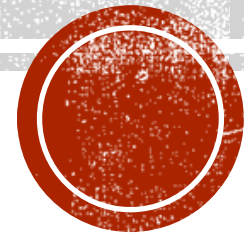


# PLANT LAYOUT

Er.Somesh Kr Malhotra  
Assistant Professor  
ECE Department, UIET



# INTRODUCTION

- Plant layout means the deposition of the various facilities(equipment, material, manpower,etc) and the services of the plant within the area of the site selected previously.
- Plant layout begins with the design of the factory building and goes upto the location and movement of the work table.
- All the facilities like equipment, raw materials, machinery,tools,fixtures,workers, etc are given a proper place.
- In deciding the place for equipment, the supervisor and workers who have to operate them should be consulted.



# OBJECTIVE OF GOOD PLANT LAYOUT

In a good plant layout

1. Material handling and transportation is minimised and efficiently controlled.
2. Bottleneck and point of congestion are eliminated so that the raw material and semi-finished goods move fast from one work station to another.
3. Work station are designed suitably and properly.
4. Suitable space are allocated to production centres and service centres.
5. The movement made by the workers are minimized.
6. Waiting time of the semi-finished products is minimized.
7. Working condition are safer, better(well ventilated rooms, etc.) and improved
8. There is increased flexibility for changes in product design and for future expansion.
9. There is the utilization of cubic space.
10. There are improved work methods and reduce production cycle time.
11. Plant maintenance is simpler.
12. There is increased productivity and better product quality with reduced capital cost.
13. A good plant layout permits materials to move through the plant at the desired speed with the lowest cost.



# PRINCIPLES OF PLANT LAYOUT

A few sound principles of plant layout have been briefed as under. They are the principle of:

1. **Integration:** It means the integration of production centres facilities like workers, machinery, raw material, etc., in a logical and balanced manner.
2. **Minimum movements and material handling:** The number of movements of workers and materials should be minimized. It is better to transport materials in optimum bulk rather than in small amounts.
3. **Smooth and continuous flow.** bottlenecks, congestion points and back tracking should be removed by proper line balancing techniques.
4. **Cubic space utilization:** beside using the floor space of room, if the ceiling height is also utilise, more materials can be accomadated in the same room. Boxes or bags containing raw material or goods can be stacked one above the other to store more items in the same room. Overhead material handling equipments save a lot of valuable floor space.



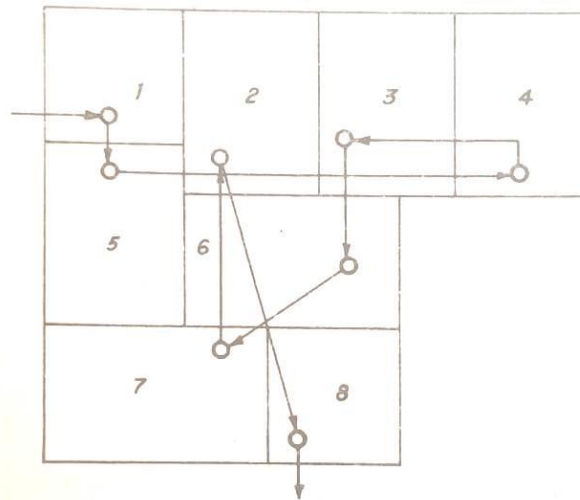
# PRINCIPLES OF PLANT LAYOUT

5. **Safe And Improve Environment:** Working place-safe, well ventilated and free from dust, noise, fumes, odours, and other hazardous conditions decidedly increase the operating efficiency of the workers and improve their morale. All this leads to satisfaction amongst the worker and thus better employer-employee relations.
6. **Flexibility:** In automotive and other industries where models of products change after some time, it is better to permit all possible flexibility in the layout. The machinery is arranged in such a way that the change of the production process can be achieved at the least cost of disturbance.



# PROCESS LAYOUT

- It is also known as functional layout and is characterised by keeping similar machines or similar operations at one location (place). In other words, all lathes will be at one place, all milling machines at another and so on, that is machines have been arranged according to their functions. This type of layout is generally employed for industries engaged in job order production and non-repetitive kind of maintenance or manufacturing activities. Fig below shows process layout.



1. Store room
2. Inspection department
3. Broaching section
4. Milling section
5. Lathe section
6. Shaper section
7. Drill section
8. Stock room.

Fig. 4.1. Process layout showing product movements.



# PROCESS LAYOUT

## Advantage:

1. Wide flexibility exists as regards allotment of work to equipment and workers.
2. Better utilization of the available equipment.
3. Comparatively less number of machines are needed, thus involving reduced capital investments.
4. Better product quality, because the supervisor and worker attend to one-type of machines and operations.
5. Varieties of jobs coming as different job orders make the work more interesting for the worker.
6. Workers of one section are not affected by the nature of the operation carried out in another section. For example, a lathe operator is not affected by the rays of the welding as the two sections are quite separate.



