

Design and fabrication of multispindle drilling machine

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Abstract- When I need a productivity increase. I make a special machine to production. In a drilling purpose I make special machine to done a job. It is an one type of drilling machine. It has two or more spindle to drilling process. The multi spindle drilling machine used to make a many number of holes at a time. If I needed I can rotate only a single spindle.. There are frequent needs of tightening and loosening screws, drilling, boring, grinding machine. Huge and complicated designed parts cannot be machined in ordinary machines. In a single machine all the above specified operations can be carried out, after drilling, the drill head is removed from the barrel key and the required tools like grinding application. By this we can achieve our industrial requirements and production targets. **Keywords:** Radial drilling machine, Drill Head, Productivity, Other operations.

I. INTRODUCTION

The main objective of my project is to perform more operation in single machine. I use a multi spindle in normal drilling machine. It is a one type of drilling machine. It has two or more spindle to drilling process. The multi spindle drilling machine used to make a many number of holes at a time. If I needed I can rotate only a single spindle. The growth of Indian manufacturing sector depends largely on its productivity & quality. Productivity depends upon many factors, one of the major factors being manufacturing efficiency with which the operation /activities are carried out in the organization. Productivity can be improved by reducing the total machining time, combining the operations etc. In case of mass production where variety of jobs is less and quantity to be produced is huge, it is very essential to produce the job at a faster rate. This is not possible if we carry out the production by using general purpose machines. The best way to improve the production rate (productivity) along with quality is by use of special purpose machine. Usefulness and performance of the existing radial drilling machine

will be increased by designing and manufacturing of multi spindle drilling head attachment. This paper deals with design and development of multi spindle drilling head for cycle time optimization of the component. Multi-spindle head machines are used in mechanical industry in order to increase the productivity of machining systems. Such machines are equipped by spindle heads that carry multiple tools for performing machining operations.

Methods of Multi spindle

- a) Movable Multi-Spindle Drilling Head: In this method the center distance between drilling spindle can be increased according to requirement.
- b) Fixed Multi-Spindle Drilling Head: In this process center distance cannot varies from its mean position.

Features

1. With the help of multi-spindle drilling heads, improving the productivity and time is minimized for multiple hole production.
2. Multi-spindle drilling giving the positional accuracy and very good precision.

1.1 LITERATURE REVIEW

Prof. Shingavi et.al. stated that the challenge of modern machining industries is mainly focused on the achievement of high quality, in terms of high production, less wear of cutting tools, economy of machining by considering cost saving and increase the performance of the product. With stiff competition and challenges in the present-day market, manufacturers are compelled to be more responsive to the customer's demands regarding right quality, right quantity, right cost, & at right time. Productivity can be improved by reducing the total machining time, combining the operations Productivity and performance of the existing drilling machine will be increased by Design & Fabrication of Multiple Spindle Drilling Head.1

Prof. M.B. Bankar- Studied Improvement in design and manufacturing of multiple spindle drilling attachment, in which they used planetary gear system for drilling operations. In this case study we briefly give information about design of drilling attachment for motor selection to its gear box. This study concludes that Multi spindle drilling attachment increase productivity reduces cycle of operation and performs drilling operation more accurately2

1.2 COMPONENTS USED

The components used in this multi spindle drill head are

1. Gears
2. Adjustable transmission systems (ATS)
3. Bearings
4. Top plates
5. Bottom plates
6. Drill chuck
7. Drill tool
8. Shank
9. Key
10. Shaft

II. DESIGN

Gear

Material of gear = EN 24

Consider diameter of gear (d) = 33 mm

Consider Module = 1 mm

No. of teeth = 33

From Lewis equation, $\sigma = \{Ft/(Cv \times b \times Y \times m)\}$

$$\sigma = \{370/(0.7102 \times 8 \times 0.3967 \times 1)\}$$

$$\sigma = 164.16 \text{ N/mm}^2$$

The induced stress value is 164.16 N/mm². This value of stress is very less as compared to yield stress of gear material. (680 N/mm²) Therefore designed gear is safe.

Spindle

Consider diameter of spindle = 16 mm

Material of spindle = Mild steel

$$P = 2\pi NT/60$$

$$T = (367.5 \times 60)/(2 \times \pi \times 720)$$

$$T = 4874 \text{ N-mm}$$

Consider 25% overload

$$T = 6092 \text{ N-mm}$$

$$D = \{(16/\pi \times \tau) \times K_t \times M_t\} 0.33$$

$$16 = \{(16/\pi \times \tau) \times 2 \times 6092\} 0.33$$

$$\tau = 15.14 \text{ N/mm}^2$$

The values of shear stress is 15.14 N/mm². This is very less as compare to yield stress of spindle material. (415 N/mm²) Therefore spindle design is safe.

Shaft

Material of Shaft = Mild Steel

Outer diameter of shaft = 14 mm

Inner diameter of shaft = 8 mm Torque transferred to the shaft = 6092 N-mm

For Shear Stress,

$$D_0 = \{(16/\pi \times \tau \times (1-K_4)) \times K_t \times M_t\}$$

$$0.33 \times 14 = \{(16/\pi \times \tau \times (1-0.5714)) \times 2 \times 6092\}$$

$$0.33 \tau = 25.31 \text{ N/mm}^2$$

The induced shear stress value is 25.31 N/mm². This value of shear stress is very less as compared to yield stress of shaft material. (415 N/mm²) Therefore designed shaft is safe.

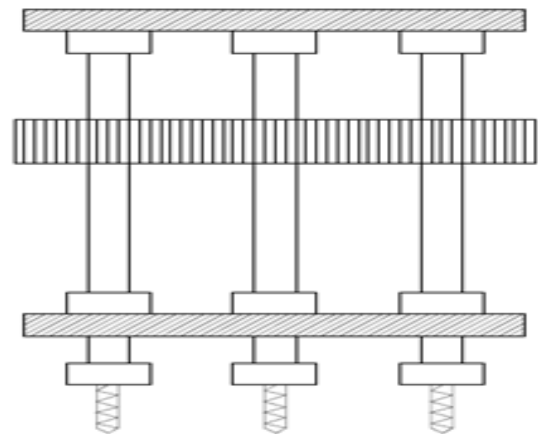


Fig 1 multispindle drilling Machine

3. CONCLUSION

The results obtained through analytical design calculations of the various parts of multi spindle drilling attachment are compared with the yield stress of that material for safe design. And static analysis is done which is compared with analytical results. Results shows the values of deformation, shear stress and equivalent stress and these values are below yield stress of the material. Therefore all the parts are safe under all the loading condition. In comparison of analytical and ANSYS results both results are close to each other. Hence by looking into this result stresses and deformation are within the limit therefore multi spindle drilling head attachment design is safe.

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