

PLANT AND WORKSHOP LAYOUT



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INTRODUCTION

In a manufacturing organization, a job to be manufactured spends most of the time in moving and waiting.



For reduction of this moving and waiting time of jobs/parts, it is necessary to have proper layout and proper scheduling procedure

INTRODUCTION

- Plant layout specifies the **position** of the **overall arrangement** of the **various facilities** such as equipments, material, manpower, materials handling, service facilities, and passage required to facilitate efficient operation of production system of the plant **within the area** of the site selected previously.

INTRODUCTION

- Workshop layout in manufacturing plant also forms an **integral part** of **factory planning** or plant layout.
- Plant layout **begins** with the **design** **the position** of the **factory building** and goes up to the **location** and movement of a **work table** of the machine.

INTRODUCTION

- All the manufacturing facilities such as equipments, raw materials, machinery, tools, fixtures, workers, etc. are given **a proper place** in each workshop of the manufacturing plant.



INTRODUCTION

- “Plant layout is such a **systematic** and **efficient functional arrangement** of various departments, machines, tools, equipment and other supports services of an industrial organization that will **facilitate the smooth processing** of the proposed or undertaken product in the **most effective, most efficient** and **most economical** manner in the **minimum possible time**”

INTRODUCTION

- In a best possible plant layout, material handling **and transportation is minimized** and efficiently controlled.
- **Bottlenecks** and points of congestions are **eliminated** so that the raw material and semi-finished goods move fast from one work station to another.

INTRODUCTION

- The primary goal of plant layout is to **maximize profits** by setting up the best possible arrangements of all plant facilities to the maximum advantage of reducing the cost of production of the proposed product.

OBJECTIVES OF GOOD PLANT LAYOUT

- The **main objectives** of a good plant layout involves **minimum material movement**, smooth flow of the product in the plant, **full utilization of the space of the plant**, provide adequate safety and satisfaction to the plant workers, evolve sufficient flexibility in the arrangement of the above factors so as to suit the minor future changes, if any and facilitates an effective supervision.

OBJECTIVES OF GOOD PLANT LAYOUT

- It helps to **integrate** all the above factors in such a way that the best compromise and coordination among them is achieved.
- The **movements of workers and manufacturing staffs** within the plant **are minimized**.
- **Waiting time** of the semi-finished and finished products should be **reduced** to the minimum.

OBJECTIVES OF GOOD PLANT LAYOUT

- **Working conditions** as far as possible should be **safer and better** for the satisfaction of the workers.
- There should **be full utilization** of **whole space** of the workshop and plant layout.
- The work methods and reduced production cycle times should be improved and the plant maintenance must be simpler.



IMPORTANT FACTORS FOR INSTALLATION OF A PLANT

- The important factors while planning for installation of plant include availability of space, power, water, raw material, good climatic conditions, good means of communication, ancillaries, low local taxes and similar other economic considerations, marketing facilities for the planned product, space for process disposal and skilled and unskilled labor locally.



IMPORTANT FACTORS FOR INSTALLATION OF A PLANT

- After finalizing the size and location of the plant, the next step is to design the inner layout of the plant to plan out the sequence of different shops and their locations accordingly to specifications of material and product, manufacturing processes, type of production, material handling facilities, system and facilities for storing, inter-dependability of one shop over the other, links among various shops, service facilities and lighting and ventilation.



IMPORTANT FACTORS FOR INSTALLATION OF A PLANT

- Next, the **internal arrangement** of the above mentioned infrastructural facilities of different shops are identified.
- This identification is termed as shop layout. The main factors namely size and type of equipment, number of **machines to be installed**, **floor area required for working on each machine**, power requirements for the machines, **requirements of factory services**, visibility to all the machines for proper supervision and control, **type of drive used**, safe working conditions, **provision of stores** within the shop



A good plant layout should meet the following basic requirement:

1. Integration of manufacturing centre facilities in terms of man, machine and material.
2. Movements of production personnel and material handling should be minimized.
3. Smooth and continuous flow of production or manufacturing work with least possible bottlenecks and congestion points.
4. Floor space utilization should be optimum as for as possible.



A good plant layout should meet the following basic requirement:

5. Working place should be free from pollution and safe working conditions should prevail in each shop of the plant.
6. The handling of raw material, semi finished and finished product should be tackled optimally and effectively
7. Plant layout and shop layouts must be flexible to facilitate changes in production requirements
8. There should be better working environment in term of proper light, ventilation and other amenities such as drinking water and toilets for welfare for the manufacturing personnel

MERITS OF A GOOD PLANT LAYOUT



The major merits of a good plant layout are given as under:

1. Reduced men and machine hours per unit of production,
2. Effectively and economical utilization of entire floor space of the plant,
3. Work flow is smooth and continuous
4. Work in process inventory is less
5. Production control is better
6. Manufacturing time is less
7. Relatively less floor area is required
8. Material handling is less.

