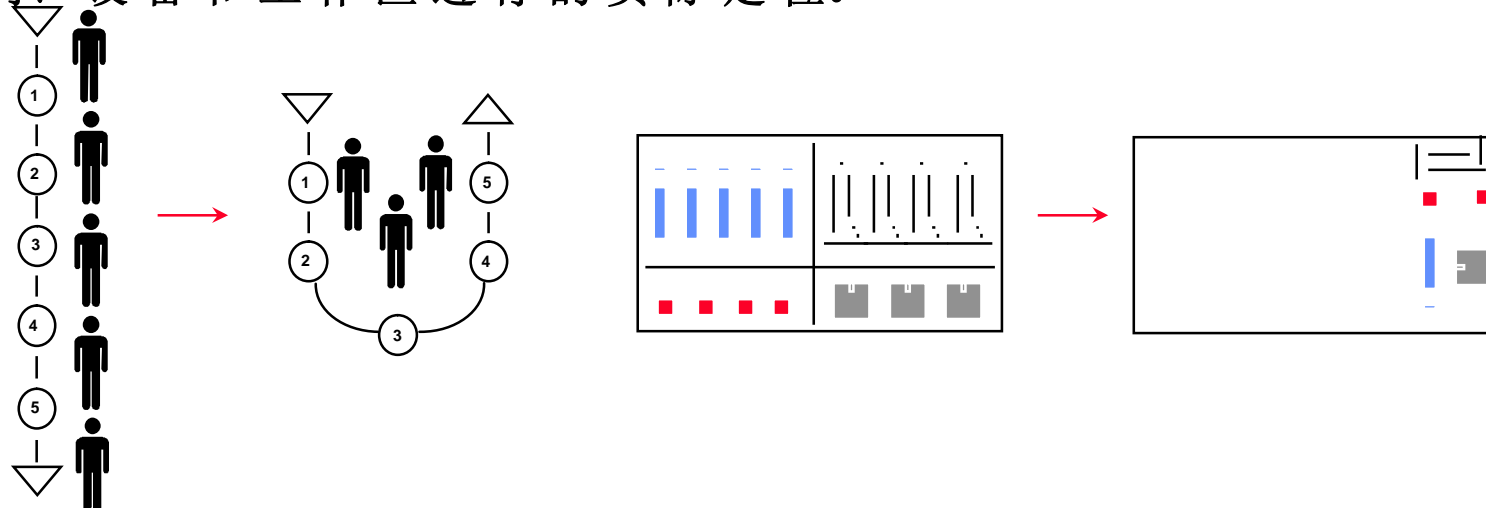
Plant, Machine & Office Layout

工厂，机器和办公室布局

Definition 定义

The physical positioning of processes, departments, equipment and work areas to optimize an organization effectiveness in achieving its operating objectives.

一个组织为实现其操作目标，和效率最优化，对其工艺、部门、设备和工作区进行的实际定位。





布局的意义和目的

人:

- 提高工作热情;
- 减少不必要动作和走动

材料:

- 减少材料、产品的运输距离和次数;
- 减少中间制品

管理:

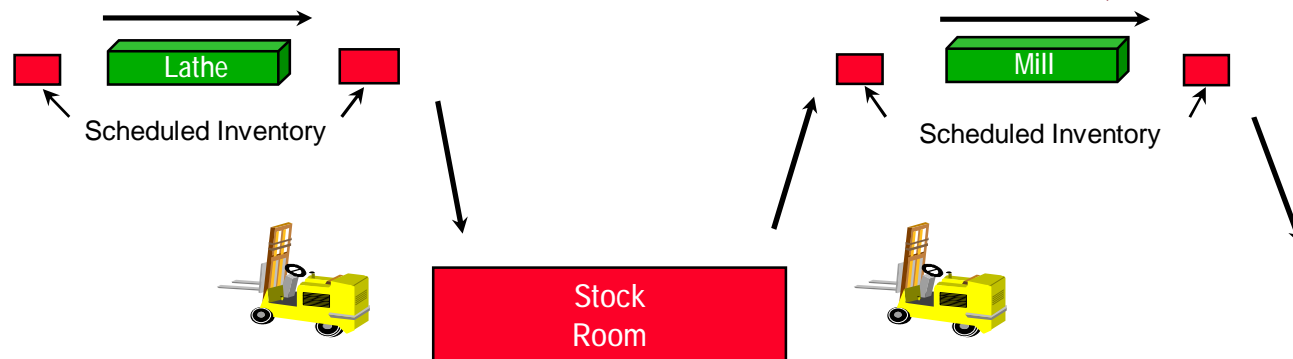
- 简化管理;
- 实现均衡生产

利用率:

- 提高人和设备的利用率;
- 提高空间利用率

Traditional Production Layout 传统生产布局

Batch Production 批量生产



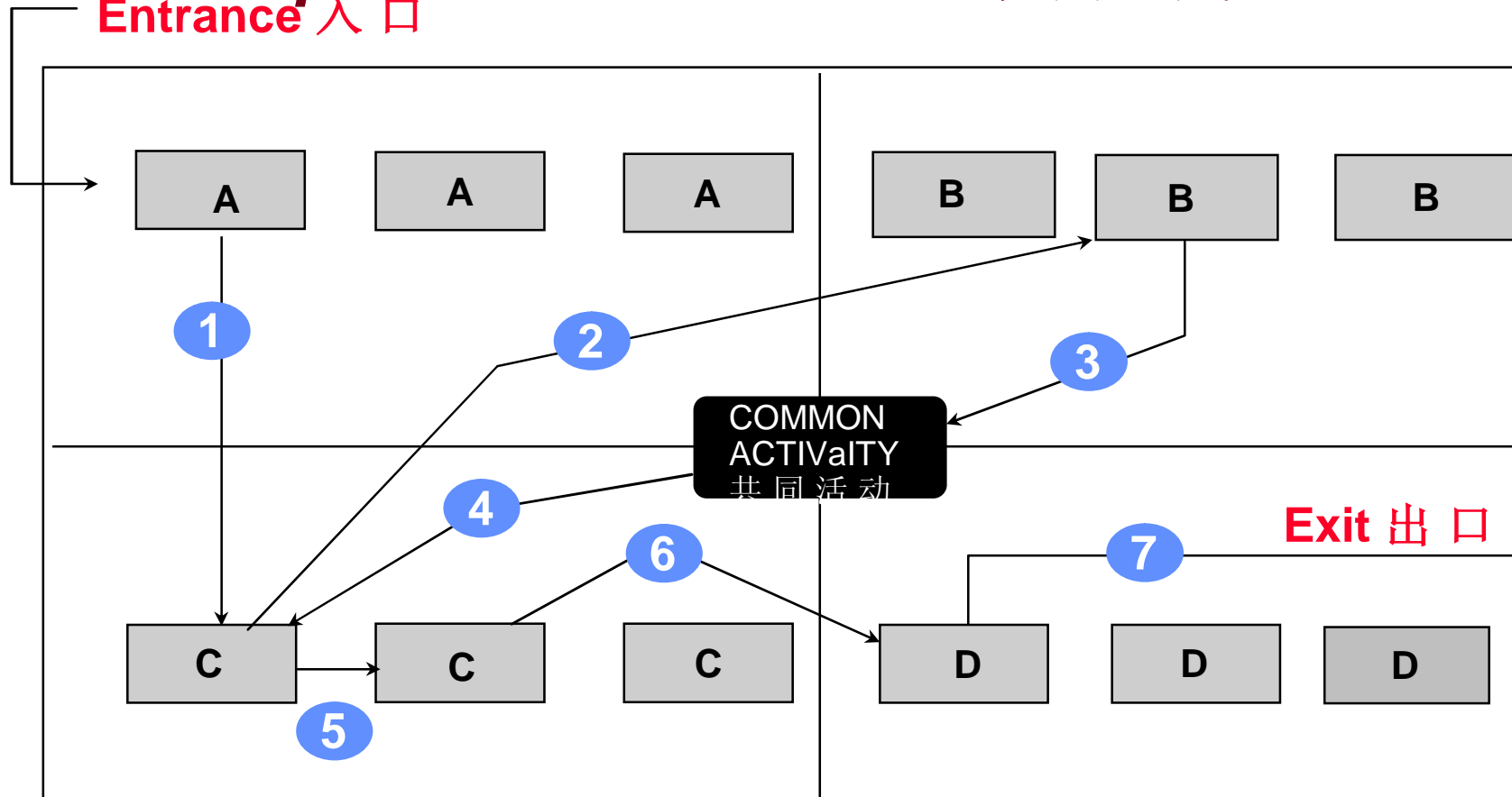
- **Departments Organized by Function** 功能决定各部门的安排
- **Inventory Banks Before/After Each Process** 每道工艺前/后都有大批库存
- **Large Batch Sizes** 大批量
- **Equipment (e.g. Fork Trucks) Required to Move Material** 需要叉车等设备移动材料
- **Resource(s) required to maintain Stock Room** 需要各种资源维护仓库
- **Lead Times are Long** 制造周期太长
- **High Inventory** 库存太多
- **Each Area Optimizes it's own Performance** 每一区域仅使自己的表现最优化
- **Processing Time is a Small % of Total Time** 工艺时间在全部分时间中占有很小比例



