



## A REVIEW ON 360<sup>0</sup> FLEXIBLE DRILLING MACHINE

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**Abstract:** Drill machines are heart of every industry. The regular industrial work is drilling in parts, sheets and structures. Perfect and well aligned drilling needs fixed and strong drills. Some parts cannot be drilled using fixed drills due to low space between drill bit and drill bed. We need to use hand drills in such cases but hand drills have alignment problems while drilling. Nowadays, the drilling machine is developing very fast with more uses and application. In basic drilling machine, the machine work in particular direction which is the limitation in this machine. And there is more problem like space between the drill and job is very less. So here we propose a 360 degree flexible drill that can be mounted on a table or wall and can be used to drill holes horizontally, vertically or even upside down. So this makes it possible for easy drilling in even complicated parts and surfaces. Thus we use rotating hinges and connectors with motor mount and supporting structure to design and fabricate a mini 360 degree drill for easy drilling operations. In basic drilling machines, there is a problem of limitation of movement of drilling machine in different directions. Also there are problems of less space between drill bit and job and alignment problems. We can overcome these problems with the help of a 360 degree flexible drilling machine.

**Keywords:** Drilling machine, Drill bit, 360 degree Flexibility, Drill Bit, Rotation, Arms, motors, Direction.

### I. INTRODUCTION:

Drilling is a cutting process in which a hole is originated or enlarged by means of a multipoint, fluted, end cutting tool. As the drill is rotated and advanced into the work piece, material is removed in the form of chips that move along fluted shank of drill.

Process characteristics:

1. Uses a multipoint, fluted, end cutting tool
2. Cutting tools are rotated and advanced relative to each other
3. Creates or enlarges no precision holes
4. May produce coarse, helical feed marks, depending on machining parameters
5. Creates small burrs on entry and coarse burrs on exit

Drilling involves relative axial and rotational motions between drill and work piece. Usually the drill rotates and advances into the work piece, but sometimes the opposite is true. Chips are removed by flowing along grooves or flutes in drill. Although long spiral chips usually result from drilling, adjustment of feed rate can result in chips with a range of shapes and sizes.

**I.I. Drill Bits:** Drill bits are cutting tools used to remove material to create holes, almost always of circular crosssection. Drill bits 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 powers them to cut through the work piece, typically by rotation. The drill will grasp the upper end of a bit called the shank in the chuck. Drill bits come in standard sizes, described in the drill bit sizes article. A comprehensive drill bit and tap size chart lists metric and imperial sized drill bits alongside the required screw tap sizes. There are also certain specialized drill bits that can create holes with a non-circular crosssection.

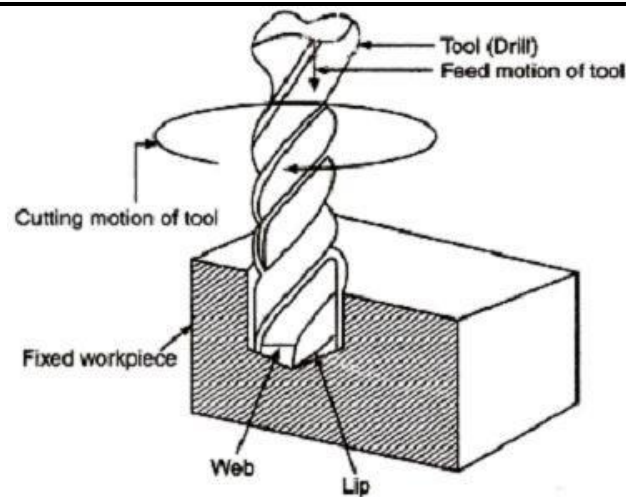


Fig. 1. Drill Bit.

- Drilling is the operation of producing circular hole in the work-piece by using a rotating cutter called DRILL.
- The machine used for drilling is called drilling machine.
- The drilling operation can also be accomplished in lathe, in which the drill is held in tailstock and the work is held by the chuck.
- The most common drill used is the twist drill.

