Design and Fabrication of 360^0 Flexible Drilling Machine

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Abstract- Drilling is one of the important operations in various fields and industries for different kinds of applications. So it is essential to design and fabricate a good drilling machine which will be flexible to produce holes without changing the orientation of the component. By reducing work setting time, tool setting time productivity can be improved. Also holes in complicated and irregular components can be easily produced.

Keywords —360^0 drilling machine, Drill chuck, D.C.Motor, flexibility, Orientation Performance, etc.

I. INTRODUCTION

Drilling is very important operation carried out in manufacturing process. By using rotating cutter (Drill), circular hole is produced in the component held in work holding device. The drill is vertically fed into the component to produce a hole and the machine used is called drilling machine. The drilling operation can also be performed on lathe, in which the drill is held in tailstock is fed against rotating workpiece. Application of drilling operation is to produce the hole in metal sheets, plates, structural members, etc. For perfect and well aligned drilling operation fixed and strong drills are required. Due to lack of enough space between spindle and machine table, for processing, there is a limitation of the size of the component. In such cases we can use hand drills but hand drills have alignment problems while drilling. So here we propose a 360^0 flexible drill that can be mechanically fastened on a table or wall and can be used to drill holes at any axes. Therefore this makes it possible for easy drilling in even complicated parts and surfaces. Thus we use the elements like rotating hinges and other supporting structures to design and fabricate 360^0 drilling machine for drilling the component by keeping fixed orientation of the work.

II. DRILLING PROCESS

Drilling is the process of producing holes in work piece with rotating edge of the cutting tool called drill. Main rotating movement is common to all these processes while combined it with a linear feed. A workpiece is held in work holding device, the drilling process can start after selecting twist drill. The drill is set into the machine spindle and also speed is set for particular operation.

First indentation mark is produced on a work by using centre punch. The point of the drill must be aligned with the identation mark on the workpiece. Then the drill is fed axially downward direction into the work producing the hole. During drilling operation, cutting fluid is used to avoid excess heat generation causing wearing of the cutting edges of the tool.

Sensitive type drilling machines are bused for lighter work, Upright drilling machines are used for medium duty work, and Radial type drilling machines are used for heavy duty work.

III. DRILLING MACHINE CONSTRUCTION

A drilling machine consists of base, horizontal arms, spindle head and three jaw chuch for holding drill. To absorb any kind of vibrations, the base of the machine is made up of Cast iron and mounted on table securely. Arms are hinged on the base to rotate in any required direction. Arms can move, rotate to achieve all degrees of freedom. The drill chuck, an electric motor and the mechanism meant for driving the chuck at different speeds are mounted on the top of the upper arm. Power is transmitted from electric motor to the drill chuck.[1]

IV. WORKING

1) All the component is mounted on table. This supports the arm to rotate freely.
2) Arm is rotate manually when where it is required.
3) Motor is connected to the arm which moves where work piece is located for the drilling.
4) Press drill point on the work piece area where the hole is required.
5) Switch on the main supply of A.C.
6) Then this A.C. flow through rectifier and convert to pure D.C.
7) This rotates motor and also bit rotates.
8) the hole will be produced on the work.
9) Then Switch off the main supply. [3]

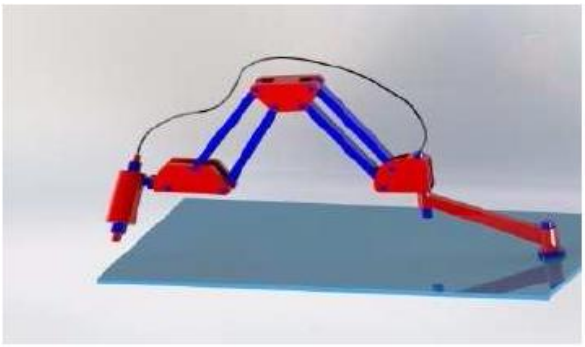

Fig.1 Concept Design

IV. COMPONENTS

1) Base:

The base acts as a support for the whole machine. It's made of a mild steel and is accurately machined. The base of the machine is mounted on the floor or table to ensure vibration free operation and better accuracy. The top of the base acts as a work table and provided with T-slot for mounting work. [2]

2) Arm:

There are two arms:

-Vertical arm

-Horizontal arm

The primary arm holds the secondary arm and it is with the help of this arm the 360^0 of rotation is transferred from the T plate to the secondary arm in order to move the drill head at an angles. These are made up of stainless steel.

3) Cross Slide:

Cross slide is very essential part on which drilling machine elements are fixed. Our drilling machine can drill holes on wood and soft metal. The drill bit can be rotated both clockwise and counterclockwise direction.