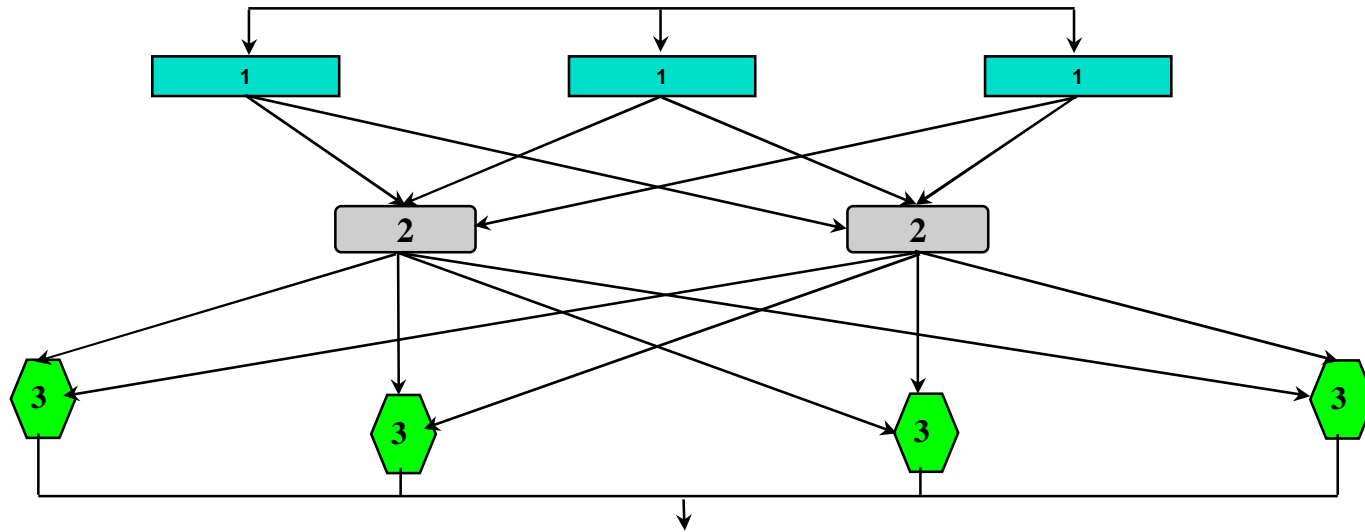
Traditional Layout 传统布局

Departmental Focus 以部门为焦点

Entrance 入口



Traditional Process Flow 传统式工艺流程

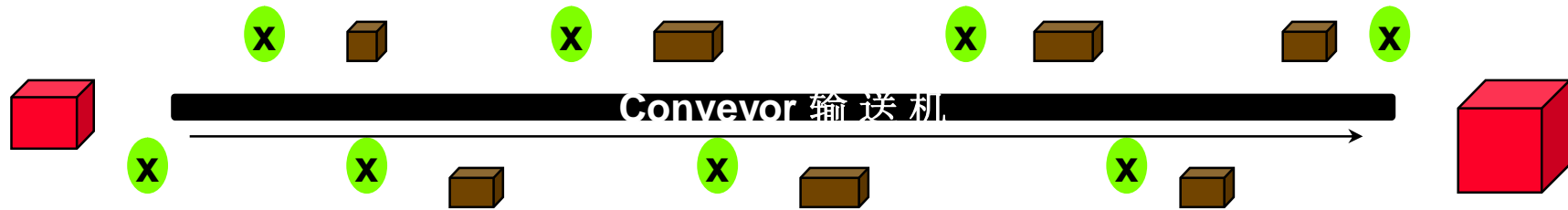


- **Complex Material Flow** 复杂的材料流程
- **Complex Scheduling Required** 复杂的生产计划
- **Large Inventories within System** 系统内大量库存
- **Long Lead Times** 很长制造周期
- **Batch Operations** 大批量操作
- **High Cost to Manufacture** 很高生产成本



Traditional Production Layout

传统式生产布局 Assembly Line 装配线



- **Work Paced by Conveyer** 工作节奏取决于输送机
- **Material Handling Reduced** 减少了材料处理
- **Individual Station Disruptions Accumulate** 个人工作站中断太多
- **High Capital Investment** 投资太多
- **Low Flexibility to Satisfy Schedule Variations** 不够灵活, 无法适应生产计划的变动
- **Usually Long Changeover Times** 调整时间过长

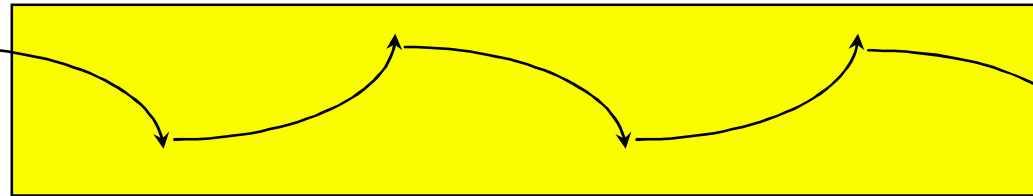


Traditional Production Layout

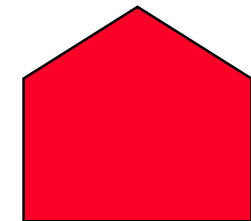


传统式生产布局

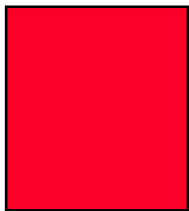
"Process Flow" "工艺流程"



Continuous Flow Process
不断流程的工艺
(i.e. Paint or Plating)
(例如: 喷漆或电镀)