#### Two main type of drilling:-

1. Hand drilling machine
2. Fixed table drilling machine

#### I.II. Advantage & Disadvantages:

##### Advantages:-

1. Compact in size.
2. Easy to carry.
3. Low cost.
4. Can drill in any direction where human can reach.

##### Disadvantages:-

1. Only small diameter of holes can be drilled.
2. Cannot get a through hole because of vibrations.
3. Less stability.

#### II. LITERATURE REVIEW:

[1]. Mr. K. I. Nargatti, Mr. s. v. Patil, Mr.G. N. Rakate (2016)- This paper deals with improvement in design & Fabrication method of Multiple Spindle Drilling Head for cycle time optimisation of the part. They develop a model which may drill 2 holes at a time with varied center distance between two drilling spindle.

[2]. R. Anandhan, P. Gunasekaran, D. Sreenevasan, D. Rajamaruthu(2016)- The main aim is to rotate drill easily in any direction. So that the job setting is no more complicated and the setting time will reduce. This method can be consider to be most efficient method that can control the drilling machine by manually. The wood, soft synthetic material, and lightmetals can be easily drilled by this system.

[3]. Mr. Jay M. Patel, Mr. Akhil P. Nair, Prof. Hiral U. Chauhan(2015)-It is based on 3-Directional drilling machine which is used to drilling holes based on their various location and movement. Due to this machine the operation can be done with less effort, high precision and accuracy. This method helps in improving the Productivity by reducing total machining time , human effort, manufacturing cycle time.

[4]. Lookesh kumar sahu, Pranesh kumar sahu, Pranesh Mohan Mishra, Deepak kumar singh, Vijay kumar Yadu(2018)- In this paper, the author propose a 360 degree drilling machine which may drill in horizontally, vertically or even upside down. The twist drill bit of carbon steel material is used in this machine.

[5]. Nandewalia Prajal, Malaviya Krunal, Prof. Chauhan Hiral, Prof. vipul Goti(2018)-In this paper , the author investigate about the Graphical Drilling Machine, and author proposed that this drill machine can drill graphically in all direction, the drill rotate about two axis (i.e x axis & z axis). These drilling machine may be used to drill on material like wood, metal. And the main purpose is to reduce time and vibration in machine.

[6]. Prof. Ms. A.A. Shingavi, Dr. A.D. Dongare, Prof. S.N. Nimbalkar(2015)- In this reseach, the authors discuss the case study and comparability of productivity of parts using conventional radial drilling machine and special purpose machine.

G.Prasanth Kumar This paper first introduces the general concept of 360° Flexible Drilling Machine. Use of rotating hinges and connectors with motor mount and supporting structure to design and fabricate a 360 degree drilling machine for easy drilling operations. Drilling machine is one of the most important machine tools in a workshop. It was designed to produce a cylindrical hole of required diameter and depth on metal work pieces. Though holes can be made by different machine tools in a shop, drilling machine is designed specifically to perform the operation of drilling and similar operations. Drilling can be done easily at a low cost in a shorter period of time in a drilling machine. Drilling can be called as the operation of producing a cylindrical hole of required diameter and depth by removing metal by the rotating edges of a drill. The cutting tool known as drill is fitted into the spindle of the drilling machine. A mark of indentation is made at the required location with a center punch. The rotating drill is pressed at the location and is fed into the work. The hole can be made up to a required depth. Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks. Drilling may affect the mechanical properties of the work piece by creating low residual stresses around the whole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface.

### III. CONSTRUCTION AND COMPONENTS:

Up/Down and rotating mechanism is available in this Drilling Machine. One end of the arm is attached to a firm base while the other has a tool. These arms are made up of Aluminum. The number of parameters in the subgroup is called the degrees of freedom of the joint. Mechanical linkages are usually designed to transform a given input force and movement into a desired output force and movement.

**1. Motor-**It rotates shaft (which is supported by bush) when power is supplied through rectifier. This shaft is connected with drill bit through chuck to rotate drill bit and makes hole on work piece when it is required.

**2. Connecting rod-**It connects the two Frames to each other for support between them and to help move when required. It consists of metal strips of two sizes one of 12" (inch) and another is of 15" (inch). Both are of four pieces of equal length.

**3. Pulleys-**A set of pulleys are assembled so that they rotate independently on the same axle to form a block. Two blocks with a rope are attached to one of the blocks and threaded through the two sets of pulleys to form a block and tackle.

