

360 Degree Flexible Drilling Machine



Gurpreet Singh, Lakshay Kishore, Pradip Singh, Abhishek Srivastava, Khushal Vashishth, Rahul Likhari

Abstract: 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. In this project we are working on the flexible drilling machine which can work in any direction and can be adjust as per choice. And drilling machine work automatically that can make work easier and can done more accurately. It is mounted on the flat surface as like table which can rotate in any direction, move up and down. It will reduce the setting time and capital for the operation. And in this drilling machine, we use permanent magnetic chuck which is attached to drilling machine.

Keywords:- 360°, Flexibility, Drill Bit, Rotation, Arms, motors, Direction, Permanent Magnetic chuck.

I. INTRODUCTION

Drill machine is one of the machines which is important and it is the heart of every industry. Drilling is a cutting and removal of material process in which a holes are made or expand with the help of a multipoint sharp end cutting tool. By power, when the drill is made to rotate on the workpiece, thus the unwanted material is withdrawn in the form of chips by moving along the shank. The purpose of our project is to rotate 360 degrees and make it more convenient to use. This machine minimize the manufacturing cycle time, the clamping of workpiece is also eliminated: once the workpiece is clamped on magnetic base plate, there is no need for moving workpiece at different location for drill at different positions, the number of machines required are also minimum, human errors are also rectified. With the contrast of this machine we can drill in any direction at a particular time with less effort. The machine is mounted on a flat surface like a table or wall. In this drilling machine we were using rack and pinion to move the drill, so the machine can be work in less space with accuracy.

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This drilling machine is works automatically, the whole machine is controlled by only one box. The machine is very simple to operate. The weight of the machine is not as heavy as we assumed, so anyone can use it easily without any uncomfortable experiences. In this we are using a rack and pinion mechanism over the arms to make it a telescopic arm for increasing and decreasing the length of the arm. A magnetic base plate is also introduced for a clamping work-piece. The machine can move from one place to another very easily. This machine can be easily transported as it light weight for easy movement. The overall space required for the setup of this machine is less. It precedes our expectations and performs pretty well, further improvement can be done through the experimental hypothesis.

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.



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The growth of India's production sector is rely on its productivity & standard of the product. Productivity depends on several factor, one of the main element factors

is production. Productivity can be increased by minimizing the machining time.