Finished Goods Storage
成品仓库



Raw /WIP Stock Room
原料/在制品仓库

- **Raw Materials Stored Externally to Process** 在工艺之外的储存原材料
- **Complicated Scheduling** 复杂的生产计划
- **Fork Trucks Required to Move Material** 需用叉车移动材料
- **Material Moved Long Distances** 长途移动材料
- **Resource(s) Required for Stock Rooms** 仓库需要资源
- **Packaging often done External to Dept.** 常在部门外包装
- **High Inventories** 大量库存
- **Long Lead Times** 很长制造周期



Layout Waste Elimination Techniques

消除布局浪费的技术

- **Group Technology** 组合技术
- **Point of Use Manufacturing** 即用即给生产
- **Cell Technology** 单元技术



Layout Waste Elimination Techniques

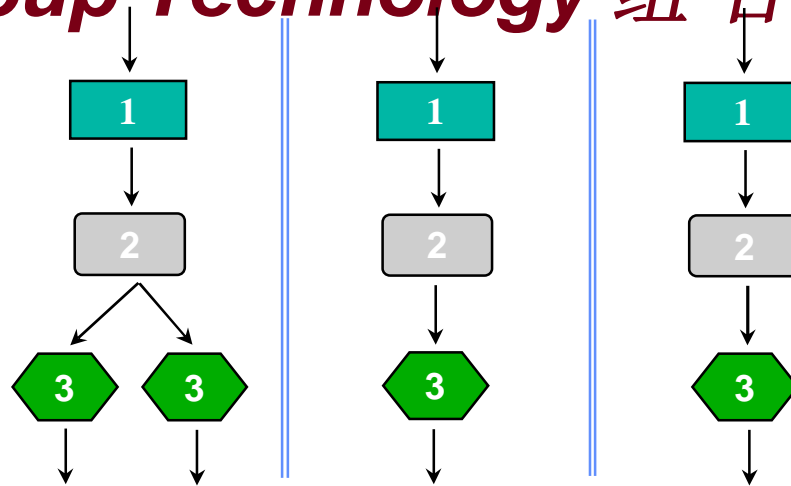
消除布局浪费的技术

Group Technology 组合技术

- **Grouping of Operations so that the End of One Operation is Located at the Start of the Next Operation**
把各个操作组合起来，使前一个操作的结尾与下一个操作的开头相接

Layout Waste Elimination Techniques

消除布局浪费的技术 Group Technology 组合技术



- **Processes Grouped by Product Families** 按照产品种类进行工艺组合
- **Simplified Material Flow** 简化材料流程
- **Simplified Scheduling** 简化生产计划
- **Small Batch Sizes between Processes** 工艺间批量很小
- **Shortened Lead Times** 缩短制造周期
- **Lower Cost to Manufacture** 降低生产成本

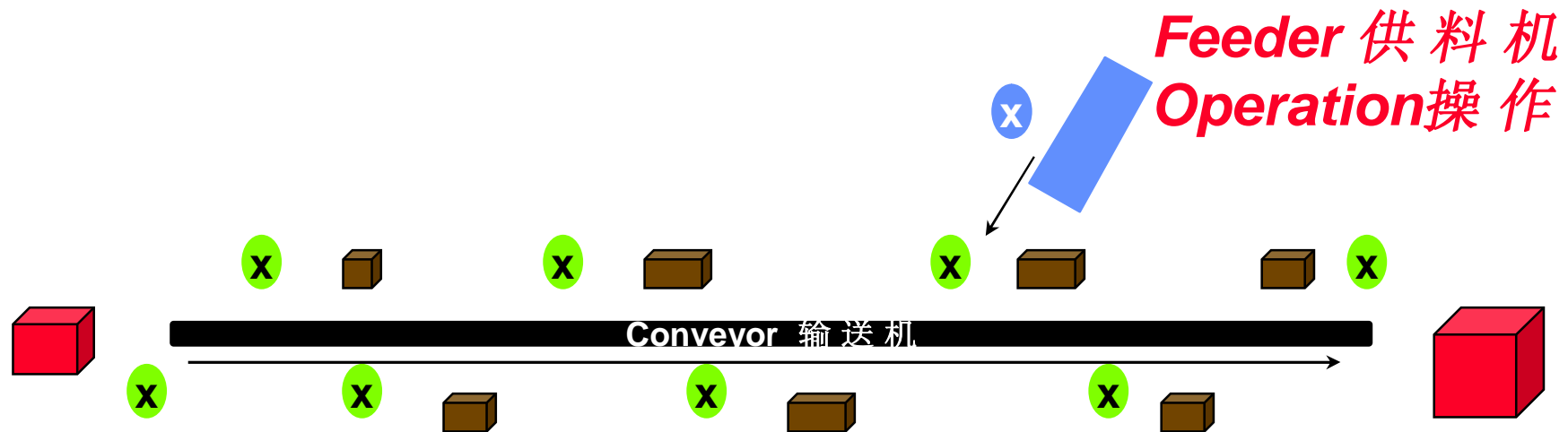
Layout Waste Elimination Techniques

消除布局浪费的技术

Point of Use Manufacturing 即用即给生产

- Locate Feeder and User Operations Adjacent to Each Other at the Assembly Line or Manufacturing Cell.

在装配线或生产车间内，使供料机与用户操作彼此相邻。



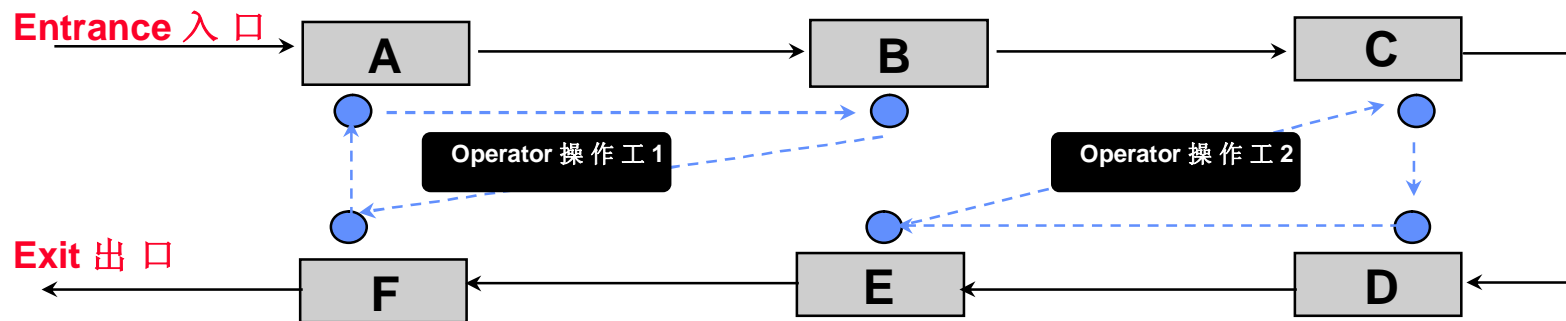


Layout Waste Elimination Techniques

消除布局浪费的技术

Cell Technology 单元化技术

- Operations are located so that one individual can produce the entire assembly - with multiple simple machines instead of one large machine.
一个人能够操作整个装配线—使用多台简单机器，而不是一台大机器。

