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Development of Multi Spindle Drilling Machine to Enhance the Productivity in Amba Stainless Steel Kitchen Trolley Manufacturer, Amravati

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Abstract: ***In India, the growth of manufacturing depends largely on its productivity. Productivity depends upon many factors, one of the major factors being manufacturing efficiency with which the operations are carried out in the industry. Productivity can be improved by reducing the total machining time, reducing manpower, reducing cost of machining, combining the operations etc. The best way to enhance the productivity along with quality is by development of special purpose multi spindle drilling machine. This paper deals with development of special purpose multi spindle drilling machine to enhance the productivity in Amba Stainless Steel Kitchen Trolley Manufacturer, M.I.D.C., Amravati.***

Keywords: Productivity, Multi spindle drilling machine, Manufacturing, Development, Amba Stainless Steel

1. Introduction

This paper discusses the case study and comparison of productivity of component using conventional drilling machine and special purpose machine. In today's market the customer wants the product of right quality, right quantity, right cost, & at right time. Therefore it is necessary to improve productivity [1]. One way to achieve this is by using multi spindle drilling machine. The most important aspect when using multi-spindle machines is the cycle time, due to parallel machining the total operating time is dramatically decreased. In this paper the following studies are carried out:

Time saved by component handling, Increase in productivity both qualitative and quantitative, less human intervention, indirectly reduction in manpower, Increase the profit of industry. Special purpose machine is the part of multi-tasking machine. This is new approach to increase the productivity of an organization. If we compare between conventional machine and special purpose machine in terms of time, costs, number of steps involved, etc., the special purpose machine is preferred choice. This paper also gives guidelines to the development of special purpose multi spindle drilling machine [2], [3].

2. Problem Definition

In the conventional manner only one drill can be drilled at a time, but with increase in productivity demands a special purpose machine is needed which will increase productivity by performing multiple operations in one cycle [2]. After the survey of complete manufacturing process it is noted that many of the components got rejected because of;

- Non uniform drilling.
- Poor finishing.

2.1 Solution of Problem

The Multi-spindle drilling machine is an ideal solution to the above problem which is used to perform fifteen drilling operations at a time. In the multi-spindle drilling machine fifteen spindles are driven simultaneously which carry fifteen dill chucks. The drill chucks can receive twist drills to perform the desired operation.

3. Methodology

The Multi spindle drilling machine requires various components, the major components are:

- Main frame made of rectangular section.
- Pneumatic cylinder
- Drills
- Motor and Shaft
- Base plate
- Gears and chain drive
- Directional Control Valve and PLC
- Resting fixture

Step-by-step process of implementing the project**:**

- Problem identification
- Defining the problem
- Conceptual design
- Selection of material and processes for machine
- Manufacturing
- Primary assembly of machine
- Trials
- Dismantling the machine
- Finishing required parts
- Final assembly
- Inspection
- Dispatch of machine

4. Multi spindle Drilling Machine

The three dimensional model of multi spindle drilling machine is shown in figure 1 which is used to drill stainless steel rod. The stainless steel rod is shown in figure 3 which is used to manufacture stainless steel kitchen racks. Operator will manually load the stainless steel rod on fixture and closes the door of machine. Then operator pushes the switch of the machine. Due to this motor starts which rotates the main shaft through chain drive. The main shaft is connected to the gearing system which rotates all the spindles attached to it. After this, the pneumatic cylinder pushes the gear box in the down word direction and fixes the stainless steel rod with fixture cap. Due to this the twist drills are also moved in the downwards direction and drilling is done at required position. Fifteen holes can be drilled at a time within seconds. After drilling the component, the pneumatic cylinders pushes back the gear box and also removes the fixture cap for unloading the component [4].