III. BASIC MODEL OF 360 DEGREE DRILLING MACHINE

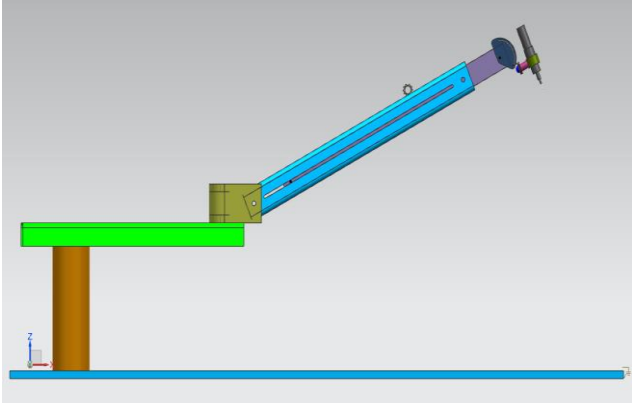


Figure: side view

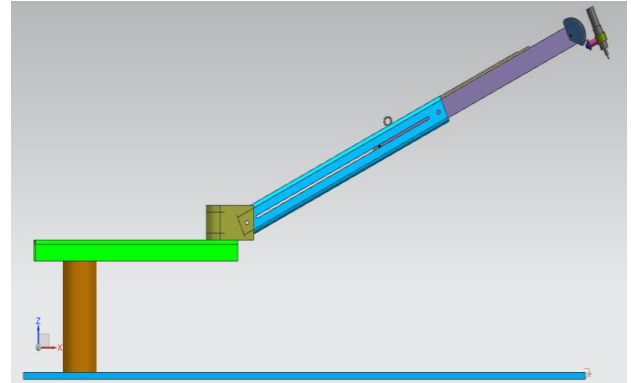


Figure: Rack & Pinion fully extended

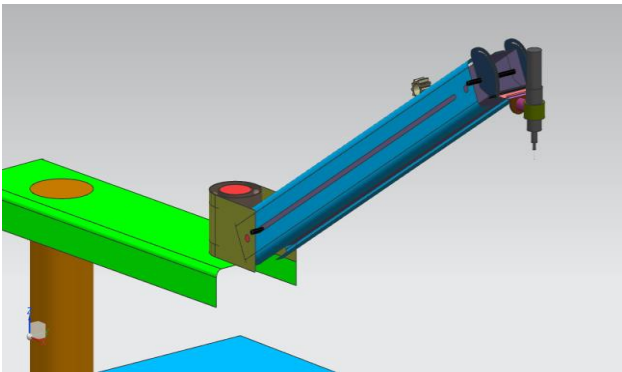


Figure: isometric view

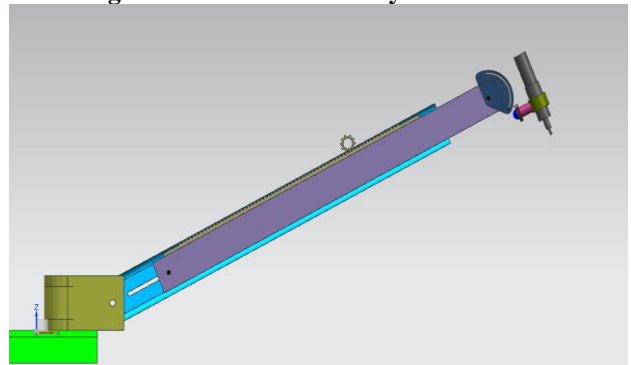