TYPES OF LAYOUTS



Fixed or Position Layout



**Process or Functional
Layout**



Line or Product Layout

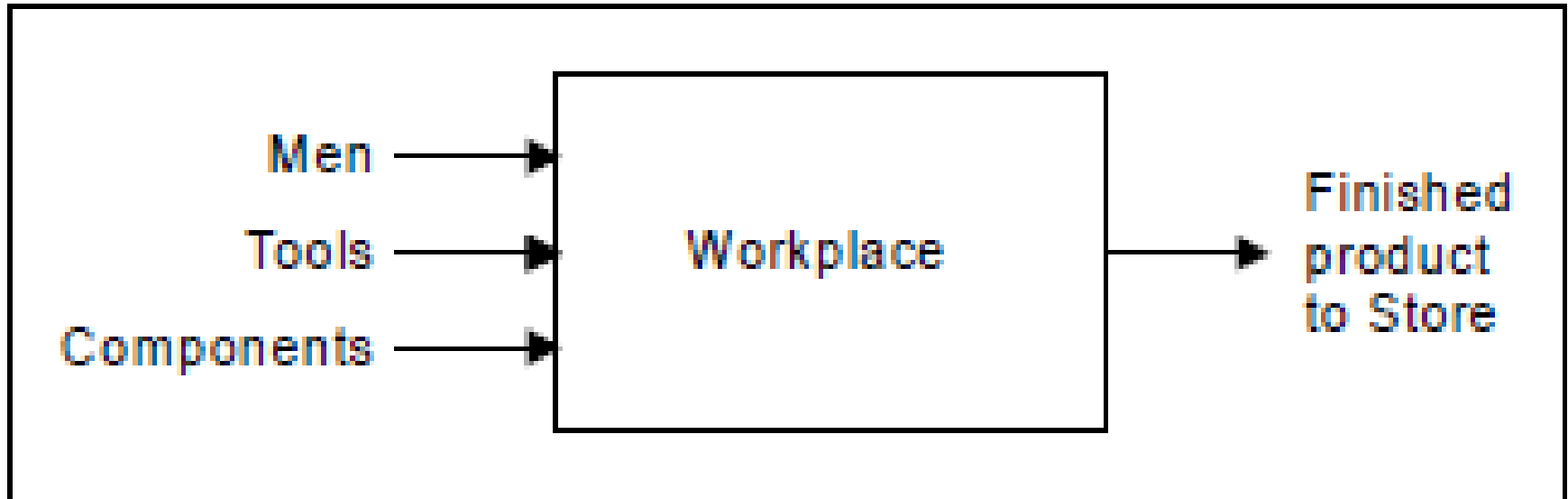


Combination Layout



Fixed or Position Layout

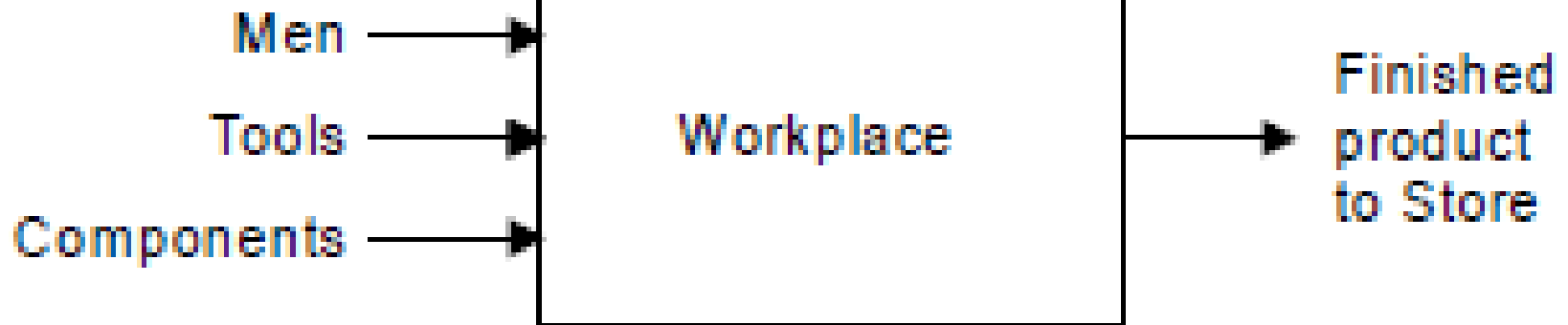
Fixed or position layout is also known as project layout. In this type of layout the **major part of an assembly** or material remains at a **fixed position**.





Fixed or Position Layout

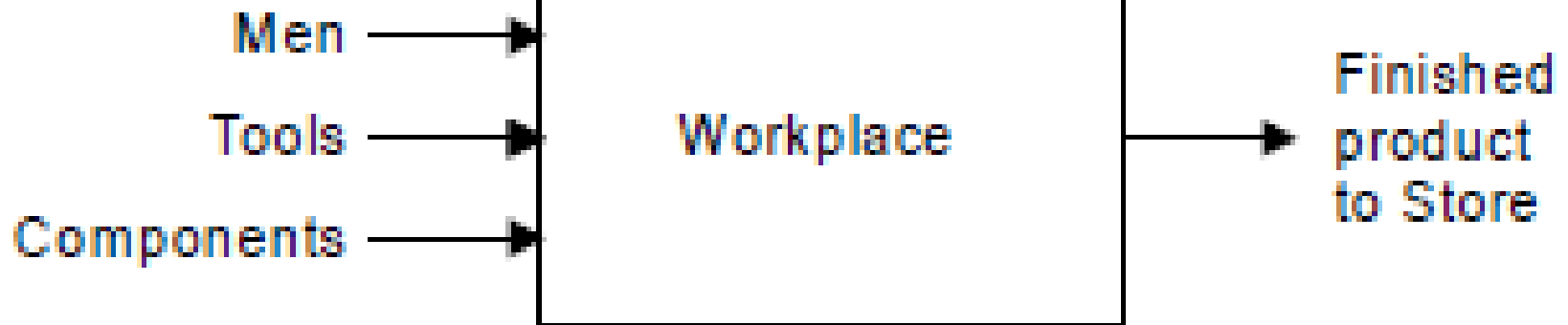
All its accessories, auxiliary material, machinery, equipment needed, tools required and the labor are brought to the **fixed site to work**. Thus, the product by virtue of its bulk or weight remains at one location.