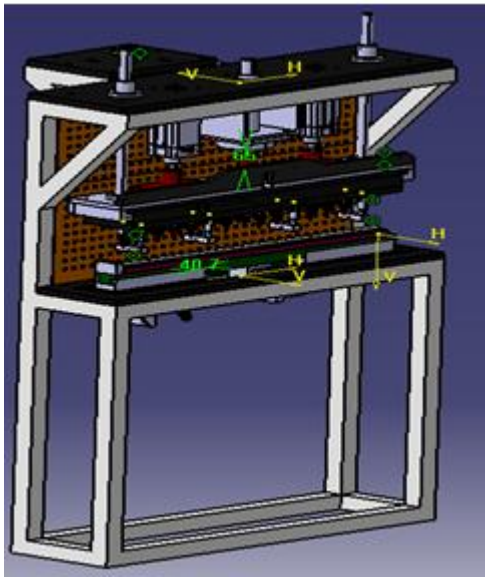

Figure 1: Multi Spindle Drilling Machine

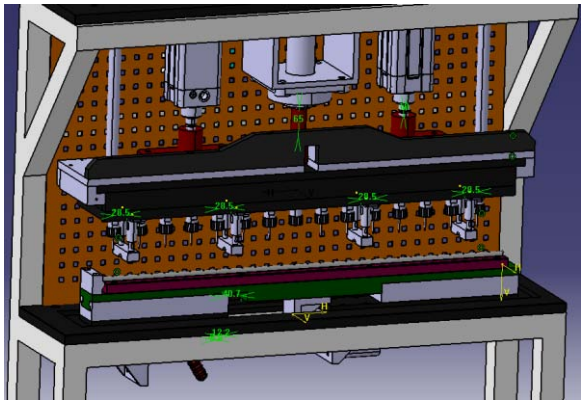

Figure 2: Close View of Multi Spindle Drilling Machine

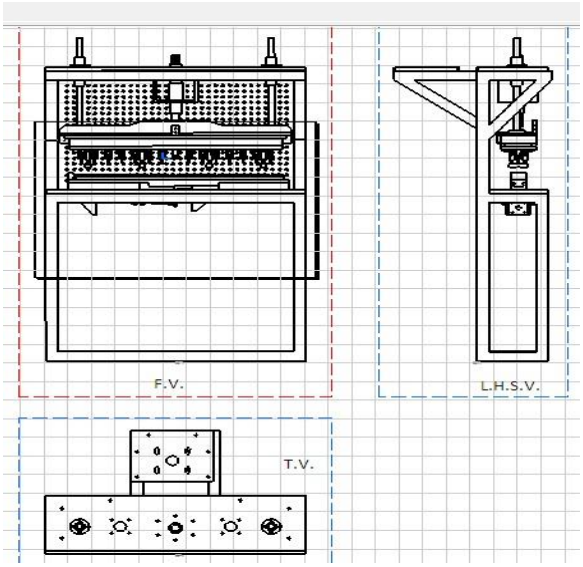

Figure 3: F.V., T.V., and L.H.S.V. of machine

Figure 4: Stainless steel rod

5. Results and Discussion

After the complete manufacturing of the machine, several trials were taken. In these trials it is found that the components are drilled out smoothly without leaving behind the burrs, an accurate and vibration free drilling operation is achieved. In results a drastic change is found in the parameters like cycle time, number of components drilled, number of operators required, finishing of the components. The final results are discussed in following table-

Table 1: Result Table [4]

Sr. No.	*Parameters*	*Before Automation*	*After Automation*
1	Cycle Time (Sec)	240	40
2	No. of Components Finished / month	4050	24,300
3	No. of Operators Required	5	1
4	Aesthetic Look and Finishing	Poor	Good

The following bar charts also shows the result-

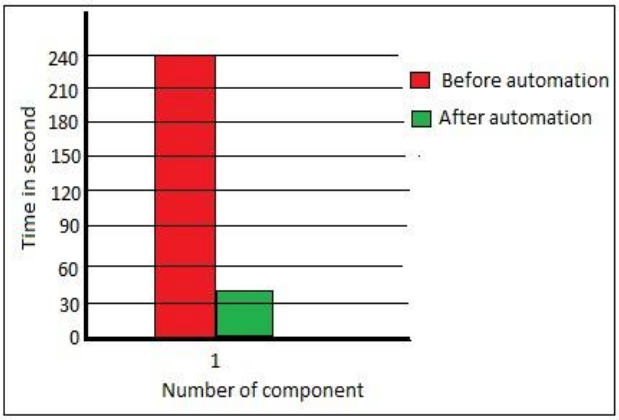

Figure 5: Bar chart showing cycle time required per component

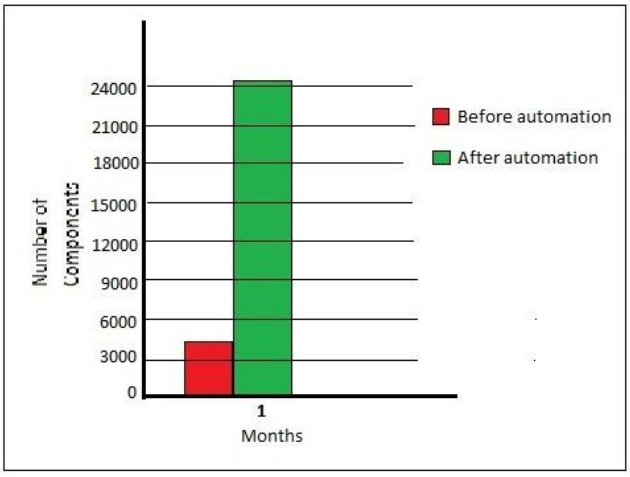

Figure 6: Bar chart showing no. of component finished per month

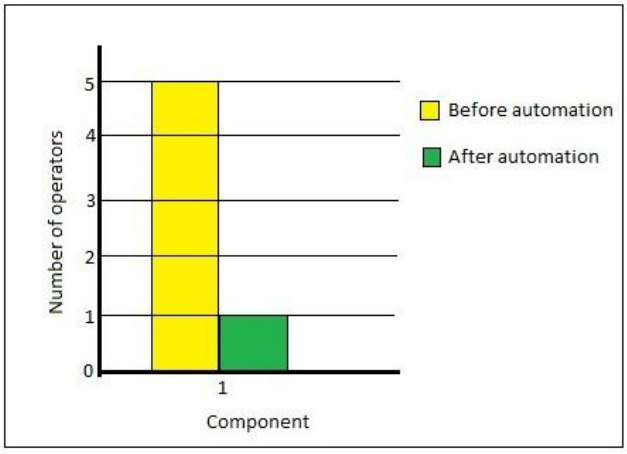

Figure 7: Bar chart showing operators required per component

6. Conclusion

With the help of this machine we can drill fifteen holes at a time. This study attempted to prioritize critical factors that influence organisation performance. Factors such as business competition and technology are supporting factor that enable organisation to enhance their competitiveness as well. The most critical factor is human resource [5]. The paper describes a special purpose machine which is capable of drilling the respective locations automatically. The paper can be concluded with major points such as the finished component looks aesthetically pleasant. Finally, we concluded that the developed machine is an important step towards fulfilling the need for the company.

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