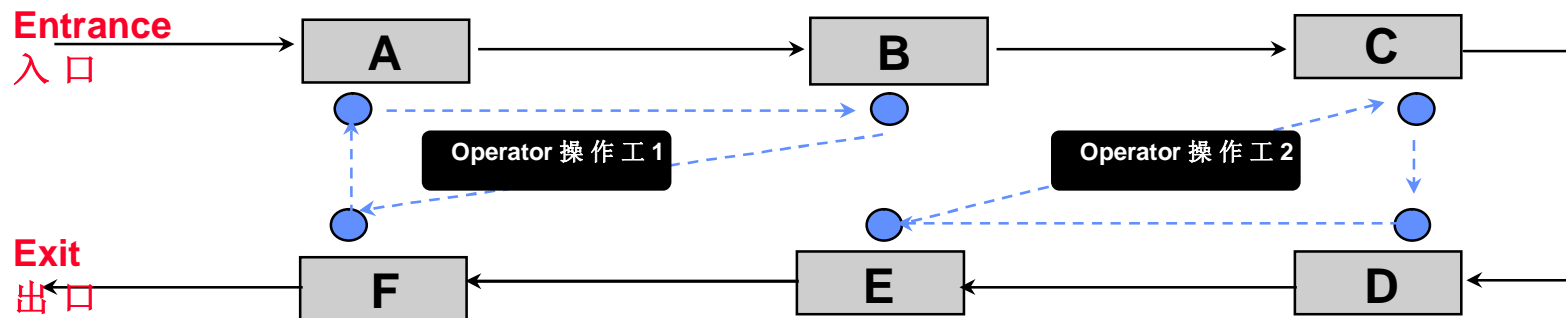


Layout Waste Elimination

Techniques

消除布局的浪费的技术

Layout Using Manufacturing Cell Concept: 布局使用单元化概念:



- **Flexibility to Increase/Decrease Number of Operators depending on Schedule**
根据生产计划, 灵活增加/减少操作工人
- **No Fork Trucks, Dedicated Material Handlers or Stockrooms Required**
无需叉车、专用材料处理机或仓库
- **Eliminates Large Inventories between Operations** 消除操作间的大批库存
- **Grouping Technology Reduces Product Variation** 应用组合技术减少产品变动
- **Better Control of Quality between Operations** 更好地控制工序间的质量



Layout Waste Elimination Techniques

消除布局浪费的技术

Cell Concept 单元化概念

- **U or other Shape for Equipment Layout; Operator could produce entire Product**
设备布局采用U形或其它形状；操作工可以生产整个产品
- **Multiple Simple Machines; not One Large Machine**
使用多台简单机器：而不是一台大型机器
- **Operators Know Every Job and Rotate between Jobs**
操作工熟悉每一项工作，并在不同工作之间周旋。
- **Vary Amount of Personnel within Cell to Match Schedule Requirements**
在车间内部变换人员数量，以适应生产计划的需要。

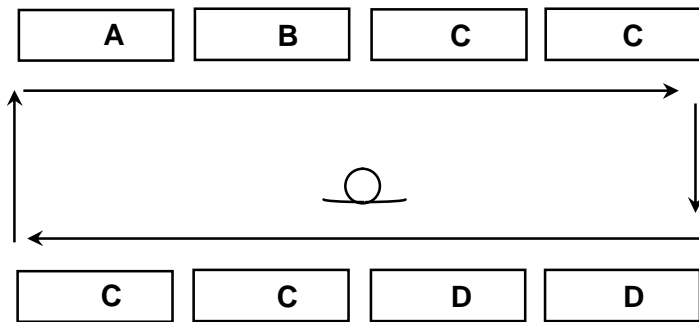


LEAN ORGANIZATION CELLS 精益公司车间

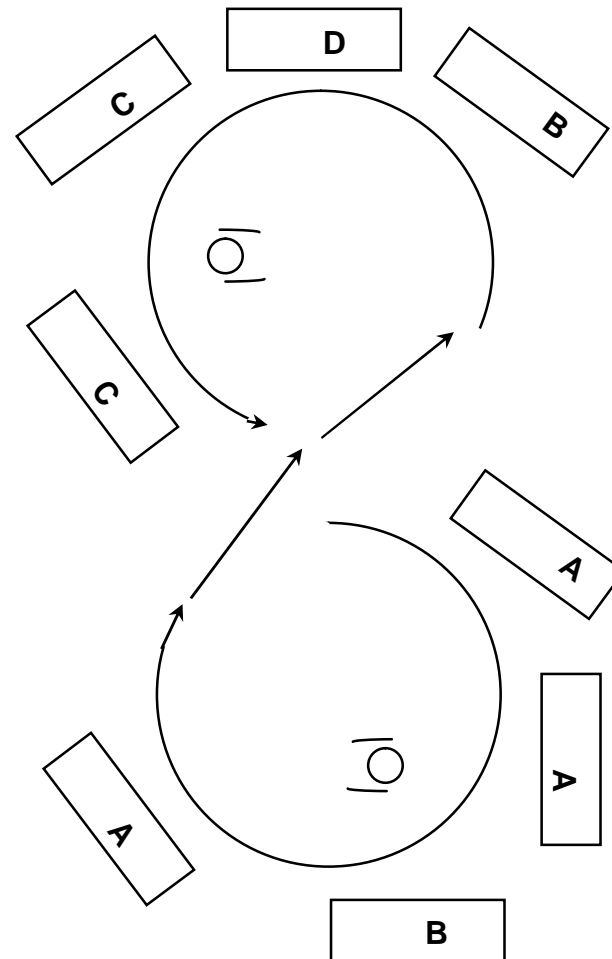
MANY SHAPES AND SIZES 多种形状与规模

Equal Sign Shaped

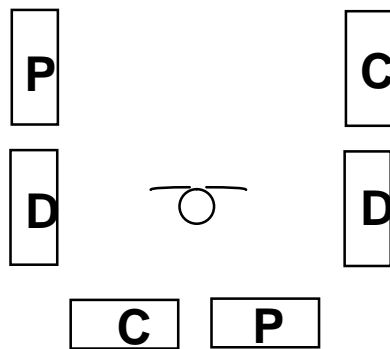
对等符号形状



S - Shaped 形状



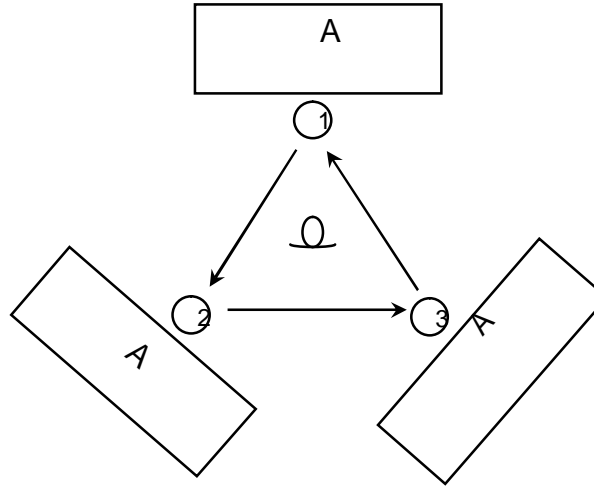
U - Shaped 形状



LEAN ORGANIZATION CELLS 精益公司车间

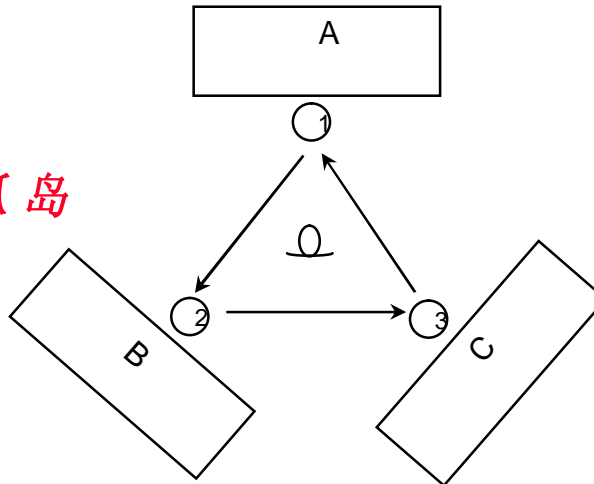
INTERIM STEPS 过渡步骤

BIRD CAGE 鸟笼



LESS WAITING 较少等待
INVENTORY INCREASES 库存增加
UN-BALANCED 不平衡

ISOLATED ISLANDS 孤岛



PRODUCT FOCUS 产品焦点
SMOOTHER FLOW 顺畅流程
BALANCING DIFFICULT 平衡困难
REALLOCATION DIFFICULT 再分配困难

