



# Design of Multi Way Drilling Machine

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## Abstract:

Engineers are always developing sophisticated machines and modern techniques. Complicated components with requirement of angular drilled holes cannot be drilled with the vertical drilling machine. The current scenario does not provide any arrangement for the multi ways and angular drilling hole. In our project the system can be rotated in three directions for drilling purpose. Therefore, the job setting is not complicated as well as reduces the setting time for the drilling operation. Materials like wood, plastic, aluminum and light metal can be drilled with this. In a drilling machine holes can be drilled quickly and at a low cost. This drilling machine provides different angle drilling on the working job. Square and circular plate and up/down mechanism is available in this Angular Drilling Machine.

**Keywords:** spur gear, Lead Screw, Portable drill machine chuck, Drill vice, Angular table, etc...

## I. INTRODUCTION

Drilling machine is one of the important machine tools in a workshop. It was designed to produce a cylindrical hole of required diameter and depth on metal work pieces. The holes can be drilled by different machine tools in shop; drilling machine is designed specifically to perform the operation of drilling and similar operations. Currently the drill heads with 90 degree inclination provided are readily available in the market for drilling the inclined holes. But it can drill holes only in the 90 degree. The aim of our project is to drill the holes from 0 degree to 90 degree. Moreover the time to drill the holes is reduced by providing the saddle slide ways in, x y direction, which supports the job to change the positions of job. The problem of angular drilling is thus solved and the time required to drill holes is lowered. Due to the industrial revolution, the industries are growing on the larger scale. Products are required to produce by the mass production techniques to reduce the cost. Special purpose machine are developed for this purpose, to achieve high quality production and reduce the time of operation. For mass production, Multiple-spindle drilling machines are used. It is the time saving technique. It is used to drill two holes at the same time, such that the two spindles of machine are driven by the single motor simultaneously. In mass production, Drilling jigs are providing to guide the drills in the work piece. Different size of hole cannot be drilled without changing the drill bit. In today's market the customer demands the product of right quality, right quantity, right cost, & at right time. Therefore it is necessary to improve productivity as well as quality. One way to achieve this is by using new design for the drilling machine which is robust, reliable and productive in construction. Our project focuses on drilling of different sizes straight & angular cylindrical holes as per requirements for industry. Project has multi way drilling machine tables with auto feed drill machine. This multi way drilling machine table with auto feed drill machine which is capable of drilling straight as well as incline hole. The angular drilling is done with the circular plate provided on the drill table. The circular drill plate can be inclined with the help of angular wedges provided for the support. The six way drilling table aims at time saving and reduces the machine time for setup of the work piece component. The operation of the new drill machine is well controlled. Complex shapes can be drilled as per the requirement and within less time

## II. HISTORY OF WORK AXIS

### 1. CROSS SLIDE TABLE W/ANGLE

These remarkably precise tilting rotary tables provide all the combinations of movements and positioning necessary to add increased versatility on drill presses Angular inclination from 0° horizontal to 90° vertical. Angular position is indicated in 1° increments and locked via 4 bolts and 2 side plates.

### 2. ANGLE PLETE

An angle plate is a work holding device used as a fixture in metalworking. The angle plate is made from high quality material (generally spheroid cast iron) that has been stabilized to prevent further movement or distortion. Slotted holes or "T" bolt slots are machined into the surfaces to enable the secure attachment or clamping of work pieces to the plate, and also of the plate to the worktable. Angle plates also may be used to hold the work piece square to the table during marking-out operations. Adjustable angle plates are also available for work pieces that need to be inclined,

### 3. ANGLE VICE

A machine table vice is equipped with jaws which clamp against the work piece, holding it secure. The vice can be bolted to the drilling table or the tail can be swung around to lay against the column to hold itself steady. Below are listed many types of special purpose machine table vises available to machine operators. The standard machine table vise is the simplest of all vises. It is equipped with two precision ground jaws for holding onto the work and a lead screw to tighten the one movable jaw to the work

### 4. ANGULAR DRILLING MACHINE

The working operation of this angular drilling machine is initially started from the universal motor through A.C. Power source. In this, there is one power sources, received from the power supply. After that the indexing mechanism is controlled, to fix the desired angle. A lock nut is attached to the indexing plate to avoid and deviation of angle during drilling

### III. DESIGN FOR PROPOSED DRILLING MACHINE

THEY DESIGN SOFTWARE IS CREO 3.0(PTC) 2014

#### 1. INTRODUCTION FOR CREO 3.0

Get up to speed quickly on Creo Parametric with five real-world tutorials. This series of exercises will take you through parts and assembly modeling, motion analysis and creating drawings. Start today and see how easy it is to get started designing with Creo Parametric.