Fixed or Position Layout

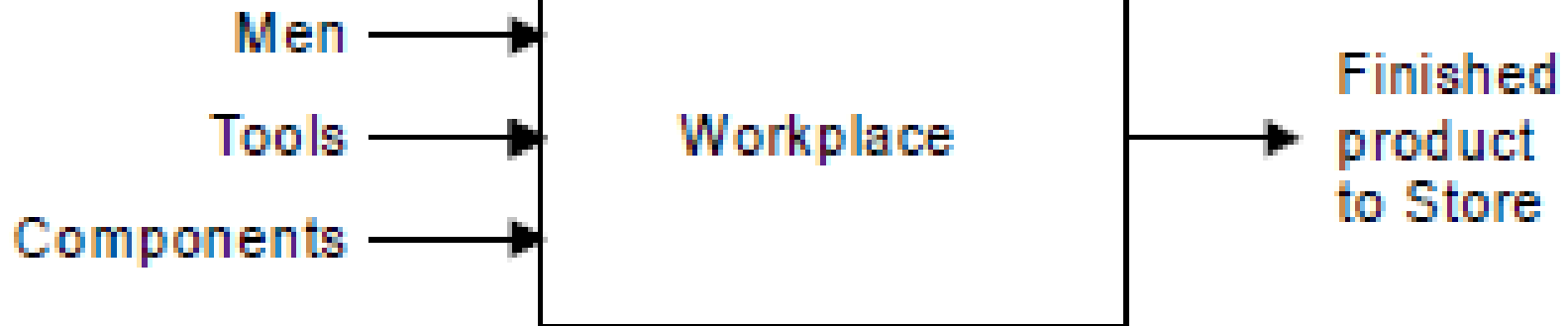
The location of the major assembly, semi assembly component and material is not disturbed till the product is ready for dispatch. This layout is suitable when one or a few pieces of an item are to be manufactured and material forming or treating operation requires only tools or simple machines.





Fixed or Position Layout

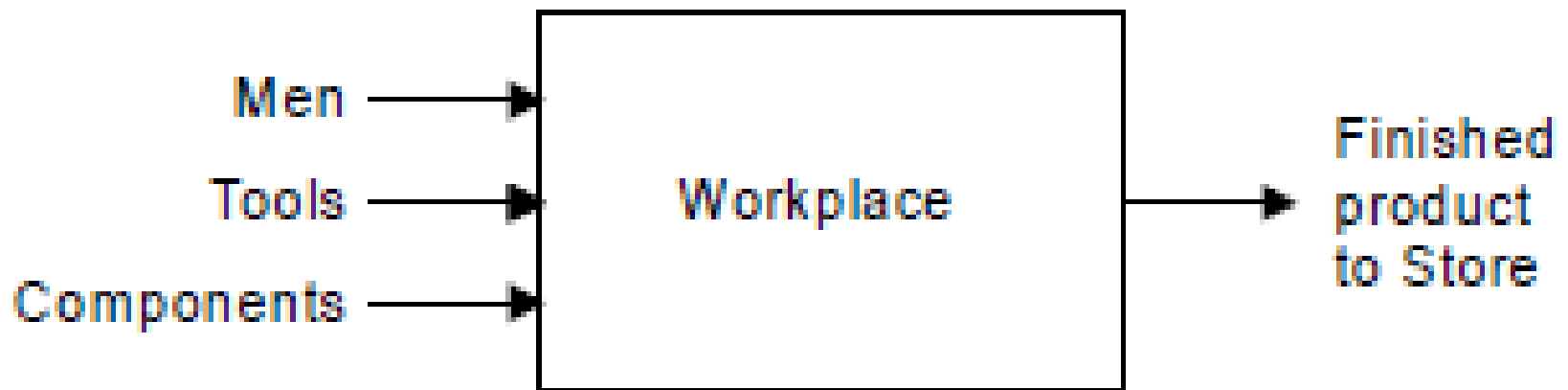
This layout is highly preferable when the cost of moving the major piece of material is high and the responsibility of product quality by one skilled workman or group of skilled workers is expected. This type of layout is mainly adopted for extremely large items manufactured in very small quantity such as ships, aero planes, boilers, reactors etc.





Fixed or Position Layout

Its main merit of this layout is the minimum movement of men, material, and tooling during manufacturing process. This layout is highly flexible as the type of product and the related processes can be easily changed without any change in the layout.





Fixed or Position Layout

Its main merits are—

1. Layout is highly flexible for varieties of products having intermittent demand as the type of product and the related processes can be easily altered without any change in the layout.
2. There is a minimum movement of men, material, and tooling during manufacturing process.
3. The material is drastically reduced.
4. Highly skilled operators are required to complete the work at one point and responsibility for quality is fixed on one person or the assembly crew.
5. Every personnel of manufacturing team is responsible for quality work for manufacturing the product.



Fixed or Position Layout

Demerits

The major demerits of this layout are

1. The cost of equipment handling is very high.
2. Labors and equipments are difficult to utilize fully.
3. It is limited to large items only.

Applications

This type of layout is mostly adopted for extremely large items manufactured in very small quantity such as ships, aero planes, aircraft, locomotive, ship assembly shops, shipyards, boilers, reactors etc.