4) Motor:

A motor which is may be operated either on direct or single phase A.C. supply at approximately the same speed and output. It is often referred as an A.C. series motor. The universal motor is very similar to a D.C. series motor in construction, but is modified slightly to allow the motor to operate properly on A.C. power. The motor is high torque capable which required for drilling. [5]

5) Connecting Rod:

The function of connecting rod is to connect two frames to each other to provide support between them. It contains four metal strips of equal length of sizes 13inch and 16inch respectively. A mechanical bearing called hinge which connects two solid objects and allowing only limited angle of rotation between them. Hinges is made up of flexible material or moving component to move easily.

6) Pulley:

Pulley is a rotating part is design to support movement and change the direction of belt. It also transfer the power between the shaft and belt. It does not transfer the power to the shaft if it is supported by frame or shell, but is used to guide a belt. The supporting shell is called as block and pulley is also called as sheave. A pulley may contain grooves between the flanges around its circumference to locate the belt. A rope, cable, belt or chain is the drive element of pulley system. [1]

7) Bearing:

A bearing is a machine element that restricts relative motion to a desired motion. It also reduces friction between moving and mating parts. The design of bearing is to provide free linear movement of the moving part. It is broadly classified according to motion allowed and type of operation. Rotary bearing is used to hold rotating parts such as shaft within mechanical systems and transfer radial and axial loads. [3]

8) Screws:

It is a one degree of freedom kinematic pair used in mechanism. Screw is used rather than the bolt because of requiring an internal thread in one of the jointed parts. It can save the space but on other hand, continuous reuse of thread would probably damage the coils. To hold the objects together and for position of objects screws are used.

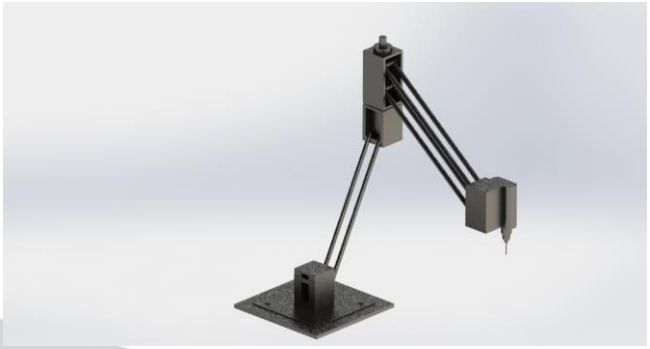

Fig. 2 Assembly of 360^0 degree flexible drilling machine

V. SPECIFICATION

A. Specification of Motor:
Type of Motor – D.C. Motor
Speed – Max 4200 rpm
Voltage – 12 Volt
Supply – D.C. Supply
Current – 0.3 – 1.4 AMP
Power – 2.5 – 16 watt
Frequency – 50 Hz
Controller – Hand
Weight – 160gm
Shaft dia. – 3.18 mm
Diameter – 35mm
Length (Body) – 52mm
Length (Shaft) – 15mm
Main Color – Silver Tone
Material – Metal Net

B. Specification of Drill Chuck:
Length = 16mm
Diameter = 8mm
Type of Chuck – Fiber

C. Bit:
Diameter – 2mm
Material – Carbon Steel
Type of Bit – Twist Drill Bit [1,2]

VI. CONCLUSION

The 360^0 flexible drilling machine is designed for producing a hole at particular location on a component which will be randomly oriented. Specially designed Arms can move, rotate at any axes to achieve all degrees of freedom.

VII. FUTURE SCOPE

1) Auto feed operation can be provided by the use of Servomotor and other controls.
2) To increase working envelope by the use of the telescoping arm.
3) Use of hydraulic system or hydraulic lubrication will minimize fatigue and efforts and ensures accuracy.

VII. REFERENCES

[1] G. Prashant Kumar , P. Guna Sekhar , P. Nadeem Khan, P. Rajesh, B.V. Krishnaiah, "Design and Fabrication of 360^0 Flexible Drilling Machine", International Journal of Engineering Trends and Application, Vol. 5 Issue 2, Mar-Apr 2018

[2] Lookesh Kumar Sahu, Pranesh Mohan Mishra, Deepak Kumar Singh, Vijay Kumar Yadu, Sandeep Kumar Kansari, "Design and Fabrication of 360^0 Flexible Drilling Machine", International Journal for Scientific Research & Development, Vol.6, Issue 02, 2018 \ ISSN (online): 2321-0613

[3] 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

[4] 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

[5] 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

[6] 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

[7] Dnyaneshwar B Bharad, Rahul D Gawande, Pratik D Ghangale, Rahul K Gunjal, Prof. A. S. Autade, Prof. P. P. Darade , " Paper on Two Spindle Drilling Head" , International Research Journal of Engineering and Technology , Volume: 04 , Apr -2017 , Pages 818 – 821

[8] S. R. Gawande, S. P. Trikal , "Development of Multi Spindle Drilling Machine to Enhance the Productivity'" Amba Stainless Steel Kitchen Trolley Manufacturer, Amravati , International Journal of Science and Research , Volume 4 , October 2015 , Pages 1659 – 1661

[9] 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