

Design and Fabrication of Multi Axis Drilling Machine

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Abstract- The industrial sectors greatly demands for productivity and quality. Productivity and quality, both should be maintained in order to endure in market. One of the key factor on which productivity depends is manufacturing competence with which the operation are carried out in some organisation. It can be increased by reducing the total machining time. The best method to improve the productivity along with quality is by use of special purpose machine. In the existing radial drilling machine performance can be increased by design and development of multi axis drill machine. In small scale industries and automobile maintenance shops, there are many needs of drilling multiple holes. In order to create multiple hole at certain distance at a same time than the usual method followed is changing the position of the workpiece in order to satisfy the hole position. The main disadvantage of altering the position of the workpiece is that it reduces the accuracy of the finished components. So in our project we have planned to use multi spindle drilling head instead of using single spindle. If we use multiple spindles we can decrease the time required to complete the operation. This helps in reducing the cost of drilling operation. So this system is one of the efficient process with increase in the accuracy of the operation.

Index Terms- Mechanical, Design, Drill, Productivity, Fabrication.

I. INTRODUCTION

Machines help us to decrease the human efforts. 1st electric drill machine was invented by Arthar Arnott & William blench in 1889. First portable drilling machine came into use after year 1895. In current situation various type of drill machines are available with various features. There is need to increase the productivity to survive in current competitive environment and it can be only possible by using proper production technology. To make work easier & to achieve more accuracy there is need to upgrade the design of available machine

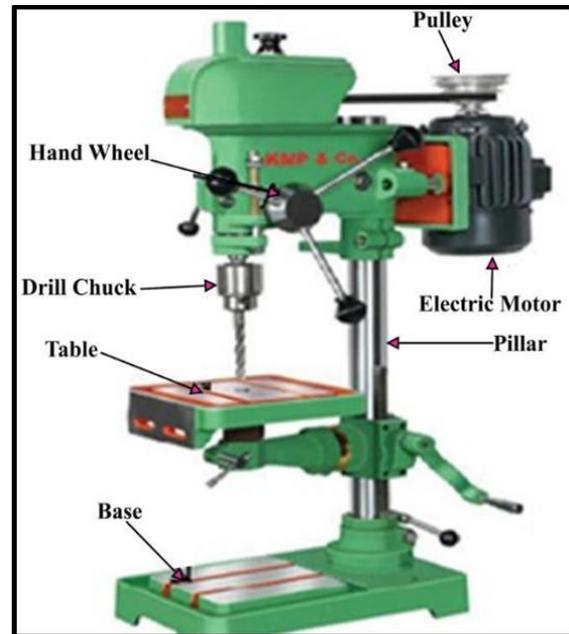


Figure 1: Different Parts of Drilling Machine

1. Introduction to drill Machine.

Drill machine is machine which is used to rotate the drill bit at specific speed & to feed it into the workpiece being drilled. Diameter of hole is depends on size of drill bit (tool). In conventional methods drill machine is consist of the single spindle but Nowadays multiple spindle drilling is used to increase the productivity. In multiple spindle drilling machine multiple holes are produced simultaneously in the same workpiece with same accuracy.

2. Introductions to multi axis drill machine.

In multi axis drill machine we use multiple spindles which are fitted on the columns. All this columns are arranged in circular pattern to drill multiple holes on lateral surface of workpiece. We can change the angular distance between the two columns and height of the column is adjustable, hence we can drill a hole at different angular distance and at different height.

II. LITERATURE REVIEW

Prof. Ms. A. A. Shingavi, in this paper they given productivity will increase with the help of multi spindle drilling machine, because using conventional drilling machine four minutes required for produce single hole with tool changing take place for different diameter hole i.e. Only few component produce in one hour. By using multi spindle drilling head production rate is approximately double. Also chance of hole missing is eliminated because multiple holes drilled at a time. By using multi spindle drilling head machine hour cannot be changed.

P. Kishor Kumar, studied on thrust force and torque in drilling on aluminium 6061-T6 alloy. In this case study they show that as diameter of hole increases, thrust force and torque in drilling also increases. They predict the value of the thrust force and torque by using equation and then they measure the actual value by using a drill dynamometer setup. Predicted value of a thrust force and torque is nearly equal to the observed value.

G. Niranjana, from this paper we studied that drilling depth can be controlled by programmable microcontroller circuit. It is very difficult to control and measure the drilling depth of hole manually .in this paper they design and develop drilling machine which used to drill holes with its different depths using programmed microcontroller system. They integrate all necessary features of IC's to control the depth of holes. This paper is integration of production using technology.

R. Anandhan, in this paper they given idea about angular drilling machine, which is used to drill hole in any direction it is very complicated to setup job .also time required to setting job is large, angular motion of drilling head is controlled with the help of bevel gears. Indexing plate and up and down mechanism is used to drill holes at different angles. With help of this machine they eliminate geometrical error of drill hole. It is efficient and quick response machine

Mr. K. I. Nargatti, in this paper they introduced multi spindle drilling head with varying centre distance. With the help of this machine we can produce two holes at same time with varying centre distance between them. Size of this machine is compact then conventional drilling machine. It has better accuracy taking position from one place to another place. So

machine can be easily transported. Efficiency of multi spindle drilling machine is better than conventional drilling machine. It is power saving machine

Geetanjali R, in this paper they give idea about special purpose machine for drilling and reaming. The purpose of this paper is to reduce the cycle time by replacing drilling machine and reaming machine by special purpose machine (SPM) for drilling and reaming operation. The concept is that the component having different size and thickness, which are drill on drilling spindle first and then reamed. Both the operation performs on same machine having two separate spindles.