Figure: Cross-Section view

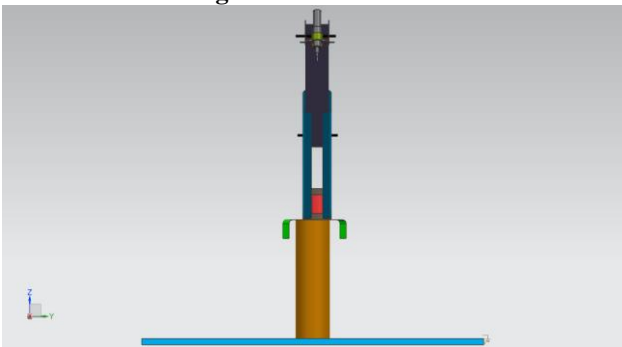


Figure: Front view

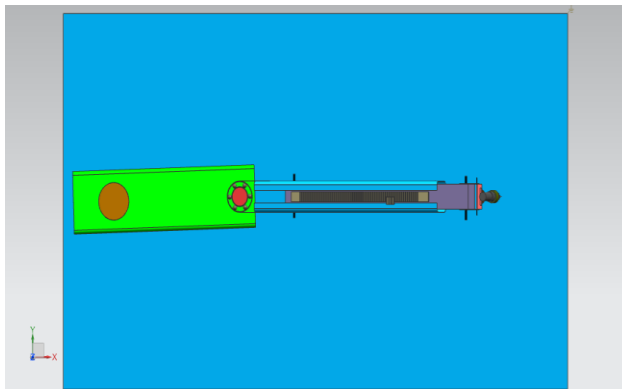
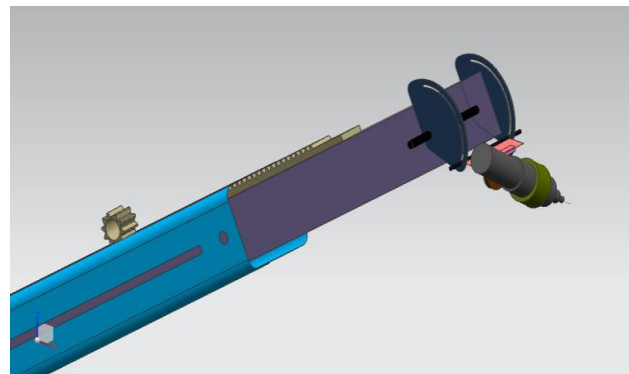
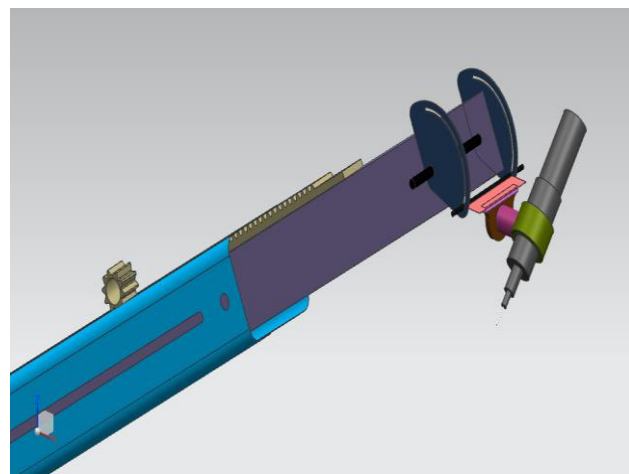


Figure: Top view



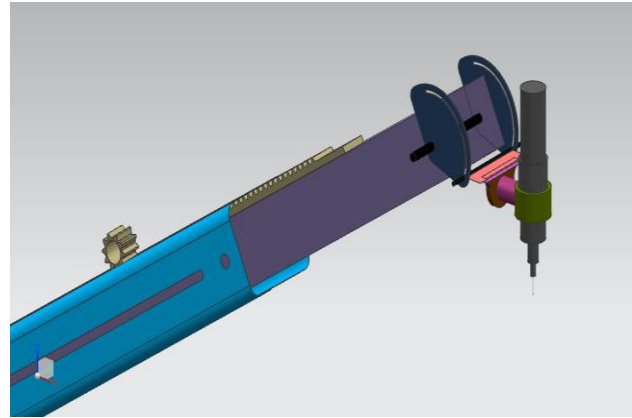
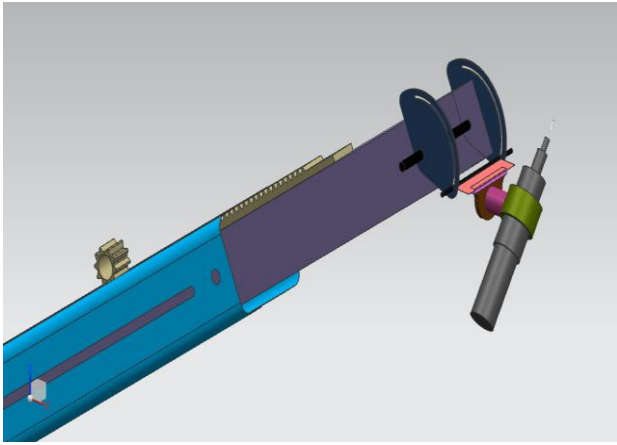