#### 2. DESIGN PROCEDURE

Initially the component was designed, modeled and edited to get the necessary details for designer of the table (saddle). Secondly the individual parts such as Base Plate, Locator, Clamping Devices, lead screw, spur gear, handle and bevel gear has been developed. All these parts have been designed, Modeled, Drafting has been done individually. The whole Design Procedure was completed with the help of creo 3.0(ptc) 2014 software by which the software helps for Designing, Drafting Assembly and Analysis which may be useful for customized applications and manipulations

- Lead Screws Linear motion can be achieved by means other than through the use of lead screws. Chain and cable drives along with belt and pulley drives do not require pumps and support hardware as do hydraulic and pneumatic systems. They can carry very small to very heavy loads at great speeds when needed. However, these systems are not as accurate or as repeatable as lead screws, and they generally require a greater number of components, are more complicated to install, and require more maintenance during operation. In addition, recalculating or running chains, cables, or belts can be a safety hazard.

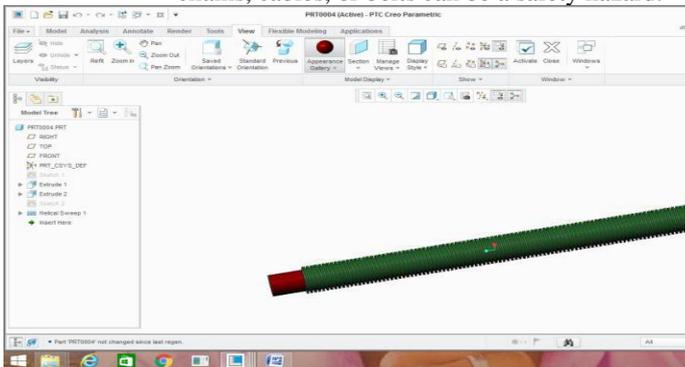


Fig -1: lead screw

#### Another component

Saddle, Bevel gear, Spur gear, Saddle table, Drill head, Column, Clamp, Bed, Bottom plate,

#### DESIGN CALCULATIONS

##### SPUR GEAR,

Reference diameter (d)  $d = z m = z m = 25 \times 2 = 50 \text{ mm}$

Tip diameter (da)  $d_a = d + 2 m = d + 2 m = 50 + 4 = 54 \text{ mm}$

Root diameter (df)  $d_f = d - 2.5 m = d - 2.5 m = 50 - 2.5 \times 2 = 45 \text{ mm}$

where, d- outer diameter of gear

z- no of teeth

m- module for data book

#### BEVEL GEAR

Number of the teeth on the driver = 18 (from design data book)

Number of the teeth on the driven = 9

Gear ratio =  $Z_2/Z_1 = i = 9/18 = 0.5$

$$d_1 = m \times z_1$$

$$m = 51/18 = 2.833$$

so, standard module = 3mm

1. Dia of driver gear,  $d_1 = 51 \text{ mm}$

2. dia of driven gear,  $d_2 = 31 \text{ mm}$ .

3. Pressure angle assume initially = 20 degree

$$\text{Pitch angle } \delta_2 = \tan^{-1}(0.5) = 26.56 \text{ degree}$$

$$\text{Pitch angle } \delta_1 = 90 - \delta_2 = 90 - 26.56 = 63.43 \text{ degree}$$