TYPES OF LAYOUTS



Fixed or Position Layout



Process or Functional
Layout



Line or Product Layout

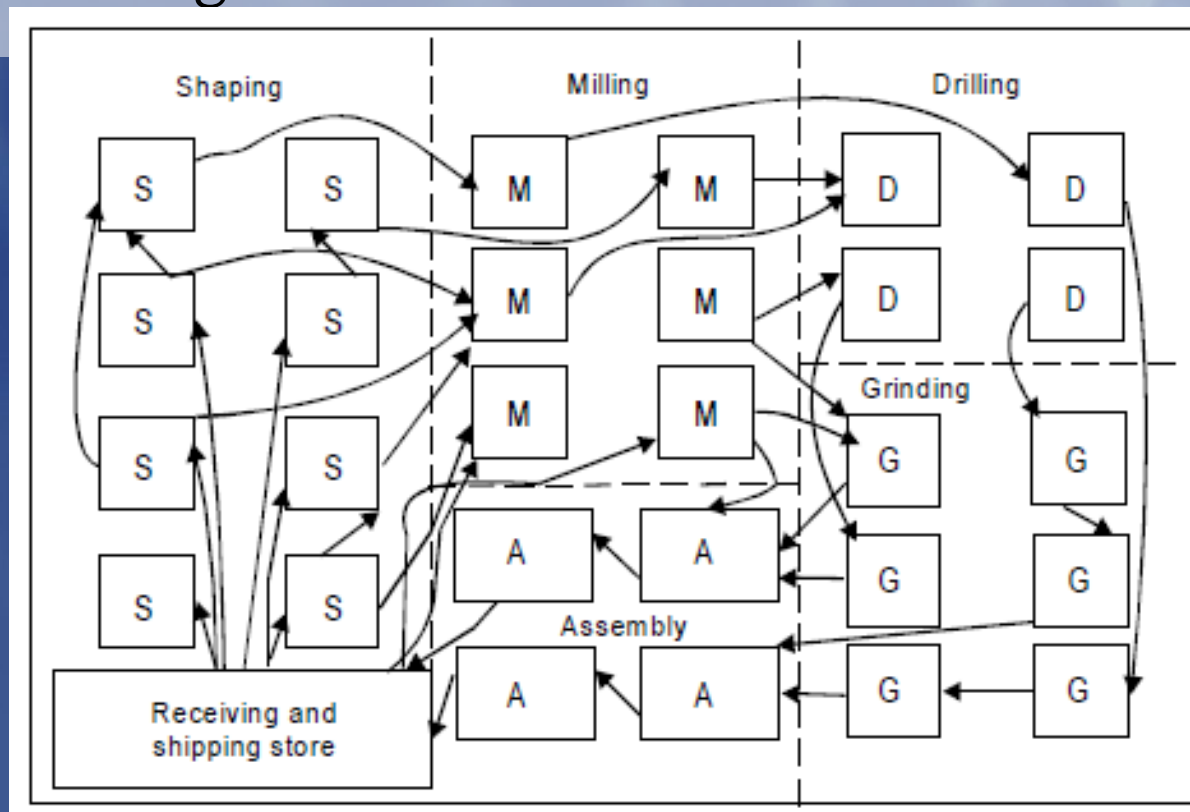


Line or Product Layout

Process or Functional Layout



In this type of layout arrangements of similar machines, production facilities and manufacturing operations are grouped together according to their functions.