Figure: Drilling Machine at different angles

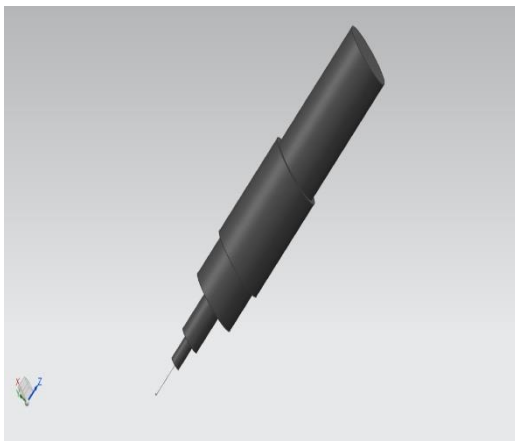


Figure: Drilling Machine

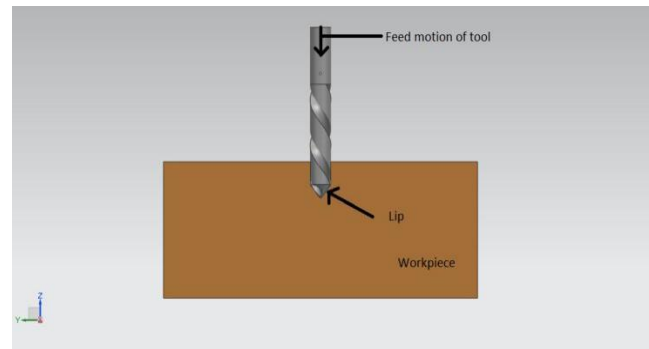


Figure: Process Schematic

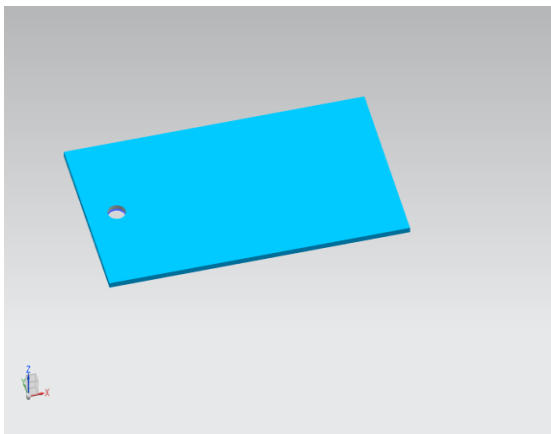


Figure: Base Plate

A. Brad Point Drill Bit

Brad Point drill bit is variance of the twist bit which can enhance drilling in wood. Brad Point drill bit can also known as lip and spur drill bit. For metalwork, this often encountered by drilling a pilot hole with a spotting drilling bit. The lip and spur drill bit can be a alternate method for drilling operation in woods.

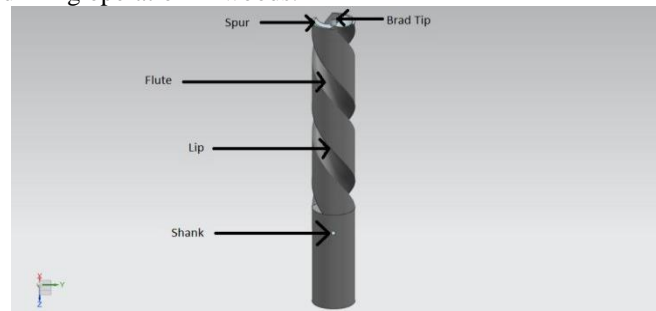


Figure: Brad Point Drill Bit

IV. PROCESS SCHEMATIC

Drilling involves respective axial and rotational motions between drill and work piece. Generally the drill rotates and advances into the work piece, but sometimes the other is true. The Chips which are formed during drilling process is removed by flowing through the grooves or flutes and therefore the coolant is required for higher rate of cutting , tool life.

B. Twist Drill Bit

Twist drills bits are the foremost widely used of all drilling bit types. This drilling bit can drill or cut anything from wood and plastic to steel and concrete. They are most frequently used for metal cutting, It's a metal rod casted into twist bit that have specific diameter that has two, three or four spiral flutes running most of its length.

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Two-flute drills are for primary drilling, whereas three and four-flute drills are just for enlarging holes during production situation.

