Design and Analysis of Linear Two Axis Drill Jigs

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Abstract – In this paper an attempt has been made to design, analyse and fabricate a linear two axis indexing drill jig. Basically, Jig is a work holding device which also guides the tool. The main purpose of making this Jig is to perform “chain drilling” without any need of shifting the job regularly, as the drilling spot is located by the movement of the tables on both X-Y directions. This results in reduction in production time and can be used for mass production. The movement of the tables is done with the help of lead screws. We have also screwed scales in the body of the jig so that the job doesn’t have to be measured again and again which will result in more time consumption, Therefore the main purpose of a linear two axis indexing drill jig is to drill proper, more accurate and precise holes.

Keywords – drill jig, chain drilling, movement.

I. INTRODUCTION

A linear two axis indexing jig is manufactured mainly to perform chain drilling. This jig can be used for job with a specific dimension of 60/60 only. The drill must fit the hole in the jig to insure accuracy. When the jig is used in drilling many holes, the steel around the holes is hardened to prevent wear. If extreme accuracy is essential, or if the jig is to be used as permanent equipment, bushings, made of steel and hardened, are used to guide the drills.

II. JIGS

A jig is may be defined as a device which hold and position the work; locate or guides the tool relative to the work piece and usually not fixed to the m/c table. It is usually lightly in construction. The use of jig makes possible more rapid and more accurate manufacturing at a reduction of cost.

The most-common jigs are drill jigs. , drill jigs are the most-widely used form of jig. Drill jigs are used for drilling.

Jigs are further identified by their basic construction. The two common forms of jigs are open and closed. Open jigs carry out operation on only one, or sometimes two, sides of a work piece. Closed jigs, on the other hand, operate on two or more sides. The most-common open jigs are template jigs, plate jigs, table jigs, sandwich jigs, and angle plate jigs. Typical examples of closed jigs include box jigs, channel jigs, and leaf jigs. Other forms of jigs rely more on the application of the tool than on their construction for their identity. These include indexing jigs, trunnion jigs, and multi-station jigs.

III. DESIGN

The calculations and explanations on the design of the drilling jigs are based on the six principles of jigs design: clamping, clearance, stability, rigidity, handling and accuracy.

The material used for all the components on the jig is mild steel(carbon contain 0.3%). These are less ductile but harder and have greater tensile strength. It balances ductility and strength and has good wear resistance. They have also better machining qualities and it is easily available in market.

Properties: Harder, better tensile strength, good wear resistance.

IV. PROJECT DESCRIPTION

A jig is manufactured which is used for chain drilling. For making this project, mild steel material, clamps, lead screws.

Specification

- Type of JIG = Linear Indexing Jig
- Length of Body = 350 mm
- Breadth = 150 mm
Material of Body = mild steel
Type of Screw = lead screw
Travel = 180mm movement

V. WORKING PRINCIPLE

The working principle of this project is that, first the job of 60/60mm is setup with the help of clamp on the plates. After that it is to be seen that the proper alignment of the drill bit and the bush is done in order to guide the drill bit. After drilling one hole on the job, a guide of jig slide on a one axis and another guide slide on a another axis i.e in “X” and “Y” axis. Due to such mechanism a workpiece can slide in any of the two axis. Which may result to reduce a production. Main purpose of this jig is that once a job is located then it’s not required to locate again and again till the completion process.

VI. PROCESS PLANNING

Process planning is the process of design specification from operating instruction from the necessary manufacturing. The manufacturing process plan refers to either machining process planning or assembly.

Purpose of Planning
- Interpretation of production design.
- Tooling design.
- Selection of machining operations.
- Selection of machine tool.
- Determination of fixture tool.
- Calculation of total time.
- Sequence of operation.
- Generation of process status.

The process planning of this machine fabrication or design was done in a systematic manner. The process Planning was done as soon as the drawing was received.
- Start.
- Collect Components Required.
- Designed.
- Manufactured.
- Inspection.
- Assembly.

VII. DESIGNING

Main parts or the main components:
This is a “Linear two axis indexing Jig” meant for chain drilling which consists of the following component and parts:
- hardened material rod
- Mild steel material
- Lead Screws (hardened material)

VIII. DESIGN OF LEAD SCREW

Lead screw is a power transmitting device. Which convert rotary motion into linear motion.

Diameter of a lead screw “d”; 
\[ d = (d_s/8) + 8.0 \text{mm} \]
\[ d = \text{major diameter or nominal diameter of the screw} \]
P= pitch of the screw
\[ D_m = \text{mean diameter} \]
\[ d_c = \text{core diameter or minor diameter of the screw} \]
\[ d = 22 \text{mm}; \quad p = 5 \text{mm}; \]
helix angle “\( \alpha \)”
\[ d_c = d - p; \]
\[ d_c = 22 - 5 \]
\[ d_c = 17 \text{mm} \]
mean diameter = 0.5*(d+d_c)
\[ D_m = 0.5*(22+17) \]
\[ D_m = 19.5 \text{mm} \]
helix angle tan\( \alpha \) = l/\( \pi D_m \)
\[ tan\alpha = 10/19.5*\pi \]
\[ \alpha = 9.27 \text{ degree.} \]
Use Of mild Steel In Designing

It is the alloy of iron and carbon containing carbon from 0.08 to 0.30%. Mild steels can be hardened by heat treatment. These steels have good machinability. Mild steel is used for making wires, nuts, bolts, nails, rivets, sheets, plates, rods, tubes, screws, structural steel sections, general purpose steel shafts etc.

- Good conductor of heat and electricity.
- Good mach inability.
- Shock resistance.
- Good thermal stability
- Good mechanical properties.
- Easily available.

IX. CONCLUSION

This Project has deal with the designing a Linear two axis Indexing Drill Jig that is used for drilling on metal jobs with more ease and convenience and also with more accuracy and precision.

X. REFERENCES