# PROCESS LAYOUT

## **Disadvantage:**

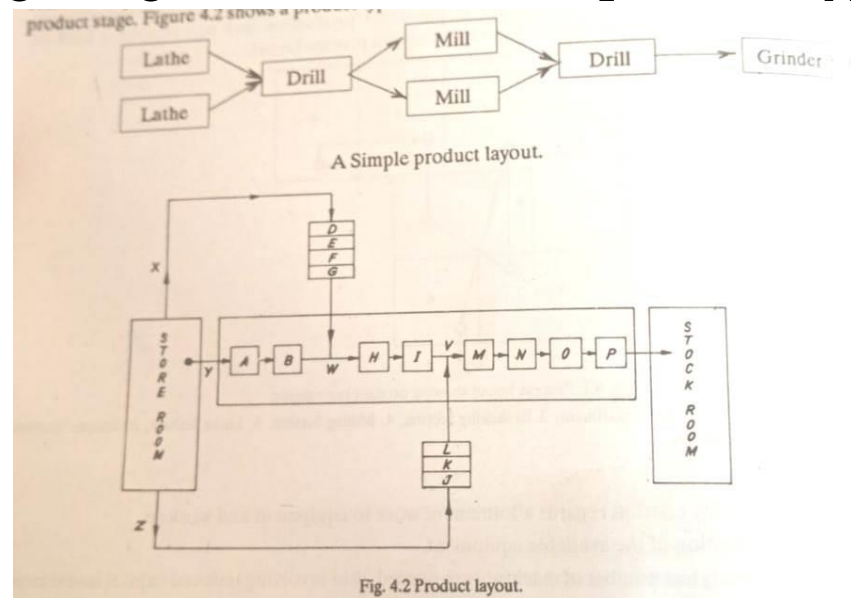
1. For the same amount of production, process layout needs more space.
2. Automatic material handling is extremely difficult.
3. More material-in-process remains in queue for further operations.
4. Completion of some product takes more time.
5. Work-in-process inventory is large.
6. Production control becomes difficult.
7. Raw material has to travel larger distances for being processed to finished goods. This increases material handling and the associated costs.
8. It needs more inspections and efficient co-ordination.





# PRODUCT LAYOUT

It is also known as line(type) layout. It implies that various operation on raw materials are performed in the sequence and the machines are placed along the product flow line ,i.e., machine are arranged in the sequence in which the raw material will be operated upon. This type of layout is preferred for continuous production,i.e., involving a continuous flow of in-process material towards the finished product stage. Fig below shows the product type of layout



# PRODUCT LAYOUT

- Raw material from the store is fed to three line X,Y, and Z. Material in X line get processed on machine D,E,F and G and meets material of Y line after it has been processed on the main assembly line machines A & B. Products of X and Y lines are assembled at W and get processed on machine H and I till another part come from Z line and assembles with the main product V. After the total assembly get worked on machine M,N,O and P and goes to the stock room.

## **Advantage**

1. Less space requirement for the same volume of production.
2. Automatic material handling, lesser material handling movement,times and costs.
3. Less in process inventory.
4. Product completes in lesser time.
5. Better coordination and simple production planning and control.
6. Smooth and continuous work.
7. Less skilled workers may serve the purpose.



# PRODUCT LAYOUT

## Disadvantage:

1. Since the product determine the layout, a change in product involves major changes in layout and thus the layout flexibility is considerably reduced.
2. The pace or rate of working depends upon the output rate of the slowest machine. This involves excessive idle time for other machine if the production line is not adequately balanced.
3. Machines being scattered along the line, more machine of each type have to be purchased for keeping a few stand by, because if one machine in the line falls, it may lead to shut down of the complete production line. This is how product layout involves higher capital investments.
4. Through it involves less supervision as compared to process layout, sometimes it (inspection) becomes difficult when one inspector has to look after many (say all welding) machines in two or more production lines.
5. It is difficult to increase production beyond the capacities of the production lines.



# COMBINATIONAL LAYOUT

A combination of process and product layouts combines the advantage of the both type of layouts. Moreover, these days pure product or process layout are rare. Most of the manufacturing sections are arranged in process layout with manufacturing lines occurring here and there (scattered) wherever the condition permit. A combination layout is possible where an item is being made in different types and sizes. In such cases machinery is arranged in a process layout but the process grouping is then arranged in a sequence to manufacture various type and size of products. The point to note is that, no matter the product varies in size and type , the sequence of operation remain same or similar. Fig below shows a combinational type of layout for manufacturing different sized gear.

A combinational layout is also useful when a number of item are produced in same sequence but none of the item are to be produced in bulk and thus no item justified for an individual and independent production line. For example, files, hacksaws, circular metal saws, wood saws, etc. can be manufactured on a combination type of layout.