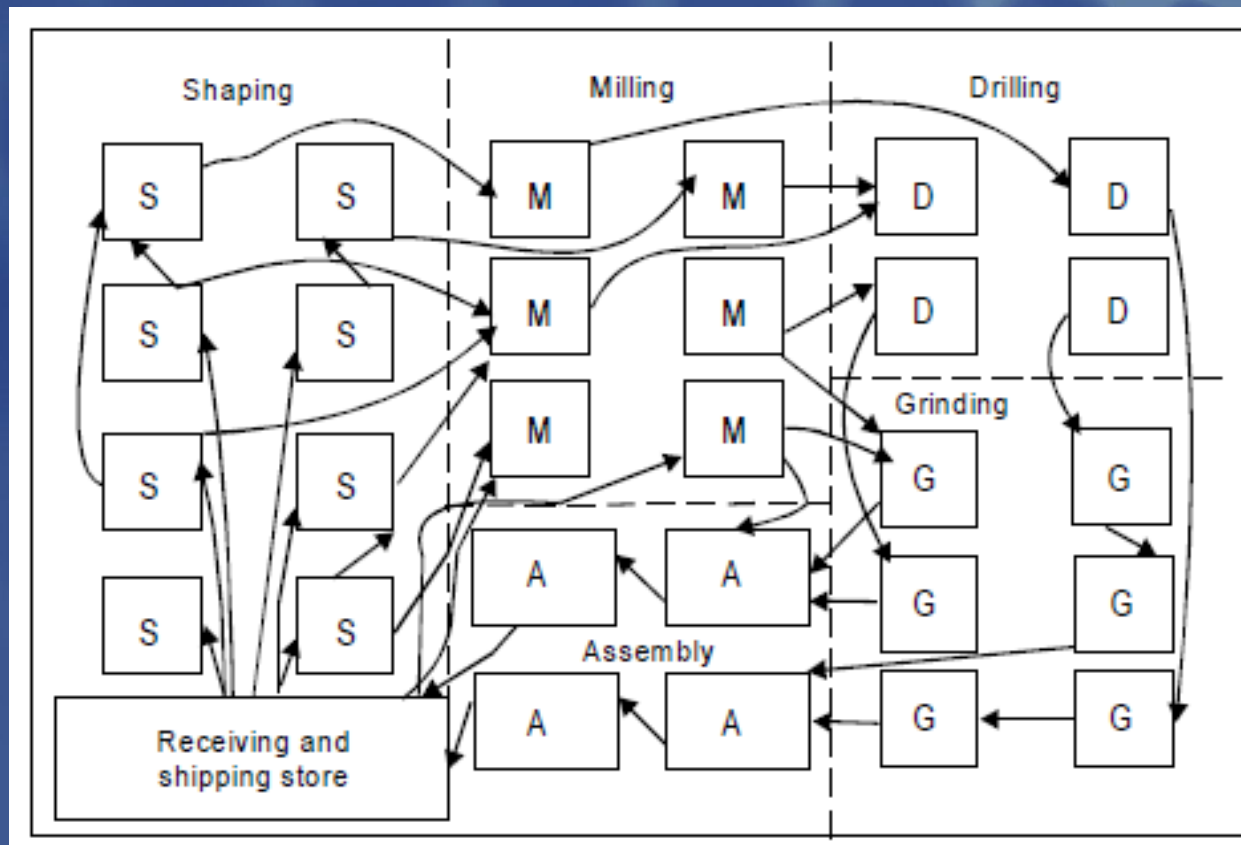


Process or Functional Layout

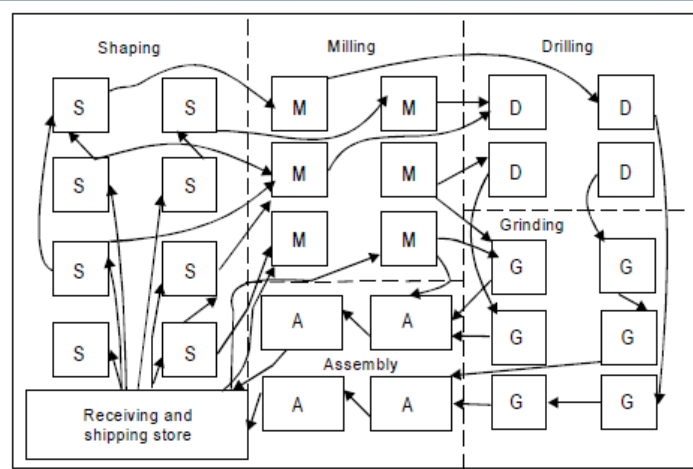


Application

1. This layout is used for batch or moderate production.
2. It specifies path for group technology.



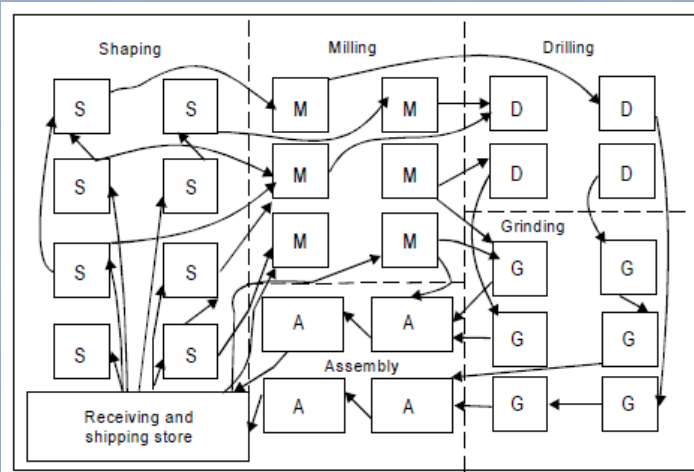
Process or Functional Layout



Machine tools of one kind are positioned together so that all the similar operations are performed always at the same place e.g. all the machines in one area for clothes may be grouped together for all

kinds of turning and threading operations, all drillingarrying out drilling work, all tapping machines in one area for carrying out tapping work, all milling machines in one area for carrying out milling work all buffing and polishing machines at one place for carrying out surface finishing work, and so on.

Process or Functional Layout



This type of layout is normally preferred for the industries involved in job order type of production and manufacturing and/or maintenance activities of non-repetitive type.

This layout needs not to have to be changed every time of the product or component changes. Also the breakdown of any machine does not affect the production. This type of layout is highly suitable for batch production.

Process or Functional Layout



Merits

The major merits of this layout are :

1. There exists a wide flexibility regarding allotment of work to equipment and workers.
2. There is a better utilization of the available equipment.
3. Comparatively less numbers of machines are needed in this layout and hence thus reducing capital investment.
4. There is an improved product quality, because the supervisors and workers attend to one type of machines and operations.
5. Varieties of jobs coming as different job orders thus make the work more interesting for the workers.
6. Workers in one section are not affected by the nature of the operations carried out in another section.

Process or Functional Layout



Demerits

The major demerits of this layout are :

1. This layout requires more space
2. Production control becomes relatively difficult in this layout.
3. Raw material has to travel more which increases material handling and the associated costs.
4. This layout requires more efficient co-ordination and inspections.
5. Increased material handling cost due to more movement of process raw material to various paths
6. More material in process remains in queue for further operations.
7. Requires large in-process inventory.
8. Completion of same product takes more time.

TYPES OF LAYOUTS



Fixed or Position Layout



**Process or Functional
Layout**



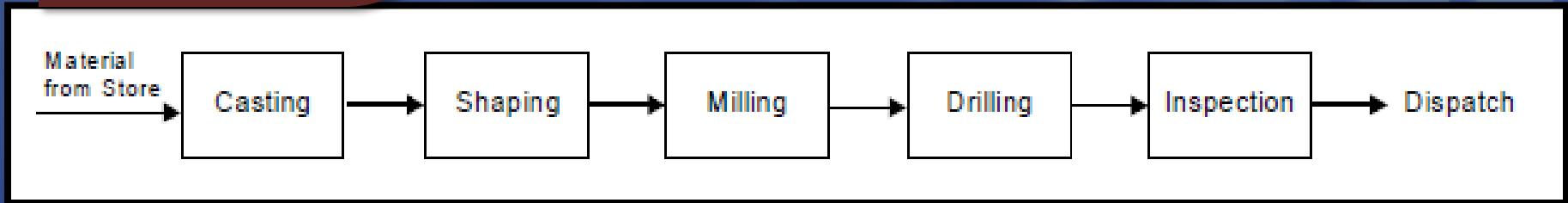
Line or Product Layout



Line or Product Layout



Line or Product Layout



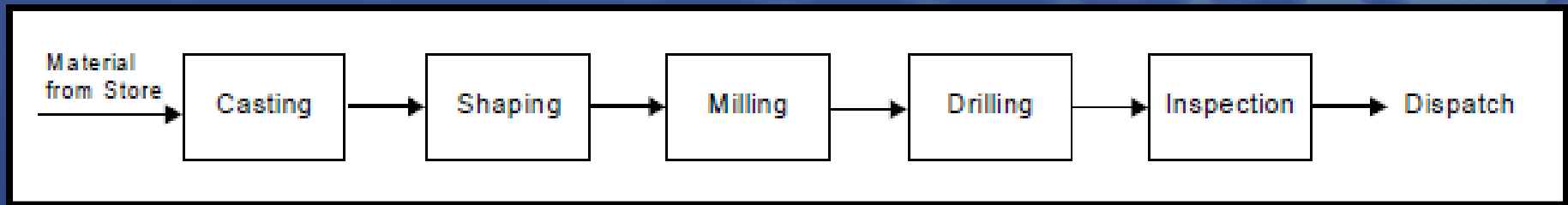
This layout implies that various operations on raw material are performed in a sequence and the **machines are placed along the product flow line**, i.e., *machines are arranged in the sequence in which the raw material will be operated upon.*

Applications

It is used in assembly work.