**4. Bearing-**The bearings constrains relative motion to only the desired motion, and reduces friction between moving parts

**Screws-**A screw joint is a one-degree-of-freedom kinematic pair used in mechanisms. Screw joints provide single-axis translation by utilizing the threads of the threaded rod to provide such translation.

**5. Base-** The base acts a support for the whole machine. It's made of a mild steel. The base of the drilling machine supports the entire machine and when bolted to the floor, provides for vibration-free operation and best machining accuracy. The top of the base is similar to the worktable and may be equipped with t- slot for mounting work too larger for the table.

#### 6. Arm-

There are two arms:

- A) Vertical arm
- B) Horizontal arm

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

#### 7. Cross Slide-

We have used a hand drilling machine to be fixed on the cross slide. Our drilling machine can drill holes on concrete, wood and metal. The drill bit can be rotated both clockwise and anticlockwise direction.

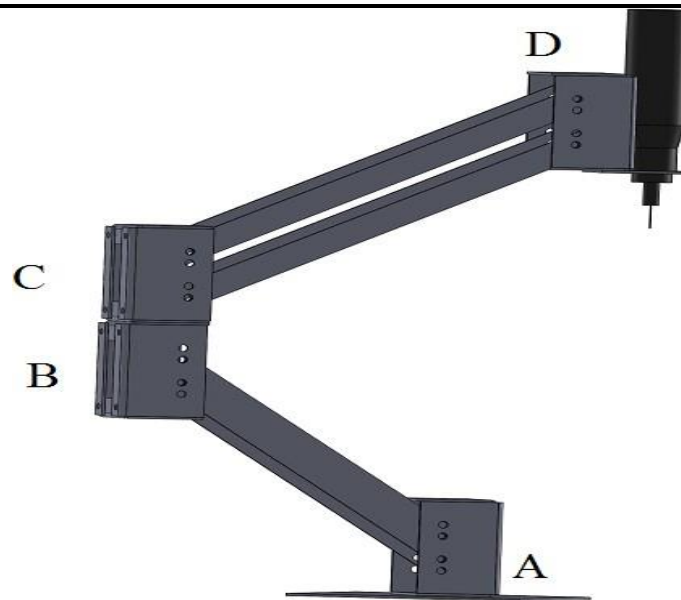


Fig. 2. Structure

#### IV. SPECIFICATIONS:

##### 1. Motor:

Type -DC

Rated voltage-24v, working voltage-12v, Speed-10000 rpm, Diameter -36mm, Length -57mm, Current- 0.2amp-1.2amp, Power – 2.4watt-15watt, Shaft diameter-3.17mm, Shaft length- 14mm, Material – aluminum, Color- black

##### 2. Drill chuck:

Outside diameter- 21mm, Clamping range- 0.3mm-4mm, Taper-6mm

##### 3. Drill bit:

Type-brad point bit, Diameter-3mm, Length -60mm, Material-HSS.

#### V. Cutting Parameters:

**A. Cutting Speed (V) :**  $V = \pi DN$   
 $N=1750$ ,  $V=274.88$  mm/sec

**B. Feed Rate (f) :** 40 mm/min

**C. Depth of Cut (d) :**  $d=D/2$ ,  $d=1.5$

**D. Material Removal Rate :**  $MRR = (\pi D^2/4) f N$ ,  $MRR = 494800.84$

**E. Machining Time :**  $t = L/f$

Where, L = length of the hole to be drilled = 100mm, f = feed of the drill = 40 mm/min, t = 2.5 min.

**F. Torque :**  $P = 15$  watts ,  $N = 1750$  rpm

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

$$T = P \times 60/2\pi N, T = 15 \times 60/2\pi \times 1750$$

$$T = 81.8511 \text{ N-mm}$$

#### VI. WORKING:

- Box A is mounted on a plate, which can be further mounted on the table or wall for stability. The whole mechanism can rotate 360 degree at the vertical axis of box A.
- Box B is attached to Box A with the help of two slant links, hence keep a angle of 45 degrees between both boxes. Now the box B can rotate 360 degree at the vertical axis of box A.
- Box C is mounted on Box B in such a way that it can rotate 360 degrees on its vertical axis.
- Box D is attached to box C with the help of four movable links, hence achieving a vertical motion of box D. So now the box D can rotate 360 degrees at vertical axis of box C.

