

Fabrication of Universal Drilling Machine

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Abstract – There are many operations are carried out to obtain the final product from raw material. These operations are performed with the help of various machineries. Drilling operation is one of the most important operations in industries. Generally these operations are carried out by two types of drilling machines, these are Bench drilling Machine & another is hand Drill machine. The bench drill machine can be used for the heavy operations but for performing many operations it get failed. It requires multi spindle machine for doing the same. In case of hand drill machine, the maximum efforts from the human are required, these machines are heavy also. This universal drilling machine is a combination of both hand drill machine and bench drill machine, which is designed to obtain the better result with reduced efforts and time too. This machine provides more flexibility to move in any direction due to the linkages and its construction. This machine can perform in every direction given by the operator. There are various linkages and joints are made in its construction which delivers the more flexibility in the operation. The vertical column is made in such a way that it can rotate in circular direction. The arm gives angular up and down motion and the final are gives directional stability and it holds the motor and further assembly to perform work.

Key Words: Drill Machine, Existing Machine, Developments, Working.

1. INTRODUCTION

Drilling is an operation carried out to make a hole or increase in the size of hole for specific reasons. Drilling is very important operation in fitting or tightening industry. We are going to introduce universal drilling machine in this chapter.

1.1 History

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 woodworking, stonework and dentistry. Archeologist discovered a Neolithic grave yard in Mehrgrath, Pakistan dating from the time of the Harappa's, 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.

1.2. Existing Drill Machines

Drilling machine is a power operated machine tool which holds the drill in its spindle rotating at high speeds and when actuated move linearly against the work piece to produce the hole.

The drill machine is a tool fitted device which used to rotate the tool and to obtain the hole on particular work piece. There are various types of drill machines such as

- a. Portable Drilling Machine.



Fig -1: Portable Drilling Machine

b. Bench Drilling Machine.

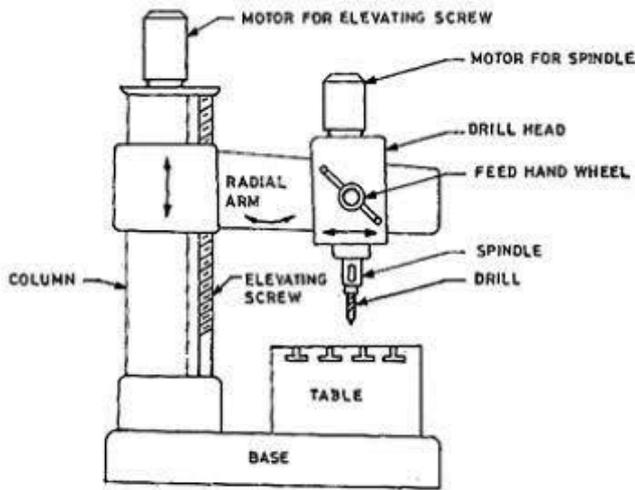


Fig -2: Bench Drilling Machine

c. Radial Drilling Machine.

d. Pillar Drilling Machine.

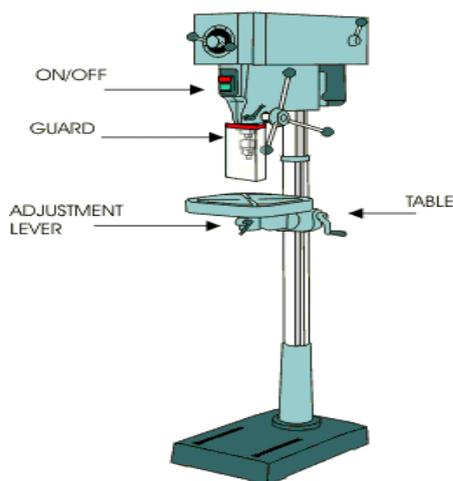


Fig -3: Pillar Drilling Machine

e. Gang Drilling Machine.



Fig -4: Gang Drilling Machine

f. Multiple Drilling Machines.



Fig -5: Multiple Drilling Machines

These machine are used to perform the various operations like,

1. Reaming
2. Boring
3. Counter Boring
4. Counter Sinking
5. Spot facing
6. Tapping.

The various operations are done on work piece with the special purpose drill machine to achieve the higher accuracy for the operation.

2. PROBLEM DEFINITION

As we know, a drilling operation is a heart of many industries as well as it is also important machine in domestic use. But if you want to have more number of holes on a same work piece, you have to use multi spindle drilling machine having a combination with radial drilling machine which become more costly and expensive. So it cannot be affordable for all. It also required varying the positions of work piece then it also affects the accuracy of the operation. If we are going to use hand drill machine: i.e. portable drilling machine, then we can obtain the flexibility in the operations but the stability during the operation and the working conditions there is a possibility of reducing the accuracy of the operation and the weight of the machine is also affects the performance. For such kind of machines, the weight and vibrations also have to be under the considerations. In portable drilling machines it is not easily possible to achieve same accuracy and efficiency of operation every time.

