

Design & Development of 360° Flexible Drilling Machine

Jayesh Makwana¹ Ratnesh Soni² Vaibhav Ovhal³ Yash Joshi⁴

^{1,2,3,4}Student

^{1,2,3,4}Department of Mechanical Engineering

^{1,2,3,4}Shivajirao Kadam Institute of Technology & Management, Indore, Madhya Pradesh-452020, India

Abstract— The standard drilling is commonly found in every industry. Drilling machine which can be use for drilling holes in various parts, sheets, structures. Perfect and well aligned drilling needs fixed and strong drills. Some parts can't be drilled using fixed drill due to low space between drill bit and drill bed therefore in such case we use hand drill but hand drill have alignments problem while drilling. Therefore we propose a 360o flexible drill that can be mounted on a table easily and can be uses to hole horizontally vertically or even upside down. In this thesis a CAD model of 360o flexible drilling machine modeled by uni-graphics. Then the fabrication is carried out based on the CAD model.

Keywords: CAD Model, Design, 360° Drilling, Development, Fabrication, Flexible

I. INTRODUCTION

A drilling machine is a tool used to drilling holes in various types of wood, plastic and metal. The bench drill is bolted down for safe drilling of such materials. The pillar drill is a larger version of the bench drill and has a long column enabling it to stand on the floor. It function the same as the bench drill but can drill larger piece of material.

Drilling machines, also known as drill presses, are used for drilling different sized of holes in a variety of material at many different depths. It is a necessary tool in many types of industrial jobs and can perform several other functions aside from drilling.

Tapping is one of the other functions a drilling machine can perform, referring to drilling holes in pipelines that are under pressure. Spot facing refers to refining the edge of a hole to fit a bolt head or washer. Reaming makes holes more dimensional and improves the finished surface. Countersinking creates a space at the top of the hole to hold a bolt screw head in place. Counter boring makes an existing hole larger to fit the size of specific screws.

Other types of drilling machine include the upright sensitive drilling machine, Radial drilling machine, Special purpose drilling machine.

A. Types of Drilling Machine

- 1) Portable drilling machine
- 2) Sensitive drilling machine
- 3) Upright or column drilling machine
- 4) Radial drilling machine
- 5) Multiple spindle drilling machine
- 6) Vertical drilling machine
- 7) Automatic drilling machine
- 8) Deep hole drilling machine

Drill machines have been the heart of every industry. But when we talk about to drill where low space between drill bit and drill bed, so in that case we can't use fixed drill machines. So here we propose a 360° flexible drill machine that can be mounted on table and can be used to

drill hole in any direction whether it is horizontal, vertical, upside-down or in any direction and it is easy to carry anywhere.

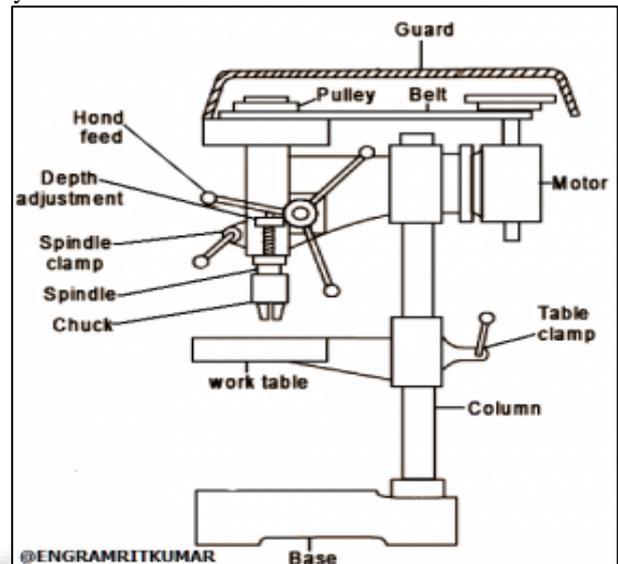


Fig.1:- Fixed drilling machine

II. MATERIALS & METHODS



Fig. 2: 360° drill machine

In my project the drilling machine can rotate their arm at 360° and moves anywhere when drilling is required up to its maximum arm length. With the help of my project we can drill in complicated parts accurately and it is also reduces the setting time of operation. It also takes into the consideration the most effective method of controlling the

drilling machine by manually. Materials like wood, plastic, and light metal drilled with this. The work is fixed on the work table. As the machine tool exert vertical pressure to original a hole it loosely called a drill press. Up/Down and rotating mechanism is available in this drilling machine. The upper arm of the project is made up of mild steel and the bottom arm is a square pipe which is also of mild steel which will give more stability to the hand drill machine.