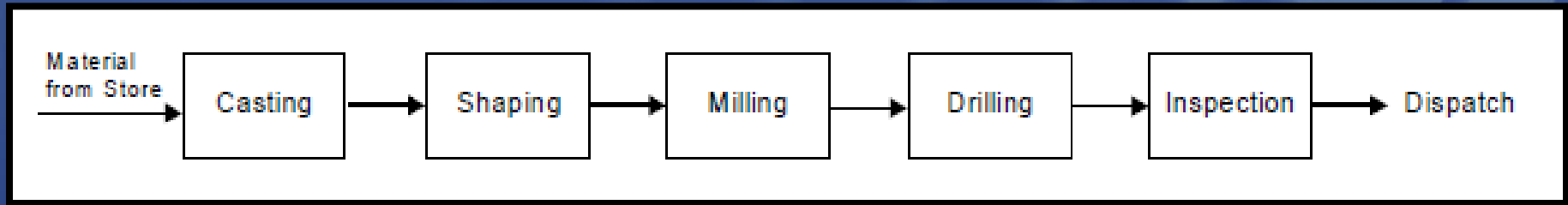
Line or Product Layout



In this type of layout all the machines are placed in a line according to the sequence of operations, i.e., each following machine or section is arranged to perform the next operation to that performed by its preceding machine or section.



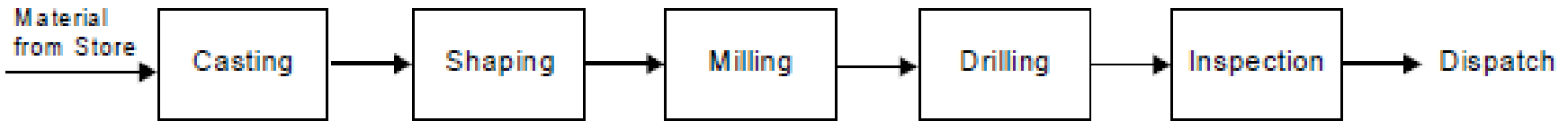
Line or Product Layout



In this layout raw material starts from one end of production lines and moves from one machine to next along a sequential path. **Line layout is advantages in the continuous-production system** where the number of end products is small and the **parts are highly standardized and interchangeable.**



Line or Product Layout



It is suitable for products having **steady demand**. This layout may have operational sequence namely forging, turning, drilling, milling, grinding and inspection before the product is sent to the finished goods store for packing and shipment.

This layout is used for **mass production** and **ensures smooth flow of materials** and reduced material handling. Breakdown of any machine in the line in this layout may result in even stoppage of production.



Line or Product Layout

Merits

1. It involves smooth and continuous work flow.
2. It may require less skilled workers
3. It helps in reducing inventory.
4. Production time is reduced in this layout.
5. Better coordination, simple production planning and control are achieved in this layout.
6. For the same amount of production, less space requirements for this layout.
7. Overall processing time of product is very less.
8. This layout involves automatic material handling, lesser material movements and hence leads to minimum possible cost of manufacturing.



Line or Product Layout

Demerits

The major demerits as compared with process layout are—

1. It is very difficult to increase production beyond the capacities of the production lines.
2. When single inspector has to look after many machines, inspection becomes difficult
3. This layout is very less flexible for product change.
4. The rate or pace rate of working depends upon the output rate of the slowest machine and hence leading to excessive idle time for other machines if the production line is not adequately balanced.
5. Machines being put up along the line, more machines of each type have to be installed for keeping a few as stand by.