$$\text{Cone distance, } R = 0.5 \times 3 \times 18 + 9 = 40.5 \text{ mm}$$

$$\text{Transverse module, } M_t = R / 0.5 \times (Z_1 + Z_2)$$

$$= 40.5 / 0.5 \times (18 + 9) = 3 \text{ mm}$$

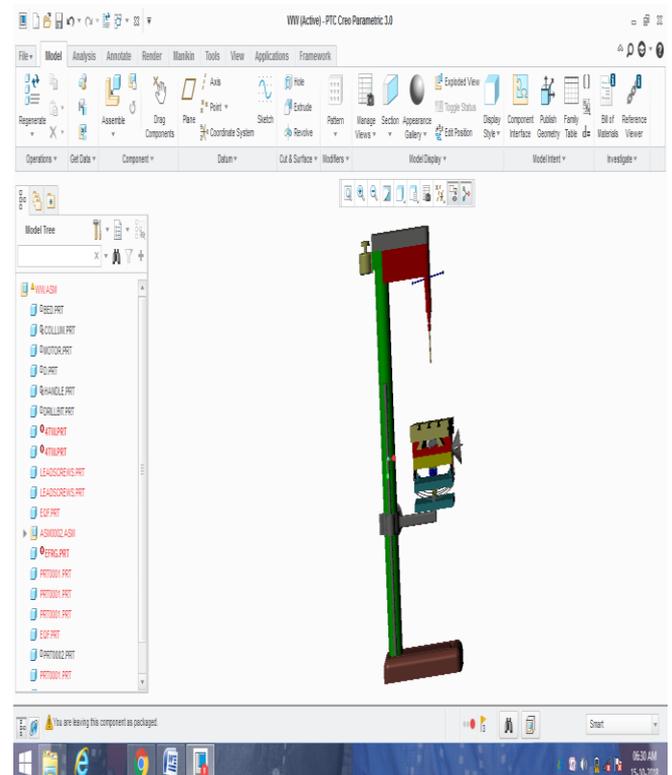
$$\text{Addendum, } h_a = 3 \text{ mm}$$

$$\text{Dedendum, } h_f = 1.2 \times m_t = 1.2 \times 3 = 3.6 \text{ mm}$$

$$\text{Clearance, } c = 0.2 \times m_t = 0.2 \times 3 = 0.6$$

$$\text{Addendum angle, } a = \tan^{-1} \frac{h_a}{R} = \tan^{-1} \frac{3}{40.5} = 0.07 \text{ deg}$$

#### FINAL DESIGN FOR PROPOSED DRILLING MACHINE



#### 5. WORKING FOR PROPOSED DRILLING MACHINE

Angular ways Drilling machine table with hand feed drill machine has two main parts first drill head & another drill table. Job holding table assembly normally involves Angular

Ways work piece moving adjustments .While adjustment of drill table during jobholding also in inclined whole drilling. In this project job moves in Angular ways. The coordinates of moving drilling machine table with auto feed drill machine capable of drilling straight as well as inclined hole which is requirement for industry. The motion of drill table as given below,

- Linear +X & -X.
- Linear +Y & -Y.
- Linear +Z & -Z.
- Clockwise +Z & Anticlockwise -Z.
- Angular Inclination about X-axis.
- Angular Inclination about Y-axis.

In additional it provided auto feed drill machine at upper side of the drill table which can give drill machine feed by using motor & linear Guide ways Up & Down.

## 6. RESULTS AND DISCUSSION

This proposed drill machine gives a better operational stability with reference to the drilling machine. It also seems that it is more advantageous over the conventional drilling machines. There easy operate to angular holes 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.

### Advantages

- Any degree angle hole can be done
- Materials to have cast iron, so load will accept
- Double lead screw to using for load carriage

### Application

- To put angular and straight holes with high Precision on engine heads and blocks and Cylindrical shell Used in general furniture making Angle

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## 7. REFERENCES

[1] Rajendra Kelwa, Design and Fabrication of Drilling Cum Cutting Machine, Volume 9, Issue 2, February-2018

[2] V.B. Bhandari, "Design of Machine Elements "TMH Publishers, New Delhi, 2nd Edition, 2013

[3] Saifee, M. A., & Mehta, U. S. (2014). "Design and Implementation of 2-Axis Circular Interpolation Controller in Field Programmable Gate Array (FPGA) for Computer Numerical Control (CNC) Machines and Robotics". International Journal of Computer Applications, 106.

[4] Amosh Shanker, Hemant Gurung, Laden Doma Bhutia, Saurabh Sharma & T.Y Ladhaki Design and Analysis of Linear Two Axis Drill Jigs

[5] <http://www.ijsr.in/upload/816854820Microsoft%20Word%20-%20NCRIET-242.pdf>

[6] <http://data.conferenceworld.in/ICDAVIM/P413-479.pdf>

[7] <http://www.rsisinternational.org/Issue15/32-37.pdf>

[8] [http://www.ijirset.com/upload/2016/nciime/11\\_011\\_DESIGN.pdf](http://www.ijirset.com/upload/2016/nciime/11_011_DESIGN.pdf)