

Design & Fabrication of 360 Degree Flexible Drilling Machine

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Abstract- Nowadays, the drilling machine is a rapid growth product with more uses and applications. Drilling machines are used to make the holes on the given workpiece. The Basic Drilling Machine efforts more constraints by limiting their movements and direction. There is a severe problem between drill and job which provides less space to make the holes. In this project, we are working on a 360-degree drilling machine to eradicate the problems by moving the drill in different locations. The precision and accuracy are higher in this Machine because the setup provides the proper straightness to the drill bit. This makes efficient holes on the workpiece rather than deformation in the drill bits. The 360 degree drill setup consists of different connecting arms which assists the movement of the drilling machine in horizontal, vertical and upside down direction which is mounted on a flat surface like a table provided with the swivel wheels. The caster locks are introduced to limit the movement of the drilling machine. The cost of manufacturing and setup is comparatively lower than other drilling machines. The feasibility of the project is expected to be good. The handling is easily done by the operator. This 360 degree drilling machine can be implemented to all the industries using drilling operations because of the selective axis and angle of drilling with the higher accuracy.

Index Terms- 360 degree, Precision, Accuracy, Portable, Drilling, Drill Bits.

I. 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.

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 centre 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.

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 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 (above), allowed a user to drill quicker and more efficiently.

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.

I. COMPONENTS AND WORKING

1) Base: The base acts as a support for the whole machine. It's made of a mild steel. The base of the drilling machine supports then tire

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 large 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.

4) Drill Bit :- In which drill bit are used of twisted type drill. It is of material Carbon Steel. Its diameter is of 2mm. This is used to make drill on wood, plastic and light metals. Drill bits are cutting tools used to remove material to create holes, almost always of circular cross-section. 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 the drill bit is usually between 1:1 and 1:10.

Much higher ratios are possible (e.g., "aircraft length" twist bits, pressured-oil gun drill bits, etc.), but the higher the ratio, the greater the technical challenge of producing good work

5) Bearing :- A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free

rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as

shafts or axles within mechanical systems, and transfer axial and radial

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

WORKING PRINCIPLE AND ADVANTAGES

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.

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.

II. CALCULATIONS

CUTTING PARAMETERS

Cutting Speed (V) : $V = \pi DN$

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

Depth of Cut (d) : $d = D/2$

- Torque : $P = 15$ watts ,
 - $N = 1750$ rpm
 - $P = 2\pi NT/60$
 - $T = P \times 60/2\pi N$
 - $T = 15 \times 60/2\pi \times 1750$
 - $T = 81.8511$ N-mm

Design

The basic parts of a drilling machine are its base, supporting arms and drill bit. The base made of mild steel 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 cuboidal box at base 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.

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.

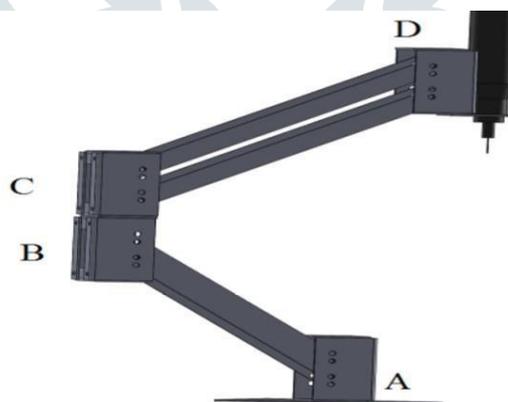


Figure 1:-360 degree drilling machine

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

Results and Discussion

Our product's goal is to rotate 360 degrees and make it more user-friendly. Our 360-degree flexible drilling machine is smaller than previous models available on the market. As a result, getting from one place to another is relatively straightforward. This machine is lightweight and portable. The total amount of space needed is similarly little. We can drill holes in any direction at any moment with the help of this machine. This machine reduces manufacturing cycle time, eliminates re-clamping (once the workpiece is clamped in one direction, there is no need to re-clamp in a different direction), reduces the number of machines needed, and

eliminates human error. The machine is quite easy to use. It is not as hefty as we had assumed, so anyone may operate it without difficulty. It surpasses our expectations and performs admirably. The results obtained from the simulation satisfied the manufacturing criteria and withstand the high loads at the end of the connecting arms. This assures the different weight portable drilling machines can be clamped at the end of the connecting arms, It can withstand the load upto 57(566 N) kg of weight with the addition of gravity. The whole weight acts on the rotating point of the connecting arm and also satisfies the manufacturing requirements

III. CONCLUSION

- 1) 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.
- 2) With the help of this machine we can drill holes in any direction at a particular time.
- 3) 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.

- 4) The machine is very simple to operate.

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