TYPES OF LAYOUTS



Fixed or Position Layout



**Process or Functional
Layout**



Line or Product Layout

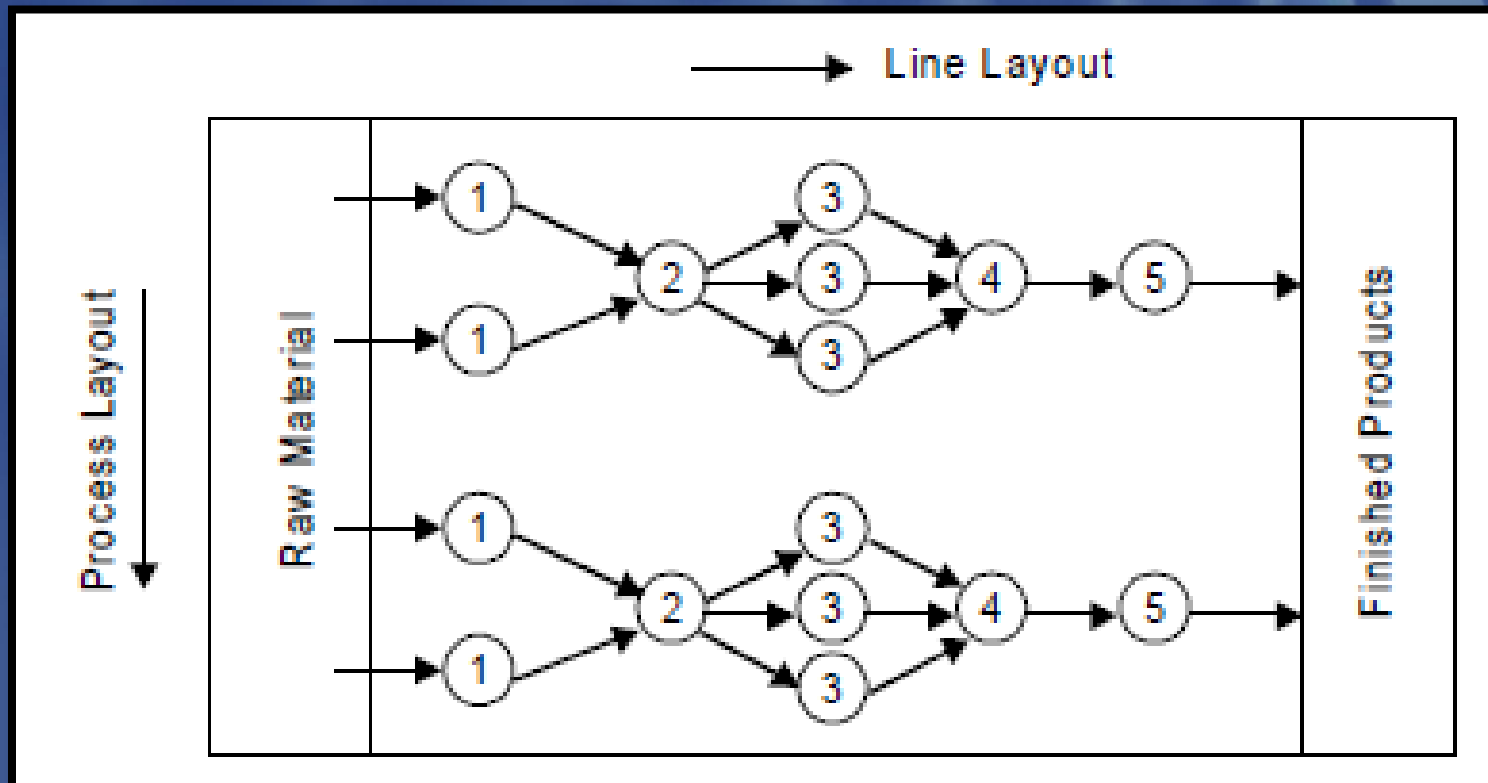


Combination Layout

Combination Layout



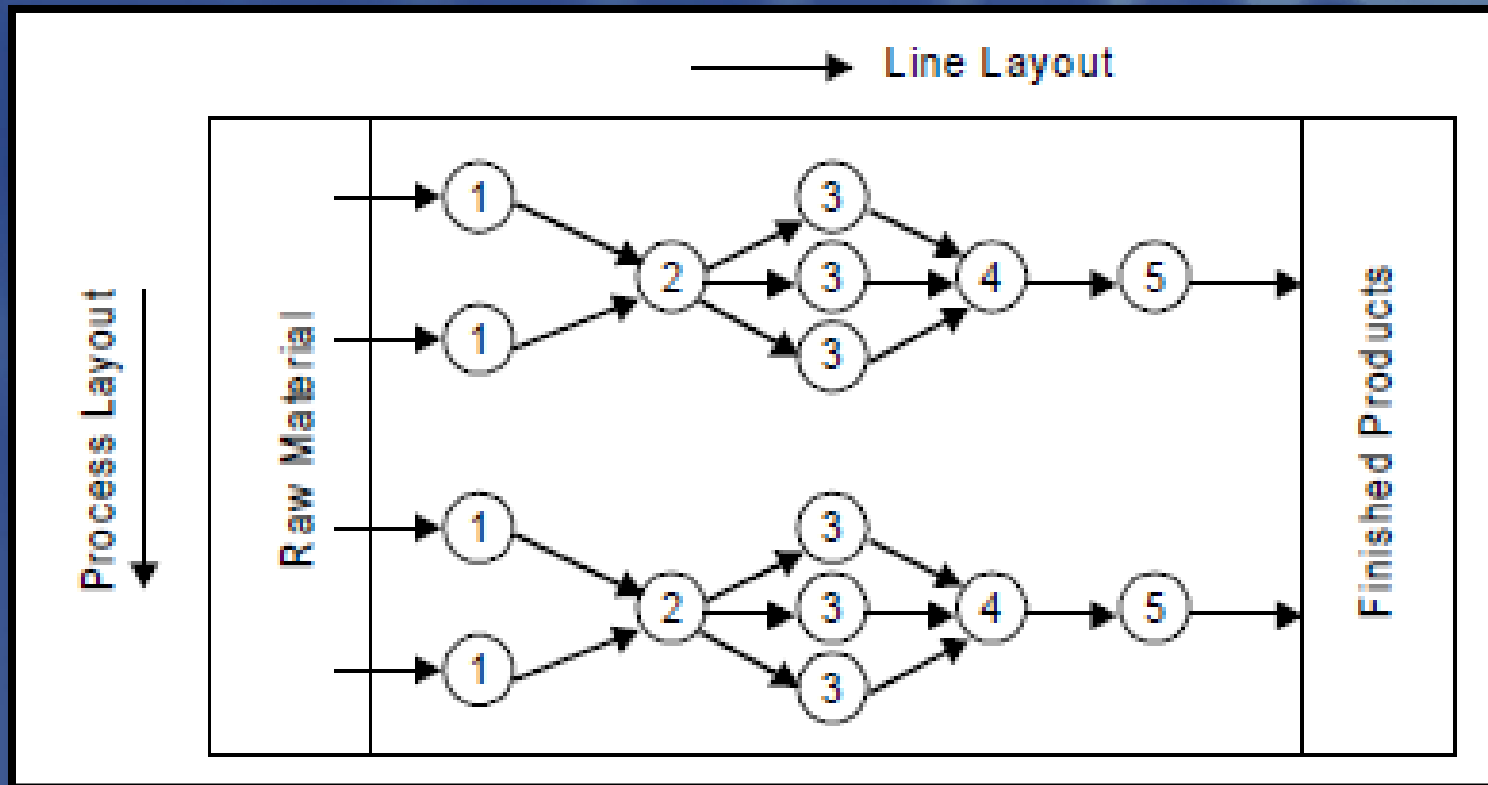
It is also known as group layout. A combination of process and product layouts combines the advantages of both types of layouts.