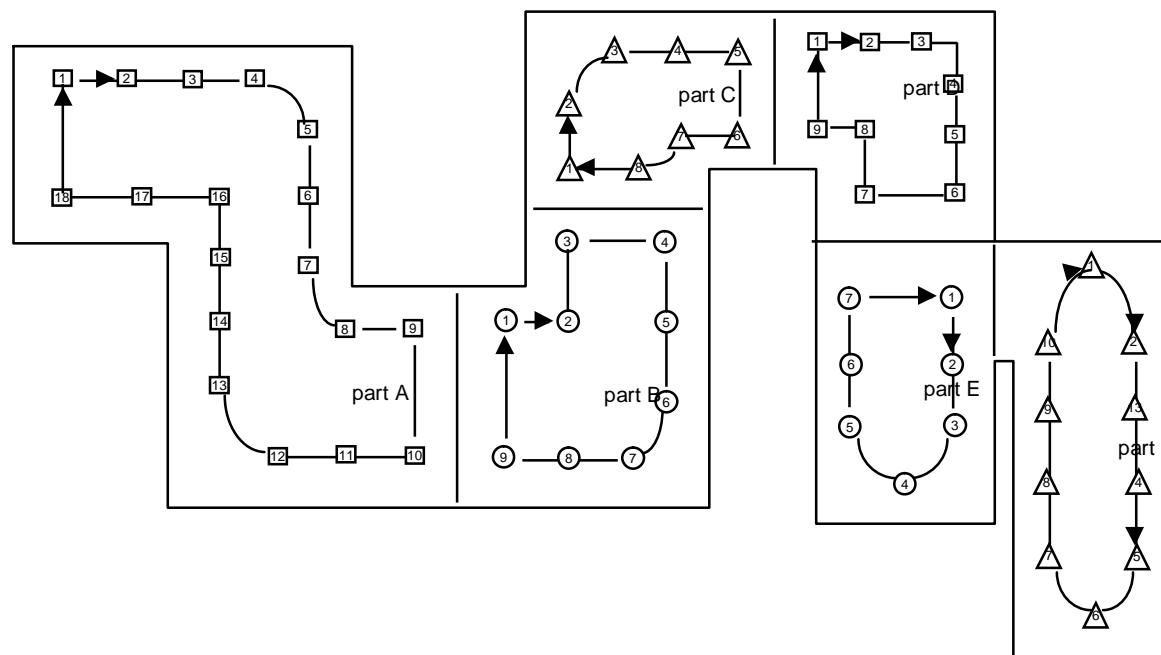


LEAN ORGANIZATION CELLS 精益公司车间



COMBINED CELLS 组合车间

6 PARTS 部分

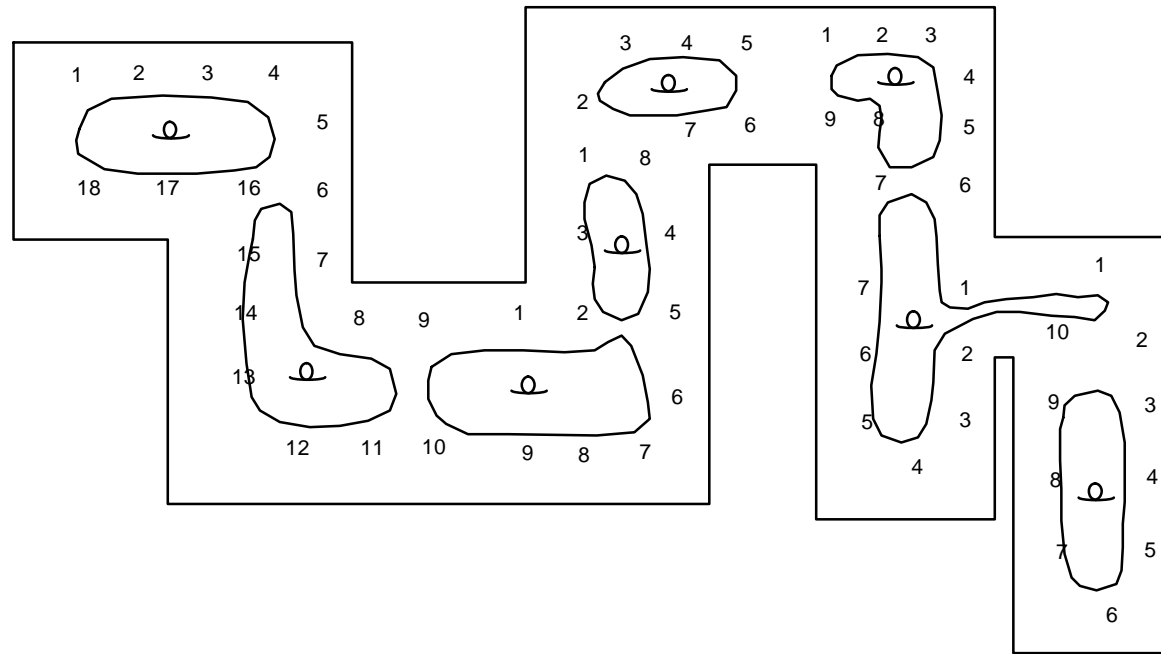




COMBINED CELLS 组合车间

1 MINUTE CYCLE- 8 WORKERS

1 分钟循环 - 8 个工人



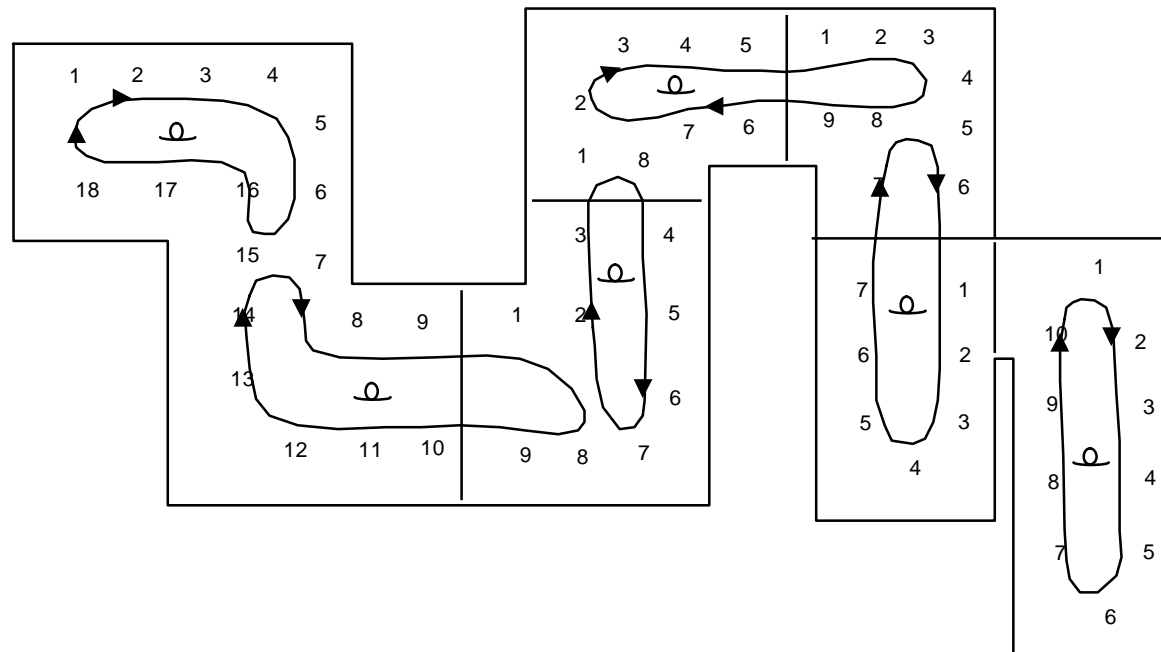


LEAN ORGANIZATION CELLS 精益公司车间

COMBINED CELLS 组合车间

1.2 MINUTE CYCLE - 6 WORKERS

1.2 分钟循环 - 6 个工人





U Cell Guidelines for Waste Elimination **消除浪费的U形单元指导原则**

- **More Machines than People; Operators should Run More than One Machine.**
机器比人多；操作工要运转不止一台机器
- **Keep Large Containers Out of Cell 不使用大料箱**
- **No Physical Barriers within Cell; e.g. Control Panels, Tool Boxes, etc.**
没有实物障碍；例如，控制板、工具箱等等
- **Arrange Machines Close Enough together to Allow Operators to Operate Machines on Both Sides of Cell.**
机器靠得很近，操作工可以操作车间两边的机器
- **Operators Should Perform Material Handling between Machines; Minimum or Single Parts.**
操作工应在机器之间进行物料搬运；机器之间零件应为最少，或只有一个零件。



U Cell Guidelines for Waste Elimination

消除浪费的U形车间指导原则

(Continued) (续)

- **1st and Last Operation should be done by Same Operator (Where Feasible)**

第一个与最后一个操作应由同一操作工来完成（在可行的情况下）

- **OK for Operators to Walk between Stations (unless Excessive); Machines can wait on People**

操作工可以在工作站之间走动（多余的工作站除外）；
机器可以等候操作工来操作

- **Total Operator Work Content should not Equal 100 % of Demand Cycle Time to Allow for:**

操作工全部工作内容不能100%等于需求周期时间，以便能够：

- **Material Handling** 物料装卸
- **Preventative Maintenance** 防护维修
- **Changeovers** 调整与改装



