

# DESIGN AND FABRICATION OF 360 DEGREE FLEXIBLE DRILLING MACHINE

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## **ABSTRACT**

Drill machines have been the heart of every industry. Drilling holes in parts, sheets and structures is a regular industrial work. 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. 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.

Keywords: Drilling machine, Drill bit, 360 degree

## **INTRODUCTION**

**Drilling** is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.

In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside of the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills.

In rare cases, specially-shaped bits are used to cut holes of non-circular cross-section; a square cross-section is possible.

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

## **Project methodology**

- 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

As our project is on hand drill machine, we will talk about hand drill machines advantages and 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.

So looking at the disadvantages we came up with an project which can remove this disadvantages of hand drill machine.

## **Literature Review:-**

**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.

### **A. Drilling Machine Construction**

The basic parts of a drilling machine are its base, supporting arms, drill head and chuck. The base made of cast iron or other hard material may rest on a bench, floor depending upon the design. Larger and heavy

duty machines are grounded on the floor. The arms are mounted on base with the help of hinge to rotate about it. It is accurately machined and the arms can move up, down and rotate about x-axis. 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 the electric motor to the drill chuck.

### **B. Drilling Machine Working Principle**

The working principle of this flexible drilling machine is initially started from the D.C. motor through full wave rectifier. In which there is one power sources, received from the rectifier. Then the arm rotates at 360 degree 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.

#### **WORKING :-**

- 1) In which all the component is mounted on table. This support the arm to rotate freely.
- 2) Arm rotates manually when where it is required.
- 3) Motor are mounted on Arm which moves where work piece is to drill.
- 4) Put drill bit point on work piece area where drill is required.
- 5) Switch on the main supply which 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) After make hole where on work piece is required.
- 9) Then switch off the main supply.

**Mr. Jaynt khade** Around 35,000 BCE, Homo sapiens discovered the benefits of the application of rotary tools. This would have rudimentarily consisted of a pointed rock being spun between the hands to bore a hole through another material. This led to the hand drill, a smooth stick that was sometimes attached to flint point, and was rubbed between the palms. This was used by many ancient civilizations around the world including the Mayans. The earliest perforated artifacts such as bone, ivory, shells and antlers found, are from the Upper Paleolithic era. Bow drill (strap-drills) are the first machine drills, as they convert a back-and-forth motion to a rotary motion, and they can be traced back to around 10,000 years ago. It was discovered that tying a cord around a stick, and then attaching the ends of the string to the ends of a stick (a bow), allowed a user to drill quicker and more efficiently. Mainly used to create fire, bow-drills were also used in ancient woodwork, stonework and dentistry. Archeologist discovered a Neolithic grave yard in Mehrgarh, Pakistan dating from the time of the Harappans, around 7,500-9,000 years ago, containing 9 adult bodies with a total of 11 teeth that had been drilled. There are hieroglyphs depicting Egyptian carpenters and bead makers in a tomb at Thebes using bow-drills. The earliest evidence of these tools being used in Egypt dates back to around 2500 BCE. The usage of bow-drills was widely spread through Europe, Africa, Asia and North America, during ancient times and is still used today. Over the years many slight variations of bow and strap drills have developed for the various uses of either boring through materials or lighting fires.

This drilling machine possesses a radial arm which along with the drilling head can swing and move vertically up and down. The radial, vertical and horizontal arm movement of the drilling head enables locating the drill spindle at any point within a very large space required by large and odd shaped jobs. The tubular column on that the radial arm which moves up and down manually or it can be powered movement then the drilling head here this is called drilling head which holds the drill spindle here in which the drill is mounted and is subjected to rotation. The entire head is mounted on the radial arm and this can move inward and outward from the drill axis. Also the horizontal arm can slide linearly on vertical arm. Not only that, as this along with this radial arm the drilling head moves upward and downward to have large gap between the to drill and job or there is a stroke length. Not only that further this radial arm can be rotated about the column rotated about the column, say about 360 degree.

The main movements in the machine are:

- 360 degrees rotation of arm joint.
- Up & down movement of the horizontal arm on vertical arm.
- Linear slide movement of horizontal arm.