Combination Layout



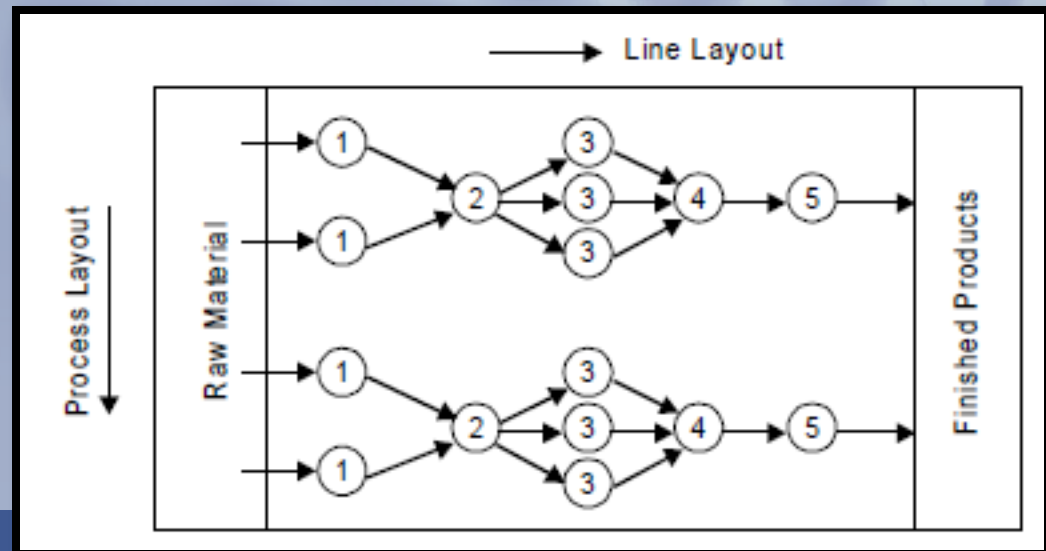
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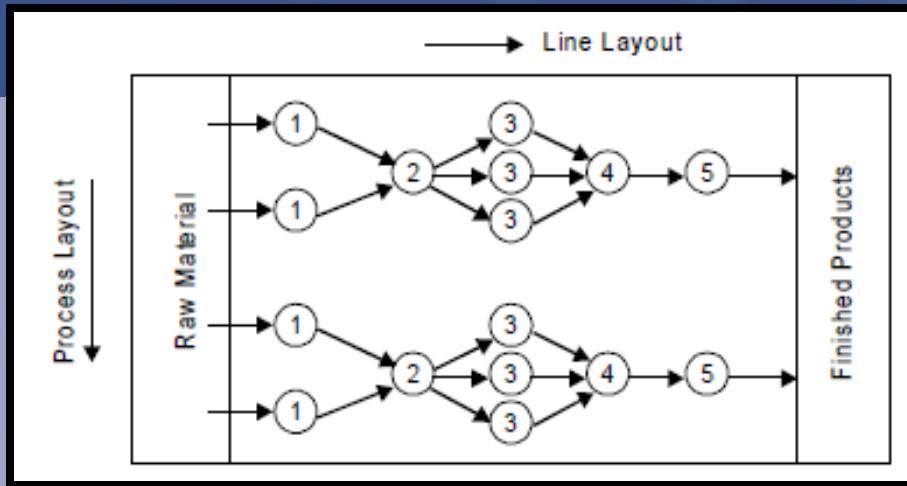
Combination Layout



These days, the most of manufacturing industries have adopted this kind of layout. In this type of layout, a set of machinery or equipment is grouped together in a section, and so on, so that each set or group of machines or equipment is used to perform similar operations to produce a family of components.



Combination Layout

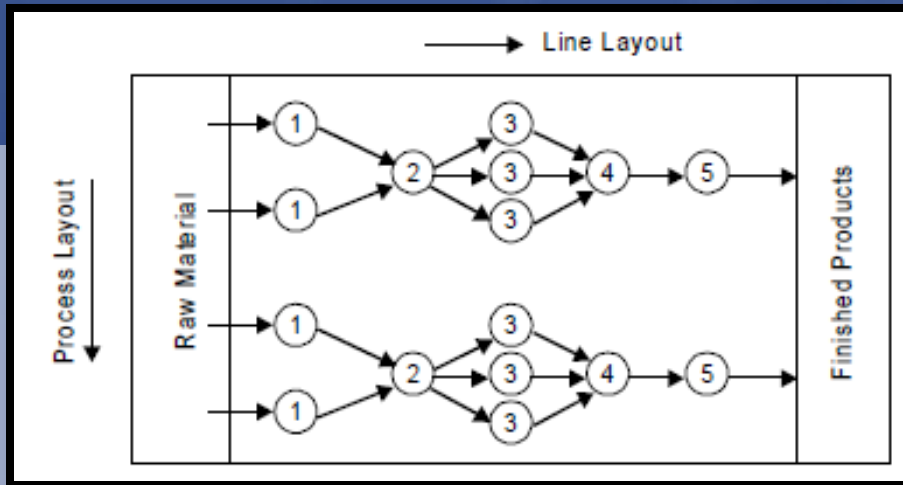


Merits

The merits of this type of layout are:

1. Reduction in cost of machine set-up time and material handling of metals.
2. Elimination of excess work-in-process inventory which subsequently allows the reduction in lot size.
3. Simplification of production planning functions, etc.

Combination Layout



Demerits

The major demerits of this layout are :

1. Change of the existing layout is time consuming and costly.
2. Inclusion of new components in the existing component requires thorough analysis.
3. Change of input component mix may likely to change complete layout structure.
4. Change of batch size may change number of machines.