Overall Layout Guidelines

for Waste Elimination

消除浪费的总体布局指导方针

- **Eliminate Need for Function (Best Alternative)**
消除对功能的需要 (最好的选择)。
- **Combine Operations where possible (Next Best)**
尽可能组合操作 (仅次于最好的选择)
 - **reduces inventory between processes** 减少工艺之间库存
 - **reduces excessive operator motions/ walking** 减少多余的操作动作 / 走动
 - **enhances operator productivity** 提高操作工生产率
- **Utilize Dedicated Equipment/Tools (where possible)**
使用专用设备 / 工具 (在可能的情况下)
- **Organize Operations by Product Flow Path (Group Technology)**
按照产品流程路线组织操作 (组合技术)
- **Incorporate Simple/Flexible Types of Equipment or Tooling**
结合使用简单 / 灵活的设备或工具



Overall Layout Guidelines

for Waste Elimination -Continued

消除浪费的总体布局指导原则—续

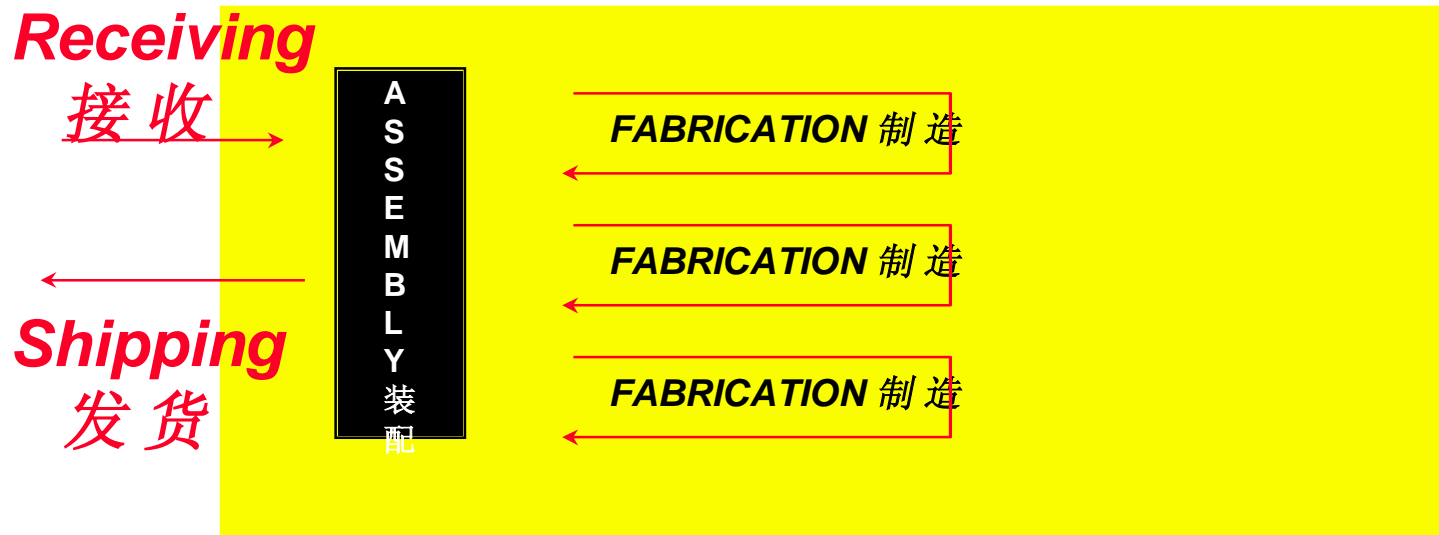
- **Store Incoming Material at Point of Use.**
把进料存储于用料点上。
- **Design Containers to Fit Point of Use.**
料箱设计适应即用即给式生产。
- **Arrange Equipment so that Output of one Process is located at Input of Next Process.**
设备安排有利于一道工艺的出口位于下道工艺的入口。
- **Design Layout for Standard Conditions; Don't Institutionalize the Exceptions**
布局设计实现标准条件; 不要把例外情况教条处理。



Overall Layout Guidelines for Waste Elimination -Continued

消除浪费的总体布局指导原则 - 续

- **Locate End of Assembly Line at Shipping Docks.**
装配线终端位于发货码头





Overall Layout Guidelines for Waste Elimination -Continued

消除浪费的总体布局指导原则 - 续

- **Use Simple Automation with Minimum Material Handling**
使用最少物料装卸的简单自动化装置
- **Progression from Manual into Automation**
手动向自动化转化

