International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

Design and Development of Flexible Drilling and Tapping Machine

Keval Malaviya[1], Jay Bhatt[2]

[1]*Bachelor of Engineering in Mechanical, Dept. of Mechanical Engineering, Atmiya Institute of Technology and Science-Rajkot, Gujarat, India.*
[2]*Bachelor of Engineering in Mechanical, Dept. of Mechanical Engineering, Atmiya Institute of Technology and Science-Rajkot, Gujarat, India.*

Abstract - *In previous drilling machine many of the problems arise during drilling and tapping. Some parts cannot be drilled or tapped using fixed drills due to low space between drill/tap bit and bed. So we use portable hand drill and tap in this case. So here we have done Design and Development of Flexible drilling and Tapping Machine that can be mounted on a table or wall and can be used to drill holes horizontally, vertically or even upside down. So this make it possible for easy drilling in even complicated parts and surface. Moreover, it save's the time for changing the tool and we have made Drilling and Tapping in one attachment only with portable machine and we have changed the design and made it portable and reliable so it is easy to place from one place to another. This machine reduces the manufacturing cycle time and elimination of human error.*

***KEY WORDS*: Rods, hinges, motor, drilling and tapping collets, wirings.**

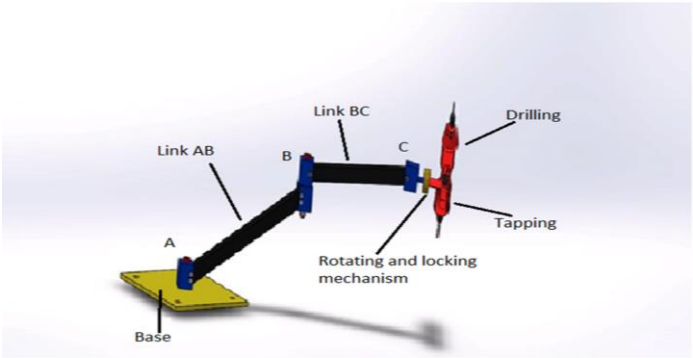
1. INTRODUCTION

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 multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolution per minutes. This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.

Tapping is the process of cutting a thread inside a hole so that a cap screw or bolt can be threaded into the hole. Also, it is used to make thread on nuts.
Tapping can be done on the lathe by power feed or by hand.

2.1 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.



2.2 OBJECTIVE:

The main objective of this project is to Drill and Tap different holes in horizontal, vertical and also Upside-down condition.

- To flexible so it is easy to move from one place to another place.
- To also used for small drilling holes.
- To make Operation easy with less effort and also reduced the time for changing tool.

3. COMPONENTS USED IN DRILLING AND TAPPING MACHINE

1. Motor

2. Connecting Arm
3. Bearings
4. Universal Joint
5. Drill Collet
6. Tap Collet

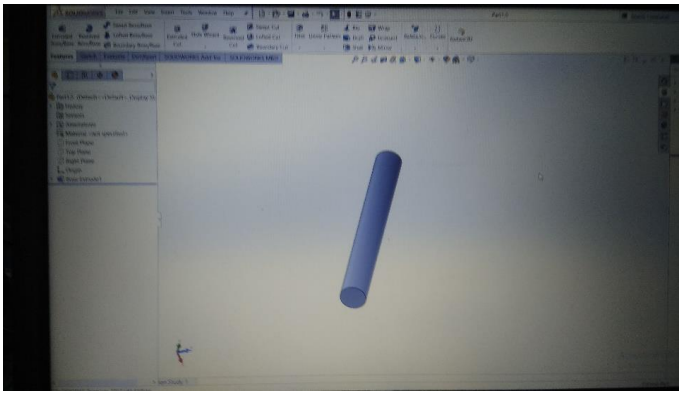
3.1 MOTOR:

It is an electrical device which converts electrical energy to mechanical energy. It rotates shaft which support by bush in it when power is supply through rectifier. This shaft connect with drill bit through chuck to rotate drill bit and make hole on work piece.

An electric motor is an electrical machine that converts electrical energy into mechanical l energy. The reverse of this is the conversion of mechanical energy into electrical energy and is done by an electric generator, which has much in common with a motor.

