Design and Fabrication of Hexagonal Cutting Lathe Machine

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Abstract
The concept of a new product includes product requirement functions, possible behavior form/structure and associated properties. Properties include material assembly-level tolerance, critical surface roughness and hardness, parameter and critical dimension. We are making the Hexagonal cutting lathe machine in which hexagonal cutting should be introduced in a new way, this pattern should be make first with proper allowances and tolerances after that casting of the pattern, aluminum is used for the casting so that weight can be reduced and so as cost. After casting machining should be done in a proper manner, operations to do so are turning, shaping, drilling, and boring so that rough surfaces will be extracted. To making hexagonal cutting into reality a live tool is used (The tool which we are using is single point cutting tool). With the live tool other things are also needed which are bearings, spur gears one of 26 teeth and two of 13 teeth and some nuts and bolts for holding the assembly.

Keywords
Hexagonal Cutting; Lathe Machine; Aluminum Rod; Turning Tool

I. Introduction

The principal of lathe machine is that it holds the work between two strong supports called as centers or chuck which revolves. The chuck is mounted on the main spindle of the machine. The cutting tool is rigidly supported in the tool post and it is fed against the rotating job. The job rotates in the axis and the tool moved either parallel or to an inclination with the axis as such a cylindrical, taper, square and spherical surface is produced.
Now we are introducing a hexagonal cutting on lathe machine. The machine we are talking about is 14" prototype lathe machine, which produces hexagonal cutting from feeding of round pipes with the help of three single point cutting tools. The cutting tools revolve around its own axis. The mechanism we used in this is a gear mechanism which helps the chuck to revolve and the cutting tools, a motor which helps to give the power to run this whole machine. This whole product is made by casting and pattern making and machining process.
A lathe may or may not have a stand (or legs), which sits on the floor and elevates the lathe bed to a working height. Some lathes are small and sit on a workbench or table, and do not have a stand.
Almost all lathes have a bed, which is (always) a horizontal beam (although CNC lathes commonly have an inclined or vertical beam for a bed to ensure that chips, falls free of the bed). Woodturning lathes specialized for turning large bowls often have no bed or tail stock, merely a free-standing headstock and a cantilevered tool rest.
At one end of the bed (almost always the left, as the operator faces the lathe) is a headstock. The headstock contains high-precision spinning bearings. Rotating within the bearings is a horizontal axle, with an axis parallel to the bed, called the spindle. Spindles are often hollow, and have exterior threads and/or an interior Morse taper on the "inboard" (i.e. facing to the right / towards the bed) by which work-holding accessories may be mounted to the spindle. Spindles may also have exterior threads and/or an interior taper at their "outboard" (i.e. facing away from the bed) end, and/or may have a hand-wheel or other accessory mechanism on their outboard end.
Spindles are powered, and impart motion to the work piece. The spindle is driven, either by foot power from a flywheel or by a belt or gear drive to a power source. In most modern lathes this power source is an integral electric motor, often either in the headstock, to the left of the headstock, or beneath the headstock, concealed in the stand.

II. Principle

The principle of this machine is similar to the ordinary lathe machine because it is the prototype of lathe machine although it is a Hexagonal cutting lathe machine. It's construction or design is based on lathe machine it has spindle which act as a center and spur gears which rotate the centers and the tool. Tool is fixed parallel to the center where job has to be fixed the name of this machine is given so because of its special cutting purpose i.e. hexagonal cutting it is achieve because of synchronization of speed of tool and the job or work piece. Synchronization is done by revolving two gears in a same direction and one gear in a opposite direction two gears are of small size and one is of large size the tool we used for special cutting is single point cutting tool with front round shapes. It is a revolutionary step in the history of a mankind so far because of this cutting cannot be achieved on any ordinary lathe machine. That's why it is Hexagonal cutting lathe machine.

III. Manufacturing of Machine Parts

A. Pattern Making

In casting, a pattern is a replica of the object to be cast, used to prepare the cavity into which molten material will be poured during the casting process.
Patterns used in sand casting may be made of wood, metal, plastics or other materials.
Patterns are made to exacting standards of construction, so that they can last for a reasonable length of time, according to the quality grade of the pattern being built, and so that they will repeatedly provide a dimensionally acceptable casting.
The pattern making is a skilled trade that is related to the trades of tool and die making and mould making, but also often incorporates elements of fine woodworking.
Pattern makers learn their skills through apprenticeships and trade schools over many years of experience. Although an engineer may help to design the pattern, it is usually a pattern maker who executes the design.

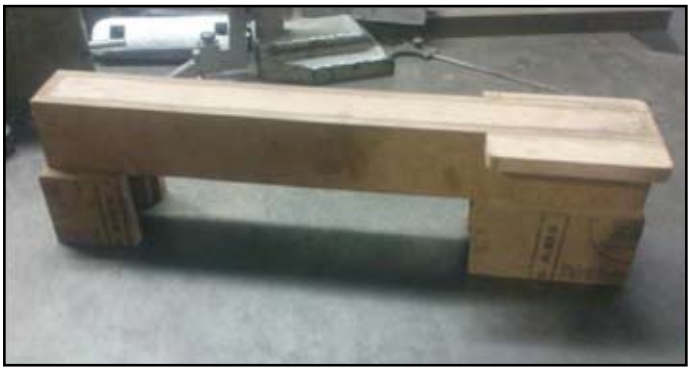

Fig. 1: Pattern

B. Casting:

Molten metal is poured into the fired shell at temperatures between 650°C – 700°C depending on the type of alloy selected, and the casting/part configuration. Pouring temperatures are maintained as cool as possible.