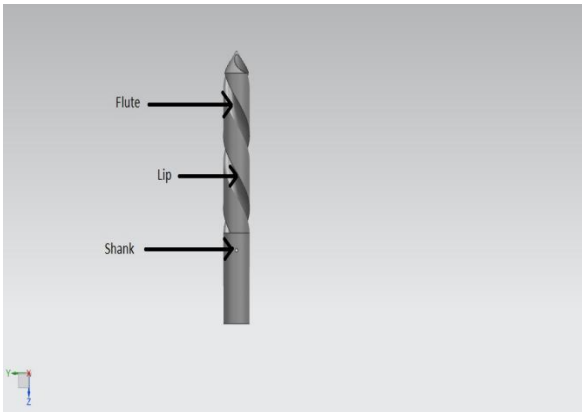


Figure: Twist Drill bit

V. COMPONENTS

A. Motor

A motor can be defined as a electrical device which can be operated by using direct or single-phase AC supply at approximately the equivalent speed and with same output. The shaft started rotating when supply is on. Shaft is supports by bush in it when power is supply through a rectifier. This shaft connects with the drilling bit through Chuck to rotates drilling bit and drill a hole on the workpiece when it required.

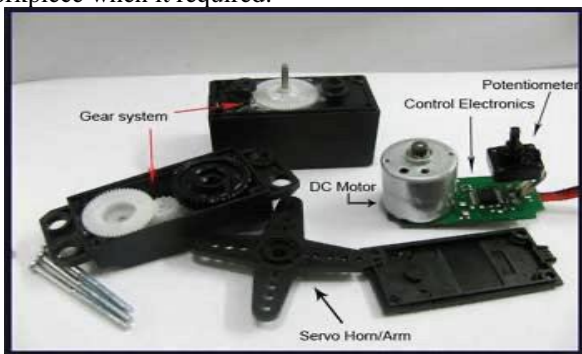


Figure: Motor

Source:-electrical4u.com

B. Connecting Arm

Connecting arm is used to connects the two objects to each other for support between them to help to move as desired. It connects two solid objects with the help of a hinge, this allows us to move at different angles of rotation between bodies. Two objects are rotated about a fixed axis of rotations connected by an ideal hinge, all other translations or rotational motion are being prevented and thus a hinge has a single degree of freedom. In this we are using a rack and pinion mechanism over the arms to make it a telescopic arm compromising of the outer arm and inner arm for increasing and decreasing the length of the arm. The pinion is attached to the outer arm and the rack is attached to the inner arm which together makes motion between the arms.

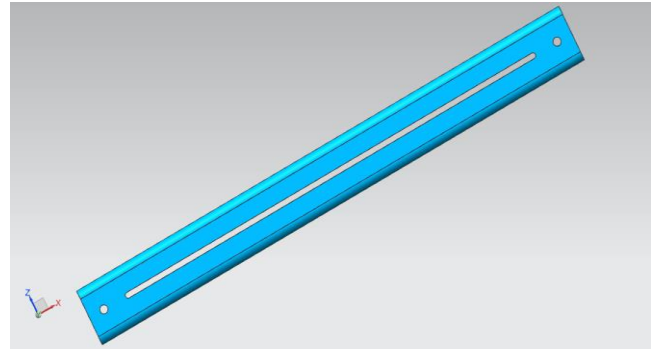


Figure: Outer Arm

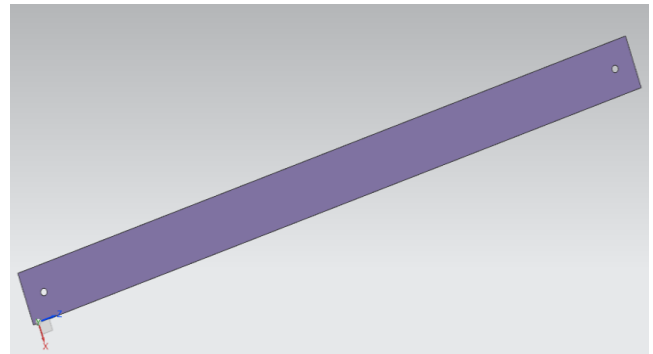


Figure: Inner Arm

C. Permanent Magnetic chuck

Magnetic chucks use the magnetism force from a permanent static magnet, electromagnet or electromaterial to accomplish chucking magnetic material or that action is held. There are a lot of people who benefits from using a magnetic chuck. Consistent clamping strength guarantees that there is no difference in how close or the workpiece is left loose; support of surface on workpiece reduces cycle time by safing its centre sector. Magnetic chucks have fast setup time, and downtime since the workpiece is always laid out down to magnetic plate, and sometimes vices secured by a magnet. For the job in our lightweight drill in a 360-degree drill machine, we use permanent rectangular chuck magnet.