3. CONSTRUCTION



Fig -6: Universal Drilling Machine

The fig shows the arrangement of various components of universal drilling machine. This universal drilling machine consists of following components:

1. Base Frame
2. Vertical Arm
3. Robotic Arm
4. Bearing
5. Linkages
6. Motor
7. Drill Chuck
8. Drill Tool
9. Battery
10. Connecting Wires
11. Switch.

Base Frame: the base frame is nothing but the member used for the foundation and provides a proper support to the assembly.

Vertical Arm: it is connected to the frame by means of bearing. It rotates about its own axis to give the rotational direction to the further assembly to cover the circular portion for the working.

Robotic Arm: it is connected with the help of flexible joint to the vertical arm. This connects the motor holder and vertical arm. It provides angular up and down motion for the operation.

Bearing: it provides support to the vertical arm and allows it to rotate freely with its own vertical axis. It is mounted over the base frame.



Fig -7: Vertical Arm with bearing

Linkages: these are used to connect or attach the various components of the system. These are flexible and can provide sliding motion between to links. These are used to make the turning pairs.

Motor: it is an element which provides rotary motion to the chuck or tool holder to obtain the output from the machine. Here we have used the 12V dc motor for this machine.



Fig -8: Motor & Chuck

Drill Chuck: it is nothing but the tool holder. It holds the tool with the jaws. It is attached to the motor to get the rotation motion and then delivers to the tool for cutting.

Drill Tool: it is also known as drill bit. We are going to use few limited but mostly used sized bits for this machine in this paper. We are going to use bit of diameter 6mm, 7mm, 8mm & 10mm.



Fig -9: Drill tool & Chuck

Battery: it is used to drive the motor to obtain desired output. Here we are going to use a rechargeable battery of 12V capacity.



Fig -10: Battery

Electric wires: wires are used to connect the battery to the motor.

Switch: it is used to control the ON-OFF action of the motor. When switch is at on position, the motor gets started & when switch is at OFF position motor get stopped.



Fig -11: Switch

4. PRINCIPLE / CONCEPT

This universal drilling machine is simply works on the principle of conversion of the electric energy from the battery in to the useful mechanical work in form of the rotational action of the chuck or spindle to achieve the cut by using tool. It also refers to the sliding pair mechanism which allows the free rotations to the links. This results the higher degree of freedom for the machine or robotic arms. This will result in the higher effective area for the machine.

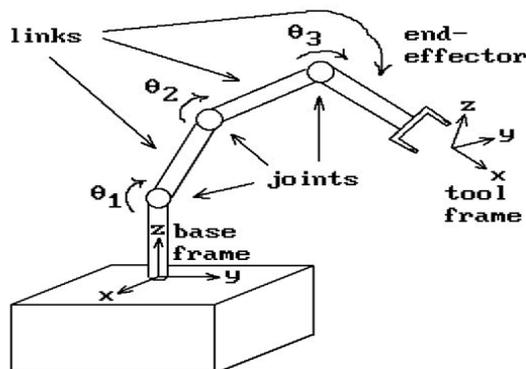


Fig -12: Concept of universal Drilling Machine

5. WORKING

As we have seen in the fig. we have provide sliding pairs for the each joint. This sliding pair provides more accessibility and the higher degree of freedom. These joints are attached with the help of bolted joints. Since the loosening and tightening of the linkages is easily possible. As the switch gets operated by the operator and turned it ON, then it connects the motor to the battery by means of the electric wiring. As soon as the motor gets started, it also rotates the chuck or spindle mounted over the output shaft of the motor. The chuck is used to hold the tool by using jaws. As the chuck or spindle gets started, it results in the rotations of the tool. This rotation of tool further gets used to obtain the cut on work piece. Before starting the machine, it is necessary to make a decision and marking for the cut size and depth with the positions of the holes to be drilled. Then put the machine in such a way that it can cover maximum points with its range. After deciding the position of where the base to be attached to obtain the drill, operator have to start the motor. Then the operator should have to provide directions towards the markings. After completing the operations operator have to shut OFF the motor and down the motor. In this manner this universal machine works with minimum possible efforts from the operator.

6. ADVANTAGES

- Light in weight
- Portable
- Easy to carry.
- Fewer efforts required.

7. CONCLUSION

This universal drill machine gives a better operational stability with reference to the portable drilling machine. It also seems that it is more advantageous over the conventional drilling machines. This is light weight and portable too. So it gives better control during the operation. The joints are made in such a way that it can rotate in all the directions and the can perform better, so it works as we have expected. It reduces the human efforts required for the drilling operations and also reduces the overall energy consumption required for performing the same operations. It also requires less space and it is easy to handle.

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