N. U. Kakade, in this paper we studied fabrication of combine drilling and tapping machine. In this machine they introduce gearbox for achieving different speed reduction. Drilling a hole required high rpm than tapping and threading. They introduce worm and worm gear for large speed reduction .the main aim of this machine is to locate and hold the work do drilling and tapping operation perfectly.

Santosh Athashere, in this paper they develop special purpose machine for drilling an angular hole. The main purpose of this machine is that to drill an angular hole on workpiece with different size and shapes. In this paper we study the design and manufacturing special purpose machine for various drilling operations like reaming, boring, spot facing and counter boring. In this project they develop six way drilling machine tables with automatic feed motion. This machine is compatible for both straight as well as inclined hole job.

M. Narasimha, in this paper they give design adjustable multi-spindle attachment for machining T-slots in a bolster plate. They have designed milling machine for milling of three T-slots in a single pass. The range of T-slot spacing for the present design is 40 mm – 160 mm. This study concluded that due use of this attachment three T-slots is done in single pass which saves the time as compared to individual milling, due to this production rate is increased.

III. PROBLEM DEFINITION

A. *Problem Statement*

In simplified manner only single hole can be drilled at a time which does not satisfies the need for increase in productivity demand. To increase

productivity we need special purpose machine which will increase productivity by performing multiple operations in one cycle. Also to make the efforts of human less, there is a requirement for better equipment which is the sole concern behind every invention that we see in our day to day life. Similarly in our project we are giving rise to a cost effective and simpler solution to currently present radial drilling mechanism.

Our project is made by keeping in mind of the needs of those small scale industries and provide them the ease of working which was previously benefited only by the large scale industries which was having a huge capital investment. The difficulties faced before of dismantling the work piece is removed because of our portable type of design of machine.

B. Solution of problems

In today's market the customer demands the product of right quality, right quantity and right cost and at right time. Therefore it is necessary to improve productivity as well as quality. The special purpose drilling machine is a best solution to the above problem which is used to perform multiple drilling operations at a time. In the multi-spindle drilling machine multi spindles are driven simultaneously which carry multiple chucks. Therefore it takes less time and it requires less human efforts as compared to conventional machining.

IV. METHODOLOGY

A. Existing Method

There are mainly two types of multiple spindle drilling head are available

a. Fixed multiple spindle drilling head

In this type of drilling head, multiple spindles are attached at fixed position. Therefore flexibility in operation is less but due to multiple spindles total time required to complete the whole operation is less i.e. time needed to drill multiple holes with multiple spindle drilling head is same as time required to drill single hole by using conventional drill machine. This helps to increase productivity but it has lower flexibility hence fixed multi spindle drilling head is only used for mass and batch production.

b. Adjustable multiple spindle drilling head

Adjustable multiple spindle drilling head consist multiple spindles which are connected by means of planetary gear. All this spindles are arranged in circular manner. In this type of drilling head we can change centre construction hence it has more flexibility than fixed multi spindle drilling head.

B. Proposed Method

By using multi axis drill machine we can drill multiple holes on lateral surface at a same time. In multi axis drilling machine by considering cost we are using three spindles, to drill three holes simultaneously on single work piece or job. Feed is given manually to drill machine by rotating the handle which rotates the bevel gears, and power is transmitted to lead-screw with the help of miter gear. The radial travel of a spindle is controlled by lead-screw mechanism, were lead screws are driven by set of bevel gears.

To control depth of the hole we use limit switch which controls ON/OFF action of drill machine. That limit switch can be adjusted in radial direction as per requirement of depth of hole, hence we can drill a hole with higher accuracy. Drill machines are mounted on a stand so by varying height of a stand we can control vertical movement of a drill spindle. Therefore we are able to vary the distance of hole from base also we can vary the angular distance between two holes.

V.RESULT AND DISCUSSION

In current scenario, for increasing productivity we have to reduce the machining time. For reducing machining time we have to perform multiple operations simultaneously. In our design we can able to drill three holes at a time. There are various method available for multiple hole drilling, but most of them are not able to drill on lateral surface and at various angular distance. Most of these mechanisms are able to drill holes only on one plane as well as by using this mechanism we are not able to vary the height of hole from base.

In our design, we facilitates to the operator to drill multiple hole, with various angular distance and at various height from the base of the job. Therefore by using this mechanism we are able to increase the flexibility of operations as well as productivity.

VI. CONCLUSIONS

By using Multi Axis Drilling Machine we can drill three holes simultaneously on lateral surface. Therefore possibility of hole missing is eliminated, cost per piece is reduced, cost of labour is reduced and increased in productivity. In our project we can vary the angular distance and vertical height of drill spindle, therefore we are able to perform drilling operation on different size of work piece at any height.

Medium scale industry can use this machine for job production. By using our machine, industries are able to reduce the total production cycle time as compared to conventional machining. Also skilled labor is not required, because use of limit switch for controlling depth of holes makes operation easier than conventional machining.

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