Reason to use Permanent magnetic chuck:-

- No need for power supply to magnetization.
- The cost of additional clampers is reduced,are not always necessary.
- Easy to load and to unload.
- Space for workpiece storage Expands.
- Less time required to set up workpiece.

Operation:- Continuous Rectangular magnetic chucks employ magnetic power hold a workpiece on while it's in place for workdone. The magnets work by causing polarity in ferrous function material connecting through its north and the poles to the south. When a piece of work is placed around the magnet's poles, this flux flows in. The ferrous elements have poles opposite to each other of polarity of the magnet, to draw them all.

Expanding and monitoring that flux is the key to magnet application working in metal operation. Nearer gap between piece of work and magnet increases the attraction nor "pull" of the magnet. Smoothly superimposed workpieces are held tighter than armor to air. The strength of the magnetic attraction functions by how you will trigger a lot of magnetic flux into that piece of work. Working:- Pole alignment determines magnet status (Anyway on or off). Such poles are physically relocated in service to lever on and off the permanent magnet with a 180 degree help flip the knob. Magnetic power holds on workpiece mounted when it is in service workaroud.The magnets work by imposing polarity in ferrous material connected through north and the south pole.When a piece of work is placed across the poles of the magnet the flux flows into it. The Ferrous components come with poles. The polarity of the magnet is so opposite that they pull each other up. Advantages:- The permanent magnet has Chucks that are independent electrical power and easy to install for shifting from one machine to another. They don't produce heat, which results in deforming the poles or workpieces, and have a very durable build. Since they don't depend on electric current, there is no danger that the parts will be control loss thrown off or discharged don't depend upon electrical current, there is no danger of the pieces being thrown off or released by power failure.



Figure: Permanent Magnetic chuck

Source:indiamart.com

D. Bearing

A bearing is a mechanical device that combines respective movement to the desired movement of the bodies and also diminishes the friction between moving components.



Figure: Bearing

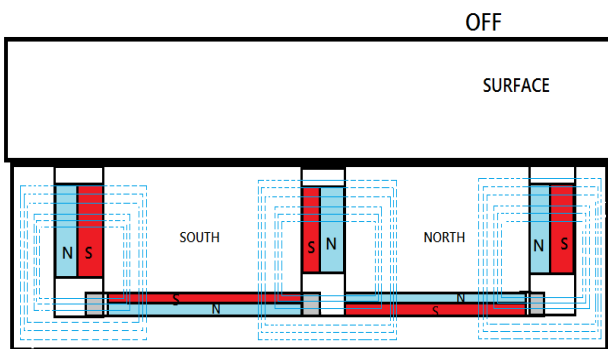


Figure: The surface is not attached to magnetic plate. It means the system is OFF.

Reference: eclipsmegnatics.com

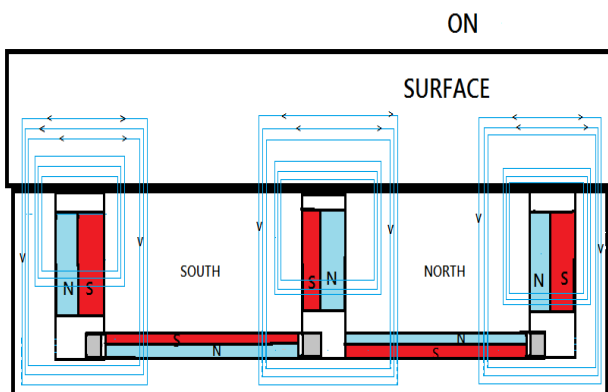


Figure: The surface is attached to magnetic plates. And magnetic field is formed, can be seen in above fig. This means system is ON.