IV. Specification of Machine

1. Head stock- Aluminum
2. Bed- Aluminum
3. Spindle- Mild steel
4. Sleeve- Mild steel
5. Spur gear - Mild steel-26 teeth's – 1 pcs.
6. Spur gear - Mild steel-13 teeth's – 2 pcs.
7. Saddle- Mild steel
8. Patterns- New wood/New board

Fig. 2: Parts of Machine

V. Equipment & Parts

A. Bed
B. Head Stock
C. Turning Tool
D. Turning Cutters with Inserts
E. Spur Gear
F. Holding Device

A. Bed:

A bed of a lathe comprises a aluminum body provided with guide ways for guiding movable lathe elements such as bed slides. The guideways are formed by horizontal parallel grooves provided in the front face of the metal body, each groove having opposite side walls.

Fig. 3: Bed

B. Head Stock:

The headstock houses the main spindle, speed change mechanism, and change gears. The headstock is required to be made as robust as possible due to the cutting forces involved, which can distort a lightly built housing, and induce harmonic vibrations that will transfer through to the work piece, reducing the quality of the finished work piece. The main spindle is generally hollow to allow long bars to extend through to the work area. This reduces preparation and waste of material. The spindle runs in precision bearings and is fitted with some means of attaching work holding devices such as chucks or faceplates.

Fig. 4: Head Stock

C. Turning Tool:

Turning tool is made up of joining three single point cutting tools on a round aluminum base. Due to the usage of these three tools rotated in the direction opposite to the direction of work piece, causes the hexagonal cutting on the work piece. The rotating speed of this tool is three times at the speed of the tool. Tools are places at 120o to each other.

Fig. 5: Turning Tool

D. Spur Gears:

The teeth of the spur gears are cut parallel to the axis of the gear. They are used to transmit mechanical power from one parallel shaft to another. These gears provide the drive mechanism to the whole system. For making the hexagonal cutting the gear ratio of 2:1 is required.

Spur gear - Mild steel-26 teeth's- 1ps.

Spur gear - Mild steel-13 teeth's- 2ps.

Fig. 6: Spur Gear

E. Holding Device:

The collet method of securing stock is used when smooth bar stock is fed through the spindle in a lathe. Collet are relatively thin steel bushing that are split into three longitudinal segments over about two third of their length. The smooth internal surface of the split end is shaped to fit the piece of stock that is to be held. The external surface at the split end is taper that fits within an internal taper of a collet sleeve placed in the spindle hole.

VI. Working of Machine

The machine we are talking about is 14" prototype lathe machine, which produces hexagonal cutting from feeding of round pipes with the help of three single point cutting tools. The cutting tools revolve its own axis. The mechanism we used in this is a gear mechanism which helps the chuck to revolve and the cutting tools, a motor which helps to give the power to run this whole machine. This whole thing is made by casting and pattern making and machining process. This machine works unusually because of hexagonal cutting machine and no machine would relate to this machine. This machine has its own unique quality that differs this machine from the other machines in this entire world.

Fig. 7: Hexagonal Cutting Lathe Machine

This machine runs on the gear ratio of 2:1. The spindle of the tool is rotated at a speed two times greater than the speed of main spindle. Work piece is mounted on the main spindle with the use of headstock. The turning tool is joined with the tool spindle and have an arrangement of moving horizontally (Left- Right). When machine starts work piece rotates and comes in contact with three single point cutting tool. This will cause hexagonal shape on the work piece.

Fig. 8: Hexagonal Cut Work Pieces

VII. Procedure to Perform Hexagonal Turning Onlathe

1. Take the job of 12 mm external diameter which can fit into the spindle.
2. Note that the material is of aluminum.
3. Fit it into the spindle tightly so that the vibration negligible.
4. The cutters we used are single point cutting tool which are 3 in number and fixed at 1200 angle.
5. Now motor revolves the pulley at 8000 rpm, pulley revolves the idle gear at 4000 rpm and the idle gear revolves the major gear at 2000 rpm which are in the ratio of 2:1.
6. Major gear revolves one full rotation and in the meantime small gears makes twice therotation.
7. The ratio 2:1 helps us in achieving the hexagonal cutting.
8. The pieces which have six sides is called hexagonal piece.

VIII. Result & Conclusion

Result of our Hexagonal cutting lathe machine has a positive. We all succeeded to make this incredible, one of his own kind and a very creative machine. We all appreciated to do this kind of work. This machine works unusually because of hexagonal cutting machine and no machine would relate to this machine. This machine has its own unique quality that differs this machine from the other machines in this entire world.

The conclusion of this machine appears many debates because this machine is made for the first time in the history and we all know anything which is made for the first time has some defects and remedies which are likely to be appeared. These defects and remedies are occurring because of less research and initiative stage of that machine. To overcome these defects and remedies more research will has to be made and fully skilled advice and labor should be given to this machine.

Although this machine if made for even first time it has the tendency and as well as the capability to shock the mankind with its achievement and special hexagonal cutting purpose.

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