Plant Layout Restructuring of Brake Block Shop for Effective Production

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Abstract- *This paper aims to improve the plant layout of Composite Brake Block to eliminate excessive movement in material flow and thus obtain maximum productivity. The present plant layout and the operation procedure (i.e mixing, moulding, baking, inspection and packing) has been studied. The problem in term of material flow of each operation section was identified. A suitable new plant layout which can decrease the distance of material flow has been proposed.*

Keywords- plant layout, material flow, production.

I. INTRODUCTION

In industry sector, it is important to manufacture the products of desired Quality. This action could be conducted under existing resources such as employees, machines and other facilities. However, plant layout improvement, is one of the tools to improve productivity. Plant layout design has become a fundamental basis of today's industrial plants. It is needed to appropriately plan and position employees, materials, machines, equipments, and other manufacturing supports and facilities to create the most effective plant layout.

Yujieet al. [1] studied Systematic Layout Planning(SLP) method to design the overall layout of log yards, the result showed the good workflow and significant rearrangement of plant layout was made.

Jaturachatet al. [2] conducted Plant layout analysis and design for multiproduct line production and has obtained substantial benefits in productivity.[3]

Also, plant layout design is challenging due to many related factors such as employees, workflow, machine positions, and the relationship between machines and work. Moreover, investment is required for machine positioning. Hence, the primary step for plant layout improvement should be started with identifying the problems of the current plant layout in order to maximize the productivities at the minimized investment. An attempt has been made to decrease the material flow distance to enhance productivity.

II. PLANT LAYOUT PLANNING

Procedure for Plant Layout Design:

1. The fundamentals of plant layout was studied.
2. Machine details are collected.
3. The production process has been used in analysis.
4. The present plant layout was analyzed to identify the problem under flow material and operation.
5. The suggestions were collected to restructure the plant layout.
6. A modified layout was proposed considering the constraints.

2.1 Analysis of original plant layout

This work is based on Composite brake block production shop, where Brake blocks which are used in railway coaches are manufactured. This shop has has a layout designed based on Product layout as shown in fig 1.

This factory has been design the plantlayout based on process layout was shown in Fig. 1.

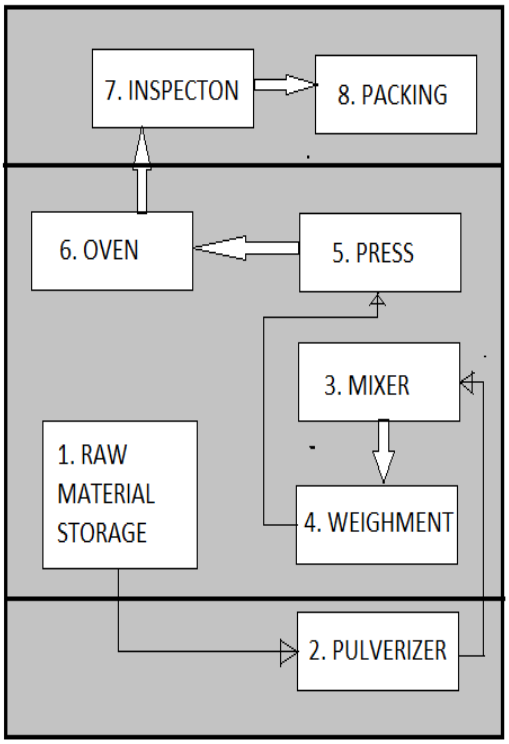

Fig 1: Block diagram of Existing Layout

Initially the individual components are powdered, mixed in proper proportions and molded. Then they are baked in oven, inspected and sent for packing. The Operational Sequence is shown in the above figure. The details of each section are described here. In additional the size and number of equipment has been shown in Table 1.

1. **Raw Material storage** is the area where individual components required for the production are stored at the required scale. The approximate area is 15 m2
2. **Pulverizer** is used to obtain the ingredients of the mixture in powdered form.
3. **Mixer** combines all the powdered ingredients fed in proper proportion.
4. **Weighing scale** is used to measure the mixture and then it is packed in separate packets so that it is ready for moulding.
5. **Press** Here the predetermined quantity of Composite mixture is fed into the die and then it is molded into the desired shape. Heat is applied in the process to obtain the solidified block. Later the blocks are ejected from the die and taken for hardening.
6. **Oven** The solidified blocks are fed into oven and baked
7. **Inspection:** The blocks are subjected to wear test at random
8. **Packing:** The accepted blocks are painted and then packed.

Table 1: Equipment area and succeeding distance for various operations.