Most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force. In certain applications, such as in regenerative braking with traction motors in the transportation industry, electric motors can also be used in reverse as generators to convert mechanical energy into electric power.

3.2 CONNECTING ARM:

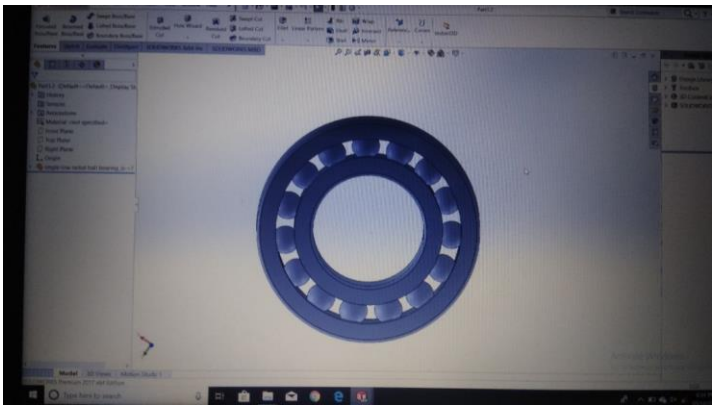


It connects the two Frames to each other for supports between them to help to move when we required. It consist of metal strips of two sizes one of 12" (inch) and another is of 15" (inch). Both are of four pieces of equal length. A hinge is a mechanical bearing that connects two solid objects, typically allowing only a limited angle of rotation between them.

Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation: all other translations or rotations being prevented, and thus a hinge has one degree of freedom. Hinges may be made of flexible material or of moving components. In a many joints function as hinges like the elbow joint. In Hinges appear in large structures such as elevated freeway and railroad viaducts.

These are included to reduce or eliminate the transfer of bending stresses between structural components, typically in an effort to reduce sensitivity to earthquakes. The primary reason for using a hinge, rather than a simpler device such as a slide, is to prevent the separation of adjacent components. When no bending stresses are transmitted across the hinge it is called a zero moment hinge.

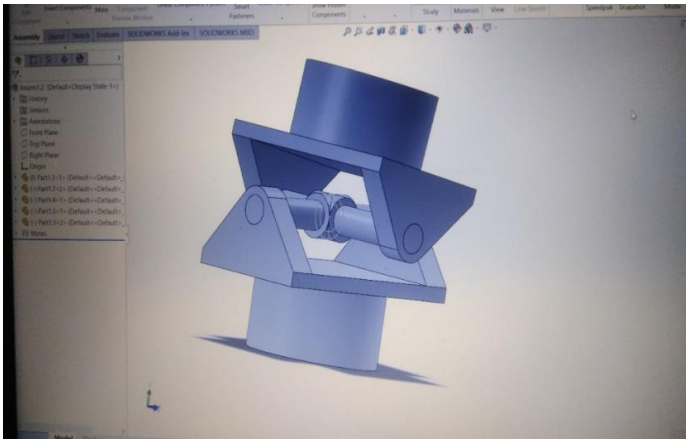
3.3 BEARINGS:



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.

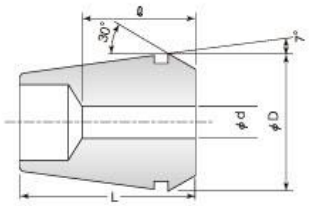
Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole.

3.4 UNIVERSAL JOINT:



A universal joint (u-joint or cardan joint) is a joint or coupling connecting rigid rods whose axes are inclined to each other, and is commonly used in shafts that transmit rotary motion.it consist of a pair of hinges located close together, oriented at 90° to each other, connected by cross shaft.

3.5 DRILL COLLET:



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.

3.6 TAP COLLET:

Tapping chucks are adapters for stationary drilling machines. They enable, for example, drilling with tools with square taper. Tools are fixed and centered by the tapping chuck. The central part of the adapter are the components for fixing the tool.