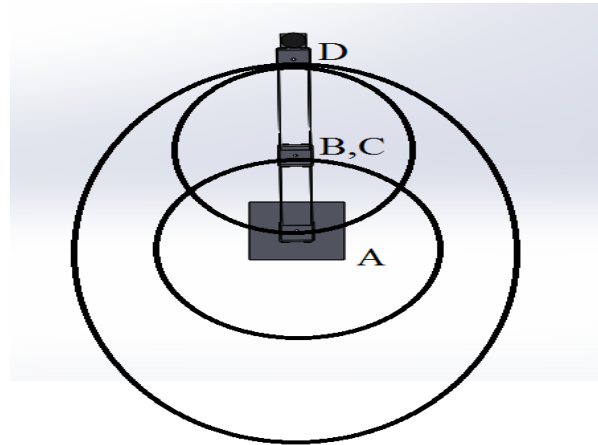


Fig. 3. Movement of 360° Rotating Drilling Machine

## VII. DIMENSIONS

1. Box A,B,C & D – 80x54x84mm
2. Made up of aluminium sheet of 1mm, laser cutted and bended on manual bending machine.
3. Link between Box A and Box B –two 45 degrees slant links made up of 1mm mild steel sheet
4. Link between Box C and Box D – four links made up of 1mm mild steel sheet.
5. Total height of the machine when arm is extended – 500mm
6. Height of the machine when arm is not extended – 300mm
7. Width of the entire arm – 54mm
8. Box B & C rotation radius at axis A – 200mm
9. Box D rotation radius at axis C – 300mm
10. Box D rotation radius at axis A – 500mm

## VIII. CONCLUSION:

The 360 degree drilling machine gives effective drilling operation and rotates in 360 degree direction. It is economical and has less handling cost and manufacturing cost. It is highly efficient compared to other units. So with the help of this project we can remove many disadvantages of hand drill machine which are mentioned above. And this mechanism is not costly, so it will be affordable to anyone. We can mount this mechanism horizontally as well as vertically depending on where to drill. The size of machine is smaller than the older machine so it is very simple to move from one place to another. So this machine can be easily transported. The overall space required is also minimum.

This machine is reduces the manufacturing cycle time, the re-clamping can be eliminated: once the work piece is clamped, there is no need for re-clamping in a different direction, reduces the number of machines needed, elimination of human error.

**References:**

1. R.Anandhan, P.Gunasekaran. 2016, Design and Fabrication of Angular Drilling Machine, International Journal of Innovative Research in Science, Engineering and Technology.
2. Bhupendra Singh Tomar, Abhinav Kumar Y, 2019, DESIGN & FABRICATION OF 360° FLEXIBLE DRILLING MACHINE, International Journal For Technological Research In Engineering.
3. Ms. P.H.Dahake, Computerized Drilling Machine, International Journal on Recent and Innovation Trends in Computing and Communication.
4. U. Hema Nikhitha, 2019, Design of 360 Degree Flexible Drilling Machine, International Journal of Engineering Research & Technology (IJERT).
5. Lookesh Kumar Sahu, 2018, Design & Fabrication of 360° Flexible Drilling Machine, IJSRD - International Journal for Scientific Research & Development.
6. 360 DEGREE DRILLING MACHINE, Atmiya Institute of Technology and Science for Diploma Studies.  
[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.
- [7] 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.
- [8] Praveenkumar, B. S., Niranjana Hugar, Ajithkumar, A. , DESIGN OF ROD GROOVING MULTISPINDLE DRILLING UNIT, Asian Journal of Science and Technology , Vol.07, March,2016 , Pages 2600-2605.
- [9] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] G.Prasanth Kumar, P.Guna Sekhar , P.Nadeem Khan P.Rajesh ,B.V.Krishnaiah Under Graduate Student ,Assistant professor Department of Mechanical Engineering Narayana Engineering College, ISSN: 2393-9516 www.ijetajournal.org Page 346 Design & Fabrication of 360° Flexible Drilling Machine Gudur Andhra Pradesh – India.