III. LITERATURE REVIEW

In order to model surface roughness, several methods had been used in previous research. Mr. K. I. Nargatti, Mr. S. V. Patil, Mr. G. N. Rakate (2016) developed a model in Multispindle Drilling Head with Varying Centre Distance. Multiple-spindle drilling machines are used for mass production, a great time saver where many pieces of jobs having many holes are to be drilled. Multi-spindle head machines are used in mechanical industry in order to increase the productivity of machining systems. This machine has two spindles driven by a single motor and all the spindles are fed in to the work piece simultaneously. Feeding motions are obtained either by raising the work table or by lowering the drills head. As the name indicates multiple spindle drilling machines have two spindles driven by a single power head, and these two spindles holding the drill bits are fed into the work piece simultaneously. The spindles are so constructed that their Centre distance can be adjusted in any position within the drill head depending on the job requirement. The positions of those parallel shafts holding the drills are adjusted depending upon the locations of the holes to be made on the job. Based on the literature review, the most parameters that widely considered when investigating the operation of a machine are feed rate, spindle speed and depth of cut. Most of the researches didn't consider the uncontrolled parameters, such as tool geometry, tool wear, chip loads, and chip formations, or the material properties of both tool and work piece.

IV. PARTS OF THE MACHINE

The following parts described separately which are used for 360° drill machine.

- 1) Hand drill machine
- 2) Bottom arm
- 3) Upper arm
- 4) Bearing
- 5) Spring
- 6) Drill bit

1) Hand drill machine

It is very small, compact and self-contained unit carrying a small electric motor inside it. It is very commonly used for drilling holes in such components that cannot be transported to the shop due to their size or weight or where lack of space does not permit their transportation to the bigger type of drilling machine. In such case the operation is performed on the site by means of the portable electric drill.

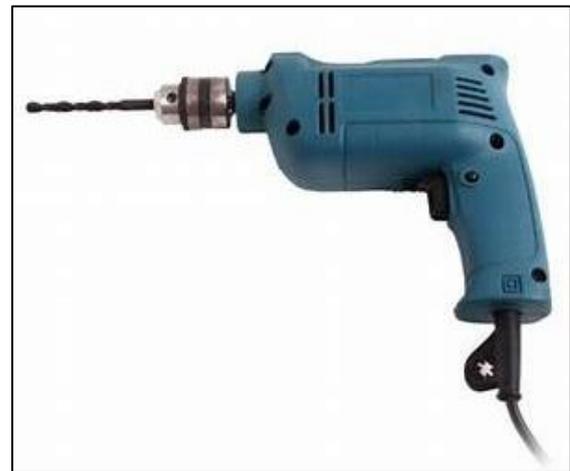
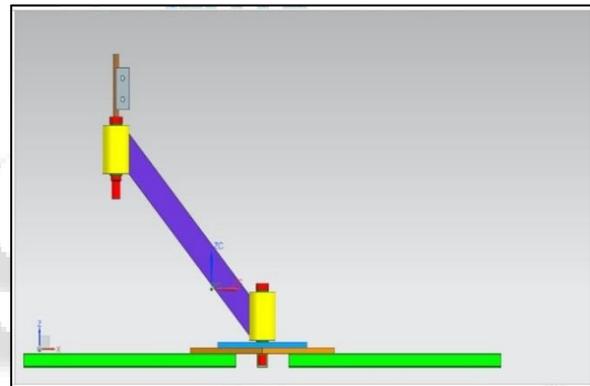


Fig. 3: Hand drill machine

2) Bottom arm

The bottom arm is made of metal square pipe of size of (1.5" x 1.5") and 18"(inch) long. The bottom arm is hold the upper arm, because of good stability the upper arm give 360° rotation and also have up and down transmit to the drill.



3) Upper arm

It connects the two frames to each other for supports between them to help to move when required. It consists of metal strips of 20" (inch) and has two pieces of equal length.



4) Bearing

A bearing is a machine element that constraint relative motion to only the desired motion, and reduces friction between moving parts. Most bearing facilitate the desired motion by minimizing friction. Rotary bearing hold rotating components such as shaft or axles within mechanical system. The simplest form of bearing is plain bearing consist of a shaft rotating in a hole.

5) Springs



Spring is an elastic machine element that can deflect under the action of load. When the load is removing it regain its original position. Spring is made of material which is having high yield strength to restore elastic. It is use for absorb shocks or it also resist to transfer shocks and vibration on various critical machine element.



6) Drill bit

This is use to make drill on wood, plastic and light metals. Drill bits are cutting tool use to remove material to create holes. It is of material of carbon steel. Drill bit come in many sizes and shapes and can create different kinds of holes in many different materials. In order to create holes drill bits are usually attached to a drill, which power them to cut through the work piece, typically by rotation. For heavy duty drilling in industry, bits with tapered shanks are sometimes used. Other type of shank use include hex-shaped, and various proprietary quick release system. The diameter to length ratio of the drill bit is usually between 1:1 and 1:10. But higher the ratio, the greater the technical challenge of producing good work.



V. SPECIFICATION

A. Specification of hand drill machine

Type of motor: - Work in both AC and DC supply.