# COMBINATIONAL LAYOUT

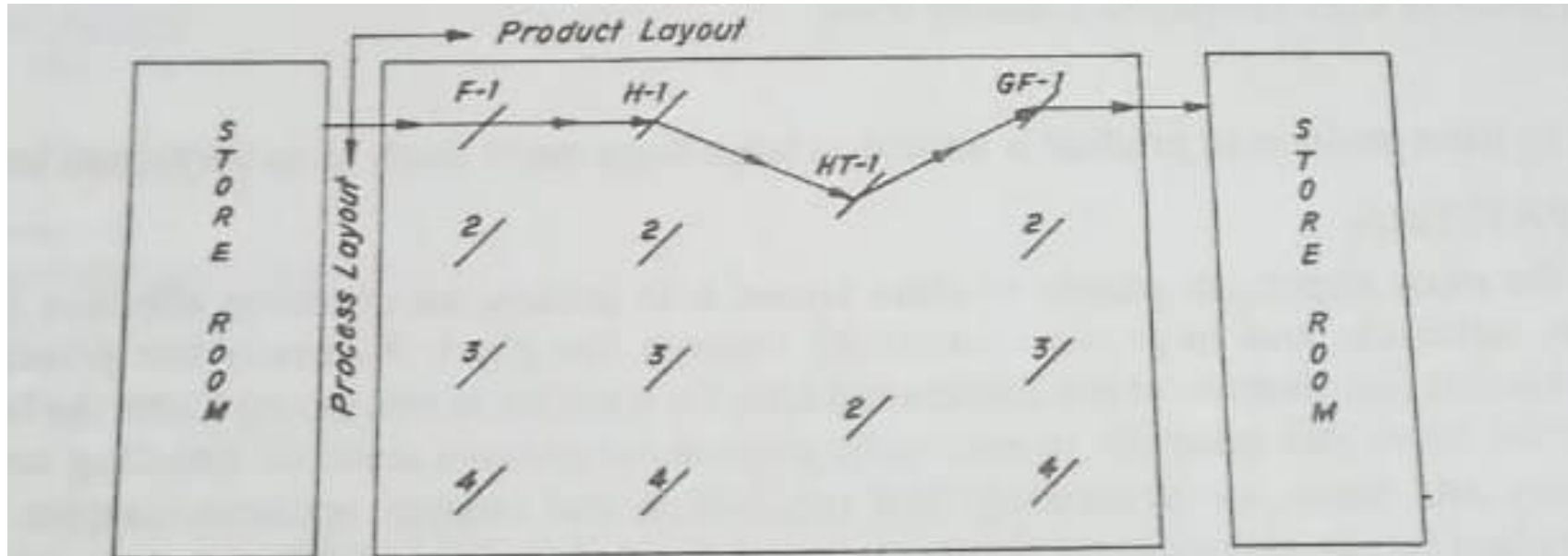


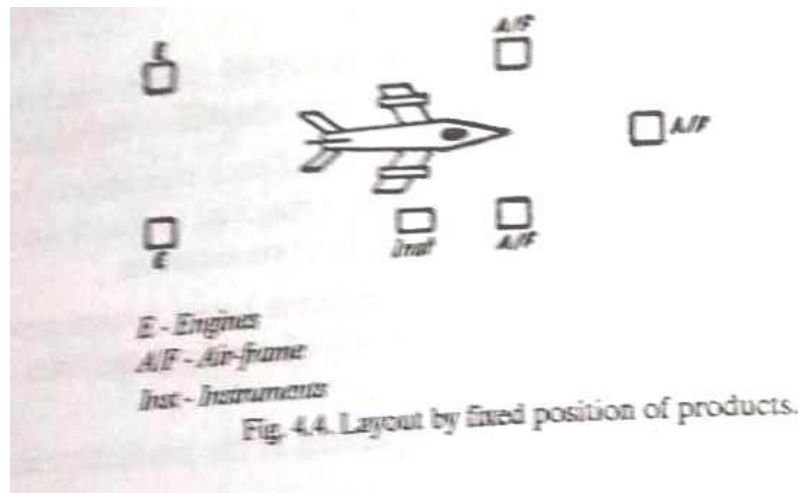
Fig. 4.3. A combination layout for making different types and sizes of gears.

- F* = Blank forging hammers.
- H* = Hobbing machines for cutting gear teeth.
- HT* = Heat treatment furnaces.
- GF* = Gear finishing machines.



# FIXED POSITION LAYOUT

- Layout by fixed position of the product is inherent in ship building ,aircraft manufacture and big pressure vessels farication.
- In other types of layouts discussed earlier,the product moves from past stationary production equipment, whereas in this case the reverse applies, men and equipment whereas in this case the reverse applies; men and equipments are moved to the material, which remains at one place and the product is completed at that place where the lies,



# FIXED POSITION LAYOUT

## Advantage

1. It is possible to assign one or more skilled workers to a project from start to finish in order to ensure continuity of work.
2. It involves least movement of materials.
3. There is maximum flexibility for all sorts of changes in product and process.
4. A number of quite different projects can be taken with the same layout.

## Disadvantage

1. It usually involves a low content of work in progress.
2. There appears to be low utilization of labour and equipment.
3. It involves high equipment handling costs.