Simplify 简化



Consolidate 合并



Automate 自动化



总体平面布置方法概论

1, 产品按不同品种、
不同生产量分类

2, 以生产流程为主
体进行平面布置设定

基本方法

3, 生产现场与其他关
联部门的平面布置设定

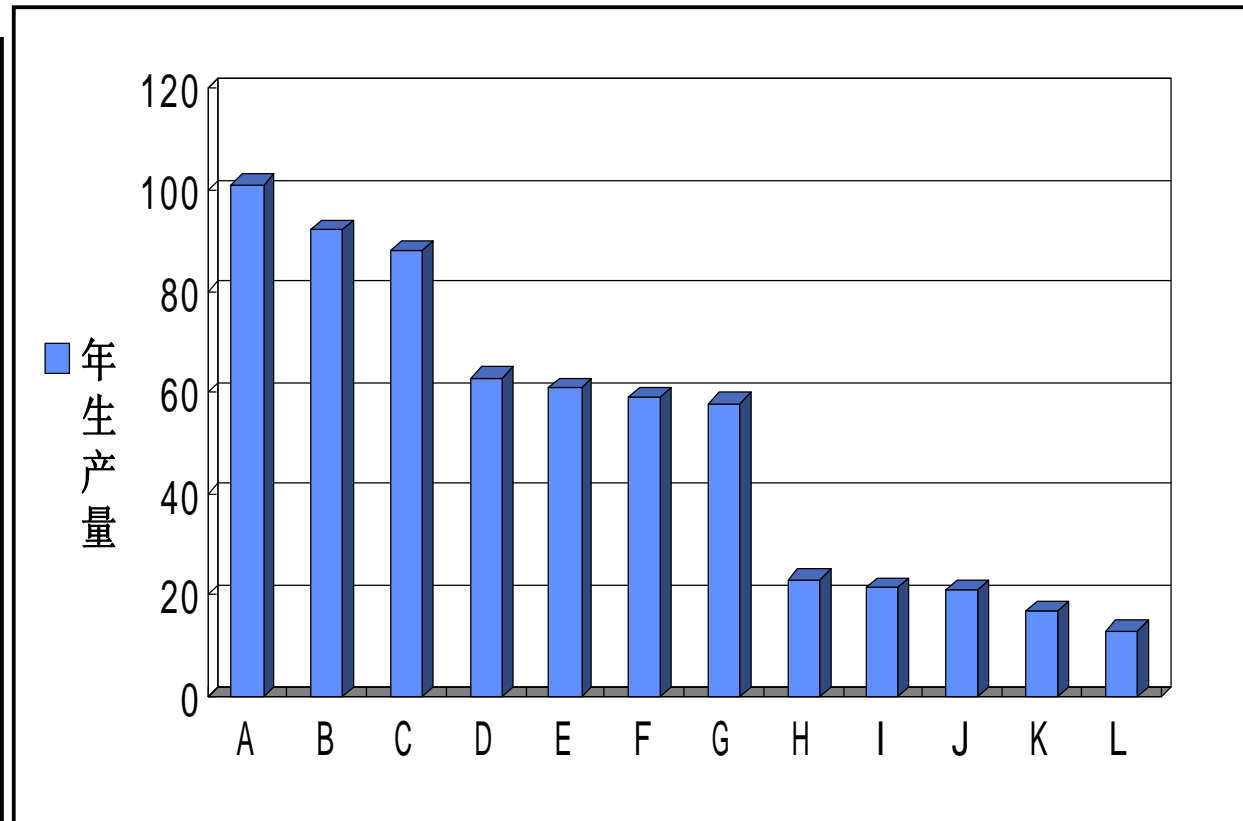
4, 整体方案评估

1, 产品按不同品种、不同生产量分类

A、B、C产品工时、产量较多，分布考虑各自的平面布置。
(对生产计划要求较严)

D、E、F、G处于中间地位、可根据类似的工序进行平面布置。
(设备利用率较低)

I、J、K、L产量、工时都比较少，按使用设备、分块进行布置。





2, 以生产流程为主体进行平面布置设定



工序表转化成路线图

	1	2	3	4	5	6	7	8	9	10	零件号码
(1)	L	PM	D	F	检						A18, D25
(2)	TL	D	F	检							A7、11、23、B15、12、C10、15
(3)	L	D	检	PG	F	检					B4
(4)	TL	F	检								普通螺母11个
(5)	L	VM	D	检	H	PG	F	检			B9、C7、D14
(6)	TL	PM	VM	D	F	检					D2、D4、D5
(7)	L	D	检	CA	L	PM	H	PG	IG	检	D1、D3
(8)	L	D	CA	PM	H	F	检				B2、B3、B5

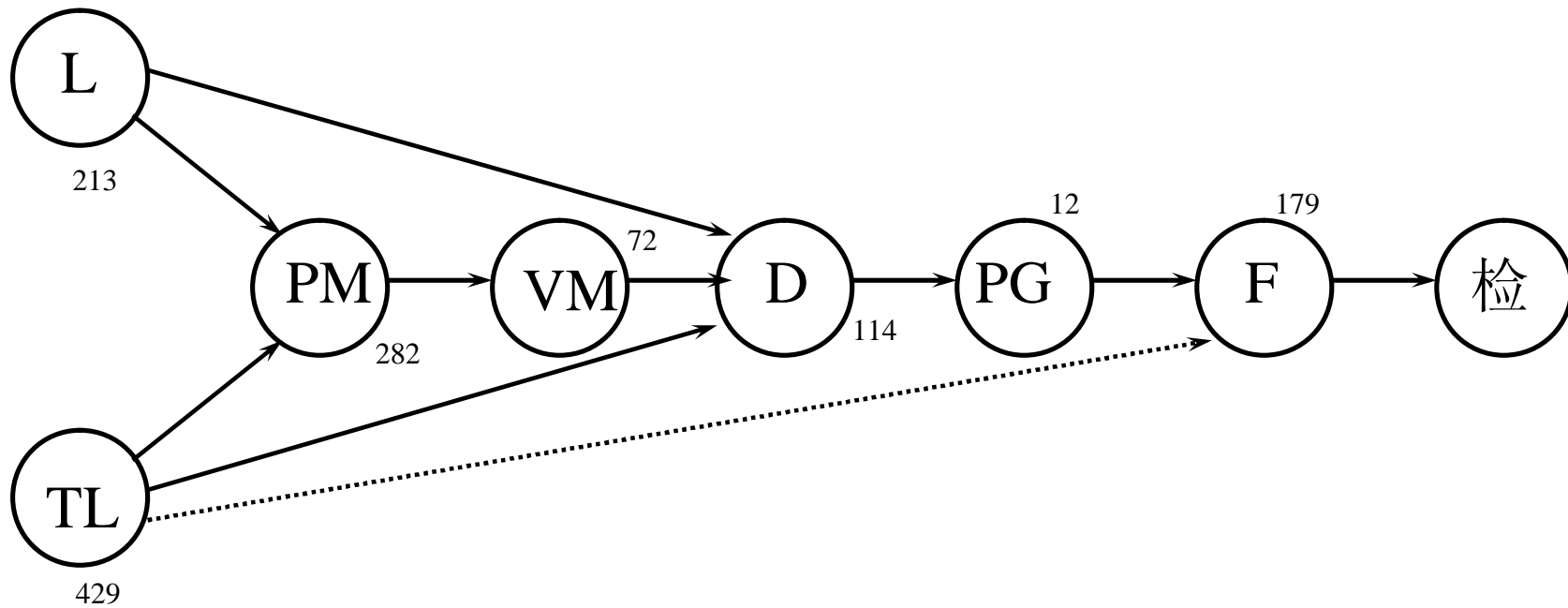
	L	TL	PM	VM	D	检	CA、H	PG	IG	F	检
(1)	1		2		3					4	5
(2)		1			2					3	4
(3)	1				2			3		4	5
(4)		1								2	3
(5)	1			2	3	4	5	6		7	8
(6)		1	2	3	4					5	6
(7)	1				2	3	4				
		5									
			6				7	8	9		10
(8)	1				2	3					
			4								
						5				6	7