Sl No	Equipment/ Location	No. of Machines	Total area(m^2)	Succeeding distance (m)	Material handling
1	Raw Material Storage	-	18	30	Trolley
2	Pulverizer	1	8	32	Trolley
3	Mixer	1	4	1	manual
4	Weighscale	1	8	4	manual
5	Press	6	24	4	Trolley
6	Oven	2	8	10	Trolley
7	Inspection	1	10	6	Manual
8	Painting and Packing	-	30	6	Trolley

2.2 Analysis for improvement in Plant Layout

1. **Raw Material Area:** The Raw Material storage area is at the convenient place situated in one corner of the shop and is near to the succeeding process. So the area doesn't need any relocation.
2. **Pulverizer:** Few raw materials which are in the form of solid blocks are sent to the Pulverizer to obtain the powdered form of the ingredient. The Equipment is placed at a far distance from the shop. The equipment is placed in an enclosed chamber as a safety issue. Also the pulverizer is located at a centralized position which is accessible for other departments. So there is a restriction in moving the equipment near to the shop. So it is not possible to minimize the material movement distance from storage to Pulverizer.
3. **Mixer and Weigh scale:** In the present layout the mixer is located nearing to the press. However the equipment can be relocated to a position where it is placed before the weigh scale. By this the flow is channelized for the succeeding process. Also there is a reduction in material movement distance.
4. **Press:** The hydraulic presses have been installed at proper location. So the material from the weigh scale is directed towards the press. No relocation is needed.
5. **Inspection apparatus and Packing:** Current layout has inspection apparatus placed away from the shop. It has been placed inside the laboratory. However there is a provision to move the apparatus inside the shop and place it next to the oven. The painting and packing area can be relocated inside the shop. By this material movement distance is substantially reduced.

Taking these factors into consideration, a modified layout has been proposed. The mixer and the Weigh scale have been relocated. Inspection apparatus has been placed immediately to the oven. Painting and Packing has been relocated adjacent to the testing apparatus. The proposed layout assumes a U-Form layout.

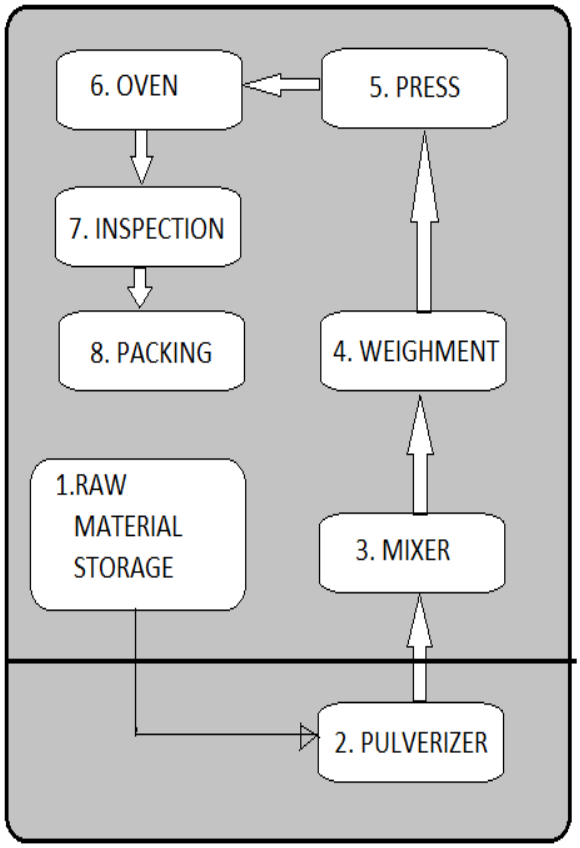

Fig 2: Block diagram of the proposed layout

Table 2: Equipment area and succeeding distance for various operations for the proposed layout

Sl No	Equipment/ Location	No. of Machines	Total area(m^2)	Succeeding distance (m)	Material handling
1	Raw Material Storage	-	18	30	Trolley
2	Pulverizer	1	8	31	Trolley
3	Mixer	1	4	1	manual
4	Weighscale	1	8	2	manual
5	Press	6	24	4	Trolley
6	Oven	2	8	4	Trolley
7	Inspection	1	10	4	Manual
8	Painting and Packing	-	30	4	Trolley

IV. CONCLUSION

In the proposed layout the material movement distance has been reduced from 93m to 80m. The hydraulically operated trolley movement from oven to Inspection area has been eliminated. Also the workflow has been made convenient. By rearranging layout time consumptionin flow of material has been decreased, resulting in an increase in productivity.

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