#### **1) 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.

## 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° 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.

## 3) 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.

## Structure Design

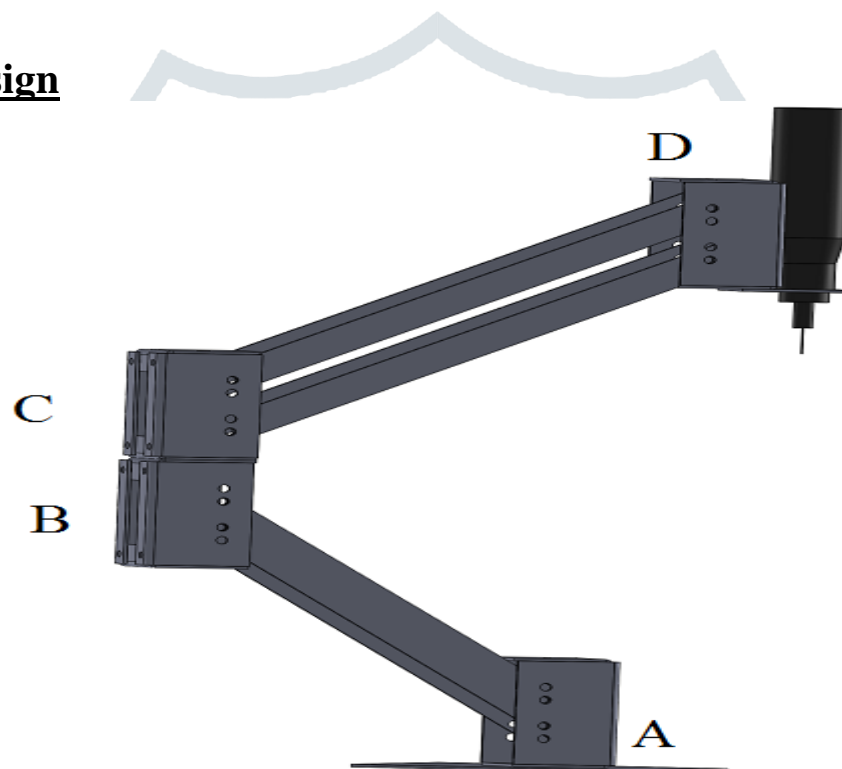


Figure 1:-360 degree drilling machine

## 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.

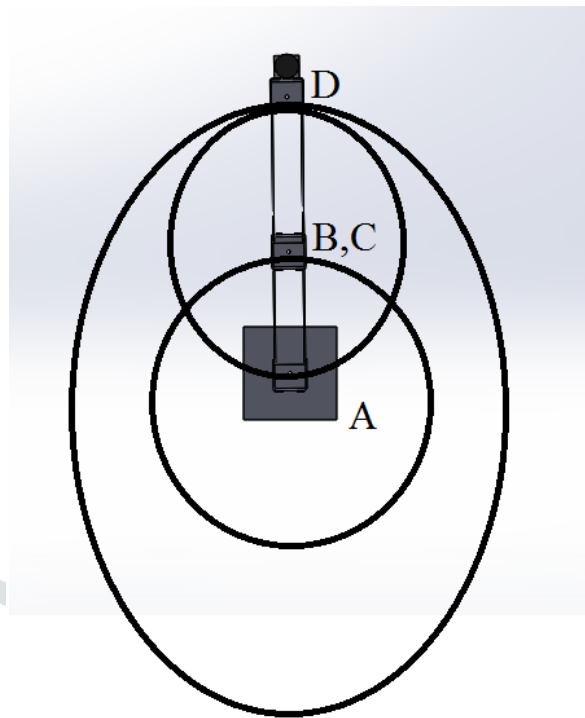


Figure 2:-Movement of 360 degree drilling machine

## Dimensions

Box A,B,C & D – 80x54x84mm

Made up of aluminium sheet of 1mm, laser cutted and bended on manual bending machine.

Link between Box A and Box B –two 45 degrees slant links made up of 1mm mild steel sheet

Link between Box C and Box D – four links made up of 1mm mild steel sheet.

Total height of the machine when arm is extended – 500mm

Height of the machine when arm is not extended – 300mm

Width of the entire arm – 54mm

Box B & C rotation radius at axis A – 200mm

Box D rotation radius at axis C – 300mm

Box D rotation radius at axis A – 500mm

## Conclusions:-

- 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.
- With the help of this machine we can drill holes in any direction at a particular time.
- 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.
- The machine is very simple to operate.

## Future scope:-

- It is used in industries.
- It is used with automation for automatic drilling.
- In future it is used in every field where drilling is required.

- Also use this method of rotation of arm in other machining operation.
- We can use servo motor in our machine to provide the automation by giving auto feed.
- We can use telescoping arm to increase the working envelope of the machine to reach in any direction easily.
- We can use hydraulic system or hydraulic lubrication to operate the machine in smooth manner without including the less fatigue of man power.

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