根据线路图归类:

	L	TL	PM	VM	D	检	CA、H	PG	IG	F	检	
1	(1)	1		2		3				4	5	
	(3)	1				2		3		4	5	
2	(2)		1			2				3	4	
	(6)		1	2	3	4				5	6	
	(4)		1							2	3	
3	(5)	1			2	3	4	5	6		7	8
	(7)	1				2	3	4				
			5									
					6			7	8	9		10
	(8)	1				2		3				
					4							
							5			6	7	

按类似工序1、2的流程进行布置整合：





3, 按搬运距离进行平面布置设定



FROM TO CHART

达到 出发	1	2	3	4	5	6	7	回数 重量
1		B 1	A, D 1, 2(3)					3 4
2				C 2	B 1			2 3
3				A 1		A, D 1, 2(3)	B 1	4 5
4			A 1		C 2		C 2	3 5
5			B 1	C 2				2 3
6							D 2	1 2
7						D 2		1 2
回数 重量		1 1	4 5	3 5	2 3	3 5	3 5	16 24



正行

逆行

合计

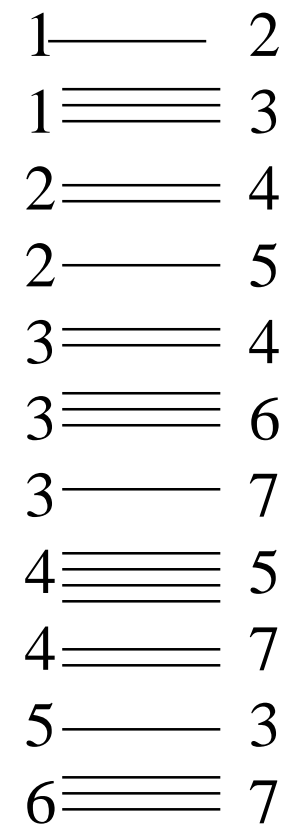
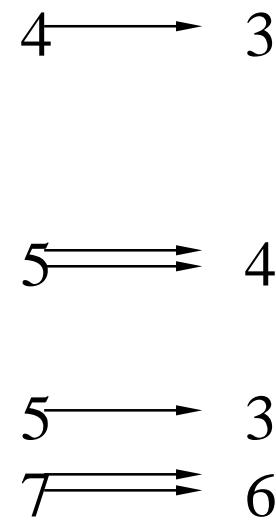
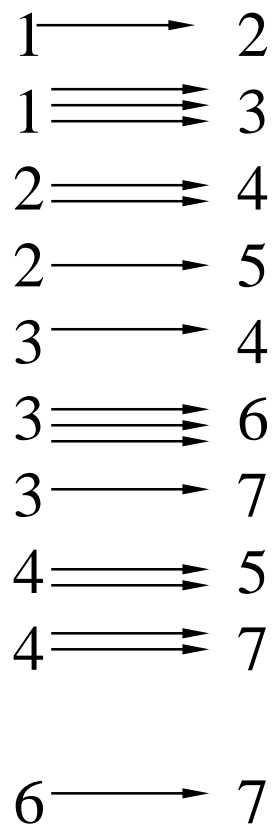
线数表示搬动次数或产量:

例:

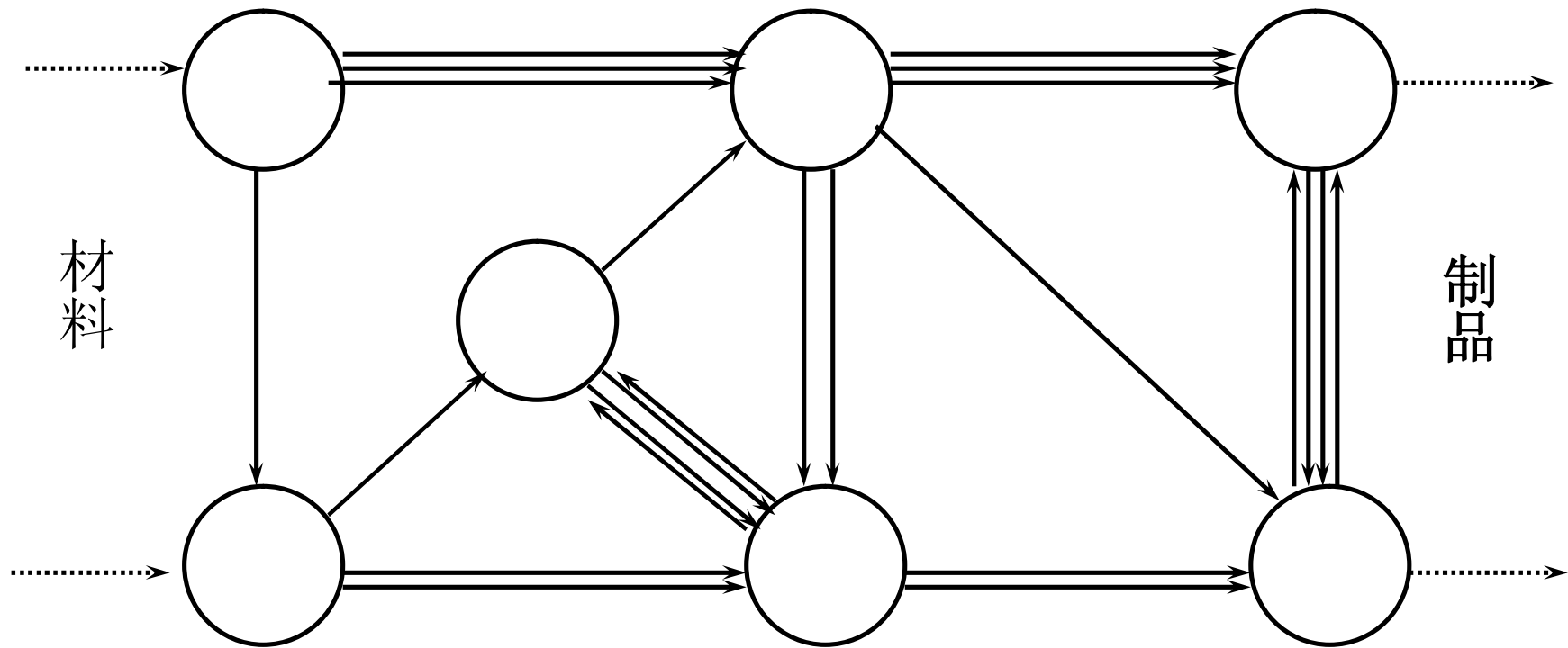
每1000只 ——

或:

每搬一次 ——



布局设定:





Plant, Machine & Office Layout

工厂，机器和办公室布局

Benefits 效益

- **Permits Immediate Feedback on Quality Problems**
即时反馈质量问题
- **Reduces Scrap and Obsolescence** 减少废品和过时产品
- **Saves Space and Investment in Material Handling and Capital Equipment**
材料处理和设备投资中，节省占地面积，节省投资
- **Provides Greater Flexibility** 更具灵活性
- **Eliminates Waste** 消除浪费
- **Improves Responsiveness to Customer Requirements**
对用户需求反应更敏捷