Below are some of the most common types of thread taps:

1. Straight flute taps
2. Spiral flute taps
3. Spiral pointed taps
4. Long shank machine taps

4. CALCULATIONS

4.1 Operation specification of Drilling Machine:

1. Cutting speed (V)

   $V = \pi DN$

   Where, D = diameter of drill in mm =5 mm
   N = speed of rotation in mm = 600mm/min
   V = 9420 mm/sec

2. Feed rate (f)

   f = 40 mm/min

3. Depth of cut (d)

   d = D/2
   d =2.5 mm

4. Material remove rate

   $MRR = (\pi D^2/4)\, f\, N$
   $MRR = 471238.89\ mm^3/min.$

5. Machining Time

   t = L/f
   t= 1 min

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

6. Torque

   P = 12 watts, N = 1750 rpm

P =2πNT/60

T = P x 60/2πN

T = 12 x 60/2x3.14x600

T =0.1909 N-mm

4.2 Operation specification of Tapping Machine:

1. Cutting speed (V)

V = πDN

Where, D = diameter of tap in mm = 5 mm
N = speed of rotation in mm = 400 mm/min
V = 6280 mm/sec

2. Feed rate (f)

f = 30 mm/min

3. Depth of cut (d)

d = D/2
d = 2.5 mm

4. Material remove rate

MRR = $(\pi D^2/4)f N$
MRR = 235619.449 mm^3/min.

5. Machining Time

t = L/f
t=1

Where, L =length of the hole to be drilled = 30 mm
f = feed of the drill = 30 mm/min

6. Torque

P = 12 watts, N = 400 rpm

P =2πNT/60

T = P x 60/2πN

T = 12 x 60/2x3.14x400

T =0.2914 N-mm

5. ADVANTAGES & DISADVANTAGES:

5.1 Advantages:

1. Efficient drilling and tapping
2. Flexible
3. 360 degree rotation
4. Easy to use
5. Reduce handling cost
6. Reduce time
7. Reduce overall manufacturing cost

Increase productivity

5.2 Disadvantages:

1. It is bit costly
2. It needed power supply because battery operated

6. FUTURE SCOPE

1) It is used with automation for automatic drilling and Tapping.
2) Also use this method of rotation of arm in other machining operation.
3) In future exact desired R.P.M. can be achieved with the help of embedded system. (With the use of micro controller)
4)The drilling head assembly with slide can be replaced by other equipment like toweling gun/gas welding nozzle/gas cutting equipment thus making it a multi-functional machine.
5) The machine can be automated by fixing motor at joints so as to rotate the base, arms and cross slide.

7. CONCLUSIONS

This project is a combination effort and the goal was to produce a cost effective drilling machine and tapping machine which would help the small scale industries. We would to help to drill holes easily at any desired angle accurately. This project is an efficient operation and competitive cost. Since a no. of operation and hole can be performed in a simple unit. It is efficient and economical. Considering its uses and cost of project, it's become relatively cheap when compare to other units. This machine 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. Dnyaneshwar B Bharad, Rahul D Gawande, Pratik D Ghangale, Rahul K Gunjal, Prof.A.S.Autade, Prof.P.P.Darade , A Paper on Two Spindle Drilling Head , International Research Journal of Engineering and Technology , Volume: 04 , Apr - 2017 , Pages 818 – 821

2. 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

3. Osamu Horiuchi et al, (2013) Bending of Drill and Radial Forces in Micro Drilling, Advanced Materials Research, 797, 642.

4. G. PrasanthKuma, P. GunaSekhar, P. Nadeem Khan, P. Rajesh, B. V.Krishnaiah "Design & Fabrication of 360° Flexible Drilling Machine" International Journal of Engineering Trends and Applications, Volume 5 Issue 2, Mar-Apr 2018.

5. Pratik parsania, Jignesh Dave, Brijeshgarala, Design of Hydraulic Power pack for SPM (Multi Spindle Drilling) Volume: 3| Issue: 6 | June 2013 | ISSN - 2249-555X.

6. B.Shivapragash, K.Chandrasekaram, C.Parthasarathy, M.Samuel "Multiple response Optimization in drilling using taguchi and grey relational analysis" (IJMER) Vol. 3, ssue 2, March April 2013, pp-765-768

7. 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

8. Suman Chatterjee, Siba Sankar Mahapatra, Kumar Abhishek, (2016) Simulation and optimization of machining parameters in drilling.