Reference: eclipsmegnatics.com

E. Screws

Single degree of movement kinematic pair used in mechanisms of screw joints. Screw joints facilitate single-axis translation motion by the employ of the threads of the screws. This type of joint is used primarily on linear actuators. A screw joint is considered as a segregated form of joint but it is actually a contrast of bolted joint.



Figure: Screw

Source: wickes.co.uk

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F. Drill bit

The tools which are required to remove material in order to create holes or enlarge them, mostly of form of circular shape. Drill bits are available in variable sizes and shapes and can create different kinds of holes as required for operation in many different materials. It is made up of carbon steel. In our model we are assumed to use a drill bit of diameter of 2mm. These bits are used to make drill holes on wood, plastic, light metals, etc.



Figure: Drill Bit

Source: availablemachinery.com

VI. SPECIFICATION

A. Drill Bit: -

Twist drill bit = 3mm
Length = 30mm
Material = HSS
2mm for wood , plastic , light materials.

B. Motor -

Servo motor
Rated voltage = 24V
Working voltage = 12V
Speed = 10,000 rpm
Diameter. = 36mm
Length = 57mm
Current variation = 0.2 - 1.2 amp
Power supply = 2.4 - 15 watt
Shaft dia. = 3.17mm
Length of shaft = 14mm
Material = Aluminum

C. Connecting Rod -

200mm 1st rod i.e. Outer Arm (Quantity-2)
200 inch 2nd rod i.e. Inner Arm (Quantity-1)

D. Permanent Magnetic chuck:-

Size :- 120L*75W*45H
Shape :- Rectangular.
Magnet grade :- N35,N52,N38,N40.
Pole pitch :- 30 mm
Accuracy as per IS: 8710-1978
Magnet pull:- 40-70% more than IS.
Pole Gap:- 14mm

VII. METHODOLOGY

In 360 Degree flexible drilling machine drill can be done at any desired orientation and angle without using any kind of

clamping or using different machine for drilling. This machine also reduces the clamping time and increases productivity time. 360 drilling machine is already invented but in our model we are using rack and pinion mechanism over the arms for making it telescopic arm whose length can increase or decrease as required. A permanent magnet chuck is also introduced which clamp the workpiece with its magnetic field without using any physical clamping device. This model is far better than our conventional drilling machines.

VIII. FUTURE SCOPE

- The complete automation can be achieve.
- This machine can be used in every industry.
- It will be more flexible and easy to adjust.
- The method of rotation of arm and drill can be used in machining operation.
- The portability of a machine can be increase.
- Locking of the base with the flat surface can be improved.
- This mechanism can also improvise in other machinery for easy movement and increase the productivity.

IX. ADVANTAGES

- The setup of the machine is simple and compact.
- Machine is easy to handle.
- The machine can drill in any direction automatically.
- It can drill in congested and difficult place.
- This method can reduce the setting time of operation.
- The handling cost of machine will be reduce.

X. CONCLUSION

Efficient operation and competitive costs can be assured in this project. Since many operations and holes can be performed from this machine. It is efficient and economical as compared to other available resources. While taking consideration of its uses and price of the model. This machine becomes relatively affordable when compared to other machines. This gives the facility to work in-between the drill bit and drill bed where minimum spaces are available. In this rack and pinion mechanism used over the arms to make it a telescopic arm for increasing and decreasing the length of the arm. A magnetic base plate is also introduced for the clamping purpose of the workpiece. The size of the machine is smaller than the older machine. So, the overall space required is also minimum. The clamping of the workpiece has been eliminated due to the magnetic base plate. In this project we can drill as many holes as we required without moving the workpiece. Hence, it reduces the number of machines required and also minimize the error occurs due to human.

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