Speed: - 2500 rpm

Rated power input: - 300W

Max. Drilling capacity(steel) :- 10mm

Max. Drilling capacity(wood) :- 18mm

Net weight: - 1.5 kg

B. Specification of drill chuck.

Length: - 15mm

Diameter: - 7mm

Type of chuck: - Fiber

C. Drill bit

Diameter: - 2mm

Material: - Carbon steel

Type of bit :- Twist drill bit

VI. MACHINING AND DESIGN PARAMETERS

A. Cutting speed (V)

$$V = \pi DN$$

Where, D= Diameter of drill =2mm

N = Rotation speed in (rpm) = 2500

$$V = 261.799 \text{ mm/sec}$$

B. Feed rate (f) = 40 mm/min.

C. Depth of cut (d) = $D/2 = 1\text{mm}$

D. Material removal rate

$$\text{MRR} = (\pi D^2/4) f N$$

$$\text{MRR} = 314,159.265 \text{ mm}^3/\text{min.}$$

E. Machining time (t) = L/f

Where, L = Length of the hole to be drilled

Machining time (t) = 0.25 min.

VII. CONCLUSION

This project is an efficient operation and competitive cost. Since a number of operation and hole can be performed in a simple unit. It is efficient and economical. Considering its uses and cost of project, it becomes relatively cheap when compared to other units.

A. Advantage

- 1) Efficient Drilling
- 2) 360 Degree Rotation
- 3) Flexible
- 4) Easy To Use
- 5) Low Cost
- 6) Reduce Handling Cost
- 7) Reduce Time
- 8) Reduce Overall Manufacturing Cost
- 9) Increase Productivity

B. Application

- 1) To put holes with high precision on engine heads, blocks and cylindrical shell.
- 2) Used in furniture making.

C. Future Scope

- 1) It is used in industries.
- 2) It is used with automation for automatic drilling.
- 3) In future it is used in every field where drilling is required.
- 4) Also use this method of rotation of arm in other machining operation.

REFERENCES

- [1] Mr. Jay M. Patel , Mr. Akhil P. Nair , Prof. Hiral U.Chauhan , 3-Directional Flexible Drilling Machine, International Journal for Scientific Research & Development , Vol. 3, January 2015 , Pages 1262 – 1264
- [2] Praveenkumar, B. S., Niranjan Hugar, Ajithkumar, A. , DESIGN OF ROD GROOVING MULTISPINDLE DRILLING UNIT, Asian Journal of Science and Technology , Vol.07, March,2016 , Pages 2600-2605
- [3] Prof. Gadhia Utsav D, Shah Harsh A, Patel Viral A, Patel Kushang P, Amin Harsh J , DESIGN & DEVELOPMENT OF UNIVERSAL PNEUMATIC DRILLING MACHINE: A REVIEW STUDY, International Journal For Technological Research In Engineering Volume 3, April-2016 , Pages 1614 – 1616
- [4] N.VENKATESH, G.THULASIMANI, S.NAVEENKUMAR, S.K.MALATHI,
- S.PALANISAMY, M.KARTHIKEYAN, Combined Drilling and Tapping Machine by using Cone Mechanism, International Journal of Scientific & Engineering Research, Volume 7, May-2016 , Pages 11 – 15
- [5] Prof. P.R. Sawant, Mr. R. A.Barawade , DESIGN AND DEVELOPMENT OF SPM-A CASE STUDY IN MULTI DRILLING AND TAPPING MACHINE, International Journal of Advanced Engineering Research and Studies, Vol. 1, January-March, 2012 , Pages 55-57
- [6] Mr. Sakate P.R. , Mr. Jadhav A.S. , Prof. Bamankar P.B. , Miss. Jagadale A.A. , Miss. Bhosale P.S. , A Review on Multi Spindle Drilling Special Purpose Machine with Respect to Productivity , International Journal for Scientific Research & Development , Vol. 3, 2015 , Pages 560 – 562
- [7] Mr. K. I. Nargatti, Mr. S. V. Patil , Mr. G. N. Rakate , Design And Fabrication of Multispindle Drilling Head with Varying Centre Distance , International Journal of Trend in Research and Development, Volume 3(3) , May-Jun 2016 , Pages 506 – 508
- [8] R.Anandhan, P.Gunasekaran, D.Sreenevasan, D.Rajamaruthu , Design and Fabrication of Angular Drilling Machine , International Journal of Innovative Research in Science, Engineering and Technology , Vol. 5, May 2016 , Pages 88 - 95
- [9] Dnyaneshwar B Bharad, Rahul D Gawande, Pratik D Ghangale, Rahul K Gunjal, Prof.A.S.Autade, Prof.P.P.Darade , A Paper on Two Spindle Drilling Head , International Research Journal of Engineering and Technology , Volume: 04 , Apr -2017 , Pages 818 – 821
- [10] S. R. Gawande, S. P. Trikal , Development of Multi Spindle Drilling Machine to Enhance the Productivity in Amba Stainless Steel Kitchen Trolley Manufacturer, Amravati , International Journal of Science and Research , Volume 4 , October 2015 